# Data Centre FAQ Headline Approach

Document Introduction:

This is the provisional Environment Agency working draft guide on our approach to the permitting and regulatory aspects for Data Centre within the context of the Industrial Emissions Directive (IED) and Environmental Permitting Regulations for 1.1A Combustion Activities ‘Chapter II’ sites aggregated to >50MWth input.

This FAQ may also have relevance for Data Centres which come under the MCPD specified generators. i.e. plant which is less than aggregated 50MWth but which falls under the Tranche A or Tranche B criteria for generating power (unless ‘excluded generator’ due to <50hours testing per year).

This document is not presently an official release but forms the basis for discussion of a common methodology and liaison with individual operators and their industry association.

Accepting this working draft as a framework for our approach in applying EPR/IED to Data Centres it must be recognised that this is not a legal document intending to create or modify the law as stated in statute; so ultimately data centre permitting and day to day regulation must necessarily be on a site specific basis.

So to repeat: **Big caveat is that the FAQ is significant but DRAFT and there is only so much that the author can address regarding concerns, ‘TBC’s and reviews/authorisation (E&B) etc. If there is anything contained herein for which costs, permit critical decisions or limits of data centre operations are impacted it is strongly advised to contact the author** **howard.tee@environment-agency.gov.uk** **and/or in any event seek Pre-application advice.**

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## Repository of up-coming issues

1. Operator/consultants still don’t appreciate and NPS should be flexible in permit app detail – model assuming worst design – conservative overall to get on queue
2. Do we want to ‘expand’ the scope of DAA i.e. water treatment chemicals for the data hall cooling; bunded stores?
3. Do we want to expand the regulation around WEEE and waste management too e.g. cardboard or servers/computers - depends co-lo or renting space only
4. Noise from mega-scale
5. BAT around on-site and off-site CEM for NO2 + weather station
6. talking about using compressed air to ‘run/cycle’ the engines to avoid firing tests – need to enquire what this is really
7. Emphasise pressing UKPN to guarantee ok to come-off engines – risk stay on too long

## What is a Data Centre?

Data centres are buildings and associated infrastructure which provide security and reliability in storing digital data on servers. The operation includes: protected and anonymous managed facility to a recognised standard (e.g. ISO27001); conditioning and temperature control for server rooms; protection for business customers against exterior risks (such as flooding, theft, climate and weather); continuity for electrical power supply using multiple grid connections, uninterruptable power supplies (UPS e.g. batteries or Diesel rotatory DR-UPS) and fuel oil powered generators as standby plant. Data centres tend to be located on strategic data networks or business hubs. Data centres can be independent companies within the data centre service market or ‘sole enterprises’ such as banks, which provide the service for themselves.

*There are many resilience configurations of installed standby generators providing for the electrical load demand of the site (building and IT). Usually this is referred to using ‘n’ where n is the specified MWelec rate delivered by a generator unit required by the customer or standard. Configurations may be for example simply n (i.e. n generators no spare), n+1 (i.e. 1 spare generator), 2n (twice as many generators as load suggests), 2n + 1. It is also noted that often IT customers build resilience into the original n specified, that is n itself includes additional spare load headroom. In this text for illustrative purposes 2n is the exemplar.*

## Bullet point key aspects of data centre permitting

We are permitting the combustion activity not the Data Centre operation itself .The summary headlines for the standby plant in a data centre role (i.e. any boilers used are obviously treated as normal under EPR and notably if >1MWth) are:

1. We accept that oil fired diesel generators are presently the default technology for standby generators in data centres. However the permit application still requires a BAT discussion detailing the choice of engine, the particular configuration and plant sizing meeting the standby arrangement (e.g. 2n). But TBC there are now site specific issues where abatement (SCR) is now the default for new plant – see the details in the text
2. Standby engine capacities are added together in MWthermal input at the quoted standby rating, being usually 110% of the continuous rating (if >=50MWth the site then needs an EA 1.1A Combustion Activity EPR permit)
3. If precise MWth figures are unavailable and spec sheets or face-plates are unclear, the calculation for MWth derived from MVA output is based on: power factor 0.8 and an assumed poor conversion efficiency of 0.35 for MWth to MWelec e.g. 3MVA = (3\*0.8)/0.35 = 6.86MWth.
4. The sum of generator plant capacities is based only on MWthermal inputs of all plant regardless of the standby configuration. MWelec output constraints such as realistic customer load or other practical output limiting factors do not constitute a limit to the MWth input as defined in the EA’s guide RGN02.
5. Proximity of data centres with a company campus, adjacent, neighbouring or close-by buildings in urban locations (e.g. within a common trading estate but only separated by a road width or notional distance) may constitute a single site for determining the boundary of the installation as ‘same site – same operator’ as per RGN02 – see the details in the text
6. Permits will include a maximum 500 hour ‘emergency/standby operational limit’ for any or all the plant producing on-site power under the limits of the combustion activity; and thereby emission limit values ELVs to air (and thus engine emissions monitoring) are not required within the permit.
7. 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.
8. 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 (and hence no monitoring) under IED/MCPD. Though clearly the EA expects planned testing and generator operations to be organised to minimise occasions and durations (subject to client requirements). Ideally a target should seek to keep individual generator testing to below 50 hours/annum each as required for MCPD specified generator exclusion. Accepting <50hours/gen/annum as a default upper limit for bespoke large data centres, the EA regards a BAT aspiration to aim for a more routine 1hour/month per generator.
9. In summary 7, & 8 means the whole or part site can only operate as emergency plant up to 500 hours as an absolute limit for grid backup issues; but that individual plant (at any load) with its own stack (or a stack with multiple plant) with justification can be operated for up to 500 hours (ideally <50) each as part of its non-emergency role under maintenance and testing.
10. For the purposes of determining operating hours, data centre diesel generators are regarded as having a minimal start-up or shut-down times. Operational hours start on the first fuel ignition.
11. Data Centre permits (unless they apply and justify it in a permit application) will expressly have a limit on the activity to exclude voluntary ‘elective power operation’ such as demand side response (i.e. on-site use) or grid operating reserve (STOR) (i.e. off-site export of electricity) and Frequency Control by Demand Management (FCDM) for grid support. This is primarily to differentiate data centres from ‘diesel arrays or MCPD specified generators’ that voluntarily operate within the balancing market, and importantly a clear way to demonstrate minimisation of emissions to air as ‘Emergency plant’.
12. The default engine specification as a minimum for new plant to minimise the impacts of emissions to air (NOx) is 2g TA-Luft or EPA Tier 2 or equivalent standard. A detailed cost benefit analysis (CBA) is otherwise needed for existing, old plant justifying worse emission such as 4g TA-Luft plant or for example a justification under FCDM. TBC There are now site specific issues where abatement (SCR) is the default for new plant – see the details in the text
13. CBA for improved exhaust emissions, dispersion and mitigations from the plant is expected for the maintenance/testing and the emergency standby roles. We would be looking for improvements particularly if Local Air Quality (LAQ) modelling (under H1) indicates anything other than an insignificant contribution to short term local air quality for the ‘planned’ maintenance emissions of the plant.
14. Retrofit abatement techniques for existing installations for engine emissions such as selective non-catalytic or catalytic reduction (SNCR or SCR) would not normally be expected for standby plant to mitigate the emissions for standby/emergency operation. BAT might include improved flue gas dispersion (e.g. stack modifications, increased height) or improved low NOx engine management controls or possibly fuel choice.
15. Operations and management procedures should reflect the outcomes of the air quality modelling by minimising the duration of testing, phasing engines into subgroups, avoiding whole site tests and planning off-grid maintenance days and most importantly times/days to avoid adding to “at risk” high ambient pollutant background levels.
16. When AQ modelling the emissions from the engines, the certified technical standard provided by the manufacturer should be used (i.e. likely worst case emissions). However any ‘fit for purpose’ monitoring (e.g. MCP guide M5) of the actual emissions from installed plant will be considered as evidence of the likely real impacts as part of the permitting decision process.
17. The groundwater monitoring of fuel storage tanks and distribution pipework using GW boreholes is risk based for the site condition report (SCR) and IED 5-yearly monitoring. Should GW monitoring be required for underground tanks and/or the SCR, the boreholes should be positioned for whole site surveillance (for the SCR) rather than as a very local control immediately around the buried fuel oil tanks (i.e. not be just an addition to double skinned tanks already protected by leak detection and hence ignoring distribution pipework etc).
18. 5-yearly GW sampling & 10-yearly soil sampling under IED is normally not needed but still needs some justification.
19. The permit application must assess and provide evidence of actual reliability data for the local electricity grid distribution (including data centre internal electrical design) for the EA to judge the realistic likelihood of the plant needing to operate for prolonged periods in an emergency mode (especially if emissions model so as to exceed short term air quality standards).
20. Optimising grid reliability within the site as part of general BAT to minimise emergency operating hours is required – evaluation is needed within the permit application on the Tier reliability standard under ISO27001 and Uptime.
21. Reporting of standby engine operational run hours and discussion of any electrical outages (planned or grid failures regardless of duration) required annually.
22. AQ modelling for permitting split into two parts:

1) for the routine planned testing regime, including scheduled on-load use supporting maintenance works like UPS or HV – if no other details are known the default is 50 hours/gen/year; Commissioning of significant new plant may be included or possibly assessed separately as a ‘one off’ under a permit ‘pre-op condition

2) A prolonged reasonable maximum full load outage (so accepting not all installed engines will run) which the default is assumed 72 hours. Looking at ambient AQ and potential areas for Acute exposure (AEGL)

1. Assuming AQ modelling, based on operating scenarios, indicates a local air quality risk then notification to the EA of unplanned (and pre-notification of planned) continuous grid outage exceeding 18 hours LAQM (or the otherwise assessed short term interval from modelling) is likely required under a permit schedule 5 notification.
2. The notification requirement stated in the permit should also indicate the actual number of generators that need to be operating above which the local air quality is at risk e.g. ‘notification of continuous emergency operation exceeding 18hours with 5 or more engines operating together is required’ (i.e. model shows 4 or less engines unlikely to breach LAQ)
3. Assuming AQ modelling, based on emergency outage operating scenarios, indicates a very significant risk to local air quality and identified receptors, the EA will ask the operator to have a written AQ outage action plan to manage the issue for prolonged emergency running of the plant (including sensitive receptors list and mitigations, assessments and impacts evaluation against modelled risk conditions i.e. occurrence at periods of most concern in the year, possibly ambient air monitoring surveillance at very sensitive receptors). An AQ outage action plan is also likely required for sites which might operate in conjunction with other neighbouring large sites during an outage i.e. data centre hubs. A template AQMP is available

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| 1. Due to the emphasis of the permit on electrical (and cooling) systems it is noted that the EA considers the F-Gas regulations as falling under the remit of the EPR permit (for notifications and management) where F-gases (or potentially any polluting potential substance) are used directly under the combustion aspects of the permitted activity (e.g. switchgear). It is important to notify the EA of any significant releases. Other uses of F-gases e.g. for server room cooling are not strictly under the EA permit but are regulated by the EA generally so it may still be prudent to make the EA aware of your F-gas releases.
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1. The permit application should detail the likely quantities of waste engine oil generated annually - EWC 13 02 waste oils following servicing for example. Although unlikely to be huge, the Pollution inventory has a reporting threshold of 1 tonne for non-hazardous waste but technically no lower thresholds for hazardous waste oil.
2. The permit application is for the combustion plant and associated environmental concerns and not for the Data Centre itself. The applicant should be aware that the permitting process and application is accessible to the public so should have regard to ‘Commercial in Confidence’ and Critical National Infrastructure. In the first instance discuss particular concerns directly with the EA and/or exclude such priority information from the application but indicate that such is ‘available on request’.

## Aggregation of the installed Generators

### RGN02 – the EA’s official guide on aggregation

The aggregated net thermal input load required for an EA combustion 1.1A permit is 50MWth input as defined by the IED Chapter II. The aggregation is not on MWelec output or MVA. The specific guidance related to the nub of the issue regarding IED Chapter II (50MWth) aggregation is at

The legislation (& latest RGN02) does not have a de minimis of MWth so aggregation applies to all combustion plant on site in making up the threshold total. Note: historically a 1MWth threshold had been used; it is practically most likely that data centre sites would clearly fall one side or the other of EPR permitting 50MWth threshold based solely on their stand-by plant rating.

It applies to all plant even those which may be regarded as ‘standby’ – so this includes those provided units in addition to customer load demands as a (2n), (n+1) or 2(n+1) data centre site. Generator set power rating is the standby figure (i.e. normally 110% thermal input of continuous rating) and summed as MWth input and then used as per RGN02.

If precise MWth input figures are unavailable, the calculation for MWth derived from MVA output is based on: power factor 0.8 and an assumed poor conversion efficiency of 0.35 for MWth to MWelec e.g. 3MVA = (3\*0.8)/0.35 = 6.86MWth. More detail may be required if the aggregation falls marginally very close to the 50MWth.

### Data Centres with additional combustion plant other than standby plant

If the operator has additional combustion plant other than standby generators such as boilers or possibly diesel fire pumps then those need to be included in the aggregation as well. This is more likely to apply for Lone Business or Pure Enterprise locations with offices to heat etc.

Boilers or power plant >1MWth which operate for regular supply of hot water, power or heating will be treated and assessed differently within the permitting because they would not be emergency (i.e. >500 hours use) and there is sufficient information and legislation for the setting of monitoring, emission limits and BAT.

BAT for >1MWth is that ELVs would be set by the medium combustion plant directive - MCPD or our best available techniques (BAT) benchmarking for plant.

BAT for <1MWth plant (accepting AQ impacts as being relatively minor compared to the larger MWth plant on-site) is likely only “operating to the manufacturer’s specifications”

Plant below 1MWth does not usually need to be included (or regulated) on the EA permit as combustion plant emissions. It is however important to mention such plant during the permit application process so that consideration as to it potentially being a ‘Directly associated activity’ can be made (e.g. sharing a link to a common fuel storage tank).

### Thermal Load Output constraints to the installed plant – RGN02

Primary legislation is clear that for combustion plant, it is the input thermal not output electrical that draws plant into the legislation for a permit. RGN02 outlines how the EA approaches the issues associated with operators wishing to de-rate plant, provide fuel flow physical constraints so as to fall below the IED 1.1A EA permit 50MWth threshold and thus avoid a permit for the site as a whole.

It should be borne in mind in the context of diesel arrays and aggregated combustion plant generally the medium combustion plant directive fills the ‘regulatory gap’ in the range 1-50MWth for such plant.

It is not for the EA to audit system’s physical design constraints or QA software to determine an alternative to the simple figures on the faceplate on engine plant input. MWelec output constraints such a realistic customer load or other practical output limiting factors do not constitute a limit to the MWth input as defined in RGN02. In RGN02 mention is made of physical (e.g. an orifice restriction plate in a fuel line) or software constraints (*meaning a separate instrumented metering control system with locked-out limits on fuel across the site*): these can only be permanent and immediately verifiable by a regulatory officer as if equivalent of a faceplate value on the input to the plant.

### Who needs a permit – ‘the same operator’

The primary legislation states permits are required for a ‘common operator on a common site’ as per RGN02. Operator definition is clear at https://www.gov.uk/guidance/legal-operator-and-competence-requirements-environmental-permits

The same company operating under different names (such as might occur when takeovers of adjacent data centres) are at risk of being the ‘same operator’.

It is possible that within a data centre and within particular phases, the ownership of the associated standby plant might technically rest with the customer not the data centre. For the purposes of the permit it is the operator not owner of the plant that is important.

If the Data centre is providing solely floor space and the ownership, management and operation of the standby plant rests wholly and completely with the IT/server ‘external customer’ then the EA will take a view on a case by case basis of the permitting options such as single small MWth best excluded from a permit altogether (later to become a MCPD plant) or aggregate it into a single ‘multi-operator’ permit.

### Who needs a permit – ‘the same site’

We would clearly regard a company’s individual campus or obvious standalone boundary as a single site. If the electrical plant within a common site boundary or building is managed by a single operator (i.e. it is not the customer ownership of the individual phase within a site that is important) or controlled by a common legal entity, the plant is included in the MW summation.

For data centres the ‘same site’ with reference to RGN02 and several premises located over an area within a commercial/urban environment is aggregated on the assessment of Proximity, Coherence and Management Systems below:-

Proximity: there is no simple distance but is a site specific decision based on a reasonable interpretation and argument. For combustion activities in the urban/commercial environment ‘proximity’ may be considered as immediately adjacent to (with or without fencing demarking individual buildings on a campus); or broadly seen as a road width (up to around 100m segment\*) and/or uninterrupted line of sight between buildings (plan view up to around 250m\*). Outlier buildings, some distance apart, can be connected by other sites closer together on the basis of ‘linking’ chains of proximity (i.e. all buildings do not need to be in ‘proximity’ with each other). The role of permitting is ultimately to prevent or minimise pollution and harm to human health, so for air quality, consideration of proximity can take account that premises share sensitive receptors or could reasonably have adverse joint impacts or conversely are so far apart as to not have in-combination effects. A final factor may be that individual buildings/premises’ short term process contributions (PC) do screen out as insignificant under our H1 guide at https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas

 \* 100m and 250m – these guidance scales are derived from 2008/50/EC EU directive on ambient air Annex III for the siting of sampling points and used as our indicative means to link common sources & receptors for ambient air quality impacts in the urban environment.

Coherence: This is the way identified sites work together and their links. Aspects related to data centres might include:

1. Direct and dedicated power link between buildings to share standby generator capacity
2. sharing physical resources like fuel tanks
3. combined generator maintenance/test regimes (e.g. engine emissions at each location are not independent because they are tested as a group set or conversely whole buildings are tested separately because of staff availability or risk management)
4. the operator has a practical concern (or indeed actually take account of in planning and testing for), that each individual building may need to operate altogether due to a common but localised grid outage cause (i.e. managing a shared HV feed or common outage risk even if perhaps statistically unlikely)
5. ownership or management of the land/estate itself by the operator.

Management Systems: Those buildings/data centres using the similar operator procedures, management system, sharing of staffing, and corporate ownership or company. Common management system such that there is the opportunity to minimise the combined impacts of locations which are in proximity.

Note1: Ultimately this will be a site specific judgement which will consider and balance the above 3 issues; and broadly the closer the proximity the less coherence is needed. Conversely the greater the physical separation the more coherence and management link is needed.

Note2: Remember once you have decided that there is one operator for a set of data centres buildings within a ‘same site’ locale, the aggregation is for that plant as a total regardless that each building or individual data hall is below 50MWth. Thus an operator managing two buildings separated physically by a road each of only 26 MWth input does need a permit for the ‘same site same, operator’ at 52MWth.

### Data Centre clusters (different operators) on a shared HV supply within a locale

Completely different operators and probably competitors (isolated buildings, different legal entities) within the same notional site area within the urban environment but each below the 50MWth threshold do not normally aggregate on to a single ‘multi-operator’ 50MWth permit (as this is usually applied for and determined on the basis of operators co-operating for the ‘same-site’ permitting purposes). However the EA will take a view on a case by case basis.

There is a case for aggregating separate sites if they are adjacent or closely located and there is a “technical connection” between them. “Technical connection” essentially means that they are operated or controlled by the same entity, possibly share the same power supply, operational management, network connectivity etc. Sites will be handled on a case by case basis and factors like substation connectivity can be taken into account (if served by different substations the likelihood of a simultaneous outage is reduced).

The aggregation that the EA derives cannot treat the HV grid supply to a series of different sites as being the defining requirement and ‘technical connection’ as this could lead to many sites widely dispersed being drawn into a common permit; or equally the determination of a single permit being limited because there are already ‘too many’ data centres on an HV link. There would also then be a query as to how far does the 132kV, 11kV or 33kV hierarchy go. The HV cannot be considered as a technical connection between sites alone since this could lead to multi-operator permits (when such are actually competitors) and the operators themselves do not have control of the HV link.

However practically the EA does need to have some appreciation that clusters of separate and independent data centres (some with permits) could all need to operate due to a significant outage event or indeed tend to similar testing and maintenance regimes see 1.15 Air Quality Emergency Action Plan (for grid outages)

### Site expansion and when to permit

Legally a permit should be applied for and held prior to operating and installing at or above the 50MWth input threshold.

All else being equal it is better to apply for and have completed the air quality (AQ) model for planned site expansion and have a permit in place before installing extra engines.

Site expansion includes fitting out new phases, acquisitions, but also physically procuring a site building on adjacent land as under 1.3.5 Who needs a permit – ‘the same site’ above.

The onus is on operators to apply for permitting and decide what level of MWelec activity they want to the permit to cover. The cost of permitting is presently fixed according to our fee schedule at <https://www.gov.uk/government/publications/environmental-permitting-charges-guidance>

Operators have to balance the additional cost of permitting for future capacity (which has the benefit of certainty) against permitting costs to vary the permit as they grow in MWth installed. In the latter case there is the possibility that additional permitting may be problematic so this has to be factored in as a business risk. Permitting requirements should not limit sustainable growth. However, there will be more sensitivity where air quality is already an issue – e.g in AQMZ – air quality management zones.

There is the potential that new sites will apply early for a limited hours MCP permit for new plant (operating/commissioning after 30/12/18) but be below the 50MWth threshold for a 1.1A(1)a permit for a period in anticipation of then expanding to need the installation >50MWth permit (i.e. vary the MCP permit). The operator should be aware that this has significant considerations:

1. Anticipate for BAT engines – even though the BAT criteria do not apply to MCP, the operator need have concern that plant installed after 30/12/18 appearing on a permit variation to >50MWth will be BAT reviewed and may need to be upgraded. The EA cannot be in the position that 49.9MWth of a new data centre MCP should avoid BAT if the operator was clearly always intending to expand.
2. MCP standby does not consider a site condition report (for fuel storage etc) – a new build expanding the site and seeking a variation will then need to address this retrospectively; it would be easier to take this requirement into account at the earliest opportunity. Again this is to avoid a retrospective requirement to say improve fuel storage secondary containment
3. MCP might not have assessed the AQ modelling to the same degree as an installation permit. The complete air quality model should be developed both to ensure expansion will be acceptable but also determine if an AQMP is needed (even below 50MWth initially)

### Temporary Containerised plant substituting on-site provision

Generally if the site needs to bring on temporary plant as a substitute for generators within the permit, for example due to a critical engine failure, then this does not need to be factored into the permit or application (i.e. assuming a short term increase in testing or pollution emissions rates). This is because by and large the MWth is not being increased (only substituted).

It is advised to let the local regulating officer that such is needed particularly for a) changes in emission point and noise that might attract public concern during start-up b) fuel oil and refilling needs to consider changes to site risks. Ideally use of temporary plant should be an agreed procedure as part of the operating techniques.

Any temporary or ‘mobile’ generators deployed at short notice or otherwise shall ideally be emission optimised BAT engines.

NB As a guide to bringing on temporary combustion plant Under RGN02 Appendix 1&2 *Note 1.1.8: Temporary Combustion Plant. Only units which are permanently situated and operated on the site should be included in the aggregation. Equipment brought in during shutdowns, compression ignition generator sets, air compressors, reciprocating engine vehicles etc would not be included in the aggregation, nor would heaters brought in during cold spells or to temporarily replace units under repair.*

### Additional temporary (adding MWth)

Any provision of extra temporary engine plant and certainly any at scale (non-BAT?) in a planned way, on an already permitted site, should be discussed in advance with the EA.

Be aware that temporary plant could include contractors like UKPN bringing in their own kit on to site.

Risk Assessment and EMS control particularly for Air Quality, noise and fuel storage (spills and refilling) should be pre-planned and managed under permit condition 1.1.1 in the first instance for temporary plant (whether at a scale to engage with the EA or not)

Any temporary or ‘mobile’ generators generators deployed at short notice or otherwise shall ideally be emission optimised BAT engines.

It would not be necessary for routine data centre use of the standby to engage the EA for pre-approvals (e.g. for UPS maintenance or HV repairs). But for significant elective use over a prolonged period of permitted engine plant (say to commission a new controller over a week with several at-load runs i.e. in essence that the original AQ model at permitting had not considered or which could be considered electively running the equivalent of a comparable full-outage) it is recommended should be discussed with the EA first.

Report the deployment arrangement, fuel use and any salient information for any temporary plant within the permit annual report.

### Commissioning new plant >1MWth (New MCP and/or reaching IED >50MWth threshold)

Under Medium Combustion plant definition putting into operation see Medium combustion plant: when you need a permit - GOV.UK (www.gov.uk) “‘Put into operation’ means the MCP has been fired up to its full load with the fuel it’s designed to use. This can be during commissioning”(\*) MCP qualifying plant (>1MWth limited hours standby generator)

Standby equipment commissioning is complex around various loads & ramp-ups, importantly controller testing perhaps across multiple units, HV feeds etc. This could be thus over a significant period. The standby units would doubtless be tested at the factory to full load too.

Because such **commissioning may well be one of the ‘one-off’ worst AQ impacts for the plant there is good reason to properly include such an event as part of having a permit (testing regime) in place**. Despite the MCP definition it would not be appropriate to argue the technicality of doing absolutely everything bar reaching ‘full-load’ (in essence “let’s commission to 95% of full load then!” as this would not meet the spirit of the legal requirement).

Also, though not part of MCP per se but under chapter2 IED 1.1A(1)a >50MWth should such a threshold be reached, consideration of site condition report (SCR) for groundwater protection for fuel storage tanks is also needed i.e. ‘commissioning’ could include a permitted directly associated activity DAA, of filling and using the fuel tanks.

**So for the purposes of IED >50MWth first fuelling and doing a combustion start-up on a new prime-mover, even on minimal load, is “operating the plant”.**

This means new plant brought onto site at >1MWth (about 400kWelec) needs to be permitted at least as separate MCP limited hours and certainly included within the >50MWth permit to commission it under most commissioning programmes.

This means installing/commissioning new plant needs a permit in advance for MCP and especially if it takes the site to >50MWth aggregated.

## Permit operational or emergency time limits (500 hours).

### 500 hours emergency Industrial Emissions Directive (IED) under 1.1A

500 hours is an emergency mode of operation for gas turbines and gas engines included in the Industrial Emissions Directive (IED) under 1.1A combustion Chapter III Annex V. It defines the operational hours above which the Annex V emissions limit values need to apply “for emergency use that operate less than 500 operating hours per year”. There are many practical reasons for this 500 hours threshold: the difficulty in predicting operations; measuring and monitoring emissions for short durations; abatement systems are less effective, difficulty in defining stable emissions based on load interval and the allowance to switch to an alternate fuel (e.g. oil when normally using gas) in an emergency.

Technically emergency 500 hours is not a limit applying to Chapter II sites plant under IED under which permits are granted for data centres, however we use the above reasoning to apply it to combustion 1.1A Chapter II sites and as such Data Centres too.

The EA takes the view that generation plant at a Data Centre used solely for back-up and emergency standby for potential grid outages (and on-site power failures) constitutes an emergency 500 hour plant under EPR/IED and MCPD too. This allows us to evaluate the likely air quality impacts of needing to improbably operate a Data Centre in an emergency i.e. given the reliability of grid networks nationally.

A permit determination could theoretically limit the total operational hours to those below which pollution would not occur to the local area and this could technically be less than 500 hours. So 500 hours for emergency plant is a default ceiling limit if exhaust emission limit values (ELVs) are not set. The 500 hours limit could technically be adjusted to reflect the company’s maximum requirements of the offered guarantees of grid supply duration (e.g. 5 days, or 17 hours of fuel oil storage etc).

**The whole or part site plant can only operate as emergency plant up to 500 hours in total per year as an absolute limit for grid outages**. Although the EA permit is issued on this basis practically sites will be in communication with the regulatory officer assessing the impacts of the emergency operation and wishing to extend or reduce the 500 hours duration.

### How is a 500 hour notional emergency limit accounted for?

Technically under MCPD definitions, as a guide, each individual generator with its own discharge stack, can ‘operate’ for testing or emergency for up to 500 hours per calendar year (as rolling average over a 5 or 3 year period Article 6 (3 & 8)) each without ELVs under IED/MCPD.

MCPD Article 3 (22) defines operating hours based on ‘a combustion plant’ & Article 4 Aggregation defines combustion plant based on common stacks. If a set of generators is provided within a shared common discharge stack then individual or any combination of the set of generators used in parallel can be maintained and tested without ELVs under IED/MCPD up to 500 hours per year usage of the stack.

The EA considers it unlikely that individual emergency generators would ever need to be tested and/or then be used in an emergency for 500 hours per year. However there is a definitions deficiency in the wording of applicable legislation in that the EA data centre permits are issued as a Chapter II 1.1A >50MWth aggregated site under which there is technically no definition of a 500 hours emergency (Chapter III Annex V ‘emergency’ hours applies to the LCP common stack using gas turbines).

**The whole or part site plant can only operate as emergency plant up to 500 hours per year as an absolute limit for grid outages**.

Maintenance and testing hours for generators does not reduce pro-rata the available 500 hours of emergency running for whole or part site grid outage. This is because the EA wishes to address the following three issues in considering the best management of the impacts to air quality:-

1. prevent significant air quality concerns in potentially allowing sequential use of (part) plant operating in an emergency with its own independent 500 hours to power the whole site i.e. for example prevent 500 hours emergency for half of a 2n arrangement, and then another 500 hours for the other half of the 2n
2. minimise the size of the largest peaks of exhaust emissions to air during maintenance/testing by encouraging the fewest number of engines operating in parallel. (i.e. 3 engines each for one hour over a 3 hour period rather than all 3 engines for 1 hour)
3. data centres may have so many generators that testing or maintenance operations even for 1 hour each over a year could quickly use up all 500 (emergency) hours limit for the site.

Theoretically the site can run the set of single/multiple engines in series or parallel for planned test operations for more than a gross total of 500 site running hours over the year (provided this was an EA approved & modelled management procedure, covered in the permit determination, with minimisation of impacts to air quality).

For the purposes of determining operating hours, data centre diesel generators are not regarded as having a start-up or shut-down time; and so the start of fuel ignition starts the clock. This includes the shorter periods of plant ‘overlap’ when redundant plant is started for reliability before final customer load is reached and the generator is backed-off and then stopped.

The administrative complications and burden of recording run hours and checking against a notional 500 site wide emergency hour limit with shared common stacks, emergency or test operation, parallel generation with part-plant part-load could be unduly onerous - *the EA is content to use the engine management logging schemes provided by the engine/systems supplier as the reporting of run hours on each engine over the year*.

Any planned prolonged maintenance or repair of electrical systems on site such as switch gear or transformers requiring the generators to be used should be planned and managed to minimise the standby operation impacts for local air quality. Prolonged planned maintenance requiring more than the permit assessed number of standby plant likely impacting derived notification duration (such as the 18hour limit for a proportion of the installed plant) should be pre-notified to the EA under schedule 5. Again planned use does not constitute emergency hours per se. see 1.4.5 below.

**Once permitted a data centre practically need only really report each engine’s run hours annually and notify us of powering the site on outage and/or for prolonged periods using more than the predetermined number of engines.**

**If the data centre plant is offering into a non-emergency role like STOR, Triad, demand side response or market reserve as well as the standby operation, then this is not regarded as solely a 500 hour emergency site**. The site would then need to make added justification according to DECC “Developing Best Available Techniques for combustion plants operating in the balancing market”. A data centre in STOR etc would effectively need to meet the additional DEFRA requirements of diesel arrays as ‘Specified Generators’ under MCPD but importantly would also adversely influence the EA’s ability to assert the ‘unlikelihood’ for grid outage at full power operation as being very low.

### Energy Efficiency Directive (EED) and the 1500hours qualifying plant

The EED exempts “those peak load and back-up electricity generating installations which are planned to operate under 1,500 operating hours per year as a rolling average over a period of five years”. So is unlikely to apply to data centre generators (but Defra should be verifying such qualifying plant). It is also for this reason that a time limit of 1500hours if not 500 hours would be needed in the permit.

### MCPD and specified generators, 500 hours and ELVs

If the Data Centre is less than an aggregated 50MWth input but does still have plant >1MWth then it still falls under the EPR 2018 Medium Combustion Plant Directive requiring an MCPD permit. However providing the plant is likely to operate less than 500 hours no emission controls and limits would apply. It would be categorised as an ‘excluded’ specified generator and for new plant gain a standard rules SR No.7 permit see

<https://www.gov.uk/government/publications/sr2018-no-7-new-low-risk-stationary-medium-combustion-plant-1-20mwth-in-operation-after-20122018>

Be aware that a data centre site which doesn’t reach the threshold of >50MWth which expands with one or more standby engines will need:

1. An EPR chapter2 combustion 1.1A(1)a permit if the new total is >50MWth or
2. Will still need a new plant MCP limit hours (exclude SG) permit for the new engine(s); and the older ‘existing plant MCP’ from 2024 for any already installed engines before 30 Dec 2018(>5MWth)

However if the Data Centre plant (aggregated >1MWth but less than 50MWth) operates not only as a standby but meets the criteria for a ‘specified generator’ (tranche A or B) because in essence the plant is not used only for <50 hours of testing but generates electricity (i.e. balancing market, STOR, Triad, FFR or elective demand side response i.e. other than the 500 hour standby role) it will need an EPR MCPD permit that will have emission limits and a requirement for monitoring and possibly SCR abatement.

NB If the site is operating within the criteria of ‘specified generators’ then there is no de minimis on the MWth input of each generator – so can go below 1MWth individually (providing a site total >=1MWth)

### Grid outage hours – Data centre operation hours limit?

It is recognised that the EA cannot practically put time limits on the duration of grid outages and blackouts under emergency operation for Data Centres.

It is however important that the EA can track and compare any poor performance and reliability of the grid connection and can manage impacts of prolonged engine operation due to electrical failings within the site. Thus it is likely that the annual commentary of all durations for any external grid outage or ‘within site’ infrastructure failures will be expected.

AQ modelling looks primarily for any local air quality exceedances of ambient hourly averages – 18 breaches within a 12 month period. Large numbers of Diesel generators operating in unison are likely to cause breaches to the Air Quality Standard Regulations 2010 (see <http://www.legislation.gov.uk/uksi/2000/928/contents/made>) implementing EU limit values in ambient air. The permit application must provide evidence and actual reliability data for the local grid distribution and data centre internal electrical design for us to assess the actual likelihood of the plant needing to operate for prolonged periods in an emergency mode (if ambient quality breaches are predicted).

There would also be a particular requirement of immediate notification if standby operations start to exceed the notional risk level assessed as part of the air impacts modelling i.e. usually 18 hours continuously at full load or minimum number of generators. The 18hour LAQM limit for (pre)notification for a site-wide grid outage applies for that minimum number of generators at which a possible AQ breach may occur.

It is possible in the event of a large number of manageable site outages (due to poor grid reliability) and depending on the basis of BAT to minimise operational running hours that the EA may consider the need for the site to provide increased electrical system reliability e.g. dual grid connections, ISO27001 Tier 3 or 4 sites would be likely to meet this consideration.

Annual reports should include a discussion on Grid reliability and maintenance hours running.

## Maintenance, testing, grid outages

The permit application should consider the known managed hours of operation for maintenance and testing (e.g. each engine 1 hour per month). It should also justify separately the likely impacts of operating to support a grid outage.

It would be expected that the maintenance and test hours are managed to avoid potential air quality impacts especially if the site is within an urban area which has designated a local air quality management zone LAQMZ.

**Ideally a target should seek to keep individual generator testing (at any load) to below 50 hours/annum each.**

### Scheduling Plan for testing:

The important thing is that the best times to minimise impacts to do maintenance testing form the schedule. It is one way of demonstrating good practice within operational constraints (which may include Service Level Agreements, other commercial constraints, change freezes, out of hours’ noise levels, other impacts on neighbours, etc). For data centres the primary concerns relate to short term emissions with local air quality impact rather than long term base load test emissions (although this could be a factor for the largest data centres). This should be reflected in the maintenance test plan.

1. Choose times to minimise overall air quality impact potentially taking into account the additive effects of other emission sources, and the existing level of ambient air quality breaches and air quality affected by meteorological conditions
2. Test firing could be scheduled to avoid sensitive times (rush hour). 5 year air quality trends will inform this. In some areas with existing air quality issues test firing may lead to breaches. In this case the priority is to avoid the peaks and seek the least worst option.
3. Scope for splitting test runs so that not all generators fire at once – test firing in batches.
4. Scope for coordinating test firing between adjacent sites
5. It may be useful, much like reducing fuel use, to have NOx or particulate mass emissions for the testing regime (mass emission rate at the test load) as a whole as a metric. This could be used to drive improvements in reduction in overall testing regime mass emissions.
6. Does the choice of fuel potentially reduce the emissions.

The NOx or particulate impacts of plant testing (accepting potential adverse impacts of other issues like noise) may reduce at weekends, very early morning, night-time or in the summer. This is especially likely to apply to whole site (full load) tests needing the majority of the combustion plant to run.

Operations and management procedures should reflect the outcomes of the air quality modelling by minimising the duration of testing, phasing engines into subgroups, avoiding whole site tests and planning off-grid maintenance days and times to avoid adding to “at risk” high ambient pollutant backgrounds levels.

It should be borne in mind that standby plant BAT procedures may need to balance and adjust to concerns around:

1. Air quality
2. Noise nuisance
3. Visual impacts and unsightly dark smoke on start-up, when testing multiple engines in series

## Maintenance Regime to reduce emissions

Overall the standby generators should be maintained according to the OEM specifications. The following are some observations on possible areas for improvement:

TBC BAT details to be expanded by operators/TechUK

1. The newer engines may be provided with emission ports it would be useful to track NOx emissions with an MCERTed handheld instrument (following the EA ‘M5’ guide) especially either after serving and/or on-load tests
2. The performance of the ECU by tracking general engine control parameters and correlate those with actual emissions data (for CO or NOx)
3. As the engines are not used for prolonged periods on load, it is possible that service intervals might be extended and thereby miss possible ‘major service overhaul’ opportunities including
4. Air filters
5. Engine oil filters
6. Valve timing adjustments
7. Flushing of the coolant system
8. Replacement of the coolant and thermostats
9. Cleaning (external) radiators of dust etc
10. Alternator space heaters
11. DC alternator belts

The replacement of oil and air intake filters is essential for optimal performance of the generators.

The replacement of oils and other lubricating products, as recommended by the original equipment manufacturer (OEM), can reduce NOx emissions.

Such maintenance activities can be checked through the Asset and Maintenance Management systems.

## F-Gas Legislation

Due to the emphasis of the permit on electrical (and cooling) systems it is noted that the EA considers the F-Gas regulations as falling under the remit of the EPR permit (for notifications and management) where F-gases (or potentially any polluting potential substance) are used directly under the combustion aspects of the permitted activity (e.g. switchgear).

It is important to notify the EA of any significant releases. Other uses of F-gases e.g. for server room cooling are not strictly under the permit but are regulated by the EA generally so it may still be prudent to make the EA aware of your fugitive F-gas releases.

## STOR, Triad, FFR, frequency response FCDM

*It should be noted that under the Medium Combustion Plant regulations these modes of operation over and above a purely grid standby role (defined by <50 hours testing per generator) are in essence qualifying generation for the plant as ‘specified generators’. This section effectively outlines the additional data centre permit requirements, for chapter 2 aggregated to >50MWth, embracing the aspects of obtaining an MCDP specified generator bespoke permit.*

Clearly a data centre’s combustion plant could be permitted to operate in the above modes (short term operating reserve STOR, fast frequency response FFR, frequency demand management FCDM, Triad) in addition to grid standby. The application would need to justify the impacts to local air quality. It should be borne in mind however that such offerings are considered as different to emergency operation in the context of data centres. This is because in addition to any Data Centre BAT, there is also the “DECC, now BIES, BAT for the Balancing Market” and MCPD expectations which the site needs to address, and importantly there is clearly the potential that:-

* The site may be more at risk of a grid outage if electricity export systems are in place
* The site must necessarily account/model that any grid outage will be extended by an elective STOR like operation within the same period.
* STOR, FCDM operation tends to be at the peak times for risk of LAQM impacts

There is clearly some justification to want STOR, FFR, FCDM or DSR and then offer to discount these hours by not doing the planned maintenance test runs or whole plant tests that would otherwise be carried out. Clearly the difference for STOR etc (compared to planned testing) is not being able to choose the better air quality window and also minimising the durations.

**It is understood that new models of Data Centre standby may be based around a natural gas fuelled prime mover linked to MW electric store batteries (thereby incorporating & substituting the lead-acid IT UPS) whereby the batteries are offering the equivalent of a STOR or elective export with a subsequent recharge by the engines. It is deemed that electively charging after an export from the batteries renders the gas engines as ‘Specified Generator’ under EPR and would be permitted on that basis.**

### Frequency Control by Demand Management (FCDM) & FFR

Frequency Control by Demand Management (FCDM) - a demand side response (DSR) type mode using diesel Rotary-UPS or generators. The DRUPs or generators operate automatically for a short time (perhaps 10 minutes – but durations are subject to justification within the permitting process) when there is a dip/deviation in grid frequency; this occurs depending on the grid provision to the site but may be about 6 to 12 times a year. A question arises regarding options, if requested under contract by the UKPowernetworks, to provide an additional running time (perhaps another 20 minutes or more) in such events to ease the local grid loads. This mode may cause difficulties in justifying an emergency role 1.1A permit:-

1. We expect that Data Centre BAT is to do everything to reduce emissions and impacts (maintenance, tests, stacks, grid reliability, action plan, engine standards, DRUPS frequency response run times etc) especially given the >50MWth size and NOx mass emission rates. So unnecessarily running more than needed for Data Centre reliability testing is not BAT nor an emergency.
2. Negating a planned test to compensation (i.e. within the same month) does not match well to planning and controllability to avoid the worst time of day of the original event. One could argue the EA could then look to putting permit conditions to fix the total of your annual test hours knowing the site is in an FCDM scheme (e.g. for each FCDM choice, a month’s testing should stop, even if customers are expecting it)
3. Broadly DEFRA is considering proposals that diesel arrays, especially those not meeting an engine emission standard, aren’t the right thing for anything other than genuine backup i.e. looking like fuel oil diesel arrays may not be BAT even for STOR (or a DSR equivalent) too.
4. **A risk is that elective FCDM now looks more like an equivalent unplanned full load grid outage scenario which the EA accepted as being very unlikely and infrequent (which the permit application provided evidence for)**. {e.g. single 15minute outage in 5 years but minor frequency dips looks ok; but operating such that 12 minor frequency dips are electively each extended to over twice as long as the single longest emergency outage doesn’t look so good}
5. Possibly each extra extension (at site load even though less than 1 hour) could push an average hourly exceedance that wouldn’t otherwise be an issue (because the peak is so high even for a shorter than 1 hour duration). There is a concern about how many FCDM events and how long they can be under BAT, do we start thinking about a mass emission limit?
6. If you were likely to have 18 (possibly minus the local number already predicted because it’s in a local AQ zone) FCDM events in the year and there was a reasonable chance each would cause an additional breach of hourly mean AQ because you’ve run longer than necessary then the EA could legally not grant the permit.
7. Looking more like a ‘dirty diesel’ array, one needs to consider that local planning for these would not be to locate them in central urban area or LAQMZ within already AQ focused concerns now. The EA doesn’t want data centres to be a backdoor to diesel arrays or STOR as MCPD specified generators.
8. There would be likely separate BAT for diesel arrays (engine spec, stacks) in a STOR/DSR mode under MCPD/DEFRA – thus the EA might look more closely at the spec of current generator plant already installed and expect an accelerated upgrade programme i.e. the FCDM mode is less like an emergency 500 hour permit.
9. BAT for specified generators to meet the MCPD NOx ELV is to install SCR.
10. Monitoring of emission in these modes may be expected.

**We would advise that it is very unlikely operators could provide sufficient Impacts and BAT justification for FCDM and would be extremely difficult to extend more than the data centre operational requirements for DRUPs or specified generators. However**

1. The operator can ask for an additional FCDM or specified generator role but the application would need to be very clear about the justifications and mitigations. You would definitely need to model the emissions on top for a) planned maintenance testing and b) outage scenarios to demonstrate few ‘planned’ and unlikely AQ breaches.
2. The EA can imagine the operator justifying a contract up to a definite limit of ‘m’ such FCDM support events with an individual maximum duration ‘t’ and total duration ‘T’ of all BUT with a qualification and use of the main conclusions from an emergency outage AQMP to assess if any particular FCDM can be accepted and for how long – thereby refusing to extend a brown out because AQ was at too much risk. The permit might then limit to m, t and T; and need you to document/report them to us to audit.

## Management Standards 9001, 14001, 18001, 27001 and 45001 etc

The EA expects the site’s management system to embrace aspects of environmental impacts this would include the non-combustion related requirements for the protection of groundwater (i.e. fuel oil storage regulations), noise, dust and odour.

Standards like ISO27001:2003 IT Security techniques; TIA-568 Telecommunication industry Association Commercial Building Wiring and TIA-942 for Data Centres (which defines Tier reliability) are apt for the data centre industry. These should form a BAT justifications for minimising generator operations due to grid reliability.

The operator may wish to consider the on-site H&S workplace exposure of NO and NO2 to technicians in the event of major testing, commissioning, and prolonged outages

## Engine Emission Standards and BAT

**This section has been updated in light of:-**

1. **Sector is expanding rapidly with significant balance change from ‘legacy’ to new build since 2017**
2. **New builds are getting bigger (MWth) with larger fewer engines**
3. **Expansion options for mega-scale (hyperscale) including buying up adjacent land after permitting**
4. **Increased awareness for receptors high peak NO & NO2**
5. **Increased operator awareness for workplace potential exposure during outages peak NO2**
6. **Sites fitting SCR abatement under planning in GLA for long term environmental costs (Air Quality Focus Areas AQFAs, Air Quality Neutral)**
7. **Under a Corporate precautionary & Green objectives basis for some operators**
8. **Clusters and associated concerns are increasing (sites permitted/assessed separately till now) for wider outages**
9. **Possible Options to increase pool of engines (marginally non-emission optimised) to allow more flexibility on 2g/EPA Tier2 BAT with SCR to achieve equivalence i.e. buying ‘do better SCR than the minimum’ as a package?**
10. ***Future options to see the ‘standby diesel’ sector as an elective emergency resource***

**The following points are noted for information:**

* **SCR is commonly regarded and taken to be the BAT secondary abatement option for diesel engines for NOx**
* **The MCP legal requirement ELV for diesel engines, new and existing plant >5MWth on gas-oil is 190mg/m3 at 15% O2 (250mg/m3 for existing plant <5MWth)**
* **The exclusion from the above ELV is under Article6(8) – “Member states may exempt new MPD which to not operate >500hours per year”**

**Though SCR is not presently, formal BAT requirement under the original discussions with TechUk. Where SCR is mentioned in the following it is intended initially to sign-post the EA’s provisional way forward for the next level of BAT.**

**Upshot: The EA is wishing to move under the review cycle of BAT (every 4-8 years) to SCR for IED 1.1A(1)a large aggregated standby under detailed, applicable criteria herein.**

It is generally accepted that the BAT for data centre back-up generation is presently a set of diesel generators – this allows for an on-site store of fuel for reliability and a scalable provision of MWelec. However the permit application still requires a BAT discussion detailing the choice of engine, the particular configuration and plant sizing meeting the standby arrangement (e.g. 2n).

It is understood however that new models of Data Centre standby may be based around a natural gas fuelled prime movers linked to MW electric store batteries (thereby incorporating the lead-acid IT UPS).

~~The EA would expect that combustion plant for new Data Centres generators would be to the latest emission standards for standby plant unless otherwise justified under BAT. The minimum appropriate is the ‘TA-Luft 2g’ or Tier II USEPA with guaranteed emissions: this has requirements for 2000mg/m~~~~3~~ ~~NOx; 650 mg/m~~~~3~~ ~~for CO; particulates and dust 130 mg/m~~~~3~~ ~~and 150 mg/m~~~~3~~ ~~for hydrocarbons (all at reference conditions and 5% O­~~~~2~~~~).~~

So the basic summary of Engine BAT hierarchy is (taking account of BAT for stacks 1.11.10, and BAT requirement for an AQMP):

1. Generic new diesel plant BAT (as previously) (1.11.1):
	* emissions optimised 2g-TA Luft or US EPA tier 2 or equivalent – the current status quo BAT
2. Outage Ambient NOx peak limited due to scale or location of standby; or technically where the Peak NOx over short timescales (first few hours) to sensitive receptors could not reasonably be managed via the AQMP:
	* TBC\* DEFRA Air Quality Index 10 or better <600ug/m3) with a peak absolute limit see [1304251155\_Update\_on\_Implementation\_of\_the\_DAQI\_April\_2013\_Final.pdf (defra.gov.uk)](https://uk-air.defra.gov.uk/assets/documents/reports/cat14/1304251155_Update_on_Implementation_of_the_DAQI_April_2013_Final.pdf) (defra.gov.uk) is the best basis for daily and hourly targets on poor air quality
	* Check on ST absolute peaks at receptors
3. Local Authority or regionally designated AQF, AQP, planning requirement (1.11.2) and possibly EA designated clusters (notably Slough Trading Estate):
	* emissions optimised (2g/US EPA tier2) engines fitted with fast-response (<=10mins) full-SCR abatement achieving better than 90% reduction (to at least an indicative 95mg/m3 at 15% O2) to all engines
4. ADVISORY BAT “SCR-ready” configurations are included to allow retrospective fitting of SCR abatement if necessary.

Note\* the EA is not attempting to define a safe level of NOx and NO2 in the context of emergency standby diesel; the EA is highlighting that ambient AQ has standards and the most appropriate is selected and used as the basis for applying BAT. The selected are a provisional, more obvious, and readily applied target.

### New ‘2g/Tier2’ – emission optimised:-

New plant is defined as per MCP (EU) 2015/2193 which is at <https://www.gov.uk/guidance/medium-combustion-plant-when-you-need-a-permit#when-a-mcp-is-classed-as-new-or-existing>. Plant installed and commissioned for the first time after 20/12/18 is new and needs to meet ‘new plant’ standby BAT (this is the case even if the plant had been operational elsewhere before 20/12/18).

**New Data Centre diesel engines (prime movers) shall be emissions optimised (i.e. not efficiency optimised) to at least one of the two recognised main international standards 2g-TA Luft or US EPA tier 2 or an equivalent.**

There is a need to clarify how this BAT is applied, assessed at permitting and what “equivalent” in the data centre context is:-

1. In the first instance (though reducing emissions during the planned in year test regime is a reasonable secondary consideration) the main reason for BAT is to minimise emission impacts for peak NO and NO2 during a prolonged outage using primary technology.
2. The EA is not seeking to develop a new engine emission standard. The EA is also wanting to ensure the widest choice of plant is available. The EA determines that 2g TA-Luft standard historically establishes the baseline that, without additional abatement, typical emissions optimised plant can achieve around 2000mg/m3 at 5% O2 at reasonable output load (this is 750mg/m3 at 15% O2 – this figure is referenced in MCPD Annex II Part 2 Table 2 Footnote 4 as an actual compliance ELV for a ‘small isolated system SIS’ diesel >12000rpm). So the TA-Luft standard is being used and quoted by manufacturers and so is a source material defining a build specification; also the EA does recognise for standby plant there is a risk that this old standard may be superseded or formally discontinued. The EPA Tier 2 standard expresses ‘emission optimised’ in terms of mass emissions per kWhr.
3. When the EA is assessing plant emissions specification sheets and comparing between standards and engines the qualitative requirement is that NOx emissions profile over a range of representative output loads, typical for a data centre or as proposed by the operator, is less or around 2000mg/m3 at 5% O2. Data centre plant is not expected to operate in a prolonged outage at the maximum/continuous rating (i.e. because of the sharing load across multiple engines); emission concentrations can be a lot higher at lower loads but, since the net mass emission rate does not broadly change significantly from typical loads, are not so important to focus on for impacts.
4. So practically for data centres we would ordinarily expect specification sheets provided to EA at permitting to be EPA Tier 2 D1 test cycle (ISO8178-4) figures and/or 2g TA-Luft. This broadly equates to 2000mg/m3 (+/-10% tolerance) at 5% O2 = 750mg/m3 (+/-10% tolerance) at 15% O2 being realised between about 67% and 87% of peak load rating. Typically the best match to ‘2g’ being at 75% quoted load rating as the default single point for comparison. \* *International standards and spec sheets may base emissions at slightly different reference temperatures and atmospheric pressures in addition to the oxygen standard:* *it is important to also convert EU/UK 273.15K and 101.3kPa but oxygen reference 5% or 15% is usually the most crucial.*
5. *Tolerance is included to allow for:* use ‘nominal specification’ rather than the ‘site variation data’ (which may indicate a greater departure from +/- 10% concentration tolerance); slightly different reference temperatures and atmospheric pressures in addition to the oxygen standard; and on-site monitoring data to MCERTS M5.
6. It is assumed that natural gas prime movers used solely for standby shall and would clearly be expected to meet at least the above diesel BAT.
7. Local air impacts and receptor setting may require tighter controls on emissions at any scale of standby installation. Fitting BAT engines (2g) is no guarantee of obtaining a permit under EPR.

Generally it is felt that provision for BAT emission optimised 2g/EPA engine plant in the building design to allow an easy retro-fit of SCR – in essence **ensure space/design for ‘SCR-ready’.**

###  TBC BAT (SCR) Urban environments with close residential receptors – target Peak NOx.

Separately there are likely situations where unabated emissions optimized BAT engines alone might still not achieve an appropriate control of impacts\* of exhaust emissions at receptors particularly absolute peak NO and NO2 (NOx) and hence the ability of the AQMP to respond in the first few hours and possibly minutes of a significant outage.

* This is about de-linking likelihood of a prolonged outage to one of ‘in the event of any reasonable outage’ (or in some cases maintenance/tests too) operations, where, when and for how long could short peak NO2 (and NO) occur. This is looking at the process contribution PC/PEC and ultimately this may be equivalent to a site total mass emission rate (MWth density)- TBC
* It is generally recognised and currently permitted that achieving ST ambient AQ standard of <200ug/m3 at any location off-site for around 1 hour (let alone in a prolonged outage <18hours) for even some of the smallest aggregated sites (MCP scale) could be unachievable and disproportionate for reliably connected, emergency standby in urban settings.
* EA specified generator modelling guidance: “You need to include the maximum hourly (100th percentile) NO2PEC. This is to understand the potential health effects and the amount of risk to members of the public. There is no absolute hourly limit environmental standard for the acute exposure to NO2, but there can be effects on health over a certain threshold”
* [1304251155\_Update\_on\_Implementation\_of\_the\_DAQI\_April\_2013\_Final.pdf (defra.gov.uk)](https://uk-air.defra.gov.uk/assets/documents/reports/cat14/1304251155_Update_on_Implementation_of_the_DAQI_April_2013_Final.pdf) is the best basis for daily and hourly targets on poor air quality

Note\* the EA is not attempting to define a safe level of NOx and NO2 in the context of emergency standby diesel; the EA is highlighting that ambient AQ has standards and the most appropriate is selected and used as the basis for applying BAT. The selected are a provisional, more obvious, and readily applied target.

Plant fitted {new or existing plant aggregated on the same site permit} with SCR (full or lite) to all or most engines and abated to at least a level whereby no current or future sensitive receptor under most outage (and maintenance/test) scenarios for the whole site or part site realistic loads can exceed the following

*This is on a case-by-case basis (i.e. unless particularly justifying that any peak is an extreme anomaly or an indication the model itself has become unreliable), and justified through the AQ modelling.*

1. <200ug/m3 i.e. no conceivable ambient AQ breaches any hour (within ‘low pollution’ index)
2. **Target 99.7%ile 1 hour average off-site (cell max, any potential receptor) <600ug/m3 or better**
3. ***Site specific justification of the averaging period based on ability to proactively engage AQMP with receptors – precautionary default 10mins, but consider 1hour:* Absolute theoretical peak 100%ile on/off site AEGL1 (nearly =HSE Workplace exposure) 940ug/m3 (being common concentration - 10min to 8hour value)**
4. In any event the cell maximum at any location (on or off-site) is short term exposure 10mins workplace = roughly <1910ug/m3 (= 2xAELG1)*. For the purposes of setting a maximum and because it is mainly the PC not PEC the 15min or 1hour within AQ models can be treated the same i.e. this translates to a cell maximum at any location on or off-site 1 hour average as the same limit 1910ug/m3 figure*

Operating to I. means the site does not need an AQMP for risks (notification for outage clustering may still be needed).

Operating to II. & III. mean the site probably needs an AQMP to manage the risks but it is unlikely that anything other than a worst case actual prolonged outage scenario would be an issue to be escalated to the local authority.

**Operating to IV. would clearly need a detailed discussion and assessment of the AQ model as to how such an operational envelope can be acceptably managed both to on-site (i.e. workers) or off-site receptors. This is included as a pointer that there are some site specific risks which need to be addressed.**

***There may be scope to use the EA nitrogen monoxide (NO) AEL as a limit and thereby associated an NO2 level via a total NOx figure***

### TBC Heightened BAT (SCR) in an Air Quality Management Zone, Air Quality focus area, urban environment

The EA has potentially (TBC) now to have regard to the long-term impacts of the need for significant testing and total annual mass emissions due to the scale of the site i.e. lots of engines. This may be to achieve Air Quality Neutral or Air Quality Positive outcomes for local authorities (this is particularly a London issue).

Emissions optimised (2g/EPA tier2) engines fitted with fast-response (<=10mins) full-SCR abatement achieving better than 90% reduction (to at least an indicative 95mg/m3 at 15% O2) to all engines shall be used in

1. AQMAs
2. AQ focus areas (AQF)
	1. Local Authority designated Air Quality Neutral or Air Quality Positive areas
	2. Regionally designated Air Quality Neutral or Air Quality Positive areas e.g. London plans
3. Possibly EA designated clusters (notably Slough Trading Estate)

It is noted here that when fitting SCR abatement the strict tolerance of <=10% on acceptability of 2g/EPA ‘optimised’ engines is less important and more nuanced. On a case by case basis a justification that the total package of (emission optimised+SCR ) may allow a slight increase on 10% tolerance on available emissions optimised engines. Put another way if the only objective is to reduce long-term total mass emissions there could be a BAT argument that starting with the best SCR and working backward to a total package is better?

### Existing Plant already on-site

Previous terminology has used the word ‘legacy’. Existing plant is that plant which is not new.

The EA recognises there may be situations where ‘existing plant’ newly requires a permit – the most obvious example being the expansion of an existing MCP scale site to >50MWth by adding more new engines.

There is still a requirement under BAT to minimise emission impact for peak NO and NO2 during a prolonged outage, but for existing plant there would not be an immediate requirement to simply replace all existing plant with new.

Existing plant may have worse emissions than the TA-Luft 2g or EPA for various reasons: sourced from a supplier ‘outside a regulatory regime’, containerised road going engines, older rental models, ‘TA-Luft 4g’. Without a BAT and cost justification CBA this plant may need to be upgraded and improved to reduce the impacts of maintenance and testing operation of the engines, and the worst of emergency operations.

The requirement for 2g-Luft or equivalent is EA BAT and is particularly important for large new build data centres in the urban environment. AQ impacts accounting for long term mass emission and minimising testing hours is clear; it is more important to minimise NOx peaks during a full-site outage even 50% more 2g to 3g may make the difference. In reference to legacy CBA this applies to much smaller arrangements such as replacing engines which might not have a current 2g-Luft replacement due to HV or cooling configurations in the data hall.

### TBC Equivalence 2g/EPA Tier2:-

Equivalence is

1. The mutual acceptability of the two quoted standards for emission optimised
2. one of an alternatively expressed ‘emissions optimised’ standard plant (e.g. that the EA is perhaps unaware of) that the operator feels technically meets the BAT and the EA, making an assessment, thereby agrees.
3. A marginally ‘non-BAT’ engine(\*) fitted with abatement as a ‘black-box’ package, such as selective catalytic reduction SCR or HVO, that produces emissions at least as good as the new plant BAT above in terms of NOx concentrations and/or mass emissions of pollutants including aspects of SCR start-up.

This (\*) represents the situation of bringing a newly fitted engine which for various reasons fails to achieve BAT quality (say during commissioning; it would not be reasonable nor anticipated that the whole engine should be replaced to make marginal improvement in emissions). ‘SCR-lite’ or ‘full-SCR’, may have its own additional BAT (like times to effectiveness, ad-blu injection) – see below\*

Equivalence of abatement with only partial use of full-SCR on selected gensets

1. The EA does not consider 2g/EPA BAT ‘equivalence’ could be delivered only on whole (or part, down to single engines) site averaged basis for new plant particularly when datahalls will work semi-independently. Under plant resilience there is an over provision of engines (2n sharing load, n+1 etc) all of which start and could run, so it is unlikely the operator could justify fitting only a fraction of all the site’s plant with abatement for BAT. e.g. though the average of two ‘3g’ engines with one fitted with SCR to near zero (SCR-Full+) NOx is (3g + 0)/2 = 1.5g – it might be the 3g takes all the load and the SCR system is the one backed-off or worse the SCR fails at the crucial time and in an outage 6g is emitted of shared load.
2. The EA **does** however consider BAT ‘equivalent’ could be delivered on a whole averaged basis for retrospective upgrade/improvements under a CBA approach for ‘existing plant’ or legacy situations (as indicated as available in FAQ v11 on BAT for 'legacy' plant only) where abatement to near zero ‘full-SCR+’ is proposed on selected plant (either the worst primary emitters or best technically for installation etc).
3. Under plant resilience as a whole site (n+1) - all of which start and share loads as a semi-continuous load profile. “site wide net mass-emission equivalence” but the operator would need to show that “engine and demand controls will enable the standby installed to operate on a 'site wide holistic' rather than individualised data hall basis achieving a mass emission (impacts) versus demand curve which is reasonably below the equivalent under 2g/EPA tier 2, all the way from realistic lowest load to the realistic full site load/demand at environmental receptors. Also required is evidence that the 'full-SCR' systems have high reliability despite low hours use and that it is technically extremely unlikely (near impossible) that power demand could or would be met with only the unabated engines. The start-up phase of SCR abatement, and total emissions during a normal test regime would also need a clear justification.

### TBC Demonstrating BAT 2g/EPA or BAT emissions

There may be a requirement for some form of actual emissions monitored NOx concentration to be assessed to confirm that emissions optimised plant (i.e. BAT or equivalent) was installed (say during commissioning or after corrective addition of abatement). This would not be an ELV per se but given all the ‘site variations’ the EA would expect an MCERTs M5 based indicative reading to be 750mg/m3 (15% O2) +/- 20% TBC at a stable typical on-load (ordinarily this would be 75% load unless otherwise justified by the operator). This is strictly speaking the 10% allowed spec-sheet tolerance plus an allowed extra 10% for ‘‘nominal specification’ i.e. ‘site variation in situ’ and also the monitoring method uncertainty too.

SCR TBC. The same basic principle applies if SCR is used. Demonstrating start-up to effective abatement, emission to a tighter target concentration etc would likely need formal logging of readings from the start to a defined stable reading and may include several load levels. Commissioning and continued SCR abatement should be a separate agreed procedure.

### Important BAT ‘2g’ observations

1. It is important that acceptance of plant under EPR permitting can only be through a formal pre-app advice route, subsequent application and acceptable determination. Plant that meets BAT is still no guarantee of gaining a permit, as clearly site specifics are more important like number of engines, stack heights, in an AQ management zone etc. It is strongly advised that any potential user of BAT equipment check independently that their proposed arrangement and site design would be acceptable and ideally have a permit agreed in advance before binding purchase agreements.
2. TBC Sample Port: There is an apparent legal requirement under MCP (which the EA is newly beginning to believe would need to apply to large data centres under IED too) to providing an ability to monitor the emissions from the standby engines (even though there would not be any emission limit value under MCP to be met legally). This requirement has yet to be definitively agreed because, in our discussions with industry such a requirement could be very onerous for a retrospective fitting of a sample port to take these readings. But such a port fitted on initial purchase/spec could be helpful all-round. **The upshot being, it may be prudent for engine suppliers to price in a simple sample port to allow engine emission sampling of well mixed gases CO and NOx only** (i.e. this means a simple port post-turbo port which is readily accessible without the needed for scaffolding up a tall stack)
3. Because there is a requirement to fit sample ports the EA considers it BAT to check as part of commissioning that the engine specification does match that required. This could be by model if several are installed at the same time. It is also prudent, if timely, measure emissions after significant maintenance.
4. BAT for engine standard cannot be substituted for by applying other BAT like stack arrangements (vertical), stack heights since these should be applied regardless.

### HVO BAT and using HVO to achieve emissions 2g/EPA

HVO is considered as “Gas oil or equivalent substitute to be agreed in writing with the Environment Agency” within permitting.

HVO can thus substitute gasoil in permitting; though because HVO is generally regarded as improving emissions under permitting, a site permitted purely for HVO could not use diesel without a re-evaluation of AQ and permit variation – this would especially be the case as a last-minute emergency re-stocking on diesel during an outage.

HVO is generally considered to improve NOx, CO and particulates and be a low carbon fuel. On that basis HVO is a preferred option. However, for diesel standby provision and reliability of re-supply, during peak delivery demand, and source availability is a significant concern so it would not be reasonable to expect HVO across the sector, so for that reason **HVO is not considered formally as BAT by the EA for aggregated standby overall TBC.**

2g/EPA BAT can be achieved on normal diesel emissions optimised plant; so the expectation might be that moving over to HVO is a lost opportunity for BAT engines already installed – in essence the EA could take the view that BAT is 2g/Tier 2 + HVO as a (new) fuel BAT.

However there are clearly fair reasons not to be this prescriptive

1. The emissions optimised version of engines sets an emission benchmark concentration (of around 750mg/m3 at 15% O2 within reasonable tolerance and load points etc) so how you achieve it by other means is fair game (e.g. non-BAT engine + ‘SCR-lite’, near BAT engine + HVO, gas engine + MWbattery tech)
2. Within reason we have to accept that tolerances and in-situ plant variations means an absolute concentration is not so critical; i.e. it is not a legal MCP type ELV that will be measured (on HVO or otherwise etc) to such accuracy to be a compliance point per se.
3. HVO might not be a universal benefit for all engines anyway so there is a ‘fairness’ issue in supposing it’s another BAT, but conversely might increase the supply options non-2g plant models available that wouldn’t otherwise achieve BAT?

Overall the EA would have to accept the basic proposition that the emissions BAT is delivered as a ‘packaged equivalent’ of engine and fuel. But it would need to be based on evidence i.e. **Ideally it would need to be certified in advance with a spec-sheet, like diesel currently to NPS, detailing the 2g/EPA tier 2 standard compliance running on HVO.**

### Permitted monitoring frequency – 5 yearly

Permits for standby plant have the strict ‘monitoring frequency’ stated as “three times the number of maximum average annual operating hours’. This is taken directly from the wording in MCP regulations and should the monitoring requirement for standby if formally applied, this phrase really means accepting:

1. Limited hours <20MWth MCP is monitored every 5 years unless it is operated in each of three consecutive years in which case monitoring at the end of the third year is required.
2. Limited hours >=20MWth MCP is monitored annually in each year in which it is operated; or after the fifth consecutive year of non-operation?

It should be borne in mind 20MWth is an aggregation for new plant if in common stack only. So 2) does not apply for single units for existing plant nor non-aggregated new plant i.e. individual standby engines in all cases

What this basically means for single engine standby <20MWth new or existing each, monitoring is only needed every 5 years unless there are consecutive outages (i.e. not the test or maintenance events under the <50hours each) in three successive years in which case after that third year.

### Retrofitting of abatement SCR

It is likely that the retro fitting of emissions abatement will be unsuitable for standby emergency plant because space to locate the abatement is not usually available; but depending on the site the application may have to address the potential use of SCR, EGR and certainly modern Engine Control systems (injection retardation and increased compression pressure).

#### SCR-lite

It is also accepted however that a minimum size/cost of the SCR and components (e.g. catalyst) could aim only for 2g-TA Luft or EPA tier 2 (2000mg/m3 +/- tolerance, 750 mg/m3 at 15% oxygen) across all loads.

Aiming for slightly better than 2g/EPA makes up for the unabated warm-up period – so ideally the average mass emission over a typical 1 hour on-load test should ‘set’ the target NOx concentration. 2000mg/m3 less tolerance (i.e. aiming for better not worse spec)

It is recognised that choosing to fit costly SCR could be an opportunity to do much better than 2g-TA Luft or EPA tier 2 and achieve much lower emissions and concentrations on a precautionary basis.

#### Full-SCR

The emission concentration for full abatement is not defined and in principle could be 0mg/m3 of NOx (risks high ammonia slip). On a case by case basis it is the target mass emission rate (to minimise impacts to receptors etc) more than concentration per se that is important.

**For the purposes of definition full-SCR is the target ELV as included for MCP gas-oil engines being 190mg/m3 NOx at 15% O2. {basically, a reduction of 75% on 2g/EPA}**

**In air quality management areas, mega-scale sites etc 1.11.2 where the requirement is to minimise all NOx impacts (and also matching a potential for an aspiration to cease diesel use nationally) the minimum likely target would be the equivalent for natural gas engine ELV being 95mg/m3 NOx at 15% O2. {basically, a reduction of 90% on 2g/EPA} – SCR-Full+**

SCR has its own, separate BAT with an expectation of reaching the BAT concentrations within approximately 10mins.

**SCR-Lite = 2g/US EPA tier2 ‘equivalence’ (750mg/m3 at 15% O2)**

**SCR–full = MCP ELV compliance (190 mg/m3 at 15% O2) (reaching specified generator ELV too)**

**SCR–full+ = 2g/EPA + with fast-response SCR (<95mg/m3 at 15% O2) [max abatement – risks NH3 slip issues?]**

### Stacks

Data Centres usually have very low profile sites and as such can have short, below roof level emission stacks. This can impact on the efficiency of dispersion of emissions. It is appropriate to consider BAT for the adequate dispersion of exhaust emissions as part of the permit application:

1. Increased stack height
2. Vertical ports
3. Increased distances from buildings to be above roof line
4. Common windshield combining several individual flues

Stack design and modifications (if retrospective) for improved emission dispersion is reasonable; and permitting would require a BAT cost benefit justification why such modifications are disproportionate.

CBA for improved exhaust emissions, dispersion and mitigations from the plant is expected for the maintenance/testing and the emergency standby roles. We would be looking for improvements particularly if LAQM modelling (under H1) indicates anything other than an insignificant contribution to short term local air quality for the ‘planned’ maintenance emissions of the plant.

Retrofit abatement techniques for existing installations for engine emissions such as selective non-catalytic or catalytic reduction (SNCR or SCR) would not normally be expected for standby plant to mitigate the emissions for standby/emergency operation. BAT might include improved flue gas dispersion (e.g. stack modifications, increased height) or improved low NOx engine management controls.

## Other Issues

### Commercial in Confidence (CinC) and National Security

You can find guidance on national security and confidentiality in ‘Core Environmental Permitting Guidance’ published by Defra and available at <https://www.gov.uk/government/publications/environmental-permitting-guidance-core-guidance--2>

The National permitting service (NPS) of the EA has dedicated internal processes for looking at these issues specifically “Environmental Permitting: dealing with claims for national security 201\_08” and “Dealing with claims for confidentiality 202\_08”. The operator can write to NPS to claim CinC or to inform us that an application to the Secretary of State has been made for National Security.

The permit application is for the combustion plant and associated environmental concerns and not for the Data Centre itself. The applicant should be aware that the application is accessible to the public on our ‘Citizen Space, immediately after the duly-making stage, so the operator should have regard to ‘Commercial in Confidence’ and separately National security.

However the EA permits many industrial sectors that include “National Critical Infrastructure” NCI including power stations, chemical sites (COMAH) and incinerators which are also required to consider CinC and National Security. Generally we have few requests for exclusions of information from the public domain during the permitting process. Being classified as “National Critical Infrastructure” does not automatically mean the application falls under our guidance for guidance for national security or CinC.

In practice we do not generally require information that would be considered CinC – we have a test for determining this and it based on our guidance and legislation; an example might relate to a novel technology proposal linked to the combustion plant being permitted. During any pre-application you can be advised of what we require or not to be included in a permit application.

Generally we would consider any information available through the internet i.e. search engines or your website, or already covered in Local Authority planning applications or company details etc. would not be CinC.

The Environmental Information Regulations (EU 2003/4/CE) mean the EA cannot exclude from public access anything relating to emissions.

Our general guidance outlining what we need for an environmental permit is associated with the application forms see <https://www.gov.uk/government/collections/environmental-permit-application-forms-for-a-new-bespoke-permit>

Broadly this includes items like Company name; site address; non technical summary; site installation boundary; a plan of the emission points (i.e. the standby generator exhaust) and the MWth; plan showing the locations of the fuel tanks (especially where underground tanks); Groundwater sampling points if needed; Details about the EMS and pollution prevention measures related to the permit i.e. pollution notification procedures, waste handling, AQ action plan, fuel procedures related to the permit i.e. waste engine oils, test regime and reporting and containment.

We don’t generally need to include a plan of the emission points or fuel tanks in the permit itself.

We are unlikely to need the following information in an application:

1. Site drawings of detailed Data Centre infrastructure like halls, electrical circuits, transformers, security,
2. Contact details of site staff
3. Data Centre Site specific operating procedures which don’t relate to the permitted combustion process.

We recommend any detailed drawings or select information contained in specialist reports e.g. noise or air quality assessments will need to be reviewed by the operator prior to submission to the EA – if you identify areas for concern, in the first instance discuss these directly with the NPS. If in doubt you may exclude such information from the application but indicate that it is ‘available on request’; if the information is critical to the application NPS can make that request or formally issue a notice to gain access to it.

**Remember that after permit issue annual reports, hours run for the generators, pollution incidents (e.g. reported fuel spill), the permit, the determination document, EA enforcement and inspection reports will be publically viewable.**

#### Freedom of Information

We are an open and transparent organisation and take our responsibilities to provide information under the Freedom of Information Act (FOIA) and the associated Environmental Information Regulations (EIR) seriously.

These responsibilities include providing access to the information in response to a request, normally within 20 working days. The legislation applies to all the information we hold, whether created by the Environment Agency, received from third parties or even held by a third party on our behalf.

The provision of information is subject to a number of exemptions set out in the legislation. These include, for example, national security and public safety, commercial confidentiality.

### Pollution Inventory Reporting

There is an annual reporting requirement to detail the mass emissions from the permitted activity see <https://www.gov.uk/government/collections/pollution-inventory-reporting>. This is not technically an EPR permit requirement but because of permitting this becomes a requirement from associated legislation.

This includes emissions to air, controlled water, land and wastes. Broadly it is unlikely that even the largest data centre would emit enough CO2, NOx, CO, particulates etc to hit the reporting thresholds e.g.100,000kg NOx. Most often exhaust emissions would be below reporting threshold (BRT).

PI does include the reporting of wastes generated from the permitted activity – so quantities of used engine oil would be included.

It is extremely unlikely that there would be any information under PI reporting that would of concern under FOI or CinC. It is equally difficult for the EA to justify any CinC request for PI return information.

#### PI Wastes List

The permit application should detail the likely quantities of waste engine oil (probably classed as hazardous) generated annually - EWC 13 02 waste oils following servicing for example.

Although unlikely to be huge Pollution Inventory has the below reporting threshold (BRT) as 1 tonne for non-hazardous waste and technically no BRT for hazardous waste oil.

General Data Centre wastes and other domestic EWC do NOT need to be provided under PI – this includes disused UPS or upgrade works unrelated to the permit itself.

The following is a basic list of wastes that might be reasonable to include on a PI return (mirror or equivalent non-mirror as appropriate)

1. 1302xx\*  engine oils various
2. 130701 waste fuel (polishing?)
3. 140603 cleaning solvent
4. 150106 mixed packaging (should relate to the plant not the data centre)
5. 150202\* absorbents, filter materials, wiping cloths
6. 160107\* oil filters
7. 160114\* & 160115 engine anti-freeze
8. 160601\* lead-acid batteries (not the UPS but rather engine related)
9. 200127\* paints and adhesives (perhaps)
10. 200133\* & 200134 batteries and accumulators
11. 200135 & 200136\* discarded WEEE (perhaps but risks being the servers etc)

Wastes should generally not be those associated with the data centre itself such as canteen (200108), general packaging wastes, toilet facilities. Typically not 2003xx codes

### Expanding the Data Centre’s on-site provision

The permit will need to be varied if additional plant is added to the site which wasn’t included in the original permit application. This is particularly relevant for data centres expanding in phases.

It is best to apply for the permit to include the likely future expansion of the site (Data Centres tend to be developed in phases as they expand and attract customers).

### Site Condition Report (SCRep) and baseline monitoring for the ground

Permit applications require a detailed report of the status of the land on which the permit boundary is determined. See <https://www.gov.uk/government/publications/environmental-permitting-h5-site-condition-report>

SCReps can use due diligence investigations and historic assessments. However depending on risks and what may have happened on site during the ongoing operations (i.e. retrospectively) there may be a requirement to conduct a baseline soil and groundwater investigation (i.e. including installation of ground water GW monitoring boreholes etc).

We would not normally expect IED ongoing 10-yearly periodic soil sampling though technically this still needs to be based upon a ‘systematic appraisal of the risk of contamination’

The groundwater monitoring of fuel storage tanks and distribution pipework using GW boreholes is risk based to satisfy the site condition report (SCRep) and IED ongoing 5-yearly monitoring requirements.

Should GW monitoring be required for underground tanks and/or the SCRep, the boreholes should generally be positioned for whole site surveillance (for the SCRep) rather than as a very local control measure immediately around the buried fuel oil tanks (i.e. not be just an addition to double skinned tanks already protected by leak detection and hence ignoring distribution pipework etc).

We would expect GW periodic monitoring for below ground fuel tanks, unless a very clear BAT argument is provided – this should include discussion on fuel distribution pipework and day tanks across the whole site.

For operating sites we will accept proposals for the retrospective GW borehole position in respect of risks to utility inputs to the site i.e. nearness to HV cabling and transformers.

### Noise

Generally same rules acceptable for planning though clearly noise control is a BAT issue within the permit application. See <https://www.gov.uk/government/publications/environmental-permitting-h3-part-2-noise-assessment-and-control>

## Fuel and Waste Oils Storage

It is important to ensure fuel and (waste/clean) engine oils are stored correctly. A permit application must be satisfied regarding tanks, bunding (secondary containment) and tertiary containment (e.g. delivery areas) in the context of separate BAT and CIRIA guidance.

Depending on the location and risk to groundwater there may be a requirement to install groundwater monitoring as part of the SCR and IED.

### Above ground fuel storage

If the oil storage is above ground the oil storage regulations apply and are covered by permit conditions as a directly associated activity (DAA). Bunding and management control for deliveries are expected in the permit application.

### Below ground and in building (basement) fuel storage

Oil storage regulations don’t apply but we still expect BAT.

* Leak detection (pipes and tanks)
* Bunding and procedures at the filling points
* Spill procedure and kits
* Double skinned for tanks and minimisation of underground pipework i.e. maximising inspectability for leaks.

## Air Impacts Modelling

The air quality impacts need to be modelled to justify permitting the operation (testing and grid outage). Refer to web guide on risk assessment for emissions to air:

<https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>

and the requirements for AQ submission:

<https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports>

### Scenario modelling of the impacts of the emissions to air is largely split into:

1. Maintenance Schedule Model - the predictable, managed testing and maintenance activity for the standby plant (including some scope for changes and flexibility), and then
2. Outage Model - the unpredictable emergency grid outage any time during the year requiring the maximum plant to operate for the required outage duration i.e. ‘likely maximum’ specified by the company.
3. Non-emergency Elective Power Model - If the site is seeking a STOR, DRS or FCDM mode too then this needs to be modelled separately but in addition to 1. & 2.

The impacts of each is largely treated separately during the permitting determination.

One of the issues is the potential of having to rely on the engines’ certified emission ‘worst case’ parameters and then needing to justify that practically the emissions and hence impacts would be expected to lower. Three approaches delivering a more accurate and AQ impacts assessment model:

1. Simply use the certified technical standard provided by the manufacturer (as has been the case for other sites) – worst case and confirms basic BAT for the engine design.
2. Using the certified technical standard as above but provide some evidence or justification as to the realistic (hopefully lower) emission values as practically measured on site across many units (which have already been installed). Such monitoring clearly would need to be fit for purpose (e.g. calibrated Testo used for maintenance testing but correct O2 standardisation etc)
3. Site specific values only and not referring to the engine certified specification; we need extensive field testing to a high standard for the majority of the plant deployed e.g. MCERTS & CEN.

Due to the long lead times for plant procurement it is important to start the AQ model assessment to be part of the specification cycle; this is not least the point that there is little point in buying engines/plant which later AQ models as being unacceptable for permitting. It is best to model the worst case envelope of likely range plant i.e. specific engine emission size, spec etc as the conservative model to obtain a permit. The operator should not need to model knowing every detail before applying for a permit – any confirmation of the final installed plant (subtle changes in MWh, or stack heights) can be through an issued permit pre-op or improvement condition report.

### Maintenance Schedule Model

The aim of the maintenance schedule model is to get the most accurate assessment of the worst case emissions of what can be controlled by the operator. However it is unrealistic to model the full installed capacity (e.g. 2n) for an outage test; at the very least the absolute maximum specified output load is needed i.e. n of 2n for example is require.

If however the operator can provide justification that the maximum realistic load is best represented in taking account of the customers’ built in resilience into the original ‘n’ specified then this too can be factored in i.e. that n itself includes additional spare load headroom which can be reasonable discounted.

Maintenance and testing would include the 15minute or 1 hour testing of individual plant (on load or tick-over); the site black-out tests simulating a grid outage; any predictable planned electrical infrastructure maintenance needing the generators to cover for the grid.

If most of the time generators are tested at reduced load because a set ‘shares’ the actual demand load across a resilience configuration and may well not be at the optimum emissions-load operation e.g. 25% load, the model should provide some evidence of emission rates at this load rather than simply assume a pro-rata reduction of the emissions at 100% load.

The main impacts issue for modelling is the likely short term ambient air quality standard for hourly mean NOx. The significant risk is the allowance of up to 18 hourly exceedances in a calendar year and the data centres modelled contribution. **All else being equal the EA considers the receptor at which an exceedance notionally impacts to be any within a representative area (of at least 250 m x 250 m indicated by the EU Air Quality Directive 2008/50/EC); and not that a single specific receptor needs to have all 18 occurrences alone, or indeed that the receptor notionally needs to be a specific DEFRA monitoring station.**

**We would expect the controllable maintenance schedule to cause/model no or minimal numbers of individual hourly mean NOx exceedances. We would need clear justifications and BAT review if maintenance was predicted to risk causing 18 or more hourly exceedances (wherever that may be) and especially if the same single receptor was implicated.**

**Under 1.4.9 & 1.4.10 Commissioning It is clear this activity is an important focus for permitting an expanding or newly site. The AQ model should show how the ongoing test regime matches the one-off commissioning round. If not the commissioning either needs separate justification at the time of permitting and/or potentially a pre-operation condition included in the permit:-**

*Template Pre-Op “At least one month before (or other date agreed in writing with the Environment Agency) operation, the operator shall submit a commissioning plan to the Environment Agency for approval. The plan shall provide timescales for the commissioning of the generators and shall demonstrate that the commissioning of the generators is covered within the site’s permitted regular testing regime, thereby minimising durations and impacts. The commissioning of the engines shall not begin prior to receiving written approval to the plan by the Environment Agency.The plan shall be implemented in accordance with the Environment Agency’s written approval.*

### Outage Model

Unpredictable grid outages includes any unplanned electrical infrastructure failures within the data centre itself (i.e. the grid is still operational). Outages are unlikely to last long, in many cases seconds or minutes rather than hours. Due to the possibility of dual grid connections and multiple HV ring mains within the data centre it is possible that there would be a hierarchy of probabilities and potential grid-outages and the number of engines needed. The air modelling of unpredictable grid outages should include the worst case scenario (i.e. the largest number of engines operating for the longest time) but can include an assessment of the ‘more likely’ part-site outage.

We do need to clarify in modelling that the actual stack arrangement is considered e.g. horizontal, height and proximity to building.

To summarise AQ modelling for permitting is split into two parts:

For the routine planned testing regime (load banks, brown outs, off-load start-ups, whole site annual etc), but including those expected additional hours scheduled on-load use supporting maintenance works like UPS or HV – if no other details are known the default is 50 hours/gen/year on-load.

**The testing scenario(s) should be as accurate as possible, and the EA consider the modelled maximum binding for the permit under the management techniques – significant increases to testing regime theoretically could need a permit variation and remodel for AQ. Unless otherwise the test regime should therefore have enough modelled flexibilities and excess to cover additional unexpected testing and so on.**

However ordinarily the operator is not practically restricted in the permit to the test regime modelled for specific dates, durations and especially to an individual engine or data hall occasional deviation as required by circumstances as clearly the operability of the standby is paramount, however the AQ model should test the sensitivity of the planned testing schedule and any extra or over-runs if possible.

The EA advises that a significant planned use of significant standby should be notified in advance and checks under the AQMP that such use does not represent a significant AQ issue (looking like an outage?).

**If there are no other factors such as the Data centre contracting, fuel storage justifying less hours the EA now considers a prolonged reasonable maximum full load outage (but still accepting not all installed engines will run etc) which the default is assumed 72 hours duration.**

If AQ modelling, based on emergency outage operating scenarios, indicates a very significant risk to local air quality and identified receptor, we will require the operator to have a written action plan to manage the issue for prolonged emergency running of the plant (including sensitive receptors list and mitigations, assessments and impacts evaluation against modelled risk conditions i.e. occurrence at periods of most concern in the year, possibly ambient air monitoring surveillance at very sensitive receptors) see 1.15 Air Quality Emergency Action Plan (for grid outages)

Optimising grid reliability within the site as part of general BAT to minimise emergency operating hours is required – evaluation is needed within the permit application on the Tier reliability standard under ISO27001 and Uptime.

Reporting of standby engine operational maintenance hours and discussion of any electrical outages (planned or grid failures regardless of duration) required annually as normal.

Assuming AQ modelling, based on operating scenarios, indicates a local air quality risk then notification to the EA of unplanned (and pre-notification of planned) continuous grid outage exceeding 18 hours LAQM (or the otherwise assessed short term interval from modelling) is likely required under the permit schedule 5 condition.

The permit application must assess and provide evidence of actual reliability data for the local electricity grid distribution (including data centre internal electrical design) for us to judge the realistic likelihood of the plant needing to operate for prolonged periods in an emergency mode (especially if emissions model to exceed short term air quality standards).

### Modelling Start-up with SCR, and unabated peaks before dosing?

It is expected that modelling of testing and outage scenarios will take account of the unabated start-up emissions in the first few minutes after the engines are started; however factors like low-load, part load and pre-heated on a re-start can affect the practical durations to use a single duration unless it is set assuming the worst case envelope/duration.

Ordinarily the EA under MCP expects SCR to achieve ELVs within 10mins if new plant. For permitting standby no ELVs are routinely applied to formally gauge or regulate this.

The EA would expect unless otherwise justified that SCR start-up would achieve the target emission abatement levels within the first 10mins on full load. How this translates to a part and shared load duration is less clear and may arguably be on a pro-rata linear basis?

But for permitting and modelling the best metric for defining SCR time to effectiveness is once dosing of reagents has started because the catalyst has reached temperature.

Permitting and modelling needs to be clear what is the start-up definition (used for regulation and confirmation of spec through SCR commissioning). This needs to be documented either in the permit formally or accepted as a permitted operating technique.

Unabated (pre-dosing) phase NOx Outage Peaks:

The first few minutes (say 10mins) of unabated NOx concentration with SCR has the potential to be significant for large aggregated standby installations (even if fitted with emissions optimised 2g/EPA engines) and could bias a short-term impact at any time or indeed any hourly average after start-up. This does make assessing the AQ impacts of a prolonged outage difficult and potentially unreasonable given the focus of assumed up to 72 hours.

Clearly every hour running (in a prolonged outage >1hour) with SCR should not assume each hour after start-up contains an unabated 10min peak component unless it is discussed that this represents a worst-case assessment and one to identify the worst 24/7/365 of any first hour of an outage scenario.

If necessary, it may be better to assess an outage assuming the SCR is abating fully i.e. past start-up; and separately then the singular start-up peak and in deed ‘in isolation’ for absolute peak levels in a short outage event e.g. 10mins AEGL1, WEL?. It should be a consideration that the unabated, initial peak will be discharged into clean air, will be proportionately a small volume of the total exhaust emission (within the first hour or so) and represents potentially a very small fraction of the volume of air closest to the source and subsequently between, and to, off-site receptors into which this one-off peak is dissipating.

### TBC Check list of useful outcomes from AQ Modelling

1. Standard permitting application requirements of planned and emergency operations
2. Demonstrating stack and dispersion BAT
3. Producing an assessment of the safe NO & NO2 DAQI index levels, AEGL, BreatheLondon index 10 etc.
4. Demonstrating the appropriate level of abatement and emission BAT ensures the target health impacts to receptors are not exceeded.
5. Evaluating reasonable, short term outages and completing the Template AQMP – notification hours
6. Testing is carried out at times reducing impacts and potentially the only ‘safe date/time windows’
7. Includes significant Commissioning of plant (scheduling to reduce impacts)
8. TBC

### Outage Model – Sites not using UKPN as the primary power

There are potential examples of a data centre power philosophy using the primary power feed from alternate, direct sources (such as an energy for waste incinerator EfW steam turbine or solar panels) and using UKPN as a secondary feed.

The application and impact assessment for reliability needs to ensure that:-

1. The worst outage duration associated with UKPN i.e. 72 hours used as a permitting baseline, still summarises that in toto for the likelihood and duration of a prolonged outage using the alternate source.
2. That any testing and need to carry out maintenance (at the Data centre or alternate source) supported by the data centre standby plant is properly included and assessed; and not otherwise excessive compared to UKPN alone.
3. Though outage durations may be similar (assuming a similar time to fix), a key requirement is to ensure the frequency of the alternate source outages is managed to a minimum
4. The operator minimises the changeover standby runtime by manually switching from standby to UKPN (whilst the alternate source is still on outage). We would expect the permit or AQMP to agree the maximum allowed duration running standby with a full working UKPN available **and in any case <18 hours per event.**

### Non-emergency Elective power Model

The EA assumes that the operator is going to make a permit application as a data centre as an absolute requirement for what the permit is primarily needed for; and then seek to add the additional secondary capability to operate a DRS, FCDM or possibly STOR. It is best to make the permit application absolutely clear that the STOR, DRS, FCDM mode is a separate request and ensure that AQ modelling allows this assessment to be made. *Clearly if the primary role is for example a STOR diesel array then a Data Centre FAQ is not the most applicable.*

Model the practical and predictable addition of such an elective mode (assuming addition STOR type BAT improvements/upgrades have been applied for engine emissions etc) on to the maintenance test regime and then separately the outage model. If there are procedures advanced by the operator to ‘offset’ test hours then this can be included (30 minutes of FCDM traded for the 30 minutes of testing that month) but the permit will likely include constraints on operations to those offered and modelled.

### TBC National Emergency Elective power - Scheduled blackouts, pre-start?

**Operating electively or being used informally as some form of demand-side response in anticipation of, or after, an unspecified blackout is not allowed under EA permitting.** Unless there is a national critical order, it is unlikely this would be changed.

The duration of pre-starting run knowing an outage is UKPN scheduled would be a site-specific risk duration agreed at a local level. In essence the local definition, and duration envelope of what is the ‘emergency’ under the permit – there would not be a universal/arbitrary figure (example 30mins). It is suggested the reasonable, bare minimum (say 5mins) might be a reasonable starting point.

The above definition is generally universal for any anticipated operating of the engines pre-emptively including UKPN advising of their planned works on kit needing to lose power to the site.

TBC However secondary benefits of an approach for SCR as BAT in the future or otherwise could provide options to allow nationally identified emergency/resilience under certain criteria (i.e. sites with SCR doing near or better than specified generator ELV performance, or doing some form of site-specific updated to the standby AQ justification?) might be more likely allowed to do some form of very limited demand-side response or export (but formally avoiding/incorporating a limited specified generator component to the permit)?

## Regulation and auditing of a Data Centre Permit

Data centre operation is unlikely to be a high priority under environmental risk/impact and especially regarding planned formal audits. The EA has an internal combustion sector plan which is geared to large plant (LCPs) under Chapter III of the IED. This doesn’t mention the data centre regime in detail. Once permitted the site should get an inspection within 2 months of permit issue.

If during permit determination there are site specific inadequacies (particularly EMS or fuel storage) then an improvement condition might be signed off after an audit.

It is possible that planned audits might likely look at:

1. The most important data centre specific audit would be maintenance/testing run hours procedure so as to minimise impacts to local air
2. Oil storage regs
3. Hazardous waste control (i.e. waste engine oils)
4. EMS (including SCR maintenance) and reporting requirements (annual report and operating hours, possibly Pollution inventory)
5. If the site happens to have a groundwater abstraction borehole it is possible that the reporting and metering of this might be carried out (though not an EPR combustion permit requirement) by the installations officer (to reduce the workload on the EA ‘abstractions’ team).
6. The EA does think about energy efficiency audits but because data centres are for emergency with very low levels of fuel usage (and the permit isn’t really intended to double regulate with the EU-ETS and CCA overall for the site wide energy usage as a Data Centre) it’s unlikely the EA would worry about this.

It is possible that pollution incident related audits (i.e. those likely need to notify under permit schedule 5) might look at:

1. Oil spills etc
2. F-gas releases
3. Noise complaints
4. Electrical infrastructure maintenance plans to minimise data centre (non-grid) outages (i.e. if the site is having a lot of local grid trips)

All this can be pre-planned as part of an officer’s compliance assessment plan ‘CAP’ for the year. It’s more likely that such as any formal audit is actually carried out, it would occur during the annual site inspection more as ‘general topics to discuss’ rather than be an extra formal audit day in the year.

Overall the official line is at:

<https://www.gov.uk/guidance/how-youll-be-regulated-environmental-permits>

and of course <https://www.gov.uk/government/publications/combustion-activities-additional-guidance>

### TBC Good practice issues (but not strictly DAAs) arising on sites

There are a number of data centre specific functions which do not form part of the formal conditions of the EA permit but which could be an issue coming up during inspections or public complaints.

1. HV feed transformers – their condition, plant growth, oil fluid leaks etc
2. Noise for Data Centre server room HVAC
3. Wastes generated by the data centre generic operations WEEE, packaging wastes
4. Water treatment reagents and storage for the data centre HVAC – bunding chemicals and fluids

The EA would likely make observations on these such as

* 1. might link to an increased risk of an outage
	2. noise during an outage from engines would overlap with data centre noise
	3. waste handling, segregation and disposal for the engine activities would be under the site’s holistic waste management EMS (template 1.4.1)
	4. technical WEEE and packaging related to standby should technically be reported under PI
	5. poor bunding of activity related liquids (e.g. engine coolant) is technically a clear permit condition (template 3.2.3)

But would not seek to assess them as permit breaches in the first instance if they are purely data centre issues.

## Annual reporting requirement in the permit:

The annual report for Data Centres is mainly a summary of how the year was managed; and is best focused on the BAT type aspects on minimising emissions impacts:

1. Confirming the run hours per engine and how this is apportioned to testing and outage (and possibly elective power operations); any part-site/whole site blackout test and their scheduling with regards to the AQ modelling – is maintenance testing changing significantly to what was modelled?
2. Grid and internal electrics reliability issues (are you getting more brown outs and asking Grid to investigate their kit?)
3. Re-iterate any in-year notifications of grid outages and hence any need to operate in anger; and total plant emergency hours run (how close to the 18hours?)
4. Advising of future plans i.e. need to run due to servicing the switch gear, new phases being planned, reconfiguration of generators e.g. 2n going to an n+1 etc
5. Procedure reviews related to the permit
6. Confirming no incidents (oil spills, F-gas releases etc)
7. General aspects of fuel and energy efficiency

**It should be borne in mind that the Annual report is available to the public** (not least to reassure them that the site is operating appropriately) so if any details are sensitive then simply keep records on site and only refer to them in the annual report; the regulatory officer can then best review the details during an inspection.

### Permit conditions for 4-yearly reviews of 1.2.1 Energy Efficiency; 1.3.1 Efficient use of raw materials; 1.4.2 Avoidance, recovery and disposal of wastes produced by the activities

An EA IED permit includes some standard conditions and the general requirement for the 4-yearly permit review requirements for

* 1.2.1 Energy Efficiency;
* 1.3.1 Efficient use of raw materials; and
* 1.4.2 Avoidance, recovery and disposal of wastes produced by the activities

These are not reviews of the data centre operation but apply solely to the combustion plant activity. Broadly these standard permit conditions are more suited to power operations normally consuming lots of fuel for the generation of energy such as LCPs and power stations.

These can be covered for data centres within a discussion for these topics within an annual report generally; and are unlikely to be a separate focus for regulation.

The EA does not have any informed view (i.e. defined BAT) on the choice of switchgear, room air conditioning design, server rack power demands and so on, that would come under Data Centre best practice. However clearly efficient Data Centres, minimising their overall energy demand is best practice under various routes other than EPR i.e. the CCA or perhaps general standards like 9001, 14001 and 50001.

Such efficiencies may likely reduce emergency generation requirement and hence plant emissions (by needing less engine fuel and tests etc) throughout the year. This might have a marginal impact on wastes (used engine oil) and raw materials (new engine oil) or water abstractions too.

## Air Quality Emergency Action Plan (for grid outages)

Assuming AQ modelling, based on emergency outage operating scenarios, indicates a very significant risk to local air quality and identified receptors, the EA will ask the operator to have a written AQ outage action plan to manage the issue for prolonged emergency running of the plant (including sensitive receptors list and mitigations, assessments and impacts evaluation against modelled risk conditions i.e. occurrence at periods of most concern in the year, possibly ambient air monitoring surveillance at very sensitive receptors). An AQ outage action plan is also likely required for sites which might operate in conjunction with other neighbouring large sites during an outage i.e. data centre hubs.

***There is now a template AQMP which is relatively self-explanatory with its own separate completion guide.***

It is now assumed that completion of the template AQMP is best at the AQ modelling application stage but it is possible that the AQMP could be an improvement condition (IC) wording usually included in EA permitting for at risk sites might be “The operator shall develop and submit for approval a site specific AQMP which identifies the emergency operating conditions when Local Air Quality may be adversely impacted by emissions to air from the installation.”

The identified harm to human health risks will be based on AQ modelling which is routinely required for EPR permitting.

It is important to note that any planned maintenance works or testing of the installed generators should already be selected based on the details identified AQ modelling and embraced by the AQMP plan e.g. whole site tests select to minimise impacts.

**In essence in evaluating the risk impacts of an outage a ‘bad time for an outage’ should agree with the periods already avoided as being ‘bad times’ to conduct engine tests.**

**Background**

Some buildings and facilities require standalone emergency generating power to important critical infrastructure such as Data Centres, Air Traffic Control, Grid Peak & Black Start, Hospitals. The generators are usually diesel powered with their own fuel stored on site. If the peak load is sufficiently large a significant number of the installed generators and diesel rotary UPS will be needed to start-up and sustain electrical output until the incoming power has been reliably restored.

AQ models may indicate there will be likely occasions and scenarios during the year which could be impacted adversely on acute exposure to human health and/or national and local ambient air quality standards.

NOx and NO2 mass emission rates for the various engine types/standards and dispersion specifics (stacks etc) installed at the site would be minimised under BAT reviews during any permitting or local planning procedures. There is then a point at which further cost-benefit analysis (CBA) is unreasonable for an extremely unlikely grid outages and site power losses. Ultimately the site’s total ongoing release at the time of an outage cannot be reduced further but may still be of concern; this action plan details the assessment and mitigations in the event of a power outage for the largest sites.

The development of an AQMP is considered BAT by the EA after all reasonable prior physical controls (primary and possibly secondary abatement measures) have been deployed to bring schedulable generator maintenance and testing emission impacts to acceptable levels but which whole site operation is still a concern.

*Acute Exposure Guidance Level (AEGL) for causing discomfort in the general population in ambient air is 940ug/m3. Significant concern for public health and non-reversible damage for an 8-hour period starts at around 12600ug/m3.*

*Ambient Air Quality hourly mean objective limit is 200ug/m3 (with less than 18 hourly exceedances in a year).*

**The plan itself is site specific**

The plan, as a minimum, will identify a range of emergency scenarios detailing which plant will be operating and their emissions to air of NOx.

The plan will include the ongoing management of the emergency event – monitoring the likely harm to sensitive receptors as the event progresses using the above scenarios and the actual values for the relevant parameters. The plant will identify trigger points in advance of AQ breaches for sensitive receptors and appropriate on site and off site action to minimise harm.

The plan will include the notification of the EA and Local Authority at the appropriate trigger points during the event.

Following an emergency event the operator will make a report detailing the health impact and reviewing the effectiveness of the plan

**Overview of the Process:**

The operator, to develop an air quality response plan needs to assess risks, evaluate and then mitigate the impacts to sensitive receptors and ambient air quality as a result of a significant electrical supply outage to the facility. The plan would consider factors like meteorological conditions, date, time and outage duration with respect to NOx short term acute exposure and hourly mean ambient air concentration standards. The plan should be developed in conjunction with the Local Authority and its Local Air Quality Management (LAQM) process and in extreme their “Major Incident Procedures”.

So look at plausible outage scenarios Combustion plant, emissions of NO2/NOx, duration of operation, met conditions, background concentration and in-combination effects, sensitive receptors and the potential exposure to acute, hourly and more than 18 hours of the NO2 AQ standard.

Installed Factors

1. Number of generators actually operating (or equivalent if part load) compared to critical number.
2. Site partitioned and only a localised group of engines is operating
3. DRUPs or generators (operational mode pre-emptive of the outage i.e. frequency dips) or a mix
4. Stacks and location of emissions for the operating generators
5. Proximity to similar outage generators operating on the same basis by other sites

Outage Occurrence

1. Time
2. Date/season
3. Meteorology/weather
4. Wind direction
5. Prior weather conditions (e.g. prolonged temperature inversion)
6. Local air quality warnings for pollen or already ambient AQ exceedances (of the 18) etc.

Receptor

1. Those receptors identified during the air quality modelling process
2. Acute Exposure
3. General populace
4. Specific Sensitive receptors which are linked to the metrological conditions (wind direction)

Additional Considerations

1. Extent of outage across the locale for smaller generators, other data centres
2. Likely duration (<18hours, or does 1 hour cause an issue)
3. How are the receptors affected by the outage (e.g. sent home from school, go in doors or come out side, flood lighting stops play)
4. Are there any flexibilities within the site to change/alternate which generators are operating so as to be furthest from receptors (might only apply to larger sites or with particularly close receptors)
5. Outage cause: is the air quality likely to be made worse for other reasons e.g. outage cause by an on-going local fire?

### DRAFT: Use of Indicative Continuous monitoring of Ambient air quality (e.g. AQMESH) – AQMP and AQ model validation?

There are a number of indicative Continuous monitoring of Ambient air quality devices these can play a part in informing on the NOx risk during testing and particularly in prolonged outages, They are normally restricted to being located on the permitted site boundary but there is not at present a protocol for deploying them for use in conjunction with an AQMP.

There is an example of an operator using a portable confined space NO2 meter as part of the assessment of absolute peak of emissions during commissioning tests and for outages - TBA

At present it is beyond the scope of the FAQ to develop BAT for their use overall, not least because the standard, calibration and practical deployment of the instruments is currently under significant review. They are used for the BreatheLondon network [Breathe London](https://www.breathelondon.org/).

1. Ideally there should be four deployed on the cardinal points allowing up and downwind concentration comparison
2. A fifth unit should be deployed close to a local authority standard DEFRA CEM AURA
3. A portable (sixth) unit could be made available to take to a local sensitive receptor to better track the outage concentration
4. A weather and wind speed & direction station
5. The concentrations of all units should be used to average the prevailing concentrations just prior to an outage event providing the background air quality – this may match to any local air quality pollution indices.
6. During on-load major test events they should be used to validate concentrations against the model predictions – noting particularly any high reading caused by building downwash.