# HEMEL HEMPSTEAD DATA CENTRES: ENVIRONMENTAL PERMIT VARIATION

# HH4 PHASE 2

**Best Available Techniques and Operating Techniques**

Prepared for: NTT Global Data Centers EMEA UK Limited

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# BASIS OF REPORT

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# 1.0 Introduction

SLR Consulting Limited (SLR) has been instructed by NTT Global Date Centers EMEA UK Limited (NTT) to prepare an application to vary the environmental permit (EP) for the NTT owned and operated data centre facilities located in Hemel Hempstead, UK (EP reference EPRBP3800PZ).

The current EP relates to the operation of diesel-fired generators at the following NTT data centres:

- Campus data centre, Spring Way, Hemel Hempstead, HP2 7UP;
- Centro data centre, 3 Boundary Way, Hemel Hempstead HP2 7SU;
- Maylands data centre, 150 Maylands Avenue, Hemel Hempstead, HP2 7DF; and
- Hemel Hempstead 4 (HH4) data centre (Phase 1 only), Prologis Park, Hemel Hempstead, HP2 7EQ.

The total rated thermal input for these data centres is 265.64MWth.

This EP variation application relates to the following:

- HH4 Phase 2 which will involve the installation and operation of an additional 13 diesel-fired generators. Commissioning of the 13 generators is to be scheduled for July 2023 with all generators planned to be operational by Q4 2023.

The generators provide power to the data centres in the event of an emergency situation such as a brown- or black-out of the local electricity transmission network where there are fluctuations or loss of the electrical power provided by the network. On occurrence of such an event, there is the potential for a delay between fault detection and initial operation of the generators; on-site battery arrays provide a temporary uninterruptible power supply in order to cover such delays and the potential for a loss/reduction in the power supply to the on-site equipment.

Electricity for operation of the HH4 data centre is provided from connections to the local electricity transmission network; however, given the nature of data centres and their requirement to have an available energy supply at all times, HH4 incorporates the following diesel-fired generators:

- Data centre Phase 1: 15 generators (incorporated under EPRBP3800PZ).
- Data centre Phase 2: 13 generators (the subject of this permit variation):
  - HH4 01 to HH4 04;
  - HH4 11 to HH4 15; and
  - HH4 21 to HH4 24.

It should be noted that HH4 Phase 2 generators HH4-09 and HH4-23 whilst included in this permit variation application, are future generators to be installed at a later date.

The proposed generators to be installed are summarised as follows:

- HH4 Phase 2: 13 x Kohler T2500 (emissions optimised), each being 4.76MWth (2.0MWe) (at 100% load). The specification for the Kohler T2500 is presented in Appendix 01.

The total thermal rated input for:

- The 13 generators to be installed as part of HH4 Phase 2 will be 61.88MWth.
- For HH4, with the addition of the Phase 2 generators, will be 133.28MWth.
- For all four Hemel Hempstead data centres will be 327.52MWth.

This Best Available Techniques and Operating Techniques (BATOT) document is submitted on behalf of NTT, the operator, to support the application for variation to the EP for the Hemel Hempstead data centres (as per the requirements of Section 2(1), Part 1, Schedule 5 of the EP Regulations). This report is an integrated document which describes both the operating techniques that will be implemented at the HH4 facility (with respect to Phase 2 generators) in terms of operation of the diesel generators to be installed to ensure compliance with the conditions of the EP, and also demonstrates that BAT will be employed.

For the purpose of this BATOT, key technical standards in the following documents have been referenced:

- Develop a management system: environmental permits guidance, August 2021;
- Risk assessments for your environmental permit guidance, March 2021;
- Best Available Techniques: environmental permits, February 2016;
- Data Centre FAQ Headline Approach, DRAFT version 11.0 H.Tee 11/5/20 – Release to Industry; and
- Specified generator: comply with permit conditions, July 2019.

# 2.0 Regulated Activities

The four data centres comprise a thermal input of approximately 327.52MWth (including the phase 2 generators at HH4). This variation (including the associated modelling studies and risk assessments) has been prepared on the basis of a total of 13 additional generators at HH4.

Testing of the engines (either routinely or following maintenance) is undertaken at up to 100% of full (prime) load. There are currently no plans for the installation of further generators at any of the sites in order to respond to potential future business growth (i.e. increase in the on-site electrical load).

## 2.1 Schedule 1 Activities

Combustion activities that require an EP are defined in Part 2, Schedule 1 of the EP Regulations:

- Section 1.1 Part A(1)(a) burning any fuel in an appliance with a rated thermal input of 50 or more megawatts.

The EP Regulations clarify 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 aggregated total number of generators for the four data centres (including the HH4 Phase 2 generators) is 77 diesel-fired generators. The generator provision includes for a level of redundancy to the generator system such that, even in a worst-case blackout scenario, only the required number of generators would start up to deliver the required electricity IT load for the data centre; the number of operational generators at the time of a blackout would be dependent on the extent of blackout. However, it is noted that, without specific physical controls preventing operation of a generator, that the thermal input of all generators is required for determining the capacity of the site. With the addition of the Phase 2 generators at HH4, the total capacity of the data centres will be:

- 327.52MWth (77 generators).

## 2.2 Stationary Technical Unit STU

The definition of a STU is not included in the EP Regulations. However, the EA 'RGN 2 Understanding the meaning of regulated facility' (May 2015) states:

*"The essence of a "technical unit" is that it can carry out the Activity, or Activities, on its own. This means that the technical unit must include enough plant and machinery to allow the Activity to take place in a controlled manner for a sufficient period of time for the operation to reach its designed or intended output."*

Each generator could be considered as an STU (for the purposes of combusting fuel) however, in accordance with A2.5 of RGN 2:

*"If there are two or more STUs on the same site they will be treated as a single STU if they are technically connected and one of the following criteria is met:*

*a) they carry out successive steps in an integrated industrial activity;*

*b) one of the listed activities is a Directly Associated Activity (DAA) of the other; or*

*c) both units are served by the same DAA."*

In the event of a worst-case blackout scenario of the local transmission system, potentially all the generators at the HH4 data centre will be operated to deliver the required IT load. In the event of operational redundancy in case of engine failures or generators under maintenance, the remaining generators will be operated to the required load, but this can only be identified at that time. Therefore, the operation (under emergency) of individual generators is linked to the 'availability' of other engines and all generators at the data centre are thus considered to be technically connected.

Fuel storage for the generators is considered to be a directly associated activity (DAA). Discussions of the DAA (fuel oil storage) at the site are provided in sections 6.0 and 10.0.

For the purpose of the EP variation application, the Installation will include the additional generators planned for HH4 Phase 2, with the generators and associated diesel storage arrangements being considered an independent STU; the associated diesel storage arrangements will be considered a Directly Associated Activity to the diesel generators for each STU, as described below.

## 2.3 Directly Associated Activities

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

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

As stated in A2.19 of RGN 2, a DAA must "serve" a STU. Therefore, a DAA will normally be something that would not be in place if the STU was not present on-site. A2.22 continues that there are four types of technical connection with a STU including "…input activities concerned with the storage and treatment of inputs into the stationary technical unit."

A2.11 of RGN 2 states:

*"Storage facilities may be technically connected. […] Stores at the same location are normally technically connected, and as their operation can give rise to pollution, either locally or at the Activity, they are likely to be DAAs."*

In addition to the above, it must also be clear how a DAA may affect emissions from the installation. Incorrect storage of a raw material/fuel could cause off-site releases of these substances.

Therefore, the storage of fuel oil at HH4 is considered to be a DAA of the 'combustion' STU for that data centre.

## 2.4 Medium Combustion Plant and Specified Generators

The Medium Combustion Plant Directive (MCPD) was incorporated into UK law in early 2018 via the Environmental Permitting (England and Wales) (Amendment) Regulations 2018. In addition to MCPD requirements, in the UK regulations were also brought in for Specified Generators (i.e. any combustion plant generating electricity).

Whilst an Industrial Emissions Directive (IED) Chapter II Environmental Permit is required, specifically Chapter II of the IED states that:

*"Chapter II (of the IED) MCPs are in scope either where they are the primary activity i.e. where there is more than 50MWth total on the installation, or they are a Directly Associated Activity (DAA) to another Chapter II activity, e.g. chemical manufacture. As a minimum, these MCPs must meet the requirements of the directive and there may be occasions where site specific BAT requires more stringent conditions"*

In light of this, the permit variation also needs to take into consideration the MCPD and Specified Generator requirements as detailed in the Environmental Permitting Regulations (EPR) 2018.

The MCPD, as set out in Schedule 25A of the EPR 2018, defines the scope, definitions, exclusions and how the regulations apply to types of medium combustion plant (MCP), MCP being combustion plant with a rated thermal input of 1 – 50MWth regardless of the type of fuel used.

The EPR 2018 also establishes requirements for 'specified generators' in Schedule 25B. A generator is defined as any combustion plant which is used for the purpose of generating electricity, with certain exclusions. A specified generator is defined as:

*a) a generator, other than an excluded generator, with a thermal rated input –*

- *(i) more than or equal to 1 megawatt and less than 50 megawatts, or*
- *(ii) in the case of a generator used to meet a capacity agreement or an agreement to provide balancing services, less than 50 megawatts;*

*b) where two or more generators falling with paragraph (a)(i) or (ii) are operated –*

- *(i) on the same site,*
- *(ii) by the same operator, and*
- *(iii) for the same purpose,*

*Those generators together, provided that the rated thermal input of those generators together is less than 50 megawatts; or*

*c) where two or more generators, other than excluded generators –*

- *(i) are operated together as set out in paragraph (b)(i) to (iii), and*
- *(ii) together have a rated thermal input more than or equal to 1 megawatt and less than 50 megawatts, even if one or more of the generators has a rated thermal input of less than 1 megawatt.*

*Those generators together".*

The regulations go on to state that an 'excluded generator' includes back-up generators operated for the purpose of testing for no more than 50 hours per year. As the generators to be installed in HH4 Phase 2 are operated for emergency back-up purposes only, they will be considered 'excluded generators' in accordance with EPR 2018.

Therefore, in summary, the proposed HH4 Phase 2 generators:

- are not considered MCP due to the total thermal rated input being >50MWth;
- are not considered to be IED Chapter III large combustion plant (LCP) as each generator is <15MWth and is therefore not subject to Chapter III ELVs; and
- are considered to be 'excluded generators' due to being operated for emergency back-up purposes only, and for the purpose of testing are each operated for no more than 50 hours per year.

The generators are therefore 'excluded generators' in accordance with EPR 2018 and will not be required to meet the emission limit value (ELV) for NOX (190mg/kg).

# 3.0 HH4 Data Centre

The HH4 data centre is located to the north east of Hemel Hampstead town centre, Prologis Park, Hemel Hempstead, HP2 7EQ (NGR: TL 08525 07644).

HH4 is located in a predominantly commercial setting. The site setting for HH4 is summarised in Table 3-1.

**Table 3-1**
**Site Settings**

| Site | North | East | South | West |
|---|---|---|---|---|
| HH4 | Commercial/ industrial | Cemetery and open/agricultural land | Commercial/ industrial, recreational (open) land, residential | Commercial/ industrial, residential. |

The nearest residential areas are located approximately 115m northwest and 175m to the south.

There are a number of ecological sites within the vicinity of HH4. There is one designated European or International site of ecological importance located within 10km of the site boundary: Chiltern's Beechwoods Special Area of Conservation (SAC), located approximately 8.3km northwest of the site boundary. There are no Special Protection Areas (SPAs) or Ramsar sites within a 10km radius of the site. There are numerous national sites of ecological importance located within 2km of the site boundary including local wildlife sites (LWS) and ancient woodland.

With respect to cultural heritage, there are multiple listed buildings and scheduled monuments within 2km of the sites, the nearest being two scheduled monuments 175m and 1.4km to the northwest, one listed building 685m east and Gorhambury registered park and garden 1.6km east.

The following drawings accompany this application for the Environmental Permit for the site:

- Drawing 001 – Site Location
- Drawing 002– Site Layout and Emissions Points – HH4 Data centre
- Drawing 003A and 003B – Site Setting.

## 3.1 HH4 Data Centre

The HH4 data centre comprises both Phase 1 and Phase 2 generators. The site will consist of one data centre building with 6 suites with a total 28 generators. Each suite is served by either 4 or 5 generators. The data centre was developed in two phases:

- phase 1 involved the installation of 15 generators; and
- phase 2: will involve the installation of 13 generators.

There are currently no plans to increase the number of generators at this site once fully developed. The generating capacity of the generators are summarised in Table 3-2.

**Table 3-2**
**HH4 Data Centre Combustion Plant Rated Thermal Input**

| HH4 Generator Reference | Installation Phase | HH4 Suite | Model | MWe | MWth | Total MWth |
|---|---|---|---|---|---|---|
| Gens 1, 2, 3, 4 | 2 | 1 | Kohler T2500 | 2 | 4.76 | 19.04 |
| Gens 6, 7, 8, 9, 10 | 1 | 4 | Kohler T2500 | 2 | 4.76 | 23.8 |
| Gens 11, 12, 13, 14, 15 | 2 | 2 | Kohler T2500 | 2 | 4.76 | 23.8 |
| Gens 16, 17, 18, 19, 20 | 1 | 5 | Kohler T2500 | 2 | 4.76 | 23.8 |
| Gens 21, 22, 23, 24, 30 | 1 & 2 | 3 | Kohler T2500 | 2 | 4.76 | 23.8 |
| Gens 26, 27, 28, 29 | 1 | 6 | Kohler T2500 | 2 | 4.76 | 19.04 |
| | | | | Phase 1 total (15 generators) | | 71.4 |
| | | | | Phase 2 total (13 generators) | | 61.88 |
| | | | | Combined total | | 133.28 |

## 3.2 Staffing

The HH4 data centre operates 24 hours 365 days a year. The data centre is staffed by the following number of NTT employees:

- Up to 30 staff
- Minimum of circa 12 staff (comprising NTT security and facilities management personnel) on site.

## 3.3 Generator Selection and Resilience Configuration

The HH4 data centre comprise a number of customer suits; each customer, for risk management purposes, specifies the number of generators that they require to service their suit. For the HH4 data centre, this has been designed to ensure the maximum number of generators per data centre suite are installed to service potential clients and to ensure resilience.

The generators were selected based on the customer demand/required electrical load for each customer suit. This incremental approach ensures that the generators are operated at their optimal design capacity, as operating diesel generator sets at low loads (i.e. underloading) for extended periods of time can potentially impact uptime and engine life.

The Kohler T2500 generators comply with the 2g TA-Luft standard, being designed to achieve 2,000mg/m3 NOx emissions at 100% load as summarised in Table 3-3 and detailed in the generator specification presented in Appendix 01.

**Table 3-3**
**Results of Compliance Testing**

| Parameter | TA-Luft 2g Emission Standard (mg/m3) (at reference conditions and 5% oxygen) | NTT Generator Model (mg/m3) |
|---|---|---|
| | | Kohler T2500* |
| NOx | 2,000 | <2000 |
| CO | 650 | <650 |
| Particulates | 130 | 50 |
| Hydrocarbons | 150 | <150 |

The HH4 data centre has been designed to ensure the installation of the maximum number of generators per data centre suite to service potential clients and to ensure resilience. This has resulted in the installation of a number of small-scale diesel generators rather than the installation of a smaller number of larger generators. The installation of a larger number of smaller generators offers the flexibility and reliability of electrical supply in the event of an emergency, a critical factor in the operation of the data centre and an essential requirement to NTT's customers. The installation of a smaller number of larger generators would reduce this flexibility and reliability. Additionally, the installation of smaller generators minimises the potential for adverse impacts on air quality as a result of the planned phased maintenance and testing of the generators.

The resilience configuration of the installed generators providing for the electrical load demand of a site (i.e. the data centre building and installed IT equipment) is referred to using 'n', where 'n' is the specified MWe rate delivered by a generator unit. The EA Data centre FAQ states that 2n is the exemplar (i.e. twice as many generators as required are installed).

The generator configuration for the HH4 data centre is N+1. The N+1 configuration (i.e. an additional generator added to support a single generator failure or required maintenance) allows for a level of redundancy to the generator system such that, even in a worse case blackout scenario, only the required number of generators needed to meet the electrical load demand would be run. The operational capacity of the generators at the time of a blackout would be dependent on the extent of blackout. Furthermore, in the event of failure of a generator, the correct number of remaining generators will in an emergency event provide the required load. The N+1 configuration offers resilience and minimises the risk of disruption in service to NTT's clients.

The generators are all automated via the data centre's building management system (BMS). In the event of a reduction in electrical power delivered from the National Grid, the BMS phase failure relay would automatically start-up the required number of generators necessary to service the customer suits; this configuration allows for the required number of generators to be run dependant on the failure scenario. This will result in the reduced consumption of diesel fuel and hence generation of less emissions to air from the generators.

## 3.4 Reliability Data

The magnitude of risk posed by operation of the generators (other than for generator testing) is strongly linked to the reliability of the provision of electricity from the local transmission network (in addition to the uninterruptable power supply (UPS) arrangements within the site).

The data centre is designed to provide the maximum reliability of the electrical power supply to the on-site systems that are critical for operation of the site as a data centre. The HH4 data centre is designed and built to

Uptime Institute Tier III standards, ensuring the required level of resilience to ensure maximum uptime for critical IT infrastructure.

The electricity supply arrangements for the HH4 data centre includes:

- two 132KV (each rated to 60MVa) feeds from the National Grid (HH4 only requires 35MVa).

The UPSs are arrays of batteries that can provide power, almost instantaneously, in the event of a loss of electrical input to them. The data centre has battery arrays which provide sufficient protection to the supply of electrical power to the 'customer load' whilst the generator(s) are started.

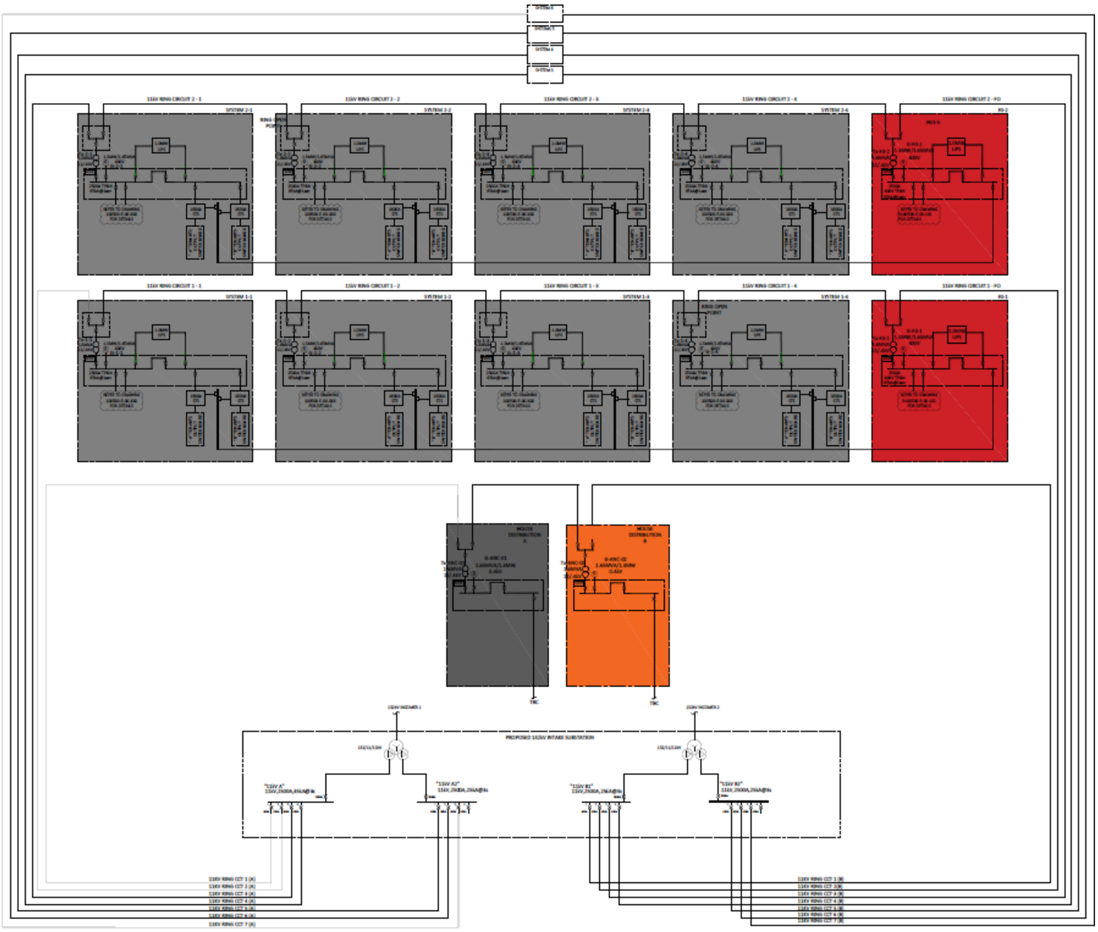
The site operates its electrical supplies on an automatic basis such that in the event of fluctuations in (or loss of) the electrical supply to the site, where such events could negatively impact on operation of the site's data centre function, these are detected and the relevant response (e.g., ignition of the generators) is automatically deployed by the data centre BMS.

The HH4 data centre has 6 customer suites each serviced by 4 or 5 generators as summarised in Table 3-4. In terms of the electrical setup, these suites are all independent having dedicated infrastructure to maximise reliability. The electricity supply arrangement for the HH4 data centre is illustrated in Figure 3-1.

**Table 3-4**
**HH4 Generators**

| HH4 Generator Reference | Installation Phase | HH4 Suite | Model |
|---|---|---|---|
| **Gens 1, 2, 3, 4,** | **2** | **1** | **Kohler T2500** |
| Gens 6, 7, 8, 9, 10 | 1 | 4 | **Kohler T2500** |
| **Gens 11, 12, 13, 14, 15** | **2** | **2** | **Kohler T2500** |
| Gens 16, 17, 18, 19, 20 | 1 | 5 | **Kohler T2500** |
| **Gens 21, 22, 23, 24, 30** | 1 & **2** | **3** | **Kohler T2500** |
| Gens 26, 27, 28, 29, | 1 | 6 | **Kohler T2500** |

**Figure 3-1**
**HH4 Electricity Supply Arrangements**



The HH4 data centre has an uninterruptable power supply (UPS) consisting of battery arrays. These arrays provide almost instantaneous power in the event of a loss of electrical input to them, providing sufficient protection to the supply of electrical power to the 'customer load' whilst the generators are started.

The electrical supplies for HH4 are operated on an automatic basis. In the event of fluctuations or the loss of the electrical supply to a data centre, where such events could negatively impact the operation of the data centre functions, these fluctuations are detected and the relevant response is automatically deployed by the BMS (i.e., UPS start-up followed by the start-up of generators, if required).

HH4 is a new data centre and to date there has been no unplanned generator maintenance required or events where there has been loss of electrical supply to the data centre.

The approach to testing of the generators is discussed in Section 4.0.

### 3.4.1 Technical Standards

The HH4 data centre comprises an individual STU for the combustion and storage of diesel fuel oil, which is large enough to serve both Phase 1 and Phase 2 generators. The STU has been designed and will be operated in accordance with the relevant sections of the following key guidance:

- Develop a management system: environmental permits guidance, August 2021;
- Risk assessments for your environmental permit guidance, March 2021; and

- Best Available Techniques: environmental permits, February 2016.

In addition, the site will be operated in accordance with the 'Data Centre FAQ Headline Approach, DRAFT version 11.0 H.Tee 11/5/20 – Release to Industry' with respect to standby operation. It is noted that this guidance, *"is not presently an official release but forms the basis for discussion of a common methodology and liaison with individual operators and their industry association."* However, for the purposes of this application, this guidance is considered to represent the current EA position of BAT for data centre back up generation systems.

Operation of the generators (other than for maintenance and testing) will commence in the event that electricity is not available from the local transmission network (e.g. brown- or black-out) or on internal failure of electrical supply (e.g. transformer failure, UPS problem).

The generators on-site will be operated for maintenance and testing purposes only. Each generator will operate for less than 50 hours per annum and therefore will not be subject to the ELV for NOx (190mg/kg).

The emissions from the site will be estimated using emissions factors, as discussed in Section 5.0.

### Emergency Operation

Emergency operations include unplanned hours required to come off grid to make emergency repair of electrical infrastructure associated within the data centre itself.

Given the short start-up and shutdown times for diesel engines, the generators are regarded, for the purposes of determining operating hours, as commencing operation at the first fuel ignition. This is taken to include the shorter periods of plant 'overlap' when engines provided as redundancy are started as a precautionary measure before final customer load is reached with the optimum/minimum number of generators.

The Operator will notify the EA:

- In advance of planned outage/maintenance of the local transmission system that is expected to exceed 18 continuous hours and will require the operation of one or more generators at the site; and
- Upon an incident of unplanned continuous outage that exceeds 18 hours and/or requires operation of more than 2 generators.

# 4.0 Operating Regime

## 4.1 Generator Scheduled Operating Regime

During planned maintenance and testing the generators are typically operated for less than 50 hours per year. The planned maintenance and testing regime for the generators at all four Hemel data centres, as stated in the EP, is scheduled so that:

- testing and maintenance is completed at one data centre at a time; and
- for each data centre no more than 2 generators are tested each day.

This staggered regime ensures that the impact on air quality as a result of the diesel combustion emissions is minimised. The HH4 Phase 2 generators will be included in this testing regime.

The typical operating regime for the generators (i.e., testing and maintenance) at HH4 is presented in Table 4-1 below.

**Table 4-1**
**HH4 Data Centre Planned Maintenance and Testing Regime**

| Event | Detail | Event Operational Time |
|---|---|---|
| Monthly on-load testing during maintenance | Each month each generator is powered-up and run at 75% load.<br><br>Testing is limited to 1 suite per day.<br><br>Operation of the generators for monthly on-load testing is undertaken out of hours after 17:00 hours and before 06:00 hours typically on a week day. | 1 hour (per month) |
| Annual UPS wrap around maintenance | Once annually maintenance is undertaken on each generator set and power operation is confirmed after maintenance.<br><br>The generators are off-load so the emissions are low.<br><br>1 generator is tested per day between 09:00 hours and 15:00 hours on a week day. | 6 hours (once per year) |
| Black Building Test | Annually a full black building test is undertaken where all the generator sets are started, synchronised and run to take the building load.<br><br>Black building testing yet to be undertaken, likely to be 1 suite at a time between 10:00 hours and 16:00 hours on a week day. | 1 hour maximum (once annually) |

| Event | Detail | Event Operational Time |
|---|---|---|
| Annual load test | Annually a full in-service test (IST) is undertaken on each generator set. The generators undergo a full load test where the generators are started and run to take the building load. The load is ramped up in the first hour with 3 hours at a steady 100% load level testing period<br><br>1 generator is tested each day between 09:00 hours and 17:00 hours on a weekday. | 4 hours (once annually) |

A summary of the planned generator operating hours for the all the HH4 generators is presented Table 4-2; the Phase 2 generators will be subject to the same as the planned operating hours for the permitted HH4 Phase 1 generators.

**Table 4-2**
**NTT HH4 Data Centre Planned Operation Hours**

| Operational Requirement | HH4 Annual Operational Hours per Generator |
|---|---|
| Monthly on-load Testing (1 hour per month) | 12 |
| Annual UPS wrap around maintenance | 6 |
| Black-building test | 1 |
| Annual Load Test (4 hours annually) | 4 |
| **Operational hours for planned maintenance and testing per year per generator** | **23** |
| **Operational hours for planned maintenance and testing per year for HH4 (Phase 2, 13 generators)** | **299** |
| **Operational hours for planned maintenance and testing per year for HH4 (all generators, 28 in total)** | **644** |

The scheduled maintenance and testing regime for each generator is substantially below the 50-hour testing regime for generators which are used purely for a stand-by emergency role as stated in the EA Data centre FAQ (v. 11).

## 4.2 Generator Commissioning

### 4.2.1 HH4 Phase 2 Generators

The 13 Phase 2 generators will following on-site installation, be subject to a period of commissioning.

The commissioning will be undertaken during weekdays between the hours of 0800-1800. Testing will be spread out over several days/weeks, but in total will be circa 24 hours. Commissioning times and dates have yet to be decided.

The main commissioning phase will involve the following tests (all at 100% load):

- Initial SBG start-up;
- 12 hour load bank testing; and
- Integrated Systems Test (IST). This phase of commissioning is intended to verify that the emergency and redundant systems will perform appropriately when required.

Generally, one generator will be tested at a time, however there will also be a building test where up to 5 generators at a time will run for a short period of typically no more than 1 hour.

In summary the anticipated commissioning will involve the following for each generator:

- Temporary load bank: 12 hours;
- Busbars: 5 hours;
- UPS Commissioning: 3 hours;
- SCR Commissioning Programme: 4.5 hours; and
- Integrated systems testing (IST): 2 x 12-hour tests.

A brief overview of the commissioning is provided below.

#### Load bank Testing

A 12-hour load bank test will be performed at a 1.0 Power Factor (PF). The load bank will include the following testing sequences:

- Load Test at 100%.
- Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the diesel engine.
- Stepped load test with resistive load bank, in immediate succession.
- Verify voltage and frequency steady state operation at 25%, 50%, 75% and 100%.
- Perform all types of generator shutdowns and prove all monitoring points back to the monitoring system.

#### Busbar Testing

- All busbar joints to be torqued.
- At the completion of busduct install ductor test of the whole busbar length.
- Perform infrared scan.

#### UPS Testing

- Perform system heat run on inverter and on static bypass on full rated load.

- Battery discharge test to confirm expected start of life capacity is met.
- Verify input current distortion, output voltage distortion and power factor (50% and 100% loads). UPS efficiency to be verified at 50% and 100% loads only (if not recorded during factory acceptance testing).
- Perform various load steps and record output voltage, current, frequency.
- Perform UPS shutdown at reduced load.
- Perform transfer to maintenance bypass (at 100% load) on both mains and generators.
- Perform all types of UPS shutdowns and prove all monitoring points back to the monitoring system.

**Integrated Systems Test**

The Integrated Systems test will include the following steps:

- Perform data hall loading to 100%– testing at generator loadings of 0%-25%, 25%-50%, 50%-75%, 75%-100% loads.
- Simulate loss of mains by switching off the upstream medium voltage (MV) circuit breaker(s).
- Fail one generator after cooldown shutdown.
- Simulate further loss of mains by switching off the upstream MV circuit breaker(s).
- Fail redundant cooling units and store once room conditions are stable.
- Perform data hall offloading to 0% in 4 steps (100%-75%-50%-25%-0% loading).

# 5.0 Emissions

## 5.1 Emissions to Air

Air emissions modelling has been completed in support of this EP variation application and reported in the Air Quality Risk Assessment (SLR Ref: 410.05391.00011 HH4 Phase 2 AERA). The findings of the assessment are summarised below

- For operation of the site for routine planned maintenance and testing and HH4 Phase 2 commissioning:
  - a low probability of exceedances of Air Quality Assessment Levels (AQAL) at all modelled human receptors;
  - no likely significant impacts on identified ecological receptors.
- For an emergency 36-hour electrical grid outage:
  - the annual mean AQAL is not predicted to be exceeded at any of the modelled human receptors;
  - the probability of exceedances of the 1-hour US Acute Exposure Guideline Level 1 (AEGL-1) is more than 5%,
  - it cannot be concluded that there will be no likely significant effects on identified ecological receptors.

  However, this outage scenario is considered highly unlikely on the basis that there has never been a grid failure at any of the operational NTT Hemel datacentres and the probability of this scenario (i.e. 36-hours) occurring can be considered very low.

- For an emergency 1-hour electrical grid outage:
  - the annual mean AQAL is not predicted to be exceeded at any of the modelled human receptors.
  - it cannot be concluded that there will be no likely significant effects on identified ecological receptors.

### 5.1.1 Emissions Factors

In order to estimate the total annual emissions to air from the site, emissions factors have been developed from the peak fuel consumption rate and the resultant 'worst case' emissions discussed in the Air Quality Risk Assessment (SLR Ref: 410.05391.00011 AERA, v0.1, April 2022).

The proposed emissions factors, calculated based on the emission rates in stated in the AERA and the planned testing and maintenance hours, are presented in Table 5-1.

**Table 5-1**
**HH4 Emissions Factors for Annual Reporting**

| Pollutant | Emissions Factor (kg emission/tonne of fuel) |
|---|---|
| | Generator Model Kohler T2500 |
| Emission Rate (g/s)* | 3.94 |
| Nox (as NO2) per engine<br>(23 hours planned testing per year) | 326.23 |
| Nox (as NO2) per total number of generators Phase 1 & 2: 28 generators<br>(total of 299 hours planned testing per year) | 9,134.5 |
| * - emission rate sourced from the SLR AERA | |

## 5.2 Emissions to Sewer

### 5.2.1 HH4

The HH4 data centre has separate foul and surface water drainage systems. The drainage to foul sewer consists of sanitary foul water (sinks, toilets, cleaning water, etc.). The operation of HH4 does not result in the generation of trade effluent.

The surface water drainage system at the HH4 data centre accepts surface water runoff from the areas where the generator container units and associated diesel storage are located, along with building roof area and other hard surfaced areas of the site.

The HH4 data centre has no discharges to foul sewer within the Plant Area where the generators and associated diesel storage are located. All run-off from this area will drain to the on-site surface water drainage system via a full retention oil interceptor (with an alarm to indicate the presence of oil) and a below ground stormwater attenuation tank (700m$^3$) prior to off-site discharge into the Thames Water surface water sewer via the permitted discharge point HH4-SW1. The interceptor will be emptied, cleaned and maintained at least annually by an appointed specialist contractor.

Procedures will be developed and included within the site's environmental management system (EMS) for the management of surface water runoff and for the management and maintenance of the interceptor; relevant staff will be suitably trained in these procedures.

HH4 phase 2 will not result in changes to the drainage arrangements at the data centre which were approved by the Environment Agency for the original EP application; for completeness the drainage plan for HH4 is provided in Appendix 02.

## 5.3 Emissions to Water

There are no direct discharges from the HH4 data centre to controlled waters.

## 5.4 Emissions to Land

The HH4 data centre will have no point source emissions to land.

## 5.5 Fugitive Emissions

Significant fugitive emissions, odours and noise are not anticipated in respect of operation of the HH4 data centre (either during testing or during full emergency operation).

A summary of the storage arrangements for diesel fuel is provided in section 6.0.

NTT maintains a spill procedure (*HS04-TT44 Spillage Response*) and operating personnel are provided with spill response training. Additionally, regular inspections of each of the data centre sites are undertaken in accordance with the site's environmental management system and maintenance procedures.

The HH4 data centre has not received complaints from nearby residents and businesses.

## 5.6 Noise and Vibration

The noise assessment for the existing NTT Hemel Hempstead generators has been updated to include the HH4 Phase 2 generators.

The noise assessment has concluded that:

- During the daytime, the rating level of the SBGs would be between 5 dB(A) and 16 dB(A) below the background sound level. The specific sound level of the SBGs would increase the baseline ambient sound level by less than 1 dB(A) at all identified receptors. These increases in the ambient noise level would not be perceptible. It is determined therefore the SBGs would be barely detectable during the daytime.
- During the night-time, the rating level of the SBGs would be between 9 dB(A) below and 2 dB(A) above the background sound level. The specific sound level of the SBGs would increase the baseline ambient sound level by less than 1 dB(A) at Wood Lane End and Crest Park, and by up to 3 dB at Farmhouse Lane. It is determined therefore the SBGs would be barely detectable during the night-time.

It is therefore concluded that the SBGs at the four data centres, including HH4 Phase 2, would result in a low impact and that action to minimise noise is a low priority.

# 6.0 Resource Use and Efficiency

## 6.1 Types and Amounts of Raw Materials

The raw materials to be used at the site are:

- Diesel fuel oil: each generator will require (when providing 'standby' power):
  - Kohler T2500 (4.76 MWth): 491.34 litres per hour (at 100% load).
- Lubricating oil: used in the engines and other mechanical equipment. Occasional top up or replacement will be required during scheduled or forced maintenance periods only.
- The lubricating oil for the generators is stored within the engine and is manually topped up during servicing by the NTT appointed service contractor.
- Transformer oil: transformer oil (free of polychlorinated biphenyls (PCBs)) will be used in oil-cooled transformers. Occasional top up or replacement will be required.

Transformers oils will not be stored on-site; the oils will be brought to site and topped up/replaced during scheduled or forced maintenance periods only.

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

The generator engines are designed for the combustion of fuel oil and there is therefore no alternative fuel for use by the site (although selection of alternative suppliers is possible).

In addition, the lubricating and transformer oils may have alternatives, however the type of oils used are limited to those recommended/specified by the engine manufacturers (again, with potential for supplier selection).

A typical composition of diesel fuel oil is shown in Table 6-1.

**Table 6-1**
**Typical Diesel Fuel Oil Specification**

| Chemical | Typical % (mass basis) |
|---|---|
| Carbon | 89.7 |
| Hydrogen | 10.2 |
| Sulphur | <0.1 |

### 6.1.1 Cogeneration (Combined Heat and Power)

The provision/implementation of combined heat and power (CHP) is not applicable as the generators will each operate for less than 500 hours per annum for the provision of emergency power generation; each engine will inherently only operate for a small fraction of the year (23 hours for planned maintenance and testing).

## 6.2 Fuel Storage

Diesel fuel will be stored in bunded 'belly' tanks for each generator. A total of 520,000 litres of diesel will be stored in the belly tanks of the HH4 Phase 2 generators. The total volume of diesel stored in all generator belly tanks at the HH4 data centre (i.e. 28 generators) will be 1,120,000 litres. This is summarised in Table 6-2.

**Table 6-2**
**HH4 Data centre Diesel Fuel Storage**

| Phase | Generator Model | Diesel Belly Tank Capacity (litres) | Total Diesel Belly Tank Capacity (litres) |
|---|---|---|---|
| **Phase 1 (15 generators)** | Kohler T2500 | 40,000 | 600,000 |
| **Phase 2 (13 generators)** | Kohler T2500 | 40,000 | 520,000 |
| **Total for HH4** | | | **1,120,000** |

### Bulk Storage Tanks

There will be no bulk storage of diesel at the HH4 data centre.

Further details of the diesel storage arrangements are provided Section 10.0 Best Available Techniques.

## 6.3 Energy Efficiency

### 6.3.1 Climate Change Agreement

NTT is a participant to a Climate Change Agreement, (CAA) for the data centre sector (agreement reference DATC/T00015). Energy management techniques have been implemented to monitor, record and track energy consumption at the data centres.

To achieve the reductions required under the CCA energy reduction targets are established in the ISO14001 Environmental Management System (EMS). The CCA will be updated to include the HH4 Phase 2 generators.

### 6.3.2 Energy Efficiency Directive (EED)

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

Based on the planned maintenance and testing schedule, in total the Phase 2 generators at HH4 will be operated for less than the 1,500-hour threshold, however all 4 data centre sites when aggregated exceed this threshold, as summarised in Table 6-3. For the purpose of this permit variation application, it is considered that the proposed data centre generators are not exempt from the EED requirements and an assessment of energy efficiency in accordance with the Reference Document on Best Available Techniques for Energy Efficiency, February 2009 has been undertaken as presented in Table 6-3.

**Table 6-3**
**Annual Operational Hours**

| Generator Operational Hours | Campus | Centro | Maylands | HH4 (Phase 1 & 2) |
|---|---|---|---|---|
| Number of generators | 31 | 4 | 14 | 28 |
| Total annual hours per generator (for planned maintenance and testing) | 23.0 | 28.3 | 29.0 | 23.0 |
| **Total hours per data centre** | **713.0** | **816.2** | **236.0** | **644.0** |

**Table 6-4**
**Compliance with Indicative BAT for Energy Efficiency**

| Indicative BAT requirement | Compliance level |
|---|---|
| BAT is to implement an Energy Management System | Energy is managed via the ISO14001 certified environmental management system (EMS). The EMS establishes energy objectives and targets and requires the monitoring of energy usage at the data centres. |
| • Continuously minimise the environmental impact of an installation by planning actions and investment on an integrated basis… considering the cost benefits and cross media effects | The environmental impacts of proposed changes at HH4 were considered at the design stage of the project; changes are designed to minimise adverse environmental impacts.<br>NTT requires that equipment suppliers provide energy efficient equipment for all new projects.<br>The latest energy efficient technologies are specified for development of new facilities and retrofits, such as the application of EC fans, adiabatic cooling, LED lighting and lighting controls. NTT has even specified electric cars for business travel between sites. |
| • Identify aspects of an installation that influence energy efficiency by carrying out an audit. | NTT operates to a formal Climate Change Agreement, which establishes fixed carbon emission targets.<br>The existing data centres are subject to a UK Emissions Trading Scheme (ETS) permit. This permit will be updated to include the HH4 Phase 2 generators.<br>In accordance with the EMS, energy usage is monitored and reviewed. Regular monitoring of energy usage allows for the investigation of any notable changes in energy usage.<br>In accordance with the requirements of the Energy Savings Opportunities Scheme (ESOS), NTT has appointed an energy consultant to undertake energy audits and to identify energy minimisation opportunities. |

| Indicative BAT requirement | Compliance level |
|---|---|
| • When carrying out an audit, ensure that the audit identifies the following aspects:<br>○ Energy use and type and its component systems and processes<br>○ Energy-using equipment and type and quantity of energy used in the installation<br>○ Possibilities to minimise energy use…<br>○ Possibilities to use alternative sources or use of energy that is more efficient …<br>○ Possibility to apply energy surplus to other processes …<br>○ Possibilities to upgrade heat quality | The ESOS energy audit focuses on opportunities for reducing energy use.<br>Energy use is also considered as part of the selection process for new equipment/ processes.<br>Energy performance in association with the facility's CCA is based on Power Utilisation Effectiveness (PUE), which measures the IT equipment power consumption within the data centre against total power consumption. |
| • Use tools or methodologies to assist with identifying and quantifying energy optimisation … | Various tools are used to identify and quantify energy optimisation including, estimates and calculations.<br>External specialist consultants have also been engaged to assist in identifying opportunities for energy reduction and optimisation in accordance with the requirements of ESOS.<br>The data centre control room has systems to monitor PUE on a suite by suite basis. NTT also monitors for local hot spots within each of the suites, which may indicate opportunities to optimise cooling air flow, with the implementation of immediate corrective actions if required. By monitoring electrical consumption, the load on the generators is minimised in the event that they are needed.<br>The data centre monitors energy performance on a daily, weekly and monthly basis by KPIs. These KPIs are high priority and action is taken on any deviation.<br>The CCA carbon emissions performance is measured and monitored on a monthly basis. |
| • Identify opportunities to optimise energy recovery … | The recovery of energy from the generators is extremely limited given that the generators are only operated intermittently for emergency back-up electricity and planned testing.<br><br>Heat exchange is performed at the HH4 data centre between data suite exhaust air and incoming air, in order to maintain the incoming air temperature within set limits. There is no active heating of inlet air, only recovered heat is used as and when required.<br><br>The external cooling circuits use adiabatic cooling wherever possible, either through external cooling circuits or with direct cooling. |

| Indicative BAT requirement | Compliance level |
|---|---|
| • Optimise energy efficiency by taking a systems approach to energy management … | NTT will adopt a systems approach when considering the energy efficiency and energy management of any proposed changes with respect to the generators, data suite cooling and lighting. |
| • Establish and review energy objectives | Establishment of energy objectives is undertaken in accordance with the EMS. Progress against energy objectives is reviewed at least annually during the Management Review. |
| • Establish energy efficiency indicators by:<br>○ identifying suitable energy efficiency indicators for the installation, and where necessary individual processes, systems, units and measure change over time<br>○ Identifying and recording appropriate boundaries associated with the indicators<br>○ Identifying and recording factors that can cause variance in energy efficiency of the process, system, units. | NTT has established energy efficiency indicators for the generators. Where peaks in energy use are identified investigation will be made into the causes of this variance.<br>NTT also monitors PUE for the data suites on a daily basis; action is taken should there be an unexpected increase.<br>NTT monitors the data centre temperatures at multiple points: high temperatures indicate potential inefficiencies in HVAC and cooling and are investigated as priority. |
| • BAT is to carry out ... comparisons with sector, national or regional benchmarks, where validated data are available | NTT has internal KPIs for energy use and targets for energy reduction in accordance with the requirements of the EMS. |
| • Optimise energy efficiency when planning a new installation, unit or system or significant upgrade by considering:<br>○ Initiating EED at early design stage…<br>○ Development/selection of energy efficient technologies<br>○ EED should be carried out by an energy expert<br>○ Initial mapping of energy consumption should also be addressed which parties in the project organisations influence the future energy consumption and should optimise the energy efficiency design of the future plant. | In accordance with the EMS management of change process, the energy efficiency of proposed generators will be considered at the design stage. |
| • Seek to optimise the use of energy between more than one process or system with the installation or with a third party | The generators have been specified and optimised to meet the very specific requirements to provide back-up energy supply to NTT's data centre customers in the event of a black or brown out scenario. |

| Indicative BAT requirement | Compliance level |
|---|---|
| • Maintain the impetus of the energy efficiency programme by using a variety of techniques such as:<br>  ○ Implementing specific energy efficiency measures<br>  ○ Accounting for energy usage based on real (metered) values…<br>  ○ Creation of financial profit centres for energy efficiency<br>  ○ Benchmarking<br>  ○ Fresh look at existing management systems<br>  ○ Using change management techniques | The EMS requires the management and monitoring of energy use and the identification of opportunities for energy minimisation. Energy usage and energy efficiency improvements/minimisation are discussed at least annually in the Management Review.<br><br>Additionally, in accordance with ESOS, energy audits are undertaken every 4 years which focus on opportunities for reducing energy use.<br><br>Targets within the CCA also provide a driver for improvement.<br><br>There is a dedicated facilities team who meet at least monthly to review utility consumption at all the Hemel Hempstead data centres and to review energy performance (PUE). The same team are also aware of and monitor any engineering improvements to infrastructure.<br><br>The energy requirements of any proposed changes are considered at the design stage, as previously discussed. |
| • Maintain expertise in energy efficiency and energy using systems by using:<br>• Skilled staff<br>• Training staff off line periodically…<br>• Sharing in-house resources between sites<br>• Use of appropriately skilled consultants<br>• Outsourcing specialist systems and/or functions. | NTT provides basic training in energy efficiency and sustainability to staff, as required.<br><br>NTT also engages specialist consultants to provide support in energy management/efficiency as required. |
| • Ensure that the effective control of processes is implemented by … | Operating procedures are in place for the operation, management and maintenance of the generators, and associated diesel storage arrangements.<br><br>Suitable training in these processes and procedures is provided to relevant staff, as required, to ensure optimal operation. |
| • Carry out maintenance to optimise energy efficiency by … | NTT has a Preventative Maintenance Programme in place; the maintenance of equipment is undertaken in accordance with manufacturer's requirements to ensure the efficiency, including energy efficiency, of equipment is maintained.<br><br>Designated maintenance personnel undertake the required maintenance activities; where appropriate, specialist contractors will be appointed to undertake maintenance of specific equipment. Records of maintenance are retained at the facility. |

| Indicative BAT requirement | Compliance level |
|---|---|
| • Establish and maintain documented procedures to monitor on a regular basis key characteristics of operations and activities that can have a significant impact on energy efficiency | Operating procedures are in place for the operation, management and maintenance of the generators, and associated diesel storage arrangements, ensuring that those operations which can have a significant impact on energy efficiency are subject to regular monitoring.<br>In accordance with the EMS, energy efficiency is reviewed on a regular basis and, where relevant, opportunities for minimising energy use are investigated. |
| • Optimise energy efficiency of combustion … | The optimal combustion of diesel in the generators is addressed during maintenance. |
| | The generators are subject to regular preventative maintenance to ensure efficient operation. |
| • Maintain efficiency of heat exchangers by monitoring the efficiency periodically and preventing/removing fouling. | See previous comments |
| • Optimise electric motors … | All electrical systems are optimised with respect to the latest motor technologies and efficient equipment. Through this optimisation and regular maintenance, the electrical load on the generators is minimised and hence the fuel consumption is minimised. |
| Compressed Air Systems | |
| • Optimise compressed air systems by .. | Not applicable: There are no compressed air systems. |
| • Optimise pumping systems | The diesel pumping systems have been designed/specified to the correct sizing; oversized pumps have not been specified.<br>Any new pumps will be correctly matched to the motor duty. The pumps and motors are subject to regular planned preventative maintenance (PPM).<br>All diesel delivery pipework has been designed to the correct diameter for fuel delivery to the belly tanks and generators and pipeline layouts designed to minimise the need for bends and valves. |
| **HVAC Systems** | Not applicable. |
| **Lighting** | Only a very small amount of lighting is provided in the generator container units to achieve the required illumination. |
| **Drying, Separation and Concentration Processes** | Not applicable. None in operation at the site. |

### 6.3.3 Energy Management

The management of energy is an integral part of the ISO14001 environmental management system (EMS). Energy use is one of the key environmental aspects, with energy use at the data centres, including operation of the generators, and efficiency typically being an EMS objective against which reduction targets are established. The Hemel Hempstead data centres are also subject to assessment in accordance with the Energy Savings and Opportunities Scheme (ESOS). The ESOS assessments, completed on a four-yearly basis in accordance with the requirements of ESOS, identify energy saving opportunities, the financially viability of which are appraised; where such opportunities are deemed viable NTT will consider implementation.

Training aimed at minimising energy use and developing good housekeeping techniques are part of staff training.

### 6.3.4 Measures for the Improvement of Energy Efficiency

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

Energy recovery is not reasonably practicable for engines with such small anticipated operational hours, however, as part of the EMS, assessment of each data centre's energy usage will be undertaken with a view to identifying measures to reduce energy consumption.

### 6.3.5 Energy Usage

Operation of the generators is for emergency back-up only. The overall efficiency of the generators (under the provision of 'standby' power) at the HH4 data centre is summarised below:

- Kohler T2500: 42.02%.

### 6.3.6 Water Minimisation

There will be no consumption of water associated with the generator combustion activities and diesel use/storage at the HH4 data centre.

### 6.3.7 Waste Minimisation

The HH4 data centre will inherently not produce significant amounts of waste. Waste oil will be generated at the site as a result of generator maintenance. Generator maintenance is undertaken by an appointed third-party specialist who is responsible for the off-site disposal of this waste; NTT has ensured that this contracted company is a certified waste carrier.

Waste oil is managed off-site, the majority of which is processed into Processed Fuel Oil (PFO) (it should be noted that this is market dependent with respect to the price of crude oil) for use as a fuel in power stations in the UK or is transported overseas for various uses.

It is estimated that waste oils (EWC 13 02) from the Phase 2 generators at HH4 will be less than 5m$^3$/4.5 tonnes per annum.

# 7.0 F-Gases

Fluorinated gases (F-gases) are used at the HH4 data centre in the refrigeration systems for chiller units and air conditioning units.

These units are subject to regular maintenance and leak testing; these requirements are included in the site's preventative maintenance system. Maintenance and testing are undertaken by an NTT approved external specialist contractor; copies of the certificates of the engineers qualified to install, maintain and service refrigeration equipment are maintained on file by NTT.

NTT maintains an F-gas register for the HH4 data centre. The register details the location of each refrigerant-containing unit, the make, model and serial number, refrigerant type and charge, the global warming potential (GWP), carbon dioxide equivalent ($CO_2$e kg), maintenance/leak test frequency and refrigerant used per year. This register will be updated to include the Phase 2 generators.

Leak detection and maintenance records are maintained which include details of the quantity of refrigerant used to recharge the units, date of recharge and leak re-test for those assets where leaks are identified.

The refrigerant in use at all the HH4 data centre is R410a, a hydrofluorocarbon (HFC) with zero ozone depleting potential (ODP) and medium-high global warming potential (GWP).

# 8.0 Management Systems

The data storage services at all four Hemel Hempstead data centre sites are managed in accordance with the following standards:

- ISO/IEC 27001:2013 that specifies the requirements for establishing, implementing, maintaining and continually improving an information security management system;
- ISO 14001:2015 that specifies the requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects; and
- ISO9001:2015 that specifies the requirements for establishing, implementing, monitoring, managing and improving quality throughout the organisation.

NTT has an overall ISO Integrated Management Systems Manual (QM22) under which all the aforementioned ISO certified management systems are included; specific requirements for each of the ISO management systems are contained within the relevant NTT ISO system manual. The HH4 Phase 2 generators will be integrated into the management systems and QM22.

## 8.1 Environmental Management System (EMS)

NTT has an ISO14001 certified EMS that includes the policies, management principles, organisational structure, responsibilities, standards/ procedures, process controls and resources which are in place to manage environmental protection across all aspects of the business. The scope of this EMS includes the HH4 data centre.

The EMS places particular importance on:

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

### 8.1.1 Policy

The ISO14001 certified EMS includes an Environmental Policy. The Environmental Policy clearly defines NTT's commitment to continual improvement and to developing objectives and targets aimed at preventing pollution and improving environmental performance. The Policy is reviewed annually and agreed with the Chief Executive Officer and is communicated to all NTT employees. A copy of NTT's ISO14001 Certificate is presented in Appendix 03.

### 8.1.2 Organisation

NTT has established and maintains documented procedures for identifying and recording environmental aspects for all its activities, products and services. Where significant, the environmental aspects have been considered in the development, implementation and maintenance of the EMS. These are also considered when introducing new or modified activities and services. NTT has also documented in the EMS the process for the setting, managing and reviewing environmental Objectives and Targets.

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

NTT maintains an internal audit programme for periodic internal audits of environmental documents, procedures, implementation and compliance status to determine whether the EMS conforms to planned arrangements, and to determine whether it has been appropriately implemented and maintained in accordance with its Environmental Policy. The EMS is externally verified through accreditation and surveillance audits by the appointed management system certification organisation.

### 8.1.3 Environmental Aspects Evaluation

The environmental significance of the site activities is determined by means of environmental aspects evaluation. NTT identifies the aspects and impacts (direct and indirect) relevant to its activities, highlighting which substances, activities or incidents related to the aspects are likely to have a harmful effect on the environment. Any substance, activity or incident that has the potential to cause harm, or under the worse case scenario has a high-risk of potential to harm, the aspect will be identified as being 'Significant '.

NTT's main activities are identified and recorded in the Environmental Aspect and Impact Register (EMS04). Evaluation of these aspects and impacts and the associated implications are recorded in the Register. Environmental aspects are considered under the following conditions:

- Normal operation (i.e. standard operating procedures and conditions);
- Abnormal operation (i.e. standard operating procedures but non-standard conditions); and
- Emergency conditions.

Aspects which are identified as being 'Significant' are managed by establishing operational controls, process, procedures, training and monitoring activities such audits. The NTT Management Team is responsible for reviewing aspects and impacts defined as being significant. All staff are responsible for working in accordance with procedures relating to environmental compliance.

### 8.1.4 Environmental Risk Assessment

Environmental risk assessments, together with the environmental aspect evaluation, allow routine management system (MS) procedures to manage risks under normal circumstances, and emergency plans to mitigate impacts under abnormal circumstances. Such assessments cover the implications of material storage, oil transfer, drainage and site security.

Environmental risk assessments are carried out:

- Under normal operating conditions;
- Under potential abnormal/emergency conditions;
- For existing equipment;
- For existing material storage;
- Before a new substance is introduced;

- Before the installation of new plant on-site; and
- Before existing plant is modified.

All significant risks will be referenced in the Aspect and Impact Register.

NTT requires/encourages full and open reporting of all environmental incidents, including near misses. Staff are encouraged to report environmental incidents and problems which may result from (inter alia) the following factors:

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

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

### 8.1.5 Adaptation to Climate Change Risk Assessment (CCRA)

In support of the original EP application a CCRA was completed. The CCRA addresses potential risks that may occur in the event of predicted changes to our climate. Predicted climate changes, which can potentially be extreme, and organisations at risk of these changes need to ensure that they have measures in place to ensure business resilience and continuity.

The CCRA was completed in accordance with Environment Agency (EA) guidance Adapting to Climate Change: risk assessment for your environmental permit[1] and a risk assessment worksheet (Thames River Basin District worksheet, this being the river basin district the data centres are located) was completed.

Based on the 'potential changing climate variables' presented in the worksheet and the potential impact on operations at the data centres, specifically related to the diesel-fired generators and diesel storage, the overall risks were low, with risk scores ranging from 1 – 3; these scores are below the threshold whereby mitigation measures are required to ensure operational resilience against potential climate change impacts. The proposed HH4 Phase 2 generators will not impact the results of this risk assessment.

The CCRA worksheet is included in the NTT ISO14001 Environmental Management System and will be updated on a regular basis. Where there are changes in the level of risk, for example as a result of new climate change predications or changes in site infrastructure, the CCRA worksheet will be updated and if necessary, mitigation measures implemented to reduce risk.

### 8.1.6 Monitoring, Control and Change Management

The primary mechanism that ensures operational control is the Environmental Aspect and Impacts Register (EMS04). Processes and procedures address each significant aspect and generate the information and data necessary to monitor adequately the environmental performance of the data centres and develop an

[1] https://www.gov.uk/guidance/adapting-to-climate-change-risk-assessment-for-your-environmental-permit

understanding of performance so as to identify faults, opportunities for improvement and to optimise maintenance routines.

The EMS provides for the controlled implementation of changes which may have environmental implications. Requests for change are issued to and reviewed by the Compliance Manager to ensure any environmental risked posed by the proposed change will be adequately managed. Final change approval is given by the Chief Operating Officer. Any changes are communicated to staff via their Line Manager and training.

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

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

### 8.1.7 Accident Prevention and Management

NTT has systems in place for managing accidents or incidents. Risks as a result of activities undertaken, or proposed to be undertaken, at the data centres are considered and documented in the Environmental Aspect and Impact Register and via risk assessments (ISO1-F03 USMS). The Environmental Aspect and Impact Register will be updated on issue of the Environmental Permit to reflect any permit requirements.

NTT also has the following in place:

- A Disaster Recovery Plan to counteract potential interruptions to its business activities and to protect critical business processes from the effects of major failures of information systems or disasters. Risk assessments have been undertaken to ensure that the Disaster Recovery Plan has appropriate controls in place;
- A Business Continuity Plan (BCP) which details emergency procedures and the incident management team and responsibilities. The BCP documents the emergency response to be implemented in the event of emergency situations and accidents and includes details of the roles and responsibilities, contact details of key company personnel and emergency services;
- An Incident Management Policy, which details the incident response process, timelines and requirements; and.
- An investigation and root cause analysis process (Action Procedure QM06). QM06 is the action tracker control document where an incident’s root causes, contributary causes and preventative actions are captured.

These documents are all reviewed annually to ensure they are up to date and effective. These documents are available for review on site.

Each generator container unit has a fire detector which is connected to the data centre's control room via the BMS; there are no fire suppression systems in the generator units. The generator engines have a drop weight valve to shut off the fuel supply; in the event of a fire the lead on this drop weight valve would melt and shut off the fuel valve preventing the delivery of fuel to the generators.

Measures are in place at HH4 to minimise the risk of vehicular damage to the generator container units, there is a mandatory speed limit on the site; and with respect to diesel deliveries, these are fully supervised by NTT personnel from the point at which the vehicle arrives at the security access gates and during delivery of diesel to the bulk tanks and/or generator belly tanks.

All Phase 2 generator container units at the HH4 data centre will be located on a raised concrete plinth. The plinths will be raised circa 200mm from floor level. There will also be an intervening louvered wall separating this plant area from the rest of the data centre site which will also add some protection to the generator container units.

### 8.1.8 Inspections

The HH4 generator diesel belly storage tanks and associated delivery pipework are subject to annual inspection by an NTT appointed contractor. NTT completes two daily plant inspections; these inspections include inspection of the generator belly tanks. The findings of these inspections are recorded on an on-line digital form.

The daily visual checks also include any issues in terms of degradation, damage and discolouration to site surfacing and kerbing. NTT has a formal written procedure for the maintenance, testing, inspection of the drains and oil interceptors.

The HH4 Phase 2 generators will be included in this inspection regime.

### 8.1.9 Training

Environmental training relates to both general awareness and job-specific training.

The site is managed by a sufficient number of staff, who are competent to operate the site. In accordance with the EMS:

- All staff have clearly defined roles and responsibilities;
- Records are maintained of the knowledge and skills required for each post;
- Records are maintained of the training and relevant qualifications undertaken by staff to meet the competence requirement of each post; and
- Operations are governed by standard operating instructions.

Each individual's knowledge and skills are 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 are identified, prioritised and planned. Training records are maintained and training needs regularly reviewed.

All contractors and sub-contractors are given appropriate training prior to the commencement of any works or services.

### 8.1.10 Review and Audit

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

The EMS and site activities are internally audited at least annually. Internal audits are carried out by site staff with suitable audit experience and / or training.

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

# 9.0 Monitoring

The HH4 Phase 2 generators will each operate for less than 500 hours per annum and will not be subject to emissions limit values (ELV) for the substances listed in Annex V of Directive 2010/75/EU on industrial emissions (Industrial Emissions Directive, IED).

As the generators will not be used for the elective generation of electricity they will not be considered 'specified generators' in accordance with EPR 2018 and hence will not be subject to the ELV for NOx (190mg/kg (within 10 minutes of the specified generator commencing operation)).

In accordance with the current EP, the HH4 Phase 2 generators will also be monitored for carbon monoxide (CO) and nitrous oxides ($NO_x$) in accordance with the monitoring requirements as stated in EP Table S3.1. The monitoring will be undertaken every 1,500 hours of operation or once every five years (whichever is soonest). This monitoring is required within 4 months of the issue date of the permit or the date when the engine is first put into operation, whichever is later.

In addition, the operator will record:

- the operating hours of each engine;
- the amount of fuel used on an annual basis;
- the estimated annual total emissions of $NO_x$ based on emissions monitoring results;
- the estimated total emissions of $SO_2$ based on the sulphur content of the fuel used.

For the purposes of determining operating hours, the generators are regarded as having minimal start-up or shut-down times. Operational hours will be counted from the first fuel ignition. This will include the shorter periods of plant 'overlap' when redundant plant is started as a precautionary measure before final load is reached with the optimum/minimum number of generators.

## 9.1 Point Source Emissions to Atmosphere

Point source emissions to air are from the generators as a result of diesel combustion. Based on the findings of the air emissions risk assessment (SLR Ref: 410.05391.00011 HH4 Phase 2 AEAR) the products of combustion which will be released to air will not result in an adverse impact on the environment as a result of routine planned maintenance and testing activities.

For operation of the site under an emergency (brown- or black-out) scenario (36-hour and 1-hour modelled), whilst the annual AQAL is not predicted to be exceeded at any of the selected human receptors, it cannot be concluded that there will be no likely significant effects based on the 36-hour emergency scenario. However, as stated previously, it is recognised that such a prolonged emergency scenario is highly unlikely.

The generators will each operate for less than 500 hours per annum and will not be subject to ELVs for the substances listed in Annex V of Directive 2010/75/EU on industrial emissions (Industrial Emissions Directive, IED).

## 9.2 Point Source Emissions to Sewer

HH4 is connected to the municipal sewer system. Discharges to sewer are limited to sanitary effluent (sinks, toilets, cleaning water, etc.). The discharges to sewer at the data centres are not considered to be a trade effluent discharge and monitoring of these discharges is not considered necessary.

### 9.2.1 Point Source Emissions to Water

There are no point source emissions to controlled water at the data centre. Uncontaminated surface water runoff from HH4 is discharged via the on-site surface water drainage system. This run-off passes via a full retention oil interceptor (with an automatic closure device and high-level audible alarm system for oil and silt levels) and a below ground stormwater attenuation tank (700m$^3$) prior to off-site discharge into the Thames Water surface water sewer via the permitted discharge point HH4-SW1.

NTT regularly inspect and clean the interceptor. Installation and operation of the HH4 Phase 2 generators will not result in a change to the drainage arrangements at the data centre. Therefore, change to the current EP monitoring requirements in relation to surface water discharge is not considered necessary.

# 10.0 Best Available Techniques

## 10.1 Basis

The assessment for the implementation for Best Available Techniques (BAT) for Phase 2 at the HH4 data centre is based on the following:

- the latest version of the EA 'Data Centre FAQ Headline Approach, DRAFT version 11.0 H.Tee 11/5/20 – Release to Industry'; and
- with respect to technology selection, Department of Energy & Climate Change, Developing Best Available Techniques for Combustion Plants Operating in the Balancing Market, Final Report, June 2016.

## 10.2 Data centre BAT–- Operating Regime

### 10.2.1 Planned Maintenance and Testing

During operation for planned testing/maintenance at the HH4 data centre, the Phase 2 generators will each operate typically for 23 hours per year; this is substantially below the 50 hour per annum Data centre BAT requirement.

In the event that electricity is not available from the local transmission network (e.g. brown- or black-out) the generators will be operated to deliver the required NTT customer load.

Whilst emergency operation (if required) would increase the total operational hours of each generator, it is extremely unlikely that operation of any single generator would exceed 500 hours per annum (this being the definition of an 'emergency' unit).

The generator provision includes for a level of redundancy to the generator system such that, even in a worse case blackout scenario, whilst all generators would start up they will not operate at full capacity; the operational capacity of the generators at the time of a blackout would be dependent on extent of blackout. Should a generator fail the engine will be covered by the remaining engine/s within the suite/building (should the maximum electrical demand for that building be required).

Emergency operations are taken to include unplanned hours required to come off grid to make emergency repair of electrical infrastructure associated only within the data centres.

The Operator will notify the EA:

- In advance of planned outage/maintenance of the local transmission system that is expected to exceed 18 continuous hours; and
- Upon an incident of unplanned continuous outage that exceeds 18 hours.

### 10.2.2 Elective Electricity Generation

The HH4 Phase 2 generators will not be operated for elective electricity generation.

### 10.2.3 Operating Regime Time Limit

The air emissions modelling (SLR Ref: 410.05391.00011 HH4 Phase 2 AEAR) has confirmed that operational hours of the generators for the planned maintenance and testing regime for all four Hemel Hempstead data centres, including the HH4 Phase 2 generators, will not result in adverse impacts on air quality. NTT will therefore not operate the generators for more than these hours per year for the purpose of planned maintenance and testing.

## 10.3 Data centre BAT: Engine Selection

Diesel-fired generators have been chosen for the provision of emergency back-up energy in the event of a black- or brown out at the facility. A BAT assessment has been undertaken which compares diesel generators to other available technologies to support the chosen technology.

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

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

A comparison of these technology types is presented in Table 10-1. Start up, efficiency and emissions data as stated has been obtained from a report prepared by DECC (Department of Energy & Climate Change, Developing Best Available Techniques for Combustion Plants Operating in the Balancing Market, Final Report, June 2016) unless otherwise stated. Figures are reported at oxygen reference values of 15%.

**Table 10-1**
**Comparison of Technologies**

| | Combined Cycle Gas Turbines (CCGT) | Open Cycle Gas Turbines (OCGT) | Aero Derivative Gas Turbines[2] | Gas Engines | Diesel Engines |
|---|---|---|---|---|---|
| **Process Description** | CCGT technology uses a primary gas turbine coupled to a secondary steam turbine.<br><br>Air is compressed through a rotating compressor, then mixed with fuel and combusted before being expanded through a gas turbine, converting the thermal energy into rotation of the turbine blades. Some of the mechanical energy powers the compressor, with the majority turning a generator which converts the mechanical energy to electricity. | OCGT consist of a compressor, combustion chamber and gas turbine. They differ from CCGTs in that they operate without the secondary component to recover heat.<br><br>Air is fed into the compressor, pressurised and then passed to the combustion chamber where fuel is added and combusted. The hot exhaust gas turns the turbine blades and energy is converted to electricity.<br><br>OCGTs can provide STOR and peaking services but not fast reserve services as during start-up thermal stresses need to be managed through a slow heating up process. | Aero Derivative Gas Turbines are similar to open cycle gas turbines but have been derived from turbines used for aeronautical applications.<br><br>As a result of the different requirements for use of gas turbines in aircraft, they are more flexible than OCGT plant, and are able to operate under wider ranges of load and start up and shut down quicker than other turbines. | A gas engine consists of a bank of fixed cylinders inside which pistons move, injecting air and fuel, compressing the mixture, igniting the mixture and then expanding the hot gas produced converting the thermal energy into rotation of a crank shaft.<br><br>The engine load is adjusted by controlling the amount of gas and air injected into the cylinder, which is controlled by an automated system.<br><br>A generator connected to the crank shaft of the engine converts the mechanical energy into electricity. | Diesel engines work in a similar fashion to gas engines with the key difference being that diesel fuel is injected into the cylinder after compression of the air has taken place, and automatically ignites as a result of the high temperature of the compressed air.<br><br>Engines are generally rated for a continuous power output, but can exceed this by stated amounts for shorter periods of time in modes named Standby (1hr maximum) and Prime (12hr maximum). These higher power outputs come at the cost of higher emissions and greater equipment stress. |

| | Combined Cycle Gas Turbines (CCGT) | Open Cycle Gas Turbines (OCGT) | Aero Derivative Gas Turbines2 | Gas Engines | Diesel Engines |
|---|---|---|---|---|---|
| | The hot turbine exhaust gases then pass through a boiler to generate steam. The steam is fed to a steam turbine which powers a second generator, producing further electricity. | | | | |
| **Start-Up Time[3]** | 1 – >3.5 hours | 15 -30 minutes | As low as 1 minute | 1-10 minutes | >10 minutes |
| **Thermal Efficiency (LHV%)** | 58.8-60.7 | 38.3-39.9 | 35-39 | 35.0-45.0 | 35.0-37.0 |
| **Notes** | The secondary steam turbine increases the start-up time of the facility, as it requires slow warming.<br><br>The complexity and footprint of a combined cycle, combined with the efficiency of steam cycles only being high at relatively large capacities means that CCGT systems are only suitable for large facilities (c.100MW+) | The significant amount of heat lost in the exhaust gas makes open cycle gas turbines significantly less efficient than combined cycle systems. | As with the open-cycle gas turbine, heat loss in exhaust gases means these systems are not as efficient as other options. Certain enhancements can be added, e.g., steam injection, but these are relatively novel and difficult to apply in a non-continuous scenario. | Gas engines are proven, reliable technology and are known to perform well and emit relatively low amounts of $NO_x$, $SO_x$ and particulates when compared to diesel fired engines. | Diesel engines, unabated, emit relatively high amounts of $SO_2$ and particulate matter as well as $NO_x$. The use of low sulphur fuel, catalysts and particle filters can reduce this but diesel engine emissions are considerably higher than other options. |

### 10.3.1 Technology Selection

#### Gas Turbines

As per Table 10-1, CCGTs are not considered BAT for the provision of emergency/standby power. This is due to their lengthy start up times and their size limitations; the efficiency of steam cycles being relatively low at small capacity and the overall system complexity being more appropriate to larger size installations.

OCGTs have relatively high capital investment, operating and maintenance costs and lower thermal efficiencies than can be achieved by CCGTs and gas engines.

Aero derivative gas turbines can achieve suitably short start-up times of as low as one minute, however they suffer from relatively low efficiencies compared to engines and the enhancements which have recently become available to improve these are relatively novel and unproven. This is especially applicable for non-continuous operation, where steam or water injection may become a problem as a result of potential condensation within turbine sections.

#### Reciprocating Engines

Reciprocating engines perform well in terms of their thermal efficiencies. At the upper end of their efficiency range, gas engines have higher thermal efficiencies than diesel engines and OCGTs.

Reciprocating engines also have shorter start up times and are thus more suitable for the provision of emergency/standby power. Under standby conditions, higher emissions are produced, including NOx, SO2 and Particulate Matter as soot.

Gas engines benefit from lower NOx emissions than diesel engines and can utilise gas delivered by the national gas grid, avoiding the additional transport and fuel storage issues associated with diesel systems.

Reciprocating engines fired on diesel fuel oil have a high response (i.e. low start-up duration) and good independent performance reliability due to the on-site storage of diesel fuel in sufficient quantities, which will be managed and controlled by the facility, with the option for fuel oil to be sourced from more than one supplier for delivery to the site. Diesel-fired engines do have a large number of moving parts which can be subject to failure and require regular ongoing maintenance to ensure reliability, however these moving parts can be readily obtained and replaced and are typically included as part of the service agreement with the generator vendor. Due to the number of moving parts, diesel generators when operated can be noisy and generate vibration.

When compared to gas-fired generators diesel engines produce polluting emissions to air, most notably NOx and particulate matter, which can impact local air quality if operated for prolonged periods of time.

#### Final Choice of Engine

From the above options, and considering all the aspects required of the plant to provide emergency/standby power for the HH4 data centre, diesel engines have been determined as BAT on the basis that:

- These engines provide a fast response speed to the required load; as stated previously, fast start-up of standby generators for data centres is fundamental as an almost instantaneous supply of electricity is required in the event of power loss to the site.
- The need for a reliable supply of fuel (diesel) is essential to ensure reliance, the on-site storage of sufficient quantities of diesel fuel provides the required level of independent performance reliability.
- Diesel engines have low maintenance costs and replacement parts are readily available.

## 10.4 Data centre BAT: Emissions

The '*Data Centre FAQ Headline Approach*' specifies the BAT emissions specification for new diesel-fired reciprocating engines as TA-Luft 2g (or equivalent standard).

The Phase 2 generators at HH4 do accord with the TA-Luft 2g standard and are therefore considered to be BAT.

Retrofit abatement techniques for existing installations for engine emissions such as selective non-catalytic or catalytic reduction (SNCR or SCR) are not applicable to emergency/standby plant.

NTT will report the following to the EA (annually):

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

Given the short start-up and shutdown times for diesel engines, the generators are regarded, for the purposes of determining operating hours, as commencing operation at the first fuel ignition. This is taken to include the shorter periods of plant 'overlap' when engines provided as redundancy are started as a precautionary measure before final load is reached with the optimum/minimum number of generators.

The emissions from the site will be estimated using emissions factors, as discussed in Section 6.0.

## 10.5 Data centre BAT: Stacks

*Data Centre FAQ Headline Approach* acknowledges that data centres usually have very low profile sites and as such can have short, below roof level emission stacks and that this can impact on the efficiency of dispersion of emissions and BAT is that release stacks are vertical to aid the dispersion of emissions from the generators.

By elevating stack heights it is possible to increase the dispersion of exhaust gases as a result of mixing with the surrounding air once the plume of exhaust gases leaves the stack. Whilst this will not reduce the concentration of pollutants leaving the stack, it will result in a lower concentration at ground level – i.e. a lesser impact on the receptor. Increasing the stack height also avoids the effects of building wake and entrainment of the emissions in the locality of the emission source. The use of taller stacks does have an impact on the operation of the engine(s) as it will marginally increase the back pressure on the engine.

The reduction in ground level concentration is achieved through improved mixing with the surrounding air once the plume of exhaust gases leaves the stack. As there will be a higher mass flowrate of gases, there is a greater momentum that increases the final height of the plume after it has left the aggregated stack. This increased mixing leads to a lower concentration of pollutants at receptors.

Each generator has a dedicated stack to aid the dispersion of the engine flue gases (for further details, please see the Air Emissions Risk Assessment (SLR Ref: 410.05391.00011 HH4 Phase 2 AERA):

- The stack release heights for the Phase 2 generators at the proposed HH4 data centre are 12.0 m above ground level.

These stacks are vertical and located on the roofs of the generator container units. The stacks at the HH4 data centre will terminate just below the roof height level.

The AERA has taken into account the profiles and heights of all the stacks and building downwash impacts at the HH4 data centre and has concluded that:

- For planned maintenance and testing there will not be significant impacts on air quality;
- For the highly unlikely 36-hour 'electrical grid outage' operational hours NOx emissions would result in impacts on air quality and as such on local sensitive receptors (as identified in the AERA)).

Further air emissions controls are not considered necessary as, given the very low probability of emergency operation at the data centres, the overall environmental risk is not considered to be significant[2].

## 10.6 Data centre BAT: Electrical System Reliability

Sections 3.0 provides a description of the on-site electricity supply system for HH4 which has been implemented to service the 'customer load' that, in addition to the generators, incorporates physical connections to the local transmission network (to allow for the failure of any single connection).

The system for HH4 provides significant protection against the failure of (or fluctuation in) the electrical supply to the site, before it would become necessary to start the generators.

HH4 is certified under ISO/IEC 27001:2013 that specifies the requirements for establishing, implementing, maintaining and continually improving an information security management system.

Operation of the existing generators at the HH4 data centre was limited to planned maintenance and testing; operation was not required for unplanned events.

## 10.7 Data centre BAT: Air Quality Emergency Action Plan

NTT in accordance with the EP will develop an Air Quality Emergency Action Plan (AQEAP) to cover all four data centres; this will include the HH4 Phase 2 generators. The AQEAP will detail the management actions to be taken in the event of an emergency outage that could result in the prolonged usage of the generators which could potentially result in adverse impacts on local air quality.

NTT will liaise with the Local Authority and the Environment Agency to agree actions to be taken in the event of a prolonged outage situation (>18 hours) and a finalised plan will be incorporated into the site's environmental management system.

NTT will maintain open lines of communication with the Local Authority, particularly to manage any risks that may be identified in the future as becoming significant threats to the local air quality, for example:

- Identification of new emissions sources (cumulative impacts);
- Prior notification of full in-service tests; and
- Potential for future site expansion.

## 10.8 Data centre BAT: Fuel Storage

There is no bulk storage of diesel at the HH4 data centre. Diesel is stored in the generator 'belly tanks' which holds the diesel supply to individual generators.

The Phase 2 generators will be sited in specifically designed container units at the HH4 data centre, and will be located within the existing dedicated Plant Area, along with the existing Phase 1 generators. This Plant Area is hard surfaced with concrete and provided with security fencing which restricts access to authorised personnel only.

The generator containment units will be raised off ground level on concrete plinths or located within steel fenced areas to which vehicular access is not permitted, all of which will act to protect the container units from vehicular damage. For raised container units, steel access steps and walkways will be provided to enable personnel to gain access to the containers.

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[2] See Air Emissions Risk Assessment (SLR Ref: 410.05391.00011 HH4 Phase 2 AEAR) and Environmental Risk Assessment (SLR Ref: 410.05391.00011 ERA).

It is considered that diesel delivery and storage arrangements are BAT. The fuel storage arrangements for diesel for the Phase 2 generators at HH4 are summarised below.

### 10.8.1 Generator Belly Tanks

The Phase 2 generators will be housed within propriety steel container units located in the external Plant Area. This area is hard surfaced with concrete and provided with security fencing which restricts access to authorised personnel only.

Beneath the floor of the container unit for each generator will be a belly tank, which is integral to the generator container unit, this will automatically supply diesel to the generator.

The HH4 Phase 2 generator belly tanks will be filled directly from refuelling vehicles (the fuel being delivered by a NTT appointed fuel supplier). Fuel will be delivered directly to the belly tanks via fill points which will be located on the generator container units; these will be positioned in lockable cabinets designed with drip trays. The tank fill point cabinets remain locked when not in use.

The HH4 Phase 2 generator diesel belly tanks will have the following protection measures:

- The belly tanks will have secondary containment measures; this containment will be alarmed to detect any releases of diesel into the bund;
- Fill points will be located in a lockable cabinet provided with a drip tray designed to capture any minor spillages from the fill point during fuel delivery, which is integral to the generator container unit. The tank fill point cabinets will remain locked when not in use;
- Tank level gauge;
- High and low level alarms connected to the BMS and the generator container units;
- A pressure delivery over-fill prevention valve;
- Leak detection alarms connected to the BMS;
- The generator sets will have pressure relief valves to prevent over pressurisation of diesel supplied from the belly tanks; and.
- To minimise the risk or corrosion all pipework is painted or is constructed of corrosion resistant material.

The container units will be designed to have a belly tank located at the base of the generator container unit. The generator engine will be located in the engine compartment of the container unit sited above the belly tank.

The generator belly tanks will be designed to British Standard BS799 Part 5 1987 (Oil Burning Equipment. Specification for Oil Storage Tanks), which stipulates a requirement for 110% containment. The belly tanks will be certified to this standard. The belly tanks are therefore considered to comply with the Oil Storage Regulations.

A drawing which includes details of the containment arrangements for the Kohler T2500 generator container unit at HH4 is provided in Appendix 04.

Tertiary containment will be provided by the hardstanding of the external areas where these generators and belly tanks will be located. In addition to these measures, the surface water drainage system serving the area where the generators are to be located includes a full retention interceptor with oil detection alarm and automatic closure device, and an on-site rainwater attenuation tank; these measures will act to contain on-site an unplanned release of diesel from a generator belly tank.

There will be no bulk storage of diesel at the HH4 data centre.

Deliveries of diesel from NTT approved suppliers is undertaken in accordance with procedure HS12-P02 Diesel oil delivery procedure. This procedure requires an NTT engineer (CFM Engineer) to escort the fuel tanker to the relevant delivery tank, to unlock and open the tank fill point and to test the tank's high- level alarm is working, only then will the fuel delivery driver be allowed to connect the tanker delivery hose and deliver the fuel. Following delivery of the fuel the tanker driver is required to ensure that the delivery hose is 'blown down' to remove any residual diesel in the hose and thus avoid fuel spillage on disconnection. The fuel supplier is required to ensure that a fuel spill kit is available on the fuel delivery vehicle. In addition, NTT has onsite spill kits.

### 10.8.2 Inspection, Maintenance and Testing of Containment on Tanks

The HH4 Phase 2 generator unit belly tanks will be subject to the same annual visual inspection, completed by an NTT appointed contractor, as the currently permitted generators. The annual inspection will include visually checking for the following:

- Leaks
- Rust
- Splits or cracks
- Bulging
- Operation of gauges
- Subsidence on tank base
- Tanks overgrown with foliage
- Strong fuel smell.

It is considered that diesel delivery and storage arrangements at the data centres are BAT.

### 10.8.3 Preventative and Predictive Maintenance

NTT has a preventative maintenance system, PPM is managed and completed by the facilities management personnel and appointed approved third-party specialists, as required. The PPM system is used to inform FM personnel of plant status and any system issues. There is a central Control Room at HH4; Control Room personnel are responsible for the following:

- Issue of all permits for plant modification and repair (the permit issuers also control and approve Risk Analysis and Method Statements (RAMS));
- Monitoring of all fuel deliveries;
- Monitoring tank levels, flow rates, tank level alarms and leak alarms; and
- Control and monitoring of all fuel transfers between bulk diesel tanks and day tanks.

The PPM system includes the requirement for checks of storage tanks and associated infrastructure, this includes the visual inspection of the bulk tanks on day and night shifts during the plant check walk round by the Facilities Management (FM) engineer, the results of which are recorded on the 'PIPE System Check'.

The facility is manned 24 hours a day by FM personnel.

Suitably experienced and trained maintenance personnel and an NTT subcontractor will also undertake the following to reduce emissions to air from the HH4 Phase 2 generators:

- Visually check for black smoke. The subcontractor will check for smoke from the generator exhaust and record their findings during testing. The NTT engineers will also visually check for black smoke from the generator exhausts during the monthly generator runs; if any black or white smoke is noted this will be reported for further investigation.

- Ensure that the generators are operated for the minimal amount of time to complete the required maintenance requirement/test (maintenance and testing of the generators is completed in accordance with manufacturer requirements to ensure optimal performance and efficient combustion); this approach minimises both diesel fuel consumption by the generators and generation of combustion emissions to air.

Furthermore, to limit the generation of emissions to air the routine testing and maintenance regime ensures that a limited number of generators are subject to planned maintenance and testing at any one time. The PPM and testing regime at all four permitted Hemel Hempstead data centres is managed via PPM software (CAFM). The planned maintenance and testing regime for the generators is scheduled so that:

- Testing and maintenance is completed at one data centre at a time by NTT and the NTT appointed specialist contractor; and
- For HH4 no more than 2 generators are tested each day and only one generator is tested at a time (an exception to this is the annual black building test which occurs for 20 minutes on an annual basis. For HH4 this test requires all generators to be operated for up to 20 minutes).

# 11.0 Conclusion

Based on the above discussions, it is considered that NTT will operate the HH4 Phase 2 generators and associated diesel storage arrangements in accordance with all relevant BAT.

# APPENDIX 01

Kohler T2500 Specification

# APPENDIX 02

HH4 Drainage Plan

# APPENDIX 03

Environmental Management System ISO14001 Certificate

# APPENDIX 04

Kohler 2500 Belly Tank Drawing

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