Permitting Decisions- Bespoke Permit

We have decided to grant the permit for Hemel Hempstead Data Centres operated by NTT Global Data Centers EMEA UK Limited.

The permit number is EPR/BP3800PZ/A001.

The application is for the operation of four data centres north-east of Hemel Hempstead town centre. These data centres and their total thermal input are:

- Campus Data Centre, Spring Way, Hemel Hempstead, HP2 7UP:
    - 2 MTU X1000 generators each with thermal input of 2.49 MWth;
    - 13 Kohler KD1800 generators each with thermal input of 4.1 MWth;
    - 16 MTU X1850 generators each with thermal input of 4.14 MWth.

    (31 generators in total with total thermal input of 124.52 MWth).

- Centro Data Centre, 3 Boundary Way, Hemel Hempstead, HP2 7SU:
    - 4 MTU X1000 generators each with thermal input of 2.49 MWth.

    (4 generators in total with total thermal input of 9.96 MWth).

- Maylands Data Centre, 150 Maylands Avenue, Hemel Hempstead, HP2 7DF:
    - 4 MTU X1000 generators each with thermal input of 2.49 MWth;
    - 10 MTU 2200 generators each with thermal input of 4.98 MWth.

    (14 generators with total thermal input of 59.76 MWth).

- Hemel Hempstead 4 (HH4) Data Centre (Phase 1), Prologis Park, Hemel Hempstead, HP2 7EQ:
    - 15 Kohler T2500 generators each with thermal input of 4.76 MWth.

    (15 generators with total thermal input of 71.4 MWth).

The default generator specification as a minimum for new plant to minimise the impacts of emissions to air (NOx) is 2g TA-Luft (or equivalent standard) or an equivalent NOx emission concentration of 2000 mg/m^3. The operator has confirmed that all generators in use in the four datacentres (including HH4 phase 1) are either compliant with the 2g TA-Luft standard or equivalent EPA Tier II standard.

At the time the operator submitted the application for permitting (July 2020), Campus, Centro and Maylands datacentres were already in operation and HH4 datacentre was under construction.

The applicant changed the scope of the proposed operation at the HH4 data centre during the determination of the application. Originally they proposed there would be 32 generators at HH4 with a total thermal input of 131.2 MWth installed in two phases (15 generators in one phase and 17 generators in the other phase). This was revised to 30 generators in total being installed in two equal phases of 15 generators per phase. Each phase would have a thermal input of 71.4 MWth (142.8 MWth in total for the entire HH4 site).

As the total thermal input and the total diesel storage capacity in the proposed reconfigured HH4 site would exceed that proposed in the original application, environmental risk would change and could have been greater than that assessed as acceptable in the determination of the original HH4 scope. We have therefore decided to permit only phase 1 of the HH4 data centre as the applicant has demonstrated that the environmental risk from phase 1 is no greater than that already assessed for the original scope of HH4 in the original application. Should the applicant require phase 2 of HH4 data centre to be permitted, they must apply for a substantial variation to the existing environmental permit for the Hemel Hempstead data centres.

Operation of the data centres will be regulated as a Section 1.1 Part A (1) (a) activity under The Environmental Permitting (England and Wales) Regulations 2016 for the burning of any fuel in an appliance with a rated thermal input of 50 or more megawatts (MW). The thermal input of three of the data centres is greater than 50 MW in their own right. Although the thermal input of the Centro Datacentre is less than 50 MW, it will be aggregated with the thermal input of the other data centres (see Key Issues, Nature of the Site).

The generators will supply emergency power to the data centres in the event of National Grid failure. In non-emergency scenarios, they will be operated only for testing and maintenance purposes to an agreed schedule. They will not provide any electricity themselves to the National Grid and all electricity generated will be used within the datacentres.

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

Purpose of this document

This decision document provides a record of the decision-making process. It:

- summarises the decision making process in the decision considerations section to show how the main relevant factors have been taken into account
- highlights key issues in the determination
- shows how we have considered the consultation responses.

Unless the decision document specifies otherwise we have accepted the applicant’s proposals.

Read the permitting decisions in conjunction with the environmental permit.

Key issues of the decision

Nature of the site.

The operator applied to permit all four datacentres as the same site within a single environmental permit.

Our existing guidance, “Data Centre FAQ Headline Approach”, notes in Section 1.3.5 that several premises located over an area within a commercial/urban environment can be designated as the “same site” on an assessment of proximity, coherence and management systems.

According to this guidance, there are no simple distance criteria that demonstrate proximity - rather a site specific decision based on a reasonable interpretation. As an example, it is stated that proximity can be understood as “immediately adjacent to” or “a road width” or “uninterrupted line of sight between buildings”. Based on these criteria, Campus and Centro are close enough to be considered the “same site”. Maylands and HH4 sites are located further from the Campus and Centro sites and do not meet the definition of proximity in our guidance.

Where there is greater physical separation, our guidance states that more coherence and management links are required.

The operation of the generators at each site would produce electricity for each site alone. There is no electricity shared between the four sites. There are no direct and dedicated power links shared between all four data centres. There is no sharing of physical resources such as fuel storage tanks between the four sites. Each datacentre will be totally independent of the other Hemel Hempstead datacentres. In fact this independence of physical resources is required by the operator for datacentre resilience purposes. There is therefore limited coherence between these sites.

NTT is certified to ISO standards (ISO/IEC 27001:2013; ISO 14001:2015 and ISO 9001:2015) at group level and these certified standards are applicable to all the NTT Hemel Hempstead datacentres. There is a single environmental policy applicable to the entire NTT Group. There are core Environmental Management System (EMS) documents that are applicable to all NTT datacentre sites such as those on staff competence, document control and internal audits. Separate procedures have been developed where there are site-specific requirements at datacentres such as maintenance and testing procedures.

The operation and accreditation of these management systems are no different to those observed in companies with multiple sites located across a wide geographical area and do not constitute a level of management system control that would demonstrate that the four Hemel Hempstead datacentres should be considered as one site.

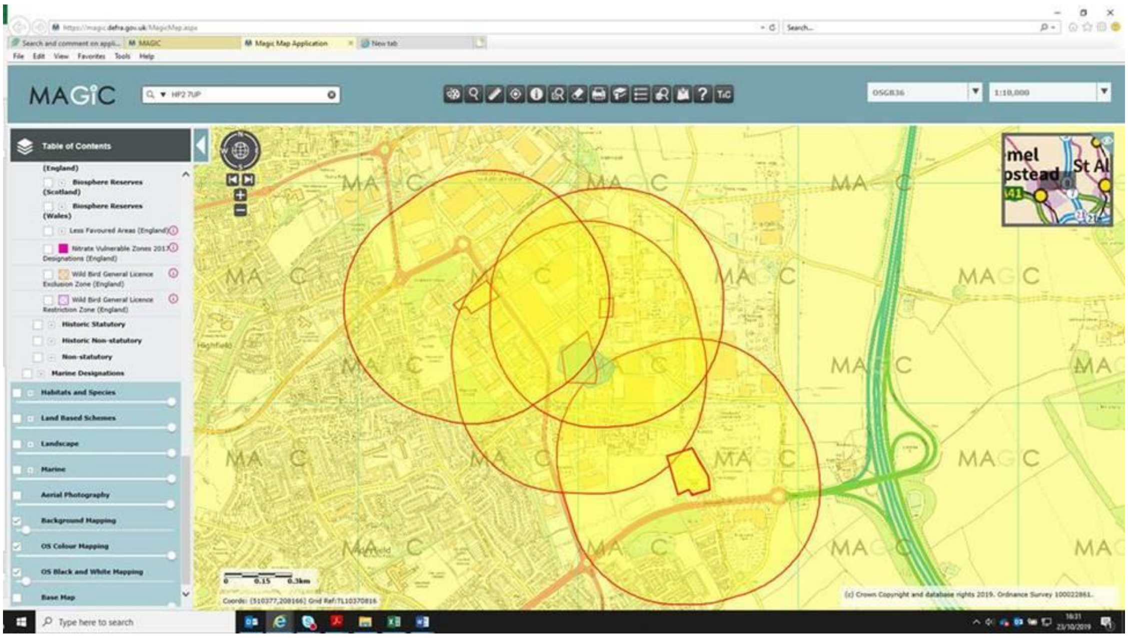
Campus and HH4 datacentres have their own dedicated staff including security and maintenance teams. The Maylands and Centro datacentres are effectively treated as a single datacentre for operational proposes and do share staff.

We have decided that the four Hemel Hempstead datacentres do not meet the criteria for proximity, coherence and management systems required for multiple sites to be defined as a single site. It is our decision therefore that the four NTT datacentres are not located on “one site”.

Although we do not consider them to be “one site”, we have chosen in this instance to include all four NTT Hemel Hempstead datacentres in the one permit because:

- The individual permitted activities are the operation of the generators at the data centres and they will therefore only run in very limited circumstances;
- When they do run, the sites share sensitive receptors and the air dispersion modelling shows there is an overlap in impacts so we consider there are environmental benefits to us taking this approach in this instance.
- We consider some of the data centres ‘one site’ (Campus and Centro) and we don’t consider the addition of the other ones to be a significant addition of regulatory input for us due to their limited operation.

We have decided on this method of permitting these sites for the reasons given above. This approach is not applicable to other permitting sectors.



<u>Best Available Techniques (BAT) Assessment – Emergency Power Provision on Site.</u>

The operator carried out a BAT assessment of the viable technologies capable of providing emergency power at the data centre.

They considered the following technologies:

- Combined cycle gas turbines (CCGT);

- Open cycle gas turbines;
- Aero derivative gas turbines;
- Gas engines;
- Diesel engines.

They compared these technologies against the following considerations:

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

The operator demonstrated there were significant reasons for not selecting combined cycle gas turbines, open cycle gas turbines and aero derivative gas turbines. However both gas engines and diesel engines provided the fast response speed required but the diesel engines had a significantly greater environmental impact from gaseous releases.

The operator further justified the choice of diesel over gas as a fuel for the engines because it allowed the required level of resilience at the datacentres. The NTT datacentre customer contracts were based on the requirement for each datacentre to have on-site sufficient energy storage to provide up to 36 hours of fuel supply for the generators in the event of an unplanned emergency situation.

The storage of sufficient gas on-site as a fuel source was not possible due to restraints on available space. Additionally there were increased health and safety risks associated with such storage. There would be reliance on an off-site supply of gas, which would have to be provided to the sites via a pipeline operated and maintained by a third party. Should this supply of gas be interrupted there would be no emergency back-up generation for the sites, and as such would not meet the resilience requirements of the facilities.

From the options considered, the applicant therefore demonstrated that diesel engines were BAT to provide emergency/standby power for the datacentres on the basis that:

- These engines provide a fast response speed to the required load (fast start-up of standby generators for datacentres is fundamental to their operation 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 on site).
- Diesel engines have low maintenance costs and replacement parts are readily available.

Based on this assessment and the fact that diesel generators are presently a commonly used technology for standby generators in data centres, we accept that diesel fired generators can be considered BAT.

The operator has justified the use across the four datacentres of a larger number of smaller generators rather than fewer but larger generators:

- A larger number of smaller generators allows them the flexibility to achieve the required electrical output in the event of an emergency situation with only the necessary number of generators operating to deliver the required electrical load. This would result in reduced consumption of diesel and hence generation of less emissions to air from the generators.

- The generators have been selected based on the customer demand and the required electrical load for each datacentre suite. This ensures that the generators are operated at their optimal design capacity. Operating diesel generator sets at low loads for extended periods of time can potentially impact uptime and engine life.

- The datacentres operate with various levels of redundancy to ensure that, in the event of failure of a generator at a datacentre, the correct number of remaining generators will in an emergency event provide the required load. To achieve the stated levels of redundancy with larger generators, the overall capacity of the generators would be higher and additionally the level of reliability would be reduced if a smaller number of larger generators were in place.

- As part of the annual maintenance programme, testing of the generators throughout the year for short periods of time is required. To minimise the mass emission rate to air of combustion emissions and potential adverse impacts on air quality, NTT tests a small number of generators together in a phased manner. The ability for a phased approach to maintenance and testing would be reduced if a smaller number of larger generators were in place, with potentially a greater mass emission rate of combustion pollutants to air at any one time from larger generators during testing and maintenance.

Based on this assessment of providing only the required amount of electrical output at any time in the most flexible of circumstances, we accept that the use of a large number of smaller capacity generators is BAT in these circumstances.

Managing emissions.

The operator has taken further measures to minimise emissions from the diesel generators both in emergency and test/maintenance operation.

The operator has confirmed that all generators in use in the four datacentres (including HH4 phase 1) are either compliant with the 2g TA-Luft standard or equivalent EPA Tier II standard to deliver NOx releases of no greater than 2,000 mg/m^3.

Retrofitting abatement techniques such as selective catalytic reduction (SCR) onto existing power generation technologies would not normally be expected for standby plant to mitigate the emission of standby/emergency operation.

Air Quality.

Applicant’s assessment of potential impact on air quality:

The applicant submitted an Air Emissions Risk Assessment which considered the potential impacts of NOx, nitrogen deposition and acid deposition on relevant sensitive human health and ecological receptors within the defined screening distances.

They considered 48 human health receptors including residential properties (both existing and proposed), cafes, hotels, day care centres, and allotments.

They considered the following protected European site:

- Chilterns Beechwoods (Special Area of Conservation).

and the following local sites:

- 1 Local Nature Reserves
    - Howe Grove Wood.

- 9 Local Wildlife Sites:
  - Disused railway line, Hemel Hempstead; Nicky Way, Dismantled Railway;
  - High Wood; Woodhall Wood; Widmore Wood; Maylands Wood;
  - Paradise Fields Central; Rant Meadow Wood/Bennets End Pit;
  - Holy Trinity Church, Leverstock Green.

- 1 Ancient Woodland
  - Unnamed Ancient Woodland.

The data centre is not situated in an Air Quality Management Area (AQMA) and there are no AQMAs within 2km of the site. The closest AQMA is St. Albans No.2 declared as a result of exceedances of the annual mean NO_2. This is located about 3.2 km south east of the four NTT datacentre sites.

NTT assessed two scenarios:

- Scenario 1 (Routine maintenance scenario - the predictable, managed testing and maintenance activity for the generators);

  - Maintenance Schedule 1 – 1 suite of generators at Maylands, 1 suite of generators at Centro, 1 suite of generators at Campus, 1 suite of generators at HH4 have been modelled operating continuously. The annual mean and 1-hour mean impacts are assessed to account for 13 hours (monthly maintenance 12hrs and black building test). This will be up to a maximum of 169 hours at any one site based on Campus having 13 suites including a pair of X1000 generators located at Campus.

  - Maintenance Schedule 2 – 1 suite at Maylands, 1 suite at Centro, 1 suite at Campus, 1 suite at HH4 have been modelled operating continuously. The annual mean and 1-hour mean impacts are assessed to account for 16 hours (monthly maintenance 12hrs and annual load test). This will be up to a maximum of 512 hours at any one site based on HH4 having 32 generators including a pair of X1000 generators located at Campus.

- Scenario 2 (Electrical grid outage of 500 hours – the maximum number of hours permitted for emergency operation. All generators (minus redundancies) operate simultaneously across all sites).

They made the following assumptions regarding the maintenance and operational scenarios to ensure a conservative assessment was undertaken:

- All gensets were modelled at full load which is not the case for uninterruptable power supply (UPS) wrap round maintenance;
- Gensets were assumed to be operating simultaneously at each site which is unlikely to be the case;
- The genset suite configurations that led to the highest mass emission rates at each site were modelled.

The applicant modelled site emissions for every hour in each year of assessment to ensure that site operations coincided with the worst case meteorological conditions.

Following further application determination discussions, they expanded their assessment to include the impacts of nitrogen oxides (NOx), particulate matter (PM_{10} and $PM_{2.5}$) and carbon monoxide (CO). The potential impact of sulphur dioxide (SO_2) was not considered due to the use of low sulphur fuel in the generators.

Their conclusions were:

Impact on Human Health Receptors:

Scenario 1:

Maintenance/Testing Scenarios:

- The annual mean NO_2 AQAL (air quality assessment level) is not predicted to be exceeded at any of the human health receptors;
- There were no exceedances of PM_{10}, $PM_{2.5}$, or CO air quality assessment levels;
- Statistical analysis of the probability of exceedance of the 1-hour mean NO_2 AQAL predicted exceedances were highly unlikely at all modelled sensitive human health receptors

500 Hours Electrical Grid Outage Scenario:

- The annual mean AQAL for NO_2 was not predicted to be exceeded at any of the selected human health receptors;
- Statistical analysis indicated there was potential for exceedances of the 1-hour mean for NO_2 at sensitive receptors;
- There were no exceedances of the air quality assessment levels for PM_{10}, $PM_{2.5}$, or CO.

Although the permit would authorise up to 500 hours operation of the generators under emergency conditions and therefore 500 hours operation would be a worst case scenario we did not believe that modelling 500 hours operation would give a realistic picture of national grid outages. The three operational sites have never simultaneously experienced operation of the generators in response to an emergency outage scenario since these sites commenced operation.

The applicant therefore submitted additional modelling of the impacts of NO_2 releases at both 1-hour and 36-hour emergency operation. The latter period was chosen as the data centres are contracted to hold enough diesel on site at any time for 36 hours operation of the generators.

With regard to the 1-hour mean NO_2 releases, this additional modelling indicated the probability of exceedance (greater than the permitted number of 18 exceedances of the 1-hour limit in a calendar year) was <0.1% for both 1-hour and 36-hour emergency outages and therefore was 'highly unlikely'.

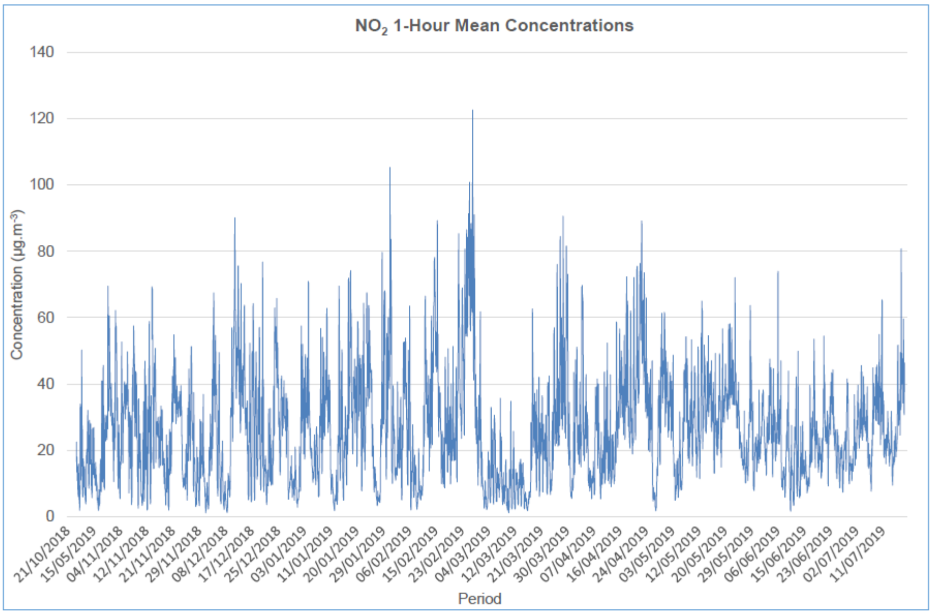
The applicant has proposed that these 1-hour and 36-hour outage scenarios have helped refine the precautionary approach to an electrical outage with the more realistic emergency scenario being effectively 1-hour. They demonstrate that any outage less than 36 hours results in the risk of an exceedance being less than 5% and therefore 'unlikely'.

Under their new 'realistic' emergency outage scenario (1-hour outage):

- Assessment against annual mean limit value results in no exceedance;
- Assessment against 1-hour mean (99.8%ile) limit value results in exceedances of <1% and therefore 'highly unlikely';
- Assessment against 1-hour mean (100%ile) indicates that the probability of a grid outage coinciding with the worst hours in the year for dispersion resulting in 100%ile impact is again <1% and therefore 'highly unlikely'.

Even these modelled electrical outages are most probably worst case as the applicant carried out further research into National Grid outages in England using the report, "National Electricity Transmission System Performance Report 2019-20". This stated that the overall reliability of supply for the national electricity transmission system in 2019-2020 was 99.999967%. During this time period there were 586 events where transmission circuits were disconnected either automatically or by urgent manual switching, the vast majority of which did not have an impact on electricity users, with only 20 such events resulting in loss of supply to customers. Of these 586 events, 355 events were related to the transmission system serving England and Wales in 2019 – 2020, affecting supplies to only 9 customers. The overall reliability of supply for this transmission system in 2019-2020 was 99.999974%. The report summarised incidents in England and Wales, the longest of which was when power was lost for 35 minutes and 26 seconds on the 19th February 2020.

Furthermore, the Environment Agency has located an ambient air monitor in Hemel Hempstead close to the NTT data centres and has issued a report on this monitoring, "Study of Ambient Air Quality at Hemel Hempstead 18 October 2018 to 18 July 2019). The applicant has compared their modelled NOx predictions to those values actually monitored for the same reporting period. The monitor was located an area where the modelling predictions indicated a 100%ile NO_2 of 800 µg/m^3. However the monitoring report demonstrated NO_2 levels were much lower than this with hourly mean concentrations reaching only 120 µg/m^3.



This would confirm the applicant's contention that their modelling report is highly precautionary and that the risks from NOx releases exceeding statutory emission limits set for human health are actually much lower.

We have included an improvement condition (IC7) requiring the operator to submit a report verifying the predicted short-term nitrogen oxides concentrations (nitrogen dioxide and nitrogen monoxide) at the boundary of the site to confirm that the actual concentrations are less than those predicted in the modelling report.

<u>Impacts on Ecological Receptors:</u>

<u>Maintenance/Testing Scenarios:</u>

- The PCs were below 1% of the annual NOx critical level of 30 µg/m^3 for the European designated Special Area of Conservation (SAC) (Chilterns Beechwoods);
- The PCs were below the daily NOx critical level of 75 µg/m^3 at the Chilterns Beechwoods SAC;
- The PCs were above 100% of the annual NOx critical levels for a number of local wildlife sites (LWSs) but the probability of exceedance was <1% and therefore 'highly unlikely';
- Acid deposition and nutrient nitrogen deposition did not exceed the relevant critical loads and were therefore 'insignificant'.

500 Hours Electrical Grid Outage Scenario:

- The PC did not exceed 1% of the annual mean Critical level (CLe) at the SAC (Chilterns Beechwoods);
- The maximum daily PC did exceed 10% of the daily mean CLe, the maximum daily PC exceeded 10% of the daily mean CLe and the PEC (predicted environmental concentration) exceeded the CLe meaning that it could not therefore be concluded that there was ‘no likely significant effect’ at the SAC (Chilterns Beechwoods);
- The PC did not exceed 100% of the annual mean CLe at the Local Wildlife Sites (LWS). However there was a risk of exceedance of the daily mean CLe for 24-hour continuous operation and therefore it could not be concluded there was ‘no significant pollution’;
- Acid deposition and nutrient nitrogen deposition did not exceed the relevant critical loads and could therefore be deemed ‘insignificant’.

Environment Agency review of applicant’s assessment of potential impact on air quality:

We have carried out our own audit by means of detailed check modelling and sensitivity analysis on the air quality and habitats assessments presented by the operator.

In this assessment we:

- Considered meteorological data from a second station at Hatfield Airport in addition to the data from Luton Airport considered by the operator;
- Reviewed the outcome of the modelling with differing surface roughness and terrain data from those used by the operator;
- Considered a more conservative background for each pollutant (NO_2, PM_{10}, $PM_{2.5}$ and CO)
- Assessed predictions against the US EPA Acute Exposure Guideline Levels (AEGLs) and nitrogen monoxide (NO) environmental assessment level both of which the operator had not done.

Whilst we did not always agree exactly with their numerical predictions, we did agree with their overall conclusions in regard to the potential impacts on both human health and ecological receptors.

We agreed with the applicant’s inclusion of 314 buildings within their modelling assessment. However the majority of stacks are below building heights which will lead to poorer dispersion and higher localised concentrations of pollutants. Whilst the sites at Centro, Campus and Maylands are existing operational facilities, the site at HH4 was being developed at the time of permit application. The operator noted that the stacks at HH4 site “will terminate just below the roof height level”.

We have included an improvement condition (IC8) requiring the operator to review the potential for reduced emissions from the generator stacks or improved dispersion of emissions which will require them to review the heights of stacks on the four sites.

We have completed a model run with all sources operational and grouped for each site and assessed which site produces the highest contributions to the impacts at nearby receptors. Our results indicate that the Campus site will likely have the highest impacts followed by the new HH4 site (original scope of HH4). We conclude that if emissions from the Campus site could preferentially be reduced then this would be beneficial to the overall impacts at receptors. We have included that requirement in IC8.

In our assessment of the impact on human health receptors, we have concluded for both testing/maintenance and emergency operation scenarios that:

- The long term pollutant concentration for NO_2 was ‘not insignificant’ for all receptors (i.e., over 1%) and the PECs were below the environmental standard;
- There were exceedances of the NO_2 1-hour environmental standard for the maintenance scenario although statistical analysis indicates that the probability of this occurring is less than 5%, i.e., ‘highly unlikely’;
- There are no potential exceedances of the environmental standard for PM_{10}, $PM_{2.5}$ or CO for human health receptors.

We reviewed the modelling provided by the applicant which appeared to indicate potential exceedances of the1 hour mean NOx AEGL-1 limits at the 100 percentile (which is a conservative approach) during maintenance/testing scenarios at up to six of the forty eight sensitive human receptors assessed. We ran our model at the 99.79^{th} percentile and also found exceedances. We then undertook further statistical analysis to understand the probability of exceedance and ran the modelling with the probability derived from the hypergeometric calculations. With this new percentile the values we obtained were lower than those proposed by the applicant and we found no exceedances of AEGL-1 limits for the maintenance/testing scenario. Exceedances of AEGL-1 limits are only appropriate for the emergency scenario.

We have concluded for the potential impact on human health receptors that in the emergency operational scenario:

- There are exceedances of the 10-minute and 1-hour averaging period NO_2 AEGLs at a total of 25 discrete sensitive human health receptors outside the site boundary;
- There are exceedances of the short term nitrogen monoxide (NO) environmental assessment limit.

We have audited the additional modelling of NOx emissions relating to the revised 1-hour and 36-hour emergency outage scenarios. We agree with the applicant’s conclusion that the probability of exceedances are <0.1% in both scenarios.

Furthermore we conclude that the probability of an emergency coinciding with the predicted exceedance hours and causing 19 or more exceedances of the short-term NO_2 environmental standard (ES) is low as long as power outages do not occur for more than 100 hours in a year.

In assessing the impact on ecological receptors, we have concluded that:

- The critical annual NOx is less than 1% for the SAC (Chilterns Beechwoods);
- The PCs are less than 100% for all local wildlife sites and can be deemed ‘insignificant’;
- The daily NOx PCs are less than 10% for the SAC (Chilterns Beechwoods);
- Daily NOx PCs are greater than 100% for the Widmore Wood LWS and Maylands Wood LWS and cannot be deemed ‘insignificant’;
- Acid deposition and nutrient nitrogen deposition do not exceed 1% of the relevant critical loads at the Chilterns Beechwoods SAC or exceed 100% of the relevant critical loads at any LWS assessed and therefore can be deemed ‘insignificant’.

We have included an improvement condition (IC7) requiring the operator to submit a report verifying the predicted short-term nitrogen monoxide (NO) concentration at the boundary of the site. We have included nitrogen monoxide within the scope of IC8 which requires the operator to carry out a review of options for reducing predicted short-term NOx emissions.

We assessed further the potential impact at the Widmore Wood LWS and Maylands Wood LWS.

For Widmore Wood, approximately 80% was exceeding and for Maylands Wood it was approximately 60% of the LWS that was exceeding under worst case conditions. The applicant modelled that, for the worst case receptors at both sites, the maximum exceedance was <200% of the daily environmental standard for the maintenance/testing scenario. We agreed with those maximum predictions.

The applicant had proposed there was a low likelihood of these maximum exceedances occurring based on the operational scenarios they proposed for maintenance/testing. They said their probability of occurring was <5%. We have calculated an even lower probability and we are confident that the likelihood of exceedance is very low. Because of this we agree with the applicant that accepting their proposed maintenance/testing regimes would likely be an acceptable risk in relation to Widmore Wood and Mayland Wood LWS.

Operation of standby generators during periods related to neither routine maintenance/testing and grid outage scenarios:

The applicant submitted data relating to the number of hours that the standby generators at the three operational sites (Campus, Centro and Maylands) had operated during 2018 for reasons other than routine maintenance/testing and grid outage. These operational scenarios related to events such as generator repair, UPS (uninterruptable power supply) repair, battery replacement and switchgear/wiring modifications. This totalled 180 hours in 2018.

These additional hours operation of the standby generators was not included in either of the operational scenarios modelled.

We have accepted that these additional hours of generator operation do not require inclusion in the modelling as:

- It is not possible for the operator to predict in advance the number of hours each year that generators would be required to be operated in this manner;
- Where unplanned maintenance activities require the generators to be operated, this operation will, if possible, replace the scheduled monthly planned testing of that generator (assuming the planned testing has not already occurred for that generator that month);
- The operation of the generators for non-planned maintenance is generally short (1-6 hours typically) with the longest run in 2018 being one generator operated for 16 hours due to a UPS repair (Campus generator 18);
- On only one occasion in 2018 did more than one generator operate on the same day for non-routine activities (9th October when Campus DC2 generators 10A and 10B operated for one hour each;
- The operation of each generator in 2018 for planned maintenance/testing plus any additional non-routine operation remained below the 50 hours annual limit stated in our FAQ Guidance (with the exception of Campus generator 18 which operated for a total of 61 hours).

We have agreed that modelling the two operational scenarios of routine maintenance/testing and grid outage are acceptable in demonstrating the potential impact on air quality from operation of the standby generators.

Protection against Power Outage and Minimisation of Generator Operation.

The largest risk of gaseous emissions from the site occurring which could impact human health or ecological receptors would be if the diesel generators had to operate for any significant period of time following a National Grid failure.

To address this scenario and minimise emissions, the operator:

- Operates the datacentres to provide the maximum reliability of electrical power supply to the on-site systems by designing and building them to Uptime Institute Tier III standards ensuring the required level of resilience to demonstrate maximum uptime for critical IT infrastructure;

- Utilises an array of batteries on each site (UPS) which can provide power, virtually instantaneous, to the on-site systems that are critical for the operation of the site as a datacentre until the diesel generators are started;

- Has developed multiple electrical feed connections:
  - Campus site has two 33kV feeds from the National Grid each capable of serving the full customer load demand at that datacentre;
  - Maylands has two 11kV feeds from the National Grid each capable of serving the full customer load demand at that datacentre;
  - HH4 has two 132kV feeds from the National Grid each capable of serving the full customer load demand at that datacentre;
  - Centro has one 11kV feed from the National Grid.

- Has ensured there are no direct and dedicated power links shared between all 4 datacentres and each datacentre has its own independent power links to the National Grid:
  - Campus connects to Springway Grid substation;
  - Centro connects to Hemel East Primary substation;
  - Maylands connects to Hemel North Primary substation.

  These three substations all connect to the Pickets End Grid substation. The Pickets End Grid substation has 2 separate 132kV feeds - one incoming line from Elstree-Sundon 132KV and the other from Watford 132KV. The 2 feeds for HH4 are connected directly to the Elstree-Sundon 132KV power line (direct to a pylon).

  It is only failure of both 132kV power lines noted above that would trigger operation of the generators across all four NTT Hemel Hempstead data centre sites. Such a failure would impact the whole of Hemel Hempstead and wider area and the risk of their failure is extremely unlikely.

  Failure of the Elstree-Sundon 132kV power line would impact **HH4** datacentre only.

  Failure of Pickets End substation would impact the **Campus, Maylands and Centro** datacentres.

  Failure of the Springway Grid substation would impact **Campus** only.

  Failure of the Hemel East Primary substation would impact **Centro** only.

  Failure of the Hemel North Primary substation will impact the **Maylands** only.

  In event of an electrical failure, the required number of generators at the datacentre or datacentres would operate to meet the customer load at the datacentre at that particular time.

- Has arranged the datacentres into multiple customer suites which each have the required infrastructure, including generators:
  - Campus datacentre has twelve customer suites all independent from each other;
  - Maylands has six customer suites served by either four or two generators all independent from each other;
  - HH4 (original scope) has six customer suites each served by five generators which are independent of each other;
  - Centro has three customer suites which are linked in terms of electrical supply allowing four generators to serve the suites as required.

- Operates the electrical supplies for each datacentre on an automatic basis where any fluctuations or loss of power are detected and the appropriate response is automatically initiated to ensure power supply is maintained (either start-up of the battery array followed by operation of the diesel generators if required);

- Maintains robust site security systems such as perimeter fencing, CCTV cameras and 24-hour on-site security staff providing protection against any form of unauthorised intrusion that could affect operation and cause the need for the generators to be operated.

Centro is a small datacentre (9.96MWth input) and the operator has assessed that the single National Grid feed and lack of independence of the customer suites provides sufficient resilience and reliability required by their customers.

The operator manages data storage services at all four datacentre sites 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 organisation to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organisation 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.

None of the sites have experienced brown- or black-out scenarios in the local power transmission system that required the use of the generators since the three pre-existing sites were first developed as datacentres in 2010/2011.

Containment and Prevention of Pollution to Ground and Groundwater.

Fuel Storage and Distribution.

The arrangements for the storage and distribution of diesel are different across the four sites but the applicant has demonstrated in all circumstances that there are robust systems in place for the containment of fuel.

Storage of diesel occurs in “belly” tanks located at the base of the generator container units and, on two of the sites, in above ground bulk storage tanks.

The generators at each datacentre are housed within propriety steel container units located in the external yard areas. Beneath the floor of the container units for each generator is a belly tank which is integral to the generator container unit and automatically supplies diesel to the generator.

The belly tanks at the three existing data centres are 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 have been certified to this standard, as indicated on the name plates of the generator units. The belly tanks at the new HH4 data centre have been designed to British Standard 799-5:2010 (Oil burning equipment. Carbon steel oil storage tanks. Specification).

The belly tanks are therefore considered to comply with the Oil Storage Regulations (2001).

The belly tanks at Maylands (Suite 1 generators only) and Centro datacentres are filled directly from bulk storage diesel tanks located on these sites. For the Maylands datacentre (with the exception of Suite 1 generators) and Campus datacentre, the belly tanks are filled directly from refuelling vehicles (the fuel being delivered by a NTT appointed fuel supplier). Fuel is delivered directly to the belly tanks via fill points which are located on the generator container units. These are positioned in lockable cabinets which are designed with drip trays.

The sites use a generator tank fuel monitoring system which will alarm, via the datacentre Building Management System (BMS) to the on-site control room, in the event of a diesel tank volume decrease when the generators are not operating.

Campus Site:

Diesel fuel is stored only in bunded "belly" tanks. A total of 881,000 litres of diesel can be stored on this site at any one time. There are no diesel bulk storage tanks located on this site.

Maylands:

Diesel fuel is stored in the "belly" tanks. A total of 193,360 litres of diesel can be stored on site in these "belly" tanks. There are also two above ground diesel bulk storage tanks at this site which serve datacentre suite 1. Each of these tanks is capable of holding 45,000 litres of fuel.

The total capacity for diesel storage on this site is 283,360 litres.

Centro:

Diesel fuel is stored in the "belly" tanks. A total of 3,366 litres of diesel can be stored on site in these "belly" tanks. There is also one above ground diesel bulk storage tank with a capacity of 75,000 litres.

The total capacity for diesel storage on this site is 78,366 litres.

HH4 (Phase 1):

Diesel fuel is stored in the "belly" tanks. A total of 600,000 litres of diesel can be stored on site in these "belly" tanks for the 15 generators comprising HH4 phase 1. There are no diesel bulk storage tanks located on this site.

Containment Protection – "Belly" Tanks:

The "belly" tanks have the following protection measures to ensure no loss of containment:

Campus & HH4 (Phase 1) Datacentres:

- A "belly" tank fuel monitoring system which will alarm, via the datacentre Building Management System (BMS) to the on-site control room, in the event of a diesel tank volume decrease when the generators are not operating.
- Fill points are located in a lockable cabinet provided with a drip tray designed to capture any minor spillages of oil from the fill point during delivery, which is integral to the generator container unit.
- The tank fill point cabinets 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 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.

<u>Maylands Datacentre:</u>

- A "belly" tank fuel monitoring system which will alarm, via the datacentre Building Management System (BMS) to the on-site control room, in the event of a diesel tank volume decrease when the generators are not operating.
- For those belly tanks that are filled directly from a refuelling vehicle, the fill points are located in a lockable cabinet provided with a drip tray designed to capture any minor spillages of oil from the fill point during delivery, which is integral to the generator container unit.
- The tank fill point cabinets remain locked when not in use;
- Tank level gauge;
- A pressure delivery over-fill prevention valve to prevent over pressurisation of diesel supplied from the bulk tanks (Suite 1 generators only);
- High and low level alarms connected to the BMS;
- The generator sets have pressure relief valves to prevent over pressurisation of diesel supplied from the belly tanks; and.
- To minimise risk or corrosion all pipework is painted or is constructed of corrosion resistant material.

<u>Centro Datacentre:</u>

- A "belly" tank fuel monitoring system which will alarm, via the datacentre Building Management System (BMS) to the on-site control room, in the event of a diesel tank volume decrease when the generators are not operating.
- Tank level gauge;
- High and low level alarms connected to the BMS;
- A pressure delivery over-fill prevention valve to prevent over pressurisation of diesel supplied from the bulk tanks;
- The generator sets 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.

<u>Containment Protection – Bulk Storage Tanks:</u>

<u>Maylands and Centro Datacentres:</u>

- Integrated secondary containment (110% containment capacity);
- A tank fuel monitoring system which will alarm, via the datacentre Building Management System (BMS) to the on-site control room, in the event of a diesel tank volume decrease when the generators are not operating.
- The fill points are located in a lockable cabinet provided with a drip tray designed to capture any minor spillages of oil from the fill point during delivery, which is integral to the bulk tank unit;
- Level gauges connected to the BMS;
- High and low level alarms connected to the BMS;

- The delivery pipework from the bulk tanks to the generators is above ground level with a pipe-in-pipe arrangement to minimise the risk of leaks. Leak detection is provided on the delivery pipework which is connected to the site's BMS; and
- To minimise the risk or corrosion all pipework is painted or is constructed of corrosion resistant material

Should there be any minor spillages of diesel, they will be cleaned up using proprietary spill kits and the oil contaminated materials will then be stored in suitable bunded containers in a waste storage area on the site prior to off-site disposal by an NTT approved waste contractor. Any major spillages/leaks of oil will be transferred to suitable containers or directly to road tanker for off-site treatment/disposal by a suitably licensed waste contractor. The management of spills will be undertaken in accordance with NTT's spill procedures HS12-P01 (Spillage Procedure) and HS04-TT44 (Spillage Response).

Bulk deliveries of diesel are from NTT approved suppliers. The delivery of diesel is undertaken in accordance with procedure HS12-P02 (Diesel oil delivery procedure). This procedure requires a NTT 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.

Tertiary containment is provided by the hardstanding of the external areas where these tanks are located.

In regard to Centro, the yard area of this site where the bulk tank is located is cambered towards the main datacentre building helping direct the flow of any significant volumes of diesel in this direction. Diesel will then either enter the surface water drainage system or collect at the lowest point of the cambered yard adjacent to the datacentre building. However, the site boundary is in close proximity to one side of the bulk storage tank and does not have a raised kerb to help contain any significant spills, whilst the cambered nature of the yard area of this site will help direct the flow of any significant volumes of diesel towards the datacentre building, there is the potential that in the event of a significant release of diesel did occur, the diesel could exit the site and impact an adjacent area of unsurfaced land. We have included an improvement condition (IC2) requiring the operator to review tertiary containment across all four sites.

Additionally, should diesel enter the surface water drainage system at Centro, there is no interceptor present and therefore there is the potential for diesel to discharge into the municipal sewage system. To minimise this risk NTT has purchased a drain bladder to block the drains in the event of an unplanned release of diesel. This bladder has been positioned by the last drainage manhole prior to offsite discharge into the municipal sewer. NTT must update their spill response procedures and provide training to designated NTT staff. NTT has also indicated in the permit application that they will investigate the possibility of installing an interceptor or the provision of alternative infrastructure to minimise the risk of discharge of diesel to the environment at the Centro site. We have included an improvement condition (IC3) requiring them to carry out this investigation.

With regard to Maylands, the external hardstanding areas are kerbed minimising the risk of an unplanned release of diesel leaving the site. Additionally, any significant volumes of leaked/spilled diesel would be directed to the surface water drainage system by the camber of the land and diesel would be captured by the on-site alarmed interceptors. To further minimise this risk, NTT has purchased a drain bladder to block the drains in the event of an unplanned release of diesel; this bladder has been positioned by the last drainage manhole prior to offsite discharge into the municipal sewer. NTT must update their spill response procedures and provide training to designated NTT staff.

As there appears to be a residual risk that there is not suitable tertiary containment on all the sites and/or additional measures and training must be implemented, we have included an improvement programme condition (IC2) requiring NTT review their tertiary containment across the four sites in line with relevant industry standards and implement any improvement work proposed.

Aqueous Releases from Sites.

Each datacentre 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 the datacentres does not result in the generation of trade effluent.

There are no discharges to foul sewer within the plant areas on each datacentre site where the generators and diesel storage are located. All run-off from these areas drains to the site specific surface water drainage systems prior to off-site discharge into the municipal surface water drainage system.

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

There are oil/water interceptors at the Campus, Maylands and HH4 sites. The interceptors at Campus and Maylands sites are not alarmed to indicate the presence of oil. Only the interceptor at the newer HH4 site will alarm if oil is present. All interceptors will be emptied, cleaned and maintained at least annually by an appointed specialist contractor. There is currently no oil interceptor at the Centro site.

Campus:

Water run-off from the permitted area (standby generators and diesel storage areas) drains to the on-site surface water drainage system via an oil interceptor prior to off-site discharge into the municipal surface water drainage system operated by Thames Water Limited. Surface water runoff discharges via one discharge point (Campus CP-SW1) off site into the municipal drainage system. The location of discharge point Campus CP-SW1 is presented on its site plan in Schedule 7 (drawing 002A in the permit application documentation).

There are six rainwater harvesting tanks (total 500m^3 capacity) beneath the Plant Area where the generators are located, which collect surface water runoff from the site for use to replace evaporative losses from the on-site cooling systems. There is also an attenuation tank beneath the Plant Area where the generators are located. This provides 265m^3 capacity to attenuate the flow of surface water to the site’s surface water drainage system and off-site flow into the municipal drainage system.

There are three interceptors on the Campus site. The surface water runoff from the Plant Area is directed via an interceptor (Klargester class 1 by-pass oil separator) located in the south of the site prior to discharge off site into the municipal surface water drainage system.

There is a second off-site aqueous discharge point on the Campus site, unpermitted, – SW2 which drains surface run-off from unpermitted areas such as the carpark and contractors’ compounds. This discharge point does not drain surface water from the permitted installation at Campus – the generators and diesel storage. The scope of IC2 on tertiary containment includes demonstration that robust tertiary containment (or other protection systems) are in place to prevent any oil-contaminated surface water from the permitted Campus installation, being discharged via the unpermitted SW2 release point.

Maylands.

Run-off drains to the on-site surface water drainage system via an oil interceptor prior to off-site discharge into the municipal sewer system. Surface water runoff discharges via one discharge point (ML-SW1) off site. The location of discharge point ML-SW1 is presented on its site plan in Schedule 7 (drawing 002C in the permit application documentation).

There are two interceptors on the Maylands site. The surface water runoff from the area where the generators and associated bulk diesel storage are located is directed via the interceptor located in the south western area of the datacentre site, prior to discharge off site into the municipal drainage system.

Centro.

Run-off from plant areas drains to the on-site surface water drainage system prior to off-site discharge into the municipal sewer system. Surface water runoff discharges via discharge point (Centro C-SW1) off site. There are no oil interceptors in place on the Centro datacentre site. The location of discharge point Centro C-SW1 is presented on its site plan in Schedule 7 (drawing 002B in the permit application documentation).

HH4 (Phase 1).

Run-off from plant areas drain to the on-site surface water drainage system prior to off-site discharge into the municipal surface water drainage system operated by Thames Water Limited via discharge point HH4-SW1. 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 storm water attenuation tank ($700m^3$) prior to off-site discharge into the municipal sewer system. The interceptor will be emptied, cleaned and maintained at least annually by an appointed specialist contractor. The location of discharge point HH4-SW1 is presented on its site plan in Schedule 7 (drawing 002D in the permit application documentation).

An improvement condition, IC10, has been included in the permit requiring the operator to confirm surface water discharge from the Maylands and Centro sites and to assess, with improvements if required, whether the surface water from the four data centre sites eventually is discharged to a waste water (sewage) treatment plant.

Permit Conditions.

The permit will include a maximum 500 hours per annum ‘emergency/standby operational limit’ for any or all the plant producing on-site power under the limits of the combustion activity. Therefore emission limit values (ELVs) to air and engine emissions monitoring are not required within the permit. Emergency hours’ operation includes those unplanned hours required to come off grid to make emergency repair of electrical infrastructure associated but occurring only within the data centre itself.

Each individual generator with its own discharge stack, can be maintained, tested and used in a planned way for up to 500 hours per calendar year each without ELVs or associated monitoring under the Industrial Emissions Directive (IED) and Medium Combustion Plant Directive (MCPD). The Environment Agency expects planned testing and generator operations to be organised to minimise occasions and durations (subject to client requirements).

The permit prevents any electricity produced at the installation from being exported to the National Grid.

Operational and management procedures should reflect the outcomes of the air quality modelling by minimising the duration of testing, the duration and frequency of whole site tests and planning off-grid maintenance days and most importantly times/days to avoid adding to any high ambient pollutant background levels.

The permit application has assessed and provided evidence of the reliability of the local electricity grid distribution allowing the Environment Agency to judge that the realistic likelihood of the plant needing to operate for prolonged periods in an emergency mode is very low.

Reporting of standby engine maintenance run hours is required annually and any electrical outages (planned or grid failures regardless of duration) require both immediate notification to the Environment Agency and annual reporting.

Improvement Conditions.

The following improvement conditions (ICs) have been included in the permit:

IC1 which requires the operator to produce an Air Quality Management Plan (AQMP) in conjunction with the Local Authority outlining measures to be taken in the event of a National Grid failure. In response to comments from Public Health England at consultation, this AQMP must consider all grid outages – including those of less than 18 hours duration.

IC2 which requires the operator to review and report on the tertiary containment systems on the four sites as there is an indication in the application that diesel spillage could escape from the Centro site onto an adjacent area of unsurfaced land and limited evidence that oil-contaminated water from the permitted site at Campus cannot be discharged via unpermitted discharge point, SW2.

IC3 which requires the operator to investigate the possibility of installing an alarmed oil/water interceptor at the Centro site which is the only one of the four permitted NTT Hemel Hempstead sites without an interceptor.

IC4 which requires the operator to submit for approval written procedures for maintenance, inspection and testing of drains along with timescales for their implementation as these systems were not fully developed when the permit application was submitted.

IC5 which requires the operator to submit for approval written procedures and timescales for the inspection of below ground storm water and attenuation tanks at Campus and HH4 (phase 1 sites) as these systems were not fully developed when the permit application was submitted.

IC6 requiring the operator to submit for approval a programme to obtain baseline soil and groundwater data for the Campus, Centro and Maylands sites as only comprehensive baseline data were submitted in the application for the newer HH4 site.

IC7 requiring the operator to submit for approval a report verifying the predicted short term nitrogen oxides concentration at the boundary of the site to include consideration of both nitrogen dioxide and nitrogen monoxide. The output of the verification exercise should be used to inform or revise the air quality management plan if necessary.

IC8 requiring the operator to submit for approval a review of options to reduce predicted short term nitrogen dioxide and nitrogen oxide emissions. In response to comments from Public Health England at consultation, this must also take into account the weather conditions demonstrated by modelling to have the greatest potential for environmental impact. It should focus primarily on the Campus and HH4 (phase 1) sites, the releases to air from whose operation has the most potential for impact.

IC9 which requires the operator to submit for approval a monitoring plan that will outline their proposal for implementation of the flue gas monitoring requirements outlined in Table S3.1. As monitoring CO and NO_2 emissions from stacks was not a requirement for the operator at the time of the application submission, this IC also includes a requirement for the operator to outline any safety, cost or operational constraints that might result in the operator not being able to comply with the monitoring requirements in Table S3.1.

IC10 which requires the operator to review surface water discharge from sites at Maylands and Centro and provide updated detailed drainage plans for these sites. It also requires the operator to review discharge of uncontaminated surface water from the four sites to demonstrate that they would not cause overloading at a sewage treatment works should site surface waters be directed to such a facility.

Risk Assessment of Revised Configuration for HH4 (Phase 1) Data Centre.

As discussed, the applicant revised the configuration of the HH4 site during the application process. The applicant proposed instead to install a smaller number of larger generators (Kohler T2500C model) with an overall thermal input greater than that proposed for HH4 in the original application (Kohler KD1800 model). The T2500C generators comply with the 2g TA-Luft standard and achieve 2,000 mg/m^3 NOx emissions.

Original HH4 Proposal:

32 generators installed across two phases with a total thermal input of 131.2 MWth.

Revised HH4 Phase 1 Proposal (2021/2022):

15 generators installed with a total thermal input of 71.4 MWth.

Proposed Future HH4 Phase 2 Proposal (2023):

15 further generators installed with a total thermal input of 71.4 MWth.

The applicant submitted a revised environmental risk assessment for HH4 phase 1 which they proposed demonstrated that the environmental risk from HH4 phase 1 was no greater than the environmental risk for the full HH4 configuration in the original application. They agreed that they could not demonstrate that the environmental risk from the reconfigured HH4 phase 1 and phase 2 would be no greater than that for HH4 in the original application.

We have reviewed the revised risk assessment for HH4 phase 1.

Impact of Air Emissions:

The stacks for the fifteen generators in HH4 phase 1 are located at fifteen of the locations previously assessed for the thirty two generators to be installed in HH4 in accordance with the original design. The emission parameters for the revised HH4 phase 1 compared with the original HH4 scenario are:

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Parameter	Original HH4	Revised HH4 Phase 1
Stack height (m)	12	12
Stack internal diameter (m)	0.35	0.558
Volume flow (Nm^3/s)	2.72	5.26
Actual flow rate (Am^3/s)	4.38	8.43
Emission temperature (^{o}C)	504	500

Emission velocity (m/s)	45.5	34.5
NOx emission (g/s)	2.04	3.94
CO emission (g/s)	1.77	3.42
PM emission (g/s)	0.35	0.68

Total Gensets	32	15
NOx emission (g/s) from HH4	65.2	59.1
CO emission (g/s) from HH4	56.5	51.3
PM emission (g/s) from HH4	11.3	10.3
Total hours per year testing	736	345
NOx emission (t/yr) from HH4	172.7	73.5
CO emission (t/yr) from HH4	149.7	63.7
PM emission (t/yr) from HH4	29.9	12.7

As the number of engines to be installed in the revised HH4 phase 1 scope is less than the total proposed for the original HH4 scenario, there will be a significant reduction in the hours these generators will be operational each year for planned testing or maintenance.

The total mass emissions (g/s) for NOx, CO and particulate matter (PM) from the newly proposed HH4 phase 1 operation are less than in the original scenario with all HH4 generators operational.

The effect of the decrease in velocity will be offset by the larger stack diameter which will maintain plume momentum and hence not significantly change dispersion characteristics. The new exit velocity of 34.5 m/s would remain an acceptable figure.

We have assessed emissions in both scenarios using our air emissions screening tool and conclude that the impact in the revised HH4 phase 1 scenario is not greater than that in the original scenario of HH4 operating with thirty two KD1800 generators.

We have also checked the modelled emission rates and agree that these rates outlined for the revised scenario above are internally consistent with the other data information such as stack internal diameter, velocity, volume flows, temperatures, oxygen and moisture concentrations etc. They are also plausible considering the additional scale of the plant.

In relation to releases to air, the conclusions of our assessment on the original permit application remain valid for the proposed reconfiguration and operation, and permitting, of only HH4 phase 1.

However if revised HH4 phase 2 comes on line, predicted impacts may be substantially higher and will require more detailed assessment to demonstrate they do not impact adversely on air quality. Because of this, no improvement or pre-operational conditions are included relating to the operation or permitting of HH4 phase 2. Should the applicant wish to expand HH4 operation to include the additional fifteen generators in phase 2, they must apply for a substantial variation to the existing environmental permit - submitting a detailed air quality assessment.

<u>Diesel Storage and Containment:</u>

The Kohler KD1800 generators proposed for HH4 in the original application would have had a belly tank each with a capacity of 27,000 litres of diesel. With thirty two such generators proposed, the total maximum diesel stored on site would have been 864,000 litres.

The belly tanks for the newly proposed Kohler T2500 generators are larger than previously proposed and can contain 40,000 litres of diesel. As there are only fifteen of these generators in the newly defined HH4 phase 1, the maximum amount of diesel that can be stored on site is 600,000 litres – less than that proposed in the original application. As outlined in the original application, there will be no external diesel storage tank at HH4 site and belly tanks will be filled directly from refuelling vehicles. The protective measures for the belly tanks will not differ from those in the original application.

Noise.

Noise is not a significant aspect of data centre permitting (noting that it is only the standby generators and associated diesel supply systems that are permitted – not the operation of the data centre itself). However the applicant demonstrated that operation of the Kohler T2500 generators will be quieter than operation of the previously planned Kohler KD1800 generators.

Conclusion:

We have assessed the predicted environmental impact of the revised proposal for HH4 data centre phase 1 operation and are satisfied that it will not be any greater than that already assessed as acceptable for the proposed HH4 configuration in the original application.

We are therefore able to permit operation of Centro, Campus, Maylands and HH4 (Phase 1) data centre sites.

Decision considerations

Confidential information

A claim for commercial or industrial confidentiality has not been made.

Identifying confidential information

We have not identified information provided as part of the application that we consider to be confidential.

Consultation

The consultation requirements were identified in accordance with the Environmental Permitting (England and Wales) Regulations (2016) and our public participation statement.

The application was publicised on the GOV.UK website.

We consulted the following organisations:

- Dacorum Borough Council Environmental Health Department;
- Dacorum Borough Council Planning Department;
- Director of Public Health and Public Health England;
- National Grid;
- Hertfordshire Fire and Rescue Services;
- Health and Safety Executive;
- Sewerage Authority.

The comments and our responses are summarised in the consultation responses section.

Operator

We are satisfied that the applicant (now the operator) is the person who will have control over the operation of the facility after the grant of the permit. The decision was taken in accordance with our guidance on legal operator for environmental permits.

The regulated facility

We considered the extent and nature of the facilities at the site in accordance with RGN2 'Understanding the meaning of regulated facility', Appendix 2 of RGN2 'Defining the scope of the installation' and Appendix 1 of RGN 2 'Interpretation of Schedule 1'.

The extent of the facilities are defined in the site plan and in the permit. The activities are defined in table S1.1 of the permit.

See key issues for more discussion on the nature of the site.

The site

The operator has provided plans which we consider to be satisfactory.

These show the extent of the site of the facility including the discharge points.

The plans are included in the permit.

Site condition report

The operator has provided a description of the condition of the site, which we consider is not satisfactory. The decision was taken in accordance with our guidance on site condition reports and baseline reporting under the Industrial Emissions Directive.

We have advised the operator what measures they need to take to improve the site condition report.

We have included an improvement condition in the permit (IC6) for the operator to obtain baseline soil and groundwater reference data for the Centro, Campus and Maylands Datacentres.

Nature conservation, landscape, heritage and protected species and habitat designations

We have checked the location of the application to assess if it is within the screening distances we consider relevant for impacts on nature conservation, landscape, heritage and protected species and habitat designations. The application is within our screening distances for these designations.

We have assessed the application and its potential to affect sites of nature conservation, landscape, heritage and protected species and habitat designations identified in the nature conservation screening report as part of the permitting process.

We consider that the application will not affect any site of nature conservation, landscape and heritage, and/or protected species or habitats identified.

We have consulted Natural England on our Habitats Regulation assessment. Natural England have made no comment on our assessment.

The decision was taken in accordance with our guidance.

Environmental risk

We have reviewed the operator's assessment of the environmental risk from the facility.

The operator's risk assessment is satisfactory.

Climate change adaptation

We have assessed the climate change adaptation risk assessment.

We consider the climate change adaptation risk assessment is satisfactory.

We have decided to include a condition in the permit requiring the operator to review and update their climate change risk assessment over the life of the permit.

General operating techniques

We have reviewed the techniques used by the operator and compared these with the relevant guidance notes and we consider them to represent appropriate techniques for the facility.

The operating techniques that the applicant must use are specified in table S1.2 in the environmental permit

Operating techniques for emissions that do not screen out as insignificant

Emissions of nitrogen dioxide (NO_2) cannot be screened out as insignificant. We have assessed whether the proposed techniques are Best Available Techniques (BAT).

We agree with the applicant that the use of diesel generators to supply power to site in the event of National Grid outage is BAT when compared with alternative power generation techniques (refer to key issues section).

Operating techniques for emissions that screen out as insignificant

Emissions of PM_{10}, $PM_{2.5}$, CO and SO_2 (by virtue of sulphur content of fuel) have been screened out as insignificant, and so we agree that the applicant's proposed techniques are Best Available Techniques (BAT) for the installation.

We consider that the emission limits included in the installation permit reflect the BAT for the sector.

National Air Pollution Control Programme

We have considered the National Air Pollution Control Programme as required by the National Emissions Ceilings Regulations 2018. By setting emission limit values in line with technical guidance we are minimising emissions to air. This will aid the delivery of national air quality targets. We do not consider that we need to include any additional conditions in this permit.

Raw materials

We have specified limits and controls on the use of raw materials and fuels.

Improvement programme

Based on the information on the application, we consider that we need to include an improvement programme.

See key issues.

Emission Limits

We have decided that emission limits are not required in the permit.

See key issues.

Monitoring

We have decided that monitoring should be carried out for the parameters listed in the permit, using the methods detailed and to the frequencies specified. In particular:

We have specified monitoring of emissions of carbon monoxide from emission points:

- HH4 (Phase 1) Data Centre: HH4 06-10, HH4 16 – 20 and HH4 26 – 30 (new medium combustion plant), with a minimum frequency of once every 1500 hours of operation or every five years (whichever comes first). This monitoring has been included in the permit in order to comply with the requirements of Medium Combustion Plant Directive, which specifies the minimum requirements for monitoring of carbon monoxide emissions, regardless of the limited operating hours of the plant.

We have also specified monitoring of emissions of nitrogen oxides from the same emission points (new medium combustion plant), with the same frequency specified for the monitoring of carbon monoxide emissions. In setting out this requirement, we have applied our regulatory discretion, as we consider that this limited monitoring, to happen in concurrence with the carbon monoxide monitoring, is proportionate to the risk associated with the emissions of NOx from the installation.

Taking into account the limited hours of operation of the engines operating at the installation, and the fact that we are not setting emission limits for NOx and carbon monoxide, we consider this monitoring can be carried out in line with web guide 'Monitoring stack emissions: low risk MCPs and specified generators' Published 16 February 2021 (formerly known as TGN M5).

We have set a requirement for the first monitoring to happen within 4 months of the issue date of the permit or the date when each new medium combustion plant is first put into operation, whichever is later.

We have linked this monitoring to completion of improvement condition 9 (IC9).

Reporting

We have specified reporting in the permit to ensure the site is operated to the standards specified in the Operating Techniques including the reporting of emissions to air agreed after completion of improvement condition 9 (IC9).

We have specified reporting to ensure the operator notifies us of any operation of the stand-by generators in emergency mode in response to national grid power outage.

Management System

We are not aware of any reason to consider that the operator will not have the management system to enable it to comply with the permit conditions.

The decision was taken in accordance with the guidance on operator competence and how to develop a management system for environmental permits.

Financial competence

There is no known reason to consider that the operator will not be financially able to comply with the permit conditions.

Growth duty

We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit.

Paragraph 1.3 of the guidance says:

"The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation."

We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5

that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections.

We consider the requirements and standards we have set in this permit are reasonable and necessary to avoid a risk of an unacceptable level of pollution. This also promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.

Consultation Responses

The following summarises the responses to consultation with other organisations, our notice on GOV.UK for the public and the way in which we have considered these in the determination process.

Responses from organisations listed in the consultation section:

Response received from: **Dacorum Borough Council Environmental Health Department – Response 1**

Brief summary of issues raised:

The consultee noted that modelling of the 500-hours electrical grid outage scenario predicted potential exceedances of the 1-hour mean at sensitive receptors in respect of nitrogen dioxide. They said that if such a development resulted in a new air quality management area being declared, the Council would strongly object to such a development being permitted.

The consultee also noted that the applicant had considered the likely impact from NOx emissions but not from fine particles, such as PM_{10} and $PM_{2.5}$, and they would not be supportive of the application without full consideration of the likely air quality impacts.

Summary of actions taken:

The scenario of 500 hours emergency outage is not deemed realistic in an operational scenario where none of the generators in the three operational sites have ever operated in an emergency outage since they commenced operation. The operator revised their modelling of emergency outage situations to include more realistic outage scenarios – one hour and 36 hours (the latter period representing the maximum amount of diesel that the data centre is contracted to hold on site in event of national grid outage).

The revised modelling indicated that, at both one hour and 36 hour emergency operation, the probability of 1-hour mean NO_2 exceeding the AQAL for more than the permitted 18 occasions within a year, is <0.1% and therefore ‘highly unlikely’.

The applicant also expanded their modelling to include PM_{10} $PM_{2.5}$ and carbon monoxide (CO). For the scenarios of routine testing/maintenance and the 1-hour and 36-hour emergency outages, there were no predicted exceedances of these parameters at the sensitive receptors. We accepted the applicant’s decision to rule out the need to model for SO_2 impact due to the use of low sulphur containing fuel in the generators.

Response received from: **Dacorum Borough Council Environmental Health Department – Response 2**

Brief summary of issues raised:

The consultee questioned:

(a) Whether, in the event of an energy crisis requiring the generators to be operated for a much longer period than the more representative 1-hour or 36-hour periods, there was anything within permit conditions requiring the operator to report their usage from each site;

(b) Whether there was any conditions triggering a permit review or corrective action;

(c) Whether the cumulative impact of other sites that might be local contributors is considered.

Summary of actions taken:

The consultee was informed:

(a) Of the reporting requirements within the permit requiring the operator to notify the Environment Agency of the use of the generators;

(b) Of the use of compliance visits and reporting of incidents to initiate corrective actions relating to incidents and potential permit variations;

(c) Of the reasoning to include all four NTT data centres within one permit partly because of the overlap in receptors (both human health and ecological) for the four sites and the use of background air concentration values in air modelling which take into account other local contributors of pollutants.

The consultee noted they had nothing further to add and had no overriding concerns.

Response received from: **Public Health England**.

Brief summary of issues raised:

The consultee noted that, although the air dispersion modelling indicated the risk of exceeding the 1-hour mean NO_2 at receptor locations for the testing/maintenance scenario was <1% and therefore 'highly unlikely', the maximum PEC (Predicted Environmental Concentration) exceeded 401ug/m^3 (the 'high' pollution band of DEFRA's Daily Air Quality Index (DAQI) with approximately 40% exceeding 601ug/m^3 (the 'very high pollution band of the DAQI). There was a predicted exceedance of 960ug/m^3 (the US Acute Exposure Guideline Level 1, AEGL-1) at six receptor locations.

The consultee noted that for the 500-hour emergency outage scenario, the modelling indicated there was the potential for more than 18 exceedances of the 1-hour mean NO_2 AQAL of 200ug/m^3 at a number of receptors. They further noted that the maximum PEC was predicted to be 2778ug/m^3 for residential receptors. Whilst they accepted it was reassuring that historically the operator had had no emergency outages, they commented that in an emergency situation there could be a potential acute health impact for vulnerable receptors.

They recommended that:

(a) The applicant should refine the risk assessment to identify the operational and meteorological population factors that could potentially lead to unacceptable levels of exposure to the nearby population, both during routine testing and maintenance, and in an emergency outage;

(b) The applicant should identify appropriate checks and controls to prevent adverse impacts on public health. They proposed that control of emissions was preferable to strategies reliant on public warning and informing. They also noted that the stack heights for a number of the generators did not currently conform to BAT;

(c) The Environment Agency should consider whether appropriate mitigation measures are in place, both during routine maintenance and testing, and should a failure of the mains electricity supply occur, noting that currently NTT only proposed to develop an Air Quality Emergency Action Plan (AQEAP) for a prolonged outage situation (>18 hours) but that potentially unacceptable acute exposure could occur before this timeframe is reached.

Summary of actions taken:

(a) The operator clarified that they had considered the recommended 5 years (43,800 hours) of hourly meteorological data rather than the minimum of 3 years as outlined with our guidance on air dispersion modelling. This extended period would ensure that a full range of meteorological and operational conditions would have been included and therefore adequately assessed.

(b) An improvement condition (IC8) has been included in the permit requiring the operator to review options for reducing predicted short term nitrogen dioxide emissions and their potential for impact on human health (and ecological) receptors. This review will include stack heights – particularly at data centres Campus and HH4 (phase 1) which have been demonstrated by air dispersion modelling to have the highest potential for environmental impact.

(c) An improvement condition (IC1) has been included in the permit requiring the operator to produce an Air Quality Management Plan in conjunction with the Local Authority. The operator agreed that this improvement condition should include a reference to the Air Quality Management Plan considering outages of less than 18 hours.

Response received from: **Public Health England – Response 2**

Brief summary of issues raised:

The consultee noted that reducing public exposures to non-threshold pollutants (such as particulate matter and nitrogen dioxide) below air quality standards has potential public health benefits. They supported approaches which minimise or mitigate public exposure to non-threshold air pollutants and address inequalities (in exposure) and encourage their consideration during site design, operational management, and regulation.

They noted they had reviewed the additional information supplied and consider that the Environment Agency may wish to seek additional reassurance from the applicant with respect to potential impacts on public health.

(a) The consultee noted that the applicant had supplied additional information with respect to comparison between modelled (100%ile) and monitored data at a sensitive receptor over several months which provided some reassurance regarding the testing and maintenance scenario although no additional modelling had been supplied for operating conditions which were more representative. They noted that the Environment Agency may wish to consider if it was reasonable to request the applicant to conduct additional modelling for maintenance/testing scenarios.

The consultee also noted that, in respect to the emergency scenario, the applicant had supplied the outputs of additional modelling for shorter, more realistic periods of outage. However, the consultee believed the applicant's responses did not fully address their previous comments with respect to evaluating the risk assessment. They noted that the Environment Agency may wish to recommend that the applicant analyses the outputs of the modelling to understand the conditions that give rise to the worst case conditions and that any monitoring and mitigation is designed for these conditions.

(b) The consultee noted that the applicant's response on identifying appropriate checks and controls to prevent adverse impacts on public health (with control of emissions preferable to strategies reliant on public warning and informing) did not fully address their comments with respect to providing that reassurance. They suggested that concentrations of NO_2 should be considered alongside generator operation duration for an assessment of potential exposure of the public at off-site locations. They suggested that the Environment Agency may wish to consider whether the applicant should develop and communicate messaging or alerts for testing and outages and/or should conduct monitoring of NO_2 emissions, especially during the annual testing for each data centre to further refine exposure assessment modelling.

(c) The consultee noted that, in relation to potentially unacceptable acute exposure occurring both during routine testing/maintenance or in a shorter period than 18 hours of power outage, the operator had agreed that an improvement condition relating to creation of an Air Quality Management Plan would include outage scenarios less than 18 hours. They also noted that the operator supplied the outputs of additional modelling for more realistic outage periods of 1-hour and 36-hours. They also noted that the requirement on the operator to produce the Air Quality Management Plan which must consider the predicted exposure of individual receptors, meteorological conditions, contingency for how the response to loss of power will be carried out and specific timescale for response measures substantively addressed their recommendation with respect to the emergency scenario.

They noted the importance of not exceeding EH40 limits or Acute Exposure Guideline Levels (AEGLs).

They recommended that the Environment Agency satisfied itself that the applicant suitably assesses, and mitigates the potential health consequences of short term exposure to high levels of nitrogen dioxide even for periods of less than 18 hours.

Summary of actions taken:

(a) The applicant analysed further the outcomes of the air dispersion modelling to investigate the meteorological conditions that would lead to the highest impact at sensitive receptors. They assessed the meteorological conditions during maximum potential 1-hour NO_2 means for both the maintenance/testing and outage scenarios. They considered temperature, wind speed, wind direction, cloud cover and relative humidity. They concluded that the main driver to impacting on air quality was wind speed with the highest impacts generally occurring during calm conditions (i.e., when wind speeds were below the limit of detection) or during conditions of low wind speed (where this wind speed was <2 m/s).

The applicant proposed that the Air Emissions Risk Assessment demonstrated that the probability of the routine testing and maintenance hours across a year coinciding with meteorological conditions that would lead to an exceedance of the nitrogen dioxide limit values are less than 1% and therefore highly unlikely. As such, the applicant proposed that no specific measures in relation to the routine testing and maintenance scenarios is considered to be required, especially given the precautionary assumptions already embedded in the assessment, e.g. assuming standby generators operate at full load for all testing and simultaneous testing across the 4 data centres which is not the case.

In addition, the applicant has revised the configuration of the HH4 data centre such that we have permitted only HH4 phase 1 which includes 15 generators instead of the 32 generators included in the original HH4 plan. This means that the testing/maintenance operations at HH4 will occur for only 345 hours/year rather than the 736 hours/year in the original application. This will further reduce the potential impact from testing/maintenance operations across the permitted sites.

The improvement condition (IC8) which has been included in the permit requiring the operator to review options for reducing predicted short term nitrogen dioxide emissions and their potential for impact on human health (and ecological) receptors, includes a requirement on the operator to take into account those weather conditions demonstrated by modelling to have the greatest potential for environmental impact in order to reduce emissions, improve dispersion and reduce potential environmental impact.

(b) The applicant demonstrated that modelled and predicted NO_2 levels at a location outside of the four data centre sites, at which an Environment Agency monitoring device had been located, had been significantly higher than those levels actually monitored – predictions of 800 $\mu g/m^3$ NO_2 compared with maximum levels of 120 $\mu g/m^3$ NO_2 measured. We believe that this indicates the modelled NO_2 emissions are very much a worst case scenario.

The reduction in the testing/maintenance hours in the permitted HH4 phase 1 also will result in a reduction in the potential environmental impact from NO_2 releases during testing/maintenance.

As the Environment Agency monitoring of NO_2 has been carried out at Hemel Hempstead and the data is being correlated with operation at the three on-line data centres (Campus, Centro and Maylands), we do not believe further NO_2 monitoring is required by the operator at this stage.

It is also relevant that additional air dispersion modelling will be required by the operator should they wish to permit HH4 phase 2 in the future.

(c) Improvement Condition, IC1, to produce an Air Quality Management Plan explicitly requires the applicant to consider grid outages that last less than 18 hours.

We have also audited the applicant's air dispersion modelling and satisfied ourselves that there will be no exceedances of AEGL-1 values at testing/maintenance scenarios. As the annual testing/maintenance will be reduced in hours as a result of permitting only Campus, Centro, Maylands and HH4 phase 1, impacts on human health receptors from that scenario will be less than modelled.

Response received from: **Hertfordshire Fire and Rescue Service**.

Brief summary of issues raised:

The consultee noted that the matter had been passed to them for consideration and noted they had no comments to make.

Summary of actions taken:

No further action taken.

Response received from: **National Grid**.

Brief summary of issues raised:

The consultee submitted plans and drawings of buried services on the four NTT data centre sites.

Summary of actions taken:

No further action taken. Information received was not relevant to permitting determination.