Sizewell C Project

Combustion Activity Submission Sizewell C

Non Technical Summary

Purpose of this Report

This report supports the application for a combustion activity environmental permit associated with a new nuclear power station to be situated directly to the north of the existing Sizewell B power station. The new power station will be referred to as Sizewell C (SZC). The power station has twelve back-up diesel generators, which have a combined thermal input in excess of 50 megawatts thermal (MW_{th}), therefore requiring an environmental permit[1] under the Environmental Permitting Regulations [1]. The Operator of the installation will be NNB Generation Company (SZC) Limited and hereafter referred to as SZC Co., which is a wholly owned subsidiary of NNB Holding Company (SZC) Limited which in turn is 80% owned by EDF Energy Holdings Limited and 20% owned by General Nuclear International Limited.

This document presents details of the installation and its potential impact on the environment. It explains the requirement to use Best Available Techniques (BAT) to ensure an appropriate balance between costs to the Operator and benefits to the environment. It also describes the commitments to implement BAT in areas where information is yet to be developed. A Forward Action Plan (FAP) is proposed to address these areas as the overall programme of work progresses and delivers more detailed information.

Site Location and Setting

The installation is located in a coastal area adjacent (to the north) of the existing SZB power station Nuclear Licensed Site boundary as shown in Figure 1 in Appendix A. The installation boundary is shown in Figure 2 in Appendix A and there are four “islands” (diesel buildings) supporting Reactor 1 and Reactor 2.

The surrounding land use is a mixture of industrial and agricultural land. The nearest residential properties are approximately 1km south (village of Sizewell) and 3km to the west (town of Leiston). The human receptors are shown in Figure 4 in Appendix A.

The installation is located on the Suffolk Heritage Coast within the Suffolk Coast and Heaths Area of Outstanding Natural Beauty. The North Sea is located immediately to the east. The Sizewell Marshes are located adjacent to the west and north west of the installation. Leiston Beck is located adjacent to the west of the installation, which then joins the Minsmere, approximately 2km north. The ecological receptors are shown in Figures 5 and Figures 6 in Appendix A.

[1]. The regulated activity is defined under Section 1.1, Part A(1), Paragraph (a) of Schedule 1 of the Environmental Permitting (England and Wales) Regulations 2016 (as amended) as “Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more”.

Proposed Activities

Each of the two UK European Pressurised Reactors (EPR™) units at SZC will require four 23.1 MW_{th} (which equates to 9.59 megawatts electrical (MW_e)) essential diesel generators (EDGs) and two 10.53 MW_{th} (3.75 MW_e) ultimate diesel generators (UDGs). It has been agreed with the Environment Agency that other combustion plant at SZC will be covered through applications for variations to the environmental permit. The installation to which the environmental permit will apply therefore comprises the twelve diesel generators, their associated fuel storage tanks and interconnecting pipework, all of which will be housed within four purpose built concrete buildings each containing two EDGs and one UDG.

The diesel generators are safety classified standby installations and would be only be infrequently operated in the event of a loss of off-site power (LOOP). The frequency of a short LOOP (<2 hours) occurring is conservatively estimated to occur a limited number of times during the lifetime of the plant and a long LOOP (between 2 hours and 24 hours) is expected to occur about once in the lifetime of a fleet of nuclear sites. Once installed and commissioned, the diesel generators would only be routinely operated for maintenance purposes and during periodic nuclear safety tests. For the purpose of this application, usage has been assumed conservatively as 60 hours per year for each EDG and UDG (based on operational experience on the most recent 'N4' generation of nuclear power station in France). The actual running hours are expected to be lower and will depend on the manufacturer's recommendations and safety case requirements.

An assessment was carried out of the technology to supply emergency electricity to the SZC power station. The assessment considered reliability, fast start-up, independent of off-site systems and services and environmental impact. It was concluded that diesel generators are the preferred option (reliable, fast start-up and independence) in the design of pressurised water reactors and are considered to be BAT. In addition, changes made to the SZC design configuration will be managed to ensure that the design and activities are consistent with the permit application and the incorporation of BAT formally into the design process.

Emissions & Monitoring

Emissions

The main emissions to air will consist of hot flue gas from the combustion units, containing oxides of nitrogen, sulphur and carbon, smoke (particulate matter) and traces of organic compounds.

Flue gases will be emitted to air via exhaust stacks, which will be approximately 27.2 metres in height. Each diesel generator will have an individual stack, a plan which details the location of the stacks is provided in Figure 2 of Appendix A. Final confirmation of the emissions to air and monitoring techniques will be provided as part of the FAP.

The infrequent usage of the plant (< 1% of the year) means that the installation of abatement equipment is not considered to be BAT (given the environmental impacts). Following operational testing and validation of the modelling carried out, this position will be reviewed.

There are no planned process related emissions to controlled water from the diesel generators installation. Should the cooling water/glycol (anti-freeze) mix need to be replaced, it will be disposed of off-site as hazardous waste.

Monitoring

Well controlled combustion is essential to minimising the emissions from the diesel generators. In order to monitor the plant during maintenance testing and operation during periodic nuclear safety tests, basic combustion monitoring equipment will be installed (e.g. temperature, oxygen levels and carbon monoxide). This will inform the Operator as to the efficiency of the combustion process which impacts on the levels of pollutants released. The equipment to be used will be determined as part of the procurement process. BAT will be considered as part of this process and will continue to be evaluated throughout the lifecycle of the project as part of the company's modifications assessment process which is designed to screen and assess the significance of any design changes to ensure that the design and activities are consistent with the permit application and will be one of the actions to be delivered through the FAP. Monitoring of fuel consumption in order to calculate CO_2 emissions will also be required under the European Union Emissions Trading Scheme (EU ETS) permit required (to be applied for in due course).

Due to the diesel generators being standby plant, it is not proposed to install continuous emissions monitoring as this would be unused for most of the year and the maintenance of Monitoring Certification Scheme (MCERTS) systems and staff certification would place a disproportionate burden on the site in comparison to the use of external MCERTS accredited contractors (where required) which is the preferred approach.

Due to the limited frequency of operation and the size of the combustion plant SZC Co. has proposed a programme of periodic monitoring of emissions to air for oxides of nitrogen, particulate matter and carbon monoxide as part of the FAP. Sulphur dioxide emission concentrations will be calculated from the sulphur content of the fuel. Maintenance of the diesel generators will be carried out based on engine running hours and manufacturers recommendations.

Environmental Risk Assessment

Emissions Benchmarks

Estimated emissions from the diesel generators' operation are compared against the appropriate BAT based benchmarks in Section 3 of this submission. Benchmarks will be considered against the role of the plant as part of the nuclear design and in the procurement

process and a validation will be carried out once the actual engines have been chosen and installed as part of the FAP.

Impact Assessment

Emissions to Air

Detailed dispersion modelling has been carried out for oxides of nitrogen, particulate matter, carbon monoxide and sulphur dioxide to consider the impacts of the emissions on the nearby human and ecological receptors. The resulting concentrations and deposition of pollutants were assessed against relevant assessment criteria and considered together with the probability of the operating scenario (commissioning, routine testing or a LOOP event occurring). The only predicted exceedances of air quality standards at human health receptors predicted by the modelling is for short term nitrogen dioxide process contributions during the LOOP event. Given the worst case assumptions, the infrequency of the LOOP event and the low likelihood of the LOOP event taking place during worst-case meteorological conditions it was concluded that the emissions would not represent a significant effect for the human receptors.

The only predicted exceedance of air quality standards at ecological receptors is for daily nitrogen oxides during routine testing. Given the worst-case assumptions and the low likelihood of the scenarios taking place during worst-case meteorological conditions, it is considered unlikely that there would be adverse effects to ecological receptors and that the exposed habitats would have time to recover. A review of nitrogen oxides generation by the diesel engines will be carried out during the operational phase as part of the environmental performance review as part of the FAP.

Habitat features are predicted to experience impacts in regard to nitrogen (ten habitat features) and acid deposition (11 habitat features) which cannot be considered insignificant. However, it should be noted that the background levels of nutrient and acid deposition already exceed the lower critical load range at these habitat features. The predicted process contributions associated with commissioning, routine testing and a LOOP event would be short-term and temporary (especially during commissioning operations) and, given the background rates of high chronic deposition, the process contributions are unlikely to result in significant changes in species composition or habitat condition.

Emissions to Water and Sewer

The only emissions to water from the installation will be uncontaminated surface water drainage, which would be discharged to the North Sea and will not give rise to adverse environmental effects.

Noise and Vibration

A detailed noise impact assessment was undertaken to assess impacts arising from the operation of the installation. The noise assessment concluded that the predicted noise levels from the combustion equipment in operation will not give rise to significant adverse noise impacts at residential and non-residential receptors. Design features to be adopted to minimise noise will be effective in reducing potential adverse noise impacts and are in accordance with the requirements of BAT.

Odour

There are not expected to be any odour issues associated with the installation. The only potential source of odour is from fugitive emissions associated with the delivery of diesel fuel. The diesel fuel is stored in vented tanks to prevent over-pressurisation. Although each of the main storage tanks will contain enough fuel for constant operation of 72 hours, it is likely they will be required to be maintained at a high level (for safety reasons). Diesel fuel deliveries will be relatively infrequent, of a short duration and supervised, reducing the potential for fugitive emissions to air and emissions of odour.

Other Emissions and Use of Resources

There are no anticipated process emissions to land or groundwater from the installation. The measures proposed to prevent unplanned emissions from the installation are considered to represent BAT.

Habitats Directive

Consideration has been given to the impacts on Habitats Directive[2] [2] sites within a 10 km radius and no adverse effect on the integrity of potentially affected European Designated Sites has been identified.

Managing the Activities

General Management

SZC Co. will implement an integrated management system (IMS) of documented procedures covering quality, health and safety and environmental management. The environmental aspects of the management system will be developed to comply with an accredited standard and will meet the indicative BAT requirements of the Regulatory Sector and Environmental Agency guidance. As the development of procedures will follow agreement of the detailed design and procurement, the management system will be one of the actions to be delivered through the FAP.

[2]. In the UK, the Habitats Directive is implemented by the Conservation of Habitats and Species Regulations 2010 (SI 2010 No. 490)

Arrangements will be developed to manage lessons learnt and improvement and/or pre-operational conditions, as the requirements may be relevant to one or more permits and/or EDF sites.

Accident & Incident Management

An initial environmental accident risk assessment has been carried out on the plant that comprises the installation. The risk assessment focused on the engineered design, as the procedural aspects as discussed above, have yet to be determined. When the engineered and procedural mitigation has been completed, a quantified risk assessment will be completed.

The main risk identified from the operations to be permitted is considered to be the loss of containment of the diesel fuel. This is mitigated by virtue of the containment of the diesel building and the integral bunding (the tanks are located in a bunded area of the diesel building, which will be impermeable to the fuel).

SZC Co. will develop, implement and maintain a hazard and risk management system, which addresses the potential accidents, associated with the installation and provide an accident & incident management plan.

Raw Materials

The main raw material used in the diesel generators is diesel fuel oil which will be consistent with BS 2869:2017 [3] and will also comply with the Sulphur Content of Liquid Fuel (SCOLF) (England and Wales) Regulations 2007 [4] . The use of fuel oil will be minimised since, under normal operations, the diesel generators will only be run for safety related testing and maintenance required by the manufacturer.

Other raw materials include lubricating oil, antifreeze and batteries all of which will be required predominantly for maintenance operations to maximise the reliability of the diesel generators. A raw materials register and supporting safety data sheets will be updated as part of the FAP.

There is no use of water for the operation of the standby diesel generators. Minor volumes may be required for cooling system top-up and cleaning, however, this requirement is not significant (some water will also be used in the initial cooling system fill).

Energy Efficiency Measures

Fuel oil supplies the energy requirement for the diesel generators. The electricity generated during the test runs will be exported to the National Grid. No operation of the diesel generators will be performed solely for commercial reasons. Electrical consumption by the diesel generators (e.g. for start-up) is considered to be trivial and will not be monitored separately from the wider station usage.

Though not confirmed, it is expected that the diesel generators will also be permitted under the EU ETS; this is consistent with the approach taken across the existing UK operational reactor sites.

Avoidance, Recovery and Disposal of Waste

Relatively small quantities of waste will be generated by the operation of the diesel generators. Waste will be managed as part of the IMS and the SZC Co. Integrated Waste Strategy (IWS). All wastes generated will be subject to assessment in line with the waste hierarchy and the IWS with disposal to landfill being undertaken only when no other options are feasible.

Installation Issues

The installation will be wholly owned and operated by SZC Co. There will not be any areas where operational responsibility is unclear.

Permit Surrender

Development of the installation will involve significant excavations. Baseline monitoring will be carried out once the construction excavations have reached their final levels and a Site Condition Report will be produced, which, describes the current state of the land upon which the installation is located and identifies the pollution prevention measures, which, will be used during the life of the installation to prevent contamination. An assessment of land quality will also be carried out during the lifecycle of the project to confirm there has been no degradation of land quality during operations under the environmental permit. A surrender Site Condition Report will be produced, which, will allow a comparison to be made with the condition of the land prior to and during the permitted operations and at the point of permit surrender.

As part of the site decommissioning and permit surrender plan, the diesel generators will be taken out of service when no longer required to support safety related activities on the power station. Although it is not practicable to develop a precise decommissioning and permit surrender plan for the standby generators at this time, the approach will be based on existing plant closure and demolition methodologies for diesel fuelled power plant. It is likely that there will be a continuous improvement in these methodologies over the station life, and the best practice at the time of site closure will be employed.

Decisions on the re-use of plant items, recycling of materials or their disposal as waste will be made at the time of decommissioning, in the light of available technology, economic considerations and legislation.

Forward Action Plan

The application for the environmental permit is being made significantly in advance of the permitted activities being undertaken. Further details will continue to be developed over the course of the project, as the power station design progresses. Therefore, as part of the permit application, SZC Co. has prepared a plan that identifies its commitments to provide the Environment Agency with further information and the timing for such provision.

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1 Introduction

1.1 Purpose of the Report

This report supports the application for a combustion activity environmental permit made by the NNB Generation Company (SZC) Limited, Registered Number 09284825 (hereafter referred to as SZC Co.), which is a wholly owned subsidiary of NNB Holding Company (SZC) Limited which in turn is 80% owned by EDF Energy Holdings Limited and 20% owned by General Nuclear International Limited. In turn:

- EDF Energy Holdings Limited is a wholly owned subsidiary of Electricité de France S.A; and
- General Nuclear International Limited is a wholly owned subsidiary of China General Nuclear Power Corporation Limited.

The EDF Group of companies own and operate a number of nuclear power stations in the UK, including Sizewell B (SZB). The EDF Group of companies also operates 58 nuclear power reactors in France, with a combined capacity of approximately 63 GW_e. EDF is the largest nuclear utility in the world.

Although SZC Co. was a newly formed company in 2016, it is a member of the EDF Group of companies and will have access to the resources, experience and expertise of the world's largest owner and operator of nuclear power stations. SZC Co. has taken and will take advantage of the experience and resources of its parents and affiliates. However, as the intelligent customer and knowledgeable owner and Operator of SZC, SZC Co. will establish its own organisation and procedures that account for the Office for Nuclear Regulation (ONR) and Environment Agency guidance, and these will be developed over time based upon the status of the project as well as lessons learnt from the power station currently in construction at Hinkley Point C (HPC). SZC Co.'s company manual [5] includes the requirements of a safety and environmental management prospectus and describes the company structure, governance arrangements and key roles and responsibilities.

SZC Co. is applying for a new combustion activity environmental permit associated with the proposed UK EPR™ units at the Sizewell C (SZC) site, to be located adjacent to the existing Sizewell A and B power stations. The power station will have twelve back-up diesel generators, which have a combined thermal input in excess of 50 megawatts thermal (MW_{th}) therefore requiring an environmental permit under the Environmental Permitting (England and Wales) Regulations 2016 [1]. For clarity, throughout this submission the Environmental Permitting (England and Wales) Regulations 2016 will be referred to as "the EP Regulations" and the new nuclear reactor at SZC will be referred to as "the UK EPR™".

The report is structured in a style consistent with the HPC environmental permit application. It should be noted that since the HPC environmental permit application was submitted and authorised by the Environment Agency, the Environment Agency combustion sector guidance [6] was withdrawn (withdrawn August 2018) and replaced with the Best Available Techniques (BAT) Reference (BREF) for large combustion plants (European Commission 2017) [7]. The Environment Agency noted that the combustion sector guidance is still current, however some of the documents referred to in the guidance have been withdrawn and replaced with new versions.

1.2 Scope of the Application

The SZC new build site will comprise two UK EPR™ units, each with a separate standalone emergency power supply. This will be provided by essential diesel generators (EDGs) and ultimate diesel generators (UDGs), and as the total aggregate rated thermal input of the combustion engines is in excess of 50 MW, they are a prescribed activity under the EP Regulations (as transposed into UK legislation to comply with the requirements of the Industrial Emissions Directive 2010/75/EU (IED) [8]).

The regulated activity is defined under Section 1.1, Part A(1), Paragraph (a) of Schedule 1 of the EP Regulations [1] as:

> *"Burning any fuel in an appliance[3] with a rated thermal input of 50 megawatts or more".*

Rated thermal input is defined as the rate at which fuel can be burned at the maximum continuous rating of the appliance multiplied by the gross calorific value of the fuel and expressed as megawatts thermal.

This application will therefore be submitted in accordance with the requirement of Part 2, Chapter 1, and Regulation 12 of the EP Regulations [1], which states:

> *"No person can operate a regulated facility except under and by the extent authorised by an Environmental Permit"*

And Part 2, Chapter 2, Regulation 13 of the EP Regulations [1], which states:

> *"On the application of an operator, the regulator may grant to that operator, a permit (in these Regulations, an "Environmental Permit") authorising the operation of a regulated facility."*

[3]. Under Section 1.1 of Part 2, Schedule 1 of the Regulations, for the purpose of paragraph (a) where two or more appliances with an aggregate rated thermal input of 50 MW or more are operated on the same site by the same operator those appliances must be treated as a single appliance (i.e. the EDGs are prescribed because the aggregate rated thermal input exceeds 50 MW).

The relevant prescribed process under the EP Regulations relates to combustion activities and not specifically to the diesel generators.

For the purposes of this application the term 'plant' generally refers to the diesel generators that form the permitted installation and not the wider nuclear power station. Other combustion plant at SZC will be covered through applications for variations to the environmental permit. The reactor operations are specifically excluded from the scope of the application as radioactive substances activities interactions will be addressed under a separate environmental permit application made under Schedule 23 of the EP Regulations.

1.3 Proposed Permitted Installation

This document supports an application which will be submitted by SZC Co. for an environmental permit to operate a Part A(1) installation under the EP Regulations[4] at the proposed SZC power station, located adjacent to the Sizewell A (SZA) and SZB power stations near Leiston, Suffolk.

The installation is located in a coastal area adjacent (to the north) of the existing SZB power station Nuclear Licensed Site Boundary. For the purpose of the EP Regulations, the installation will lie within the Nuclear Licensed Site Boundary for SZC.

Figures 1 and 2 showing the location of the site and the installation boundary are provided in Appendix A. The installation boundary has been determined using the "island" approach agreed with the Environment Agency for the permitting of similar EDF Energy (previously British Energy) reactor sites across the UK. This approach ensures that the environmental permit will apply to prescribed plant only (installation). On the SZC site, there will be four "islands" (diesel buildings), two supporting each reactor (referred to as Reactor 1 and Reactor 2 for the purpose of this submission).

The centre of the SZC site is located at the following Ordnance Survey National Grid Reference (NGR) co-ordinates:

- TM 47270 64145

The centres of the four diesel buildings that comprise the installation boundary are located at the following Ordnance Survey NGR co-ordinates:

- Reactor 1, Diesel Building 1 TM 47239, 63890
- Reactor 1, Diesel Building 2 TM 47239, 64064

[4]. The Environmental Permitting (England and Wales) Regulations 2016 transpose the requirements of the Integrated Pollution Prevention and Control (IPPC) Directive into national legislation in England and Wales.

- Reactor 2, Diesel Building 1 TM 47239, 64122
- Reactor 2, Diesel Building 2 TM 47239, 64297

In order to ensure power is always available to the site (even in the event of loss of connection/supply to the National Grid), the site proposes to operate a number of essential diesel generators. Although the largest of these is 23.1 MW_{th} (9.59 MW_e), the aggregate rated total is in excess of 50 MW_{th} and as such, is prescribed under Part A(1) of the EP Regulations. It has been agreed with the Environment Agency that other combustion plant at SZC will be covered through applications for variations to the environmental permit.

Table 1.1 outlines the scope of the installation. All the equipment (engines, pipework and fuel tanks) will be housed in specifically designed buildings; these buildings form the extent of the installation. Specifically excluded from the installation are raw material and waste storage facilities as they are outside the installation boundaries.

These areas serve the wider site with the main purpose being to serve the reactor operations. The diesel generator wastes, and raw materials comprise a minor portion of that required and generated by the wider site operations.

Oily water drains from the permitted installation will be covered in detail in a separate environmental permit application for a water discharge activity.

Table 1.1: Description of installation for Permit Application

Activities in the Stationary Technical Unit	Schedule 1 Reference	Operator
Combustion of diesel fuel in stand-by diesel generators, associated fuel storage tanks and pipework.	Burning of any fuel in an appliance with a rated thermal input of 50 megawatts or more.	NNB Generation Company (SZC) Limited

1.4 Regulatory Requirements

SZC Co. will be subject to numerous regulatory regimes, which are described below.

1.4.1 Permitting

The prescribed combustion activities at the SZC new build site relate to the twelve back-up diesel generators and as such is prescribed within the 'Combustion Activities' section of the EP Regulations [1], as amended (Section 1.1 A1 (a)).

The Environment Agency combustion sector guidance [6] was withdrawn in August 2018 and replaced with the BREF for large combustion plants [7]. The Environment Agency noted that the combustion sector guidance is still current, however some of

the documents referred to in the guidance have been withdrawn and replaced with new versions. Environment Agency guidance is discussed further in Section 1.5 Applicable Guidance.

The EP Regulations [1] were amended in 2012 to reflect the requirements of the EU IED [8]. The IED aims to achieve a high level of protection of the environment by reducing harmful industrial emissions, in particular through the application of BAT. This requires discharges into the environment to meet specific sector-led standards and and/or evidence will have to be provided for a derogation from the standards. It also makes it more straightforward to comply with the regulations. BAT reference documents are discussed further in Section 1.5 Best Available Techniques.

1.4.2 Baseline Report

Under Article 22(2) of the IED [8], Operators are required to submit a baseline report where their activity involves the use, production or release of relevant hazardous substances, and having regard to the possibility of soil and groundwater contamination at the site of the installation.

1.4.3 Habitat Regulations Assessment

The Conservation of Habitats and Species Regulations 2017 (as amended) [9], referred to in this permit application as the ‘Habitats Regulations’, require that an assessment be undertaken to determine the potential significant adverse effects on certain European Sites, either individually or in combination with other plans or projects.

1.5 Best Available Techniques

The EP Regulations [1] were amended in 2012 in relation to the IED [8]. A primary function of the IED was for tighter implementation of BAT with regards to pollution prevention and control. BAT is defined (using the definition in Article 3 of the IED Directive [8]) as:

- 'best available techniques’ shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole;

- 'techniques' shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;

- 'available' techniques shall mean those developed on a scale which allows

implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the Operator; and

- 'best' shall mean most effective in achieving a high general level of protection of the environment as a whole.

Article 11 of the IED [8] includes requirements that "Member States shall take the necessary measures to provide that Installations are operated in accordance with the following principles:

- all the appropriate preventive measures are taken against pollution;
- the best available techniques are applied;
- no significant pollution is caused;…"

The European Commission's Integrated Pollution Prevention and Control Bureau (IPPCB) continuously research BAT for processing and emissions mitigation / abatement for a number of industries. The output of the research is reference documents on BAT, known as BREF Notes. The BREF Notes are the main reference documents used by competent authorities in Member States when issuing operating permits for the installations that represent a significant pollution potential in Europe. Previously emissions limits outlined in BREF documents were a guideline / reference for setting emissions limit values (ELVs). The IED changed this with the ELVs having to be based on the BAT, as defined in the BREF Notes, unless the site can be assessed to conclude the implementation of BAT on existing infrastructure would lead to disproportionately higher costs compared to the environmental benefits due to:

- The geographical location or local environmental conditions of the installations concerned; and
- The technical characteristics of the installation concerned.

Table 1.2 present the guidance notes referred to in this application and are considered to present the BAT for the installation:

Table 1.2: BAT Guidance Notes

Guidance	Notes
How to comply with your environmental permit, Additional guidance for: Combustion Activities, EPR 1.01, EA, March 2009 (EPR 1.01) [6].	The Environment Agency combustion sector guidance was withdrawn in August 2018 and replaced with the BREF technical guidance for Large Combustion Plants. The Environment Agency noted that the combustion sector guidance is still current however some of the documents referred to in the guidance have been withdrawn and replaced with new versions.
BAT Reference Document for Large Combustion Plants (LCP) (2010/75/EU, European Commission, 2017 (LCP BREF) [7].	The LCP BREF is in line with the IED Article 29 (1) definition. Chapter III Article 29 of the IED details the aggregation rules for combustion activities with a total rated thermal input of 50MW or more. Specifically relevant to the combustion activities installation is the requirement for "separate combustion plants which are installed in such a way that, taking technical and economic factors into account, their waste gases could in the judgment of the competent authority, be discharged through a common stack, are to comply with the EU-wide emission limit values and monitoring requirements laid down in Annex V of the IED". It is considered that the diesel generators could not be aggregated to release their emissions via a common stack. Each diesel generator must be capable of operating entirely independently and a shared stack would potentially restrict this ability if the stack were to be compromised in any way. As such, for the purpose of nuclear safety, each diesel generator must have a separate, independently operated stack. It is therefore considered that the ELVs defined within the IED are not applicable to the combustion activities installation. As the standby generation plant (EDGs and UDGs) do not contain individual units, or units, which share a common stack, over 50 MWth, the LCP BREF does not apply to the power station standby generation plant.
Establishing Best Available Techniques (BAT) Conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for Large Combustion Plants, July 2017 (LCP BATc) [10].	As the standby generation plant (EDGs & UDGs) do not contain individual units, or units which share a common stack, over 50 MWth, the BAT conclusions and BAT associated emission levels (AELs) do not apply to the power station standby generation plant. It is further noted that many of the BAT conclusions relating to operating techniques specifically exclude standby plant and plant operating less than 500 hours a year.

Guidance	Notes
Directive (EU) 2015/2193 of The European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from medium combustion plants (Medium Combustion Plant Directive) (MCPD) [11].	The twelve back-up generators are defined as 'Medium Combustion Plant' in accordance with the aggregation rule in the MCPD [10], however it is considered that the plant does not fall under the scope of the MCPD, as the specified emission limit values are not applicable to combustion plant that operate for less than 500 hours/ year (over a five year averaging period). SZC Co. will be applying for an exemption from the Environment Agency under the MCPD. It is further noted that the diesel generators will have a defined nuclear safety role under a nuclear licence issued by the Office for Nuclear Regulations, and therefore are considered to be "excluded generators" as defined in Schedule 25B of the Environmental Permitting Regulations 2018 (as amended).
Specified generator guidance, UK Government, 2018 [12].	The specified generator guidance applies to generators that generate electricity and that are between 1 and 50 MWth (or to two or more generators that aggregate to a capacity over 1 MWth but less than 50 MWth). However, the specified generator guidance does not apply to excluded generators, which include generators subject to the provisions of Chapter II or Chapter III of the IED, generators operating with a defined nuclear safety role under a nuclear site licence issued by the ONR; and back-up generators operated for the purpose of testing for no more than 50 hours per year.
Environmental Permitting Technical Note 1/1(18) - Reference document for combustion plant of 20 to 50 MW thermal capacity, Revised: 2018, Environment Agency (EP Technical Note 1/1 (18)) [13].	This guidance does not apply to those plants of between 20 and 50 MW thermal input, where they are one of a number of appliances with an aggregate rated thermal input of 50 MW or more, operated on the same site by the same Operators. These plants are subject to the BAT conclusions for large combustion plant.
Developing Best Available Techniques for combustion plants operating in the balancing market, Amec Foster Wheeler Environment and Infrastructure UK Limited, Department for Energy and Climate Change, Final Report, June 2016 (Balancing Market BAT) [14].	It does not apply to plant used solely for black start or site emergency generation.

The BAT guidance notes will be considered throughout this submission; at a high level in terms of determining the technology to be implemented, at an operational level addressing the techniques and technology used on the installation and at a procedural level detailing how the site will be managed and how management arrangements will be applied for environmental protection.

The 2005 IPPC Sector Guidance Note (SGN) [15] for Combustion Activities has been replaced with EPR 1.01 [6] and the LCP BREF [7]. However, it has still been included in some of the indicative BAT requirements as these items are often listed as conditions within environmental permits.

As each section of the process is described, the indicative BAT requirement will be stated, and the proposed process compared to demonstrate that BAT is achieved or exceeded. Where any variance from BAT is identified or information is not yet available, this is tabulated and reported in this permit application.

1.6 Applicable Guidance

The current regulatory guidance used in preparing this submission is listed below:

- CIRIA. C736, Walton, I L W. (2014), Containment systems for the prevention of pollution. Secondary, tertiary and other measures for industrial and commercial premises [16];
- CIRIA C741, Charles, P., Edwards, P. (2015), Environmental good practice on site guide. 4th edition [17];
- DEFRA (2013) Core guidance for the Environmental Permitting (England and Wales) Regulations 2010 [18];
- Environment Agency (2018) Guidance for A1 installations: environmental permits, https://www.gov.uk/guidance/a1-installations-environmental-permits [19];
- Environment Agency (2009). Guidance note on combustion activities EPR 1.01 (Withdrawn in August 2018. Discussed in Section 1.4 Regulatory Requirements) [20];
- Environment Agency forms and guidance (Forms Part A, Part B2, Part B3 and Part F1);
- Environment Agency (2019) Legal operator and competence requirements: environmental permits https://www.gov.uk/guidance/legal-operator-and-competence-requirements-environmental-permits [21];
- Environment Agency (2019) Environment Agency guidance, developing a management system (updated January 2019) https://www.gov.uk/guidance/develop-a-management-system-environmental-permits [22];

- Environment Agency (2019) Adapting to climate change: risk assessment for your environmental permit, https://www.gov.uk/guidance/adapting-to-climate-change-risk-assessment-for-your-environmental-permit [23];
- Environment Agency (2016) Risk assessments for your environmental permit, https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit [24];
- Environment Agency (2016) Risk assessments for specific activities: environmental permits, https://www.gov.uk/government/collections/risk-assessments-for-specific-activities-environmental-permits [25];
- Environment Agency (2016) Control and monitor emissions for your environmental permit, https://www.gov.uk/guidance/control-and-monitor-emissions-for-your-environmental-permit [26];
- Environment Agency (2016) Guidance for best available techniques: environmental permits https://www.gov.uk/guidance/best-available-techniques-environmental-permits [27];
- Environment Agency (2016) Guidance for energy efficiency standards for industrial plants to get environmental permits https://www.gov.uk/guidance/energy-efficiency-standards-for-industrial-plants-to-get-environmental-permits [28];
- Environment Agency (2018) Collection of technical guidance for regulated industry sectors: environmental permitting https://www.gov.uk/government/collections/technical-guidance-for-regulated-industry-sectors-environmental-permitting [29];
- Environment Agency (2018) Energy efficiency standards for industrial plants to get environmental permits https://www.gov.uk/guidance/energy-efficiency-standards-for-industrial-plants-to-get-environmental-permits [30];
- Environment Agency (2017), Air emissions risk assessment for your environmental permit https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [31];
- Environment Agency (version 3.0, June 2004), H3 Part 2 Noise assessment and control – guidance for applicants https://www.gov.uk/government/publications/environmental-permitting-h3-part-2-noise-assessment-and-control [32];

- Environment Agency Guidance (Published October 2018), Noise impact assessments involving calculations or modelling https://www.gov.uk/guidance/noise-impact-assessments-involving-calculations-or-modelling [33];

- Environment Agency (March 2011), H4 Odour management – how to comply with your environmental permit https://www.gov.uk/government/publications/environmental-permitting-h4-odour-management [34];

- Environment Agency (version 3.0, April 2013), H5 Site condition report - guidance for applicants https://www.gov.uk/government/publications/environmental-permitting-h5-site-condition-report [35];

- Environment Agency (2018) Monitoring emissions to air, land and water (MCERTS), https://www.gov.uk/government/collections/monitoring-emissions-to-air-land-and-water-mcerts [36];

- Environment Agency M series Monitoring Technical Guidance Notes (TGNs); and

- Environment Agency (updated 3 January 2018), oil storage regulations for businesses 'how to store oil, design standards for tanks and containers, where to locate and how to protect them, and capacity of bunds and drip trays' https://www.gov.uk/guidance/storing-oil-at-a-home-or-business [37].

1.7 Other Consenting Regimes and Environmental Assessments

SZC Co. will also require other assessments, licenses and environmental permits related to the construction and operation of SZC, which are in addition to this application for a combustion activity environmental permit. The other assessments, licenses and environmental permits are described below.

1.7.1 Generic Design Assessment

As part of developing the EPR™ for use in the UK including for SZC, a suite of generic documentation has been produced to aid the site-specific adoption of the reactors and to formalise the basic principles to be applied in the regulatory processes. This process is called the Generic Design Assessment (GDA). The GDA reference reactor is based on the Flamanville 3 design.

The GDA process is carried out jointly by the ONR and the Environment Agency separate to the licensing process. Under the GDA process, the ONR and

Environment Agency engage with nuclear reactor vendors on the generic aspect of their design, perform technical assessment work on their submissions, consult with overseas regulators, implement a comments process and consult. This is done in order to assess the environmental, safety and security aspects of reactor designs before construction of the reactor starts.

In December 2012 the ONR issued a Design Acceptance Confirmation (DAC) and the Environment Agency issued a Statement of Design Acceptability (SoDA) for the UK EPR™ Reactor Design, concluding the corresponding GDA process.

As part of the GDA process, a generic document has been produced to support an application for a process prescribed under the IED Directive [7] (as transposed into UK law in England and Wales through the EP Regulations). The information presented in this submission is broadly consistent with that detailed in the GDA PPC application [38], produced by AREVA NP SAS and EDF, with deviations clearly stated.

The information provided in the GDA was used to inform the operational combustion activities permit application for HPC. As part of the replication strategy between HPC and SZC this permit application reflects where possible developments in design and information available from the HPC project. The SZC replication strategy is described in Section 2.1. This SZC application draws on the work undertaken from the GDA to support the HPC permit and where possible duplicates and updates this information as available from HPC.

1.7.1 Nuclear Site Licence

Nuclear Sites are required to apply for a Nuclear Site Licence (NSL) under The Nuclear Installations Act 1965 (as amended) [39]. The ONR regulates Licensees via the NSL. The NSL sets out 36 standard licence conditions for which the Licensee develops and implements arrangements. These conditions are available on the ONR website. Prior to being granted an NSL, the Licensee must demonstrate that it complies with its arrangements to meet the licence conditions and have appropriate organisational capabilities and governance in place to ensure nuclear safety. Licensees must also be able to demonstrate they have control over the site in terms of security of tenure. The arrangements are proportionate to the activities being carried out by the Licensee.

1.7.2 Development Consent Order (DCO)

Given that the proposed development exceeds 50 MW_e installed generating capacity, it is therefore designated as a Nationally Significant Infrastructure Project under the Planning Act 2008 [40]. Accordingly, development consent must be obtained to authorise the development.

The Proposed Development also falls within Schedule 1 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('the EIA Regulations') [41], and therefore constitutes 'EIA development'. As such an EIA is being undertaken and a summary of this will form the basis of an Environmental Statement (ES) that will accompany the DCO Application.

At the time of writing SZC Co. is preparing an application for a DCO. The application will be accompanied by an Environmental Statement (ES) and will be accepted by the Planning Inspectorate on behalf of the Secretary of State for Business Energy and Industrial Strategy (BEIS). SZC Co. currently anticipates that the application for a DCO will be made in 2020 and at the same time as this permit application.

1.7.3 Regulatory Justification

Before any new class or type of practice involving radiation can be introduced in the UK it must undergo Regulatory Justification. The principle of justification is that no practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes. With the support of Areva NB, the Nuclear Industry Association, as the trade association for the civil nuclear industry in the UK, submitted an application for the justification of the UK EPR™ practice, which was given effect in The Justification Decision (Generation of Electricity by the EPR Nuclear Reactor) Regulations 2010 No. 2844 [42].

1.7.4 Environmental Permits

In addition to this application for a combustion activity environmental permit, SZC Co. will also require additional Environmental Permits under the EP Regulations, which will be subject to public consultation. The three key permits are:

- Construction water discharge activity permit;
- Operational water discharge activity permit; and
- Radioactive substances regulation activity permit.

The operational water discharge activity permit and the radioactive substances permit are being submitted at the same time as the combustion activity permit application. The construction water discharge activity permit will be applied for in the future. Additional permits will also be required to support the construction and commissioning activities.

1.7.5 Emissions Trading Scheme

As the combustion plant capacity at SZC will be in aggregate over 20 MW_{th} this may require an application to be made for a European Union Emissions Trading Scheme permit under the Greenhouse Gas (Emissions Trading Scheme) Regulations 2012 (SI 2012 No. 3038) [43]. If required, this permit will be applied for separately and in due course.

1.8 Contents of the Application Technical Reports and Supporting Data

Table 1.3 below outlines the structure of this submission.

Table 1.3: Submission Structure

Section	Title	Brief Description
1	Introduction	Demonstration of the need for an environmental permit and how the EP Regulations apply.
2	Proposed Activities	A description of the prescribed process demonstrating how BAT has been employed.
3	Emissions and Monitoring	Detailing the point source and fugitive emissions on the installation. This section also discusses the odour and noise emissions from the plant as well as the process and environmental monitoring to be carried out.
4	Environmental Impact Assessment	This section details the environmental benchmarks pertaining to processes of this nature (as outlined in sector guidance) and discusses the environmental impact from the installation.
5	Managing the Activities	A description of the environmental management system arrangements across the site and a discussion of the environmental accident risks and mitigation in place. The management, storage and use of raw materials and wastes are also discussed along with justifications for use/disposal.
6	Forward Action Plan	There are some areas where the process information is not fully developed. Throughout this document proposals are made to address these gaps indicated either by the text 'TBC' (to be confirmed) or by making a reference to the FAP. Section 6 brings together all of these proposals in one place along with a programme for developing information to address any shortfalls identified.
7	References and Acronyms	Provides references used in the production of this document as well as definitions of the acronyms/abbreviations used.
Appendix A	Site Maps, Plans and Drawings	Drawings detailing the process, installation and site location.
Appendix B	Site Condition Report	A detailed report outlining the baseline site condition (with respect to the pollutants within the installation).

Section	Title	Brief Description
Appendix C	Air Quality Modelling Report	A copy of the report produced from the detailed air dispersion modelling carried out.
Appendix D	Shadow Habitats Regulations Assessment (HRA) Report	A copy of the shadow report produced from the HRA.
Appendix E	Noise Assessment	A copy of the report produced from the noise assessment.
Appendix F	Application Forms (A, B2, B3 and F1)	Completed application forms A, B2, B3 and F1.

2 Proposed Activities

2.1 Proposed technology

2.1.1 Scope of the Activities

There will be a number of combustion plant at the SZC site including the EDGs and UDGs. It has been agreed with the Environment Agency that the other combustion plant at SZC will be covered through applications for variations to the environmental permit. **Table 2.1** summarises which combustion plant are included and excluded from the installation.

Table 2.1: Combustion Plant Included and Excluded from the Installation

Plant	Included/Excluded	Reason/Comment
There will be four separated and identical EDGs for each UK EPR™ unit, these are required to restore the power supply in the event of LOOP when house load operation[5] fails or is not possible. In total there will be eight EDGs at SZC as there will be two UK EPR™ units.	Included	Provision of back-up power.
There will also be two further separate UDGs (per UK EPR™ unit) to supply power to the actuators required in the event loss of both off-site supplies and the EDGs. The UDGs will be started manually from the main control room within two hours (reserve time of batteries) of plant blackout occurring. In total there will be four UDGs at SZC.	Included	Provision of back-up power.
In addition to the plant described in the GDA, small diesel generators may also be used to provide back-up power supply to additional site-specific buildings.	To be included through permit variation at a later date.	Provision of back-up power. At this stage it is not possible to describe these engines or their emissions. It is therefore proposed that these diesel generators (and any others that may be required as the site design evolves) will be included in the permit in a later variation.

[5]. House load operation is the auxiliary power consumption of the plant itself.

Plant	Included/Excluded	Reason/Comment
Diesel pumps located around the site will only be used for short periods in the event of an emergency or during periodic tests.	To be included through a permit variation at a later date.	At this stage it is not possible to describe these engines or their emissions. It is therefore proposed that these diesel generators (and any others that may be required as the site design evolves) will be included in the permit in a later variation.

Deviations from GDA Documentation

Changes made to the SZC design configuration will be managed through the SZC Co. 'No Change Committee', which will screen and assess the significance of any design changes on the SZC project to ensure that the design and activities are consistent with the permit application and the incorporation of BAT formally into the design process.

The differences between this application and information presented in the GDA process are as follows:

- The SZC site will have two UK EPR™ units, instead of the one described in the GDA, resulting in the following changes to plant numbers:

GDA (1 UK EPR™ unit)	SZC combustion activity (2 UK EPR™ units)
2 Diesel Buildings	4 x Diesel Buildings
4 EDGs and 2 UDGs in total	8 EDGs and 4 UDGs in total

- The size of the diesel generators in the GDA was originally 17.6 MWth for the EDGs and 6 MWth for the UDGs, representing an electrical output of 7.5 MWe and 2.5 MWe respectively. However, the nominal (electrical) output of both EDGs and UDGs for SZC has been increased due to site specific aspects like the heat sink, which require more power. This is reflected in the following increase in thermal input to the diesel generators:
  - EDGs: each generator at SZC will have a thermal input of 23.1 MW_{th}; and
  - UDGs: each generator at SZC will have a thermal input of 10.53 MW_{th}.
- The operational hours for each diesel generator was originally 20 hours per year in the GDA; this has increased to 60 hours per year for the SZC combustion activity. The 20 hours per year presented in the GDA reflected the manufacturer's minimum operating specification. However, operational

experience from the 'N4' unit at Civaux in France indicates that the maximum operating time for diesel generators was 50 hours per year. Allowing for a 10-hour margin it has been estimated that the operational hours for each diesel generator at SZC will be 60 hours per year.

- The description of combustion emissions presented in the GDA documentation was only concerned with those arising during 'normal' operations. However, the combustion activity for SZC considers emissions during commissioning, routine testing and also during LOOP events, providing a better assessment of potential environmental impacts from the installation.

- Total emissions from the EDGs and UDGs have been updated to reflect the changes in operating hours and size of the diesel generators.

- Fuel consumption by the EDGs and UDGs has been updated to reflect the changes in operating hours and size of the diesel generators. In relation to this the diesel storage tanks have increased in size from 180m3 to 226m3 for the EDGs and from 25m3 to 137m3 for the UDGs.

- The layout of the site has changed given the ongoing development of the project.

- Stack height has remained the same at 27.2m above ground level. The diesel generators are located in close proximity to overhead power lines, therefore the stack height is restricted to allow a safe distance between the diesel generator stacks and the overhead power lines.

SZC Replication Strategy

The SZC Replication Strategy allows the project to maximise the opportunity to derive value from a 'Next of a Kind' series effect, duplicating the HPC plant and adopting a systematic approach to capturing, quantifying and applying lessons learnt to SZC.

Lessons learnt during the construction, commissioning, operation and decommissioning of HPC may be applied directly to SZC if considered relevant and the benefits of the change are not grossly disproportionate to the impacts including consideration of the impact to replication.

The replication strategy is supported by all the current major stakeholders. The ONR has recognised that the proposed replication approach is appropriate regarding the sequence between HPC and SZC for maintaining a high level of safety and considers that there is a safety benefit in the replication.

The replication strategy is based on the replication of the final HPC design used for construction and erection activities. SZC documentation will be a copy of the most mature state from HPC available in line with the SZC schedule. Considering the gap between HPC and SZC, the most advanced and relevant detailed design is the design established on the HPC Reference Configuration 2 (HPC RC2). This will include the necessary batch of design changes and design maturity to finalise civil construction, carry out erection works on the HPC site and enable HPC on-site commissioning, including all feedback from design, safety requirements, supply chain design, manufacturing and in-factory testing.

As discussed in Section 5, the design configuration will be managed through the SZC No Change Committee in order to maximize the scope of common documentation and data which will be applicable on both sites without any changes.

The replication strategy will be based on the following key assumptions:

- The safety case requirements and as low as reasonably possible (ALARP) conclusions that apply for HPC are applicable by default to SZC. All the design inherited from HPC will be compliant with this safety case. It is not expected to have deviations from the regulator and the HPC safety case documentation to be used as the reference is HPC Pre-commissioning safety report. This is particularly important in relation to the diesel generators which are required to be safety classified systems and will be selected to ensure that equipment can meet the probability of failure on demand/reliability rates rather than bespoke systems that have not been previously substantiated or proven to meet the required strict safety requirements;

- The codes and standards applied during the design, manufacturing and construction of HPC will be applicable to SZC;

- The same sequence of construction at HPC and SZC;

- Review and acceptance of design documentation, qualification of equipment, manufacturing processes and supplier qualification does not have to be repeated for replicated scope;

- SZC site data are assumed to be bounded by HPC site data, except for key specific areas where the evolution in site data only has a limited impact on the overall design; and

- The supply chain can be fully replicated from HPC. Future operational arrangements at HPC including the type, installation, maintenance, examination, inspection and testing of equipment can be applied to SZC, ensuring suitable equipment and suitably qualified and experienced resources

are available.

Location and Layout of Generators

The location and layout of the diesel generators has been determined as part of the nuclear safety process to prevent a failure from internal and/or external hazards and the SZC replication strategy based on HPC.

The four concrete diesel generator buildings at SZC each contain two EDGs and one UDG, which are internally separated by concrete walls. The EDGs and UDGs are required to operate independently and each generator has a separate stack which discharges vertically on the roof of the diesel generator buildings.

Re-positioning the diesel generator building(s) was assessed as part of the HPC Probabilistic Assessment of the Turbine Missile Hazard [44]. Due to the lack of available space with the current HPC UK EPR plot plan, the areas where the diesel building can be moved were very limited, because they have to be as close as possible to the turbines, be as far as possible from the low trajectory missile window, and to allow enough space to move a diesel for maintenance so as to not require the re-positioning of other buildings. The HPC Probabilistic Assessment ruled out the re-positioning of the diesel generators due to the impact on contracts, schedule, the plot plan as well as cost and the difficulty of the re-design. All these impact in terms of cost were evaluated to be greatly over £260 million, which were considered to be grossly disproportionate to the risk reduction.

In addition, the HPC Probabilistic Assessment also considered the addition of a new diesel generator in the HOR building in order to have a diversified electrical supply. The Assessment ruled out a new diesel generator due to the additional costs (£120 million) of procurement of an additional diesel and the redesign of the HOR, HGE gallery and electrical systems in order to account for the new diesel generator.

Choice of Generators

The selection of diesel generators has been assessed in the GDA as part of a standard design that has been assessed by the Environment Agency and the ONR. This comparison study provides additional evidence to support the technology chosen to provide electrical supply to essential systems, to enable the safe shutdown of the station in case of an emergency. The diesel generators are required to meet safety functional requirements, be safety qualified and meet relevant quality standards as part of the nuclear safety case provided as part of the GDA. The three feasible technology options for achieving this are:

- Compression (diesel generators)/spark ignition (SI) engines run on fuel oil;
- Gas turbines run on fuel oil; and

- Gas turbines run on gas.

The fundamental requirements for the selected technologies to fulfil their role as emergency back-up generators are:

- Reliability;
- Fast start-up; and
- Independent of off-site systems and services.

In addition, the technologies should cause the least environmental impact, whilst not compromising its required safety function.

Fundamental Requirements Assessment

The first stage in this comparison study is to establish if each option meets the fundamental requirements.

There will be three levels of performance; poor, average and good. If an option performs poorly (i.e. the technology cannot fulfil its role to provide essential systems with electricity), it will be screened out at this stage of the assessment. Options which perform higher than poor will be assessed using further criteria to determine their performance and environmental impact.

The information on reliability and fast start-up presented in **Table 2.2** below is based on an objective comparison taken from Institute of Electrical and Electronics Engineers (IEEE) Standard 446-1995[6] [45].

[6]. Context provided in the Facility Manager's Emergency Preparedness Handbook, Bernard T Lewis & Richard P Payant, 2003.

Table 2.2: Comparison of Options Against Fundamental Requirements

Option	Fundamental Requirements		
	Reliability	**Fast Start-Up**	**Independence**
Option 1 Diesel generators run on fuel oil	Problem identified with reliability: A 23.1 MW_{th} diesel generator has a large number of moving parts increasing its vulnerability to failure (e.g. thrown piston, crank issues). However, these can be replaced fairly readily and quickly.	When the application requires 100% load in less than 30 seconds, diesel generator sets can be provided to meet this requirement.	Fuel will be stored on the site in tanks. The site will have full control over the tanks. The tanks can be located separately and can be correctly sized to allow sufficient storage. The fuel can be sourced from more than one supplier who will deliver the fuel to site by road tanker.
Option 2 Gas turbines run on fuel oil	Problem identified with reliability: Certain plant failures, in particular throwing a turbine blade, could leave the plant inoperable for a longer period of time[7].	Most gas turbine generator sets require more than 30 seconds	Fuel will be stored on the site in tanks. The site will have full control over the tanks. The tanks can be located separately and can be correctly sized to allow sufficient storage. The fuel can be sourced from more than one supplier who will deliver the fuel to site by road tanker.
Option 3 Gas turbines run on gas	Problem identified with reliability: Certain plant failures, in particular throwing a turbine blade, could leave the plant inoperable for a longer period of time.	Most gas turbine generator sets require more than 30 seconds	The site will be reliant on an off-site gas source carried to the site by a pipeline. Should this gas supply be interrupted for any reason, the site will have no emergency back-up generation.

Discussion

The information in **Table 2.2** above provides evidence that Option 3, gas turbines run on gas, is reliable but performs poorly due to its dependence on off-site systems and services. For this reason, this option will be screened out at this stage. Option 3 also performs averagely in terms of the time taken to start-up.

7. Identified through experience, rather than IEEE Standard 446-1987.

Option 2, gas turbines run on fuel oil, performs to a very good standard in independence, good for reliability but average for fast start-up. This option will continue to the next part of the assessment.

Option 1, diesel generators run on fuel oil, performs to a very good standard in terms of start-up and independence. Performance was good for reliability. However, the engine is more vulnerable than a gas turbine as it has more moving parts. This option will continue to the next part of the assessment.

Performance and Environmental Impact Assessment

This section compares the performance and environmental impact of the remaining two options:

- Diesel generators run on fuel oil; and
- Gas turbine generators run on fuel oil.

The criteria and comparisons in **Table 2.3** are based on an objective comparison taken from IEEE Std 446-1995 (Revision of IEEE Std 446-1987)[8] [45].

The criteria have been ranked in order of importance. The fundamental requirements score the highest (1) and issues of lesser importance score (2) then (3). The best option has been identified for each criterion.

Table 2.3: Comparison of Diesel Generators and Gas Turbine Generators

Criteria	Importance of Criteria	Comparison	Best Option
Starting	1	When the application requires 100% load in less than 30 seconds, diesel generator sets can be provided that meet this requirement. Most gas turbine generator sets require more than 30 seconds.	Diesel generator
Reliability[9] Frequency and severity of failure	1	A 23.1 MW_{th} diesel generator is large for this type of plant (e.g. 20 cylinders), has a large number of moving parts increasing its vulnerability to failure (e.g. thrown piston, crank issues). A 23.1 MW_{th} gas turbine is not unusually small for the type of plant. However certain plant failures, in particular throwing a turbine blade, could leave the plant inoperable for a longer period of time.	Either

[8]. Context provided in the Facility Manager's Emergency Preparedness Handbook, Bernard T Lewis & Richard P Payant, 2003.

[9]. Identified through experience, rather than IEEE Standard 446-1987.

Criteria	Importance of Criteria	Comparison	Best Option
		Each option has its own issues in relation to frequency and severity of failure. However, both options are tried and tested technology with very good standards of reliability.	
Independence	1	Fuel oil to supply the diesel or gas turbine engines will be stored on the site in tanks. The site will have full control over the tanks. The tanks can be located separately and can be correctly sized to allow sufficient storage. The fuel can be sourced from more than one supplier who will deliver the fuel to site by tanker.	Either
Achievable emissions benchmarks [6]	2	Regulatory benchmarks are on the whole the same for both types of technology: ▪ Particulate Matter (PM): 15 mg/m^3; and ▪ Sulphur dioxide (SO_2): 66 mg/m^3 There are different performance benchmarks for oxides of nitrogen (NO_X): ▪ Diesel generator: 150 mg/m^3; and ▪ Gas turbine: 125 mg/m^3.	Either
Efficiency	2	Under full load, the diesel generator operates more efficiently than a gas turbine. However, the reduced exercising requirements for the gas turbine normally make the turbine the lower fuel consumer in standby operation.	Either
Ratings	2	Gas turbines are not readily available in sizes < 5 MW, whereas diesel generator plant ranges from 1.5 MW and upwards.	Diesel generator
Installation	2	Gas turbines are considerably lighter and smaller and require total cooling and combustion air. Installation costs are normally less than for diesel generators.	Gas turbine
Cost	2	Basic diesel generator costs (not installed), are less than that of a gas turbine. However, the overall installed cost for both are comparable due to the lower gas turbine installation cost.	Either
Maintenance	2	The gas turbine is a simpler machine than a diesel generator. However, repair service for a diesel generator is generally more readily available than for a gas turbine.	Either
Fuel supply	3	Gas turbines and diesel generators can generally burn the same fuel (kerosene to No. 2 diesel) and both fuels can be stored on site until required.	Either
Noise	3	Gas turbines operate more quietly and have less vibration than a comparable output diesel generator.	Gas turbine

Criteria	Importance of Criteria	Comparison	Best Option
Cooling	3	Diesel generators and gas turbines normally require water-cooling.	Either
Exercising	3	The periodic operating requirements under load are more rigid for diesel generator plant than for gas turbines.	Gas turbine
Frequency Response	3	The gas turbine generator is superior in full-load transient frequency response (ANSI/IEEE Std. 446-1995, Chapter. 4) giving it more flexibility once operational.	Gas turbine

Discussion

It is clear that, for many of the performance criteria, there is very little difference in performance between the diesel generator and the gas turbine engine. Where there are differences, the importance of the criteria is low, and the poorer performing option can usually be improved in performance or to mitigate environmental impact. For instance, the noisier diesel generator can be housed in such a way that the noise levels to the environment do not differentiate from the gas turbine.

The assessment shows a very close comparison of the two options; however, the one outstanding advantage the diesel generator has over the gas turbine is the ability to start-up in less than 30 seconds. This is the one area where the gas turbine cannot be improved to match the speed of the diesel generator. For this reason, the use of diesel generators has been the preferred option in the design of pressurised water reactors around the world. This commonality in design also has other benefits, including:

- A wider pool of experience in terms of environment and safety issues, which makes it possible to improve environmental and safety matters using feedback from this experience; and

- Optimised staff management (i.e. commonality of training and procedures), which in turn leads to better environmental and safety performance.

It is not possible at the present time to provide the BAT options appraisal to show that the diesel engines chosen minimise discharges of nitrogen oxides compared to alternative diesel engines. The primary reason for this is that the engines themselves have not yet been procured; therefore, they have not yet been through the detailed design process. The figures on NOx are based on the figures provided for NOx emission in the HPC EPR contract specifications, although the SZC combustion activities permit application takes into account a site specific 5% increase in the net rated thermal input (MWth) of both the EDGs and UDGs.

A Fundamental Requirements Assessment was carried out and it is important to note that diesel engine technology (as opposed to gas turbine technology) was selected for the back-up generation function at HPC as the most suitable choice to fulfil the nuclear safety role of the generators. The key nuclear safety factors considered when selecting diesel engine technology were:

- Reliability;
- Response time;
- Independence; and
- Diversity of technology (different design of engine for EDG and UDG).

- The specifications for procurement of the EDGs and UDGs will be through a turnkey contract incorporating design, procurement, and installation and testing. The contract will contain an obligation for the supplier to provide a BAT assessment in relation to emissions optimisation for the preferred engines. This will be subject to SZC Co. review. There will be regular dialogue with the supplier throughout the detailed design process which will allow SZC Co. to control the application of BAT. The BAT appraisal will be provided to the Environment Agency when it becomes available.

Experience

Experience from France in operating a range of standby combustion plant at existing nuclear power stations. (The CP0, CPY, 1300 and N4 denote the distinct generations of French Pressurised Water Reactor (PWR)):

- 1300/N4 power stations have standby diesel generators, which have demonstrated a reliability of some 1 x 10-3 (either on operation or on demand). Repair time for such combustion plant has been about 600 hours (operation) and 10 hours (demand);

- CPY power stations have standby diesel generators, which have demonstrated a reliability of some 1 x 10-3 (either on operation or on demand). Repair time for such combustion plant has been about 100 hours (operation) and 20 hours (demand); and

- CP0/1300/N4 power stations have standby gas turbines run on fuel oil, which have demonstrated a reliability of some 1 x 10-2 (on operation) and 8 x 10-2 (on demand). Repair time for such combustion plant has been about 10 hours (either on operation or on demand).

In summary, the reliability of diesel generators is about one decade higher than for the gas turbines run on fuel oil. Repair times are, however, shorter for gas turbines run on fuel oil.

Conclusion

This assessment compared three options for the technology to supply an emergency electricity supply to SZC power station. The first screening, using the fundamental requirements for the technology as the assessment criteria ruled out Option 3, gas turbine run by gas, as it did not fulfil the requirement for independence.

Options 1 and 2 were compared further using criteria from the IEEE standard [45]. The assessment showed that both options were equally matched in most areas and the majority of the differences were found under criteria of relatively low importance. However, the diesel generator performed better than the gas turbine in one particularly important area; fast start-up. Fast start-up is a fundamental requirement of the technology as it is essential to resume, almost instantaneously, a supply of electricity to essential systems. This is why diesel generators are the preferred option in the design of pressurised water reactors around the world, resulting in improved environmental and safety performance associated with a wide pool of operational experience and optimised staff management.

It is concluded that Option 1, diesel generator run on fuel oil, is considered to be the best technology and should be used to provide the emergency electricity supply to the essential systems for SZC power station.

It may be emphasised that:

- The choice of diesel generators rather than gas fired engines, for the reactor emergency power supply, is considered to be BAT, with regards to safety aspects and based on the operational experience feedback available on the fleet of French nuclear power stations, which has shown that this equipment is highly reliable and well-tried. Tried and tested diesel generators outweigh the benefits of using bespoke never before classified equipment;

- EDGs can be started from cold very quickly (in the less than 30 seconds). This is vital given the role on the site;

- Gas turbines are more expensive to purchase than the equivalent size diesel generator due to the high spinning speeds and temperatures they operate at however this is balanced by lower operating expenditure so there is little difference in cost;

- The diesel generators are required to be safety classified equipment to ensure that their safety critical components and systems meet relevant quality

standards. These standards include availability and reliability rates, which need to be confirmed by the relevant qualification tests as well as proven operational use. In addition, the safety case requires EDGs and UDGs to be of diversified technologies (different types of diesel generators will be used). The cost to classify an alternative diesel generator with reduced NOx emissions (if this is even possible to meet the availability and reliability requirements) would be grossly disproportionate to the benefit;

- The decision to use EDGs is part of the reference design in GDA and safety assessments carried out for the EPR™. As discussed in Section 6.2, the ONR and Environment Agency granted Design Acceptance Confirmations and statements of Design Acceptability for the UKEPR reactor design, which are valid for ten years (unless any new information emerges regarding the ONR's original assessment of the design). The information provided in the GDA was used to support the combustion activities application for the diesel generators at HPC which was duly made in September 2011 (HPC EPR/ZP3238FH/A001) and determined in March 2013; and

- The choice of diesel generators is also aligned with the SZC Replication Strategy and allows the project to maximise the opportunity to derive value from a 'Next of a Kind' series effect, duplicating the HPC plant and adopting a systematic approach to capturing, quantifying and applying lessons learnt to SZC.

In addition to this, EDF Energy and the wider EDF Group of companies have extensive experience in successfully maintaining and operating EDGs on sites across the UK as well as in support of 58 nuclear reactors in France and has provided engineering expertise to the nuclear sector across Asia and the United States of America.

2.1.2 Choice of Fuel

As part of the development process, SZC Co. has considered suitable fuels for the provision of emergency power. A range of considerations are discussed below. As each plant will only be operated (under normal operations) for maintenance purposes and during periodic nuclear safety tests, the storage of the fuel is an important aspect in decision making. Fuel tanks will provide independence from external supply services for emergency generation.

Reciprocating engines can be operated on diesel (typically $C_{14}H_{30}$) or a short chain hydrocarbon such as kerosene or petroleum (typically C_9H_{20}). There are two main reasons that diesel is the preferred fuel choice:

- Diesel is a long chain hydrocarbon which has a greater energy to volume ratio. This means that slightly lower volumes need to be stored; and

- The long chain hydrocarbons evaporate more slowly than short chain hydrocarbons resulting in a smaller release of fugitive loss to the environment from the storage tanks.

Both of these aspects are key decision-making factors where larger volumes of fuel are stored for standby use.

Oil (including bitumen) emulsions and many heavy fuel oils have high sulphur contents and may have high vanadium and nickel contents. The use of oil fuels containing sulphur will result in some sulphur dioxide (SO_2) releases, (as well as sulphur trioxide), however the EDGs will use low sulphur oils (below 0.1% w/w sulphur) in line with the SCOLF Regulations 2007 [4] (or relevant future legislation). This precludes the need for any form of flue gas desulphurisation (FGD).

There will be a safety requirement to ensure that there is diversity in the fuel supply chain. This will not have an effect on the sulphur content of the diesel fuel used as all suppliers will be able to provide diesel with sulphur levels that comply with the SCOLF Regulations 2007 [4] (or relevant future legislation).

2.2 Description of Plant

2.2.1 Requirement for Combustion Plant

The sizing and number of diesel generators is based on the power demand and the equipment role in each of the emergency situations which form the design basis of the standby/emergency power supply required. The nominal power of the diesel generators is determined by the reference emergency situation (accident) having the greatest power demand [46] together with an additional safety margin.

The functional criteria [46] for the EDG plant state the following:

- In order to comply with the principle of segregation of the four electrical divisions, each division must be backed up by an independent diesel (hence the four EDGs);
- The plant can be started without any auxiliary power;
- The diesel reaches nominal speed (frequency) and voltage within 15 seconds from start-up signal;
- In back-up mode, the diesel generator plant provides electrical power at the voltage and frequency defined by the French nuclear industry in RCC-E10;

[10]. Association Française pour les règles de conception, de construction et de surveillance en exploitation des Chaudières

- The auxiliary diesel systems enable each diesel generator plant to function at full load for 72 hours. This period is compatible with the time taken to commission heavy equipment which could be used to provide a long-term supply [45]; and

- The 15 day LOOP is taken into account in the design. A LOOP scenario is a loss of connection to the National Grid resulting in a need for the power station to generate its own essential power supplies.

The functional criteria for the UDGs states:

- UDGs with their auxiliaries are sufficient to provide the required electrical power following a total loss of the external electrical supplies and of the EDGs supplies;

- The function of the system is to supply power to all required equipment at a voltage and a frequency fulfilling the safety criteria and with respect to the dynamic and static limits allowed by the equipment; and

- The UDGs must be available for operation within two hours after total loss of electrical supplies.

Both the EDGs and UDGs will normally operate only during periodic tests. The tests aim to ensure that the back-up generators and associated equipment are in good working order. Air emissions oxides of nitrogen (NO_x), sulphur dioxide (SO_2), particulate matter (PM) and carbon monoxide (CO)) are produced only during these periodic tests.

Non-process sources will be excluded such as domestic heating and non-fixed equipment including portable grounds maintenance equipment and mobile on-site equipment such as tractors or forklift trucks.

The diesel combustion engines are only used to provide emergency power supplies. During test runs, any electricity generated will be exported to the National Grid. Day-to-day requirements for power during normal/routine operation, will be provided through on-site generated electricity or external electricity imported from the National Grid.

A list of individual plant on the installation is provided in **Table 2.4** below with further detail on the plant proposed for the HPC site provided in **Table 2.5**; the HPC site is

Electro-Nucléaires (French society for design and construction and in-service inspection rules for nuclear islands), Design and Conception Rules for Electrical Equipment of Nuclear Islands (RCC-E) published in Code form.

the best source of alternative data for the UK EPR™ and though, not yet operating, the HPC plant is significantly further ahead in terms of construction and procurement.

It has been agreed with the Environment Agency that other combustion plant at SZC will be covered through applications for variations to the environmental permit.

Table 2.4: SZC Combustion Plant Size

Plant	Number of Plant	Size (MW_{th}) per unit
EDG	8 (4 per UK EPR™ unit)	23.1
UDG	4 (2 per UK EPR™ unit)	10.53

Table 2.5: HPC Combustion Plant Details

Plant	EDG	UDG
Engine	Hyundai Heavy Industries Himsen 20H32/40V	MTU 16V956TB33
Speed	750 rpm	1,500 rpm
Nominal power	9,300 kWe	3,600 kWe
Generator	Hyundai Electric HAR7 189-08P	LSA 56 XL 85/4p
Voltage	10 kV	690 V

2.2.2 Plant Description

The reference reactor unit includes four main EDGs, each rated around 9.59 MW_e (23.1 MW_{th}) and two UDGs at around 3.75 MW_e (10.53 MW_{th}), giving an aggregated thermal input of 227 MW_{th}. The generators are classified as safety equipment, providing back-up power supply to supported systems in the unlikely case of LOOP. Figure 3 shows the layout of the diesel generator buildings.

Each of the diesel generators (EDG and UDG) is a self-contained plant in a separate room in each of the diesel buildings. The plant comprises:

- Diesel fuel system:
  - The EDG main diesel fuel oil storage tank will have a 226m^3 capacity and the smaller day (2-hour) tank will have a 5.15m^3 capacity. The capacity of the day (2-hour) tank is sufficient to allow operation at full load or Maximum Combustion Rate for two hours. The UDG main diesel fuel oil storage tank will have a 137m^3 capacity and the day (2-hour) tank will have a 3m^3 capacity

(sufficient for operating at full load for at least two hours). The diesel fuel oil tanks are located within the diesel generator buildings.

- Lubricating oil system:

  - The EDGs will have a self-contained lubrication system using a coupling booster pump. A pre-lubrication device fitted with a recirculating electrical pump reduces the time taken for the engine to run on a priority start-up signal. The UDG plant will have continuous pre-lubrication, although it is not required. Each of the EDGs holds 10,560 kg of lubricating oil and each of the UDGs holds 1,000 kg.

- Coolant system:

  - The cooling system provides engine cooling in operation and pre-heating to enable rapid starting. The cooling system will be air cooled, with a closed loop water-based coolant. For the EDG engines, the cooling system capacity is approximately 14.2m^3 in total. The cooling system capacity for UDGs is approximately 15.8m^3 in total. The heat produced by the diesel generators is transferred via a cooling loop to a heat exchanger.

  - Continuous pre-heating will be undertaken for both the EDG and UDG plant using an electric pump and heater with electricity supplied by the power station. During station black out conditions, the UDG pre-heating equipment may be pre heated by battery for a short duration (about 30 mins) however this modification is yet to be implemented. As discussed in Section 5.5, utilising waste steam is not possible due to the systems being shut down during a loop event or the complexities involved in routing steam from the turbine hall to the diesel generator buildings would be immense. The type of continuous pre-heating will be confirmed at detailed design stage.

- Start-up air system:

  - Each diesel generator will have a complete compressed air start-up plant comprising a compressor, two start-up lines (with one being sufficient to start an engine), start-up valves and one (or more) tanks where the capacity of a single tank is sufficient for several consecutive compressor start-ups without refilling. Compressor condensate will be collected within leak pans and disposed of using a licensed waste disposal facility.

- Air intake and extract system:

  - Air will be supplied for combustion and is designed to avoid any recirculation of flow. Combustion air will be taken from outside the building and filtered before use.

- Alternator, excitation and protection circuit:
  - Voltage regulator and protection for the diesel engines.
- Local instrumentation and control/ alarm signalling. The diesel generators can be started:
  - Locally from the control panel to allow tests to be carried out (measurements and plant data are recorded by the panel);
  - Remotely from the main control room; or
  - Automatically by a signal from the protection systems (for EDGs and only for UDGs in certain plant states).

The standby diesel generators are proposed to be installed in separate rooms in the diesel buildings; two EDGs and one UDG per building. The buildings will be located separately to protect against damage, which could potentially be caused by an aeroplane crash and positioned to allow easy movement of the diesel generators in and out of the buildings for maintenance/replacement purposes. The buildings are designed to withstand a range of internal and external hazards [46].

Each generator will exhaust through its individual stack, which is located on the roof of the diesel building, i.e. 27.2 metres above ground level. In regards to the tanks, the requirements of the Oil Storage Regulations 2001 [47], the Environment Agency guidance on Oil Storage Regulations for businesses [37], BS 5410:2014 Code of practice for oil firing [48] and the Construction Industry Research and Information Association (CIRIA) Advice [16] & [17] will be considered where relevant.

Both the EDGs and UDGs will undergo test runs to demonstrate reliability. Test runs of each diesel generator will be required every other month and a qualification test will be performed after maintenance and at least once per operating cycle. If for any reason a diesel generator fails to start during a test run, an additional start would be required. The detailed test programme will depend on the station safety specification and manufacturer's recommendations.

Availability

The EDGs are safety related plant qualified as “Category K3 Equipment” according to RCC-E (design and construction rules for electrical components of PWR nuclear islands). This qualification confirms the plant is capable of performing its design functions under seismic and accidental, as well as normal conditions.

Operational Regime

There are three main types of operational regime covered by this application:

- Commissioning;
- Routine testing; and
- LOOP events.

Commissioning

During commissioning it is not anticipated that more than one EDG or UDG will be in operation at any one time. Each EDG and UDG will be operated for 242.5 hours and 738 hours, respectively, during its testing period, i.e. 4,892 combined hours. It should be noted that some of the 738 hours needed for commissioning the UDGs will involve tests that can be carried out before the engines are brought to site. The commissioning hours presented therefore represent a conservative estimate of the time for which plant will be run during this phase. It also should be noted that commissioning operations were not considered in the GDA as this is a site-specific activity dependant on manufacturer's recommendations.

Routine Testing

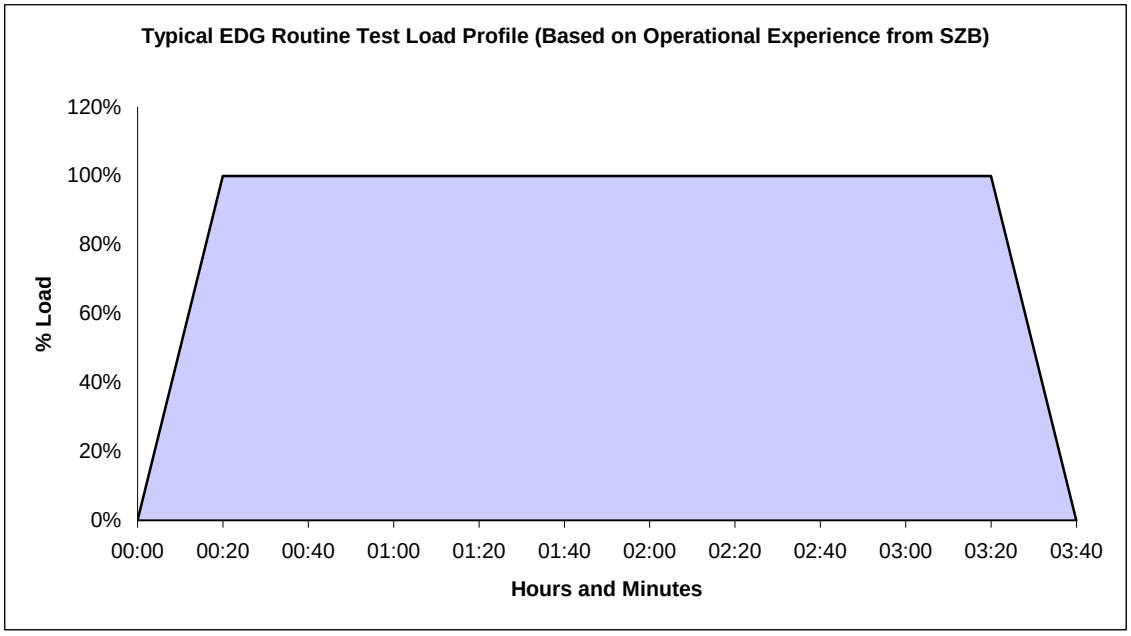
Experience of operating diesel generator plant in France suggests that each EDG and UDG will be operated for less than 60 hours per year. The conservative assumption is therefore made for the basis of the air quality assessment (see Section 4) and in support of the environmental permit application that a figure of 60 hours per year will be used as the maximum annual run time for each EDG and UDG diesel generator. In reality, it is expected that running hours will be much lower than this conservative figure as the required hours for tests are lower.

Figure 2.1 below provides a typical load profile for an EDG engine during routine testing, based on operational experience from SZB. In summary the EDG test run will be as follows:

- At least 20 minutes to raise the load from 0% to 100%;
- Operation at 100% load for 180 minutes; and
- At least 20 minutes to reduce the load from 100% to 0%.

A typical EDG routine test will last somewhere between 3 hours 40 minutes and 5 hours.

Figure 2.1: Typical EDG Routine Test Profile



LOOP

The duration of LOOP events cannot be easily determined. However, LOOP frequencies can be assessed and allocated to a significant range of durations. As EPR™ design principles include an enhanced robustness against LOOP situations, LOOP scenarios are thoroughly assessed within the safety case prepared to support the application for the NSL. The safety case LOOP durations vary from a very short LOOP (less than 2 hours, typically 30 minutes) to a very long LOOP (15 days). The NSL submission identifies the following LOOP frequencies for HPC (SZC have not been determined yet):

Table 2.6: Details of LOOP Scenarios for HPC (SZC have not been determined yet) [49]

Faults	Frequency for Nuclear Site Licence Application	Existing Assessments for SZB
Short LOOP (< 2h)	6.12 x 10^{-2}/ry in all states	2.60 x 10^{-2}/ry
Long LOOP (between 2 - 24h)	Base case: 1.02 x 10^{-3}/ry. Sensitivity: 5.4 x 10^{-3}/ry in all states.	5.4 x 10^{-3}/ry
Very long LOOP (between 24 -192h)	1.0 x 10^{-4}/ry in all states	N/A*
Conditional LOOP after Reactor Trip	1.0 x 10^{-3}. 1/3 short LOOP. 2/3 long LOOP	1.1 x 10^{-4}/ry

Note: ry = reactor year

* N/A = Not Applicable

As far as short and long LOOP events are concerned, the above frequencies are understood as follows:

- A short LOOP is expected to occur a limited number of times during the lifetime of the plant; and
- A long LOOP is expected to occur about once in the lifetime of a fleet of nuclear sites.

During a LOOP event, the EDGs sequentially take load automatically to supply all Safety Classified Loads required to bring the plant up to and maintain it at a safe shutdown state. This is for LOOP and total loss of AC power (TLAP). The UDGs do the same but for station blackout and TLAP.

Following a LOOP event, the EDGs are not immediately shut down when LOOP is over, in order to ensure that off-site power has been successfully secured.

Plant Items

There will be total of four diesel buildings at the SZC site, two diesel buildings per UK EPR™, with each building housing the following plant:

- 2 x EDGs and 1 x UDG;
- Compressed air starter systems;
- Batteries for UDG and air compressor start-up;
- Engine lubrication circuits;
- Engine cooling circuits with their air-coolers;
- The pre-heat circuits;
- The main and day fuel tanks;
- Electrical protection and instrumentation and control equipment; and
- Technical equipment for operation of the system.

The diesel buildings will include a leak tight discharge area for loading and unloading of tanker vehicles to allow for capture and clean-up of any hydrocarbon leaks occurring during deliveries and will comply with the Environment Agency guidance on oil storage regulations for businesses [37], BS 5410 Code of practice for oil firing [48] and CIRIA advice [16] & [17] where relevant. The floor will be built to withstand the physical and chemical actions of hydrocarbons and will be fire resistant. Drainage for floor washings will either be collected within hydrocarbon effluent system sumps or be connected to the oily water drainage system (penstock/isolation valves will be located on the oily water drainage system).

The diesel tanks will be stored within self-contained impermeably lined areas in the diesel generator buildings. There are no internal drains within the diesel rooms and any spills would be captured in sumps and pumped out and disposed off-site as hazardous waste. Storage containers with a capacity greater than 200 litres of hazardous material will be stored in a retention area with a volume at least equal to 110% of the capacity of the largest container or 25% of the total capacity of the containers present. This will ensure compliance with the Oil Storage Regulations 2001 [47] as a best practice measure. Drainage will either be collected within sumps or be connected to the oily water system (penstock/isolation valves will be located on the oily water drainage system) discussed in the separate permit application for a water discharge activity.

The design of the diesel buildings will also minimise hazards that might potentially lead to incidents, accidents or failures associated with:

- Pipe leaks and breaks;
- Failure of tanks, pumps and valves;
- Internal flooding;
- Failing loads (i.e. physical damage);
- Internal explosion; and
- Fire.

Demonstration of these measures will be provided as part of the FAP (Refer to Section 6 – FAP Ref. 3) through development of the Accident Management Plan.

Fuel Oil

EDGs and UDGs will use fuel oil grades with characteristics complying with the requirements of the applicable standards. As an example of this, the fuel oil currently used across the operational fleet of EDF Energy UK reactor sites complies with the specification of BS 2869:2017 [3]. The diesel fuel used also complies with the SCOLF Regulations 2007 [4] (or relevant future legislation) which requires a maximum of 0.1% sulphur by weight (BS 2896:2010 [3] specifies a maximum sulphur content of 1%).

Table 2.7 details the predicted fuel use per year (based on 60 hours of operation per diesel generator).

The engines will be cooled by a mix of water and glycol within a closed loop system. Air coolers may also be used if required.

Each diesel generator will be fitted with a crankcase fume extract system. Fumes from the EDG crankcase fume extract system are discharged at roof level (those from the UDGs are recovered into the air intake). Any oil/liquid leakage from the engines will be collected into the hydrocarbon effluent system sumps and routed (depending on their physical and chemical characteristics) to the site dirty lubricating oil drain tank or to a drum for off-site recycling or disposal (as appropriate).

Table 2.7: Predicted Fuel Use and Storage

Engine	Predicted Fuel Use per Engine per Year (m^3)	Storage Volumes (m^3)	Delivery	Storage Arrangements
EDG	240	Main tank: 226 Day tank: 5.15	Tanker delivery direct to diesel building.	All tanks will be located within the diesel generator buildings in bunded rooms.
UDG	56	Main tank: 137 Day tank: 3	Tanker delivery direct to diesel building.	All tanks will be located within the diesel generator buildings in bunded rooms.

Note: Fuel use based on routine testing with up to $30m^3$ of diesel per year per EDG and up to $14m^3$ of diesel per year per UDG, based on a 2-hour test of every engine every 2 months. If there is a loss of off-site power, then the fuel consumption will be much higher.

Indicative BAT Requirements for General Environmental Performance of Combustion plants to Reduce Emissions to Air

Table 2.8 below outlines the indicative BAT for general environmental performance of combustion plants to reduce emissions to air.

Table 2.8: Indicative BAT for General Environmental Performance of Combustion Plants

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
LCP BATc 9. In order to improve the general environmental performance of combustion and/or gasification plants and to reduce emissions to air, BAT is to include the following elements in the quality assurance/quality control programmes for all the fuels used, as part of the environmental management system (see BAT 1): i. Initial full characterisation of the fuel used including at least the parameters listed below and in accordance with EN standards. International Organisation for Standardisation (ISO), national or other international standards may be used provided they ensure the provision of data of an equivalent scientific quality; ii. Regular testing of the fuel quality to check that it is consistent with the initial characterisation and according to the plant design specifications. The frequency of testing and the parameters chosen from the table below are based on the variability of the fuel and an assessment of the relevance of pollutant	The Operator will procure a contractual agreement to receive gas oil including a requirement for the gas oil to comply with specified quality criteria (SCOLF and BS 2869:2017). Additional treatment of the fuel is therefore not proposed to be undertaken by the installation. The quality of the incoming gas oil is expected to be monitored by the provider to confirm that it meets the agreed supply criteria. Intermittent analyses of the supplied gas oil will be undertaken by the plant Operator to confirm that the fuels conform to the purchase specification. No additional conditioning or treatment of gas oil supplied is proposed to be undertaken prior to use in the engines.

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>releases (e.g. concentration in fuel, flue-gas treatment employed);

iii. Subsequent adjustment of the plant settings as and when needed and practicable (e.g. integration of the fuel characterisation and control in the advanced control system). Initial characterisation and regular testing of the fuel can be performed by the Operator and/or the fuel supplier. If performed by the supplier, the full results are provided to the operator in the form of a product (fuel) supplier specification and/or guarantee.
<table>
<tr><td>Fuel</td><td>Substances/Parameters subject to characterisation</td></tr>
<tr><td>Gas Oil</td><td>— Ash
— N, C, S</td></tr>
</table>
</td><td></td></tr>
</table>

3 Emissions & Monitoring

3.1 Emissions

3.1.1 Point Source Emissions to Air

The role of the EDGs is to supply electrical power needed to shut down the reactor safely when off-site power is lost (i.e. when a LOOP is detected). A LOOP event is only expected to occur a limited number of times during the lifetime of the plant. Emissions to air from the diesel generators would only occur during operational maintenance purposes to ensure their functionality should they been needed. The assessment is based on the worse case operation, whereas previously stated the dis-benefits of the emissions are greatly outweighed by the benefits of ensuring the continued safe operation of the reactor and protection of the wider environment.

Emissions to air from point sources will only occur when the plant are operated. For the purpose of environmental assessment this has been assumed to be a worst case of 60 hours per diesel generator for operational maintenance purposes and during periodic nuclear safety tests – for justification methodology please refer to Section 2.2. The emissions will be from:

- The stacks of the diesel generators, with hot flue/exhaust gases potentially containing the combustion products listed below and traces of volatile organic compounds (VOCs):
  - Oxides of Nitrogen (NO_X) comprising nitrogen dioxide (NO_2), nitric oxide (NO) and nitrous oxide (N_2O);
  - Sulphur dioxide (SO_2);
  - Particulate Matter (PM); and
  - Carbon dioxide (CO_2) and carbon monoxide (CO).
- The EDGs crankcase fume extract system vents (the UDG crankcase fume extract is recovered back as intake air and are unlikely to present an issue). Fumes from the EDG crankcase fume extract system will be discharged via a vent at roof level of the diesel building. This emission will consist of air with traces of lubricating oil fumes (VOCs). Abatement could be installed in the form of a coalescing filter, however, this is not considered reasonably practicable due to the limited operational hours. The emissions will be monitored during operation to assess the need for abatement if the emissions are problematic; and
- The EDGs' and UDGs' main and day fuel tanks vents. Although these are point sources, the tanks will be configured such that releases to air would only be

expected during filling operations, which would be infrequent.

Since the EDGs are to be operated on an intermittent basis (i.e. each diesel generator will be operated less than 1% of the year per plant), no continuous stack emissions monitoring system is proposed as per the guidance documents. The diesel generators will be fitted with simple process control instruments to monitor smoke density and oxygen and periodic emissions testing during operation will be undertaken. Monitoring ports will be fitted to allow monitoring to be carried out at an agreed frequency and to meet MCERTS requirements. SZC Co. will develop arrangements for monitoring emissions to air and monitoring will be performed in accordance with the required standards.

A plan showing the location of the emissions points from the diesel generators across the site is provided in Figure 2 of Appendix A and provides additional information about each of the point source.

Table 3.1: Point Source Release Nomenclature

Emission Point Reference*	Reactor	Diesel Building	Plant Type	Grid Reference	Manufacturer MCP Specific Identifier to be confirmed	Rated Thermal Input MWth	Type of Combustion Plant	Type of Fuel Used	Date of Operation	Sector of activity or the facility in which it is applied (NACE code)	Expected number of annual operating hours and average load in use
A1	1	1	EDG	647224, 264307	HHI	23.1	Diesel engine	Fuel Oil (Diesel)	To be Constructed	D.35.11	< 60 hours for each engine <500 hours/ annum
A2		1	EDG	647243 ,264307	HHI	23.1					
A3		1	UDG	647259, 264307	MTU	10.53					
A4		2	EDG	647224, 264133	HHI	23.1					
A5		2	EDG	647243, 264132	HHI	23.1					
A6		2	UDG	647259, 264132	MTU	10.53					
A7	2	1	EDG	647224, 264075	HHI	23.1					
A8		1	EDG	647243, 264074	HHI	23.1					
A9		1	UDG	647259, 264074	MTU	10.53					
A10		2	EDG	647224, 263901	HHI	23.1					
A11		2	EDG	647243, 263900	HHI	23.1					
A12		2	UDG	647259, 263900	MTU	10.53					

* Excluding other unknown combustion plant at SZC and those not required to provide back-up power (these will be included within a permit variation).

Manufacturer's data, typical of the size of the EDGs and UDGs that will be installed at the UK EPR™ power station, is provided in **Table 3.2**. This is indicative of the characteristics of point source emissions to air.

Table 3.2: Stack Emission Characteristics

Diesel Generators	**Emission Point Characteristics**				
	Stack Height (m)	**Internal Diameter (m)**	**Efflux Velocity (m/s)**	**Volumetric Flow Rate (m^3/s)**	**Temperature (ºC)**
EDG vent stacks (A1, A2, A4, A5, A7, A8, A10 & A11)	27.2	1.1	28.9	15.99	375
UDG vent stacks (A3, A6, A9 & A12)	27.2	1.1	8.3	3.75	515
EDG Crankcase fume extract vents	TBC	TBC	TBC	TBC	TBC

Note: Stack data is taken from the dispersion modelling report (Appendix C). Normalisation based on actual flows @ 12% O_2 and 8% H_20. Normalised to standard temperature and pressure, dry gas @ 15% O_2 reference conditions.

Table 3.3 gives the indicative composition of the point source emissions to air.

Table 3.3: Indicative Composition of Point Source Emissions to Air from the Installation

Diesel Generators	**NO_X (NO_2) (mg/m^3)**	**SO_2[2] (mg/m^3)**	**CO (mg/m^3)**	**Unburned Hydrocarbons (HC) (mg/m^3)**	**PM (mg/m^3)**
EDG vent stacks[1]	1,918	66	150	TBC	50
UDG vent stacks[1]	1,143	0.3	194	TBC	6.4
EDG crankcase fume extract vents[1]	Trivial	Trivial	Trivial	TBC	Trivial
Environment Agency Data Centre Emission Standards[1]	750	-	250	56	50

[1] Emission point composition (0ºC, 15% O_2, 101.3 kPa and dry)
[2] SO_2 will be determined by the Sulphur Content of Liquid Fuel Regulations

The NO_x emission concentrations for the EDGs and UDGs provided above are based on the HPC permit application and equipment manufacturer. The emissions of SO_2 are based on the SCOLF Regulations 2007 with a maximum sulphur content in diesel of 0.1%. The emissions of CO and PM are based on the Environment Agency's Environmental Permitting Regulations sector guidance for combustion activities for compression ignition engines, in the absence of other appropriate guidance. The pollutant emission concentration for the UDGs in **Table 3.3** are from the manufacturer's technical specification.

The Environment Agency currently use the draft Environment Agency data centre headlines FAQ guidance [50] as its BAT benchmark for all emergency diesel generators. This guidance provides engine emission standards for standby plant, which reflect the German 'TA-Luft 2g' and Tier II USEPA Standards. The German 'TA-Luft 2g' standards include emission limits for waste gases including NO_x, CO and PM and for SO_2 the sulphur content of the liquid fuel. Emissions from the EDGs and UDGs are below the TA-Luft 2g Standards for CO, PM and SO_2, however they exceed the NO_x limit. However, the NO_x and CO emission limits are not applicable to stationary internal combustion engines used exclusively for emergencies such as the EDGs and UDGs. The Tier II USEPA Standards include emission limits for non-road engines. However, the emission limits are not applicable to stationary engines used > 12 months such as the EDGs and UDGs. Stationary internal combustion engines in the US are generally required to comply with other standards.

Unlike other standby generators, the safety classified EDGs and UDGs will be required to meet stringent nuclear safety requirements. A nuclear safety case has been prepared which requires that the diesel generators meet safety functional requirements, be safety qualified and meet relevant quality standards including the RCC-E Design and Construction Rules for Electrical Components of PWR Nuclear Islands [51]. Therefore, the draft Environment Agency data centre headlines FAQ guidance [50] emission standards are not considered relevant to the nuclear qualified EDGs and UDGs.

The role of the EDGs is to supply electrical power needed to shut down the reactor safely when off-site power is lost (i.e. when a LOOP is detected). The EDGs sequentially take load to supply all safety classified loads required to bring the plant up to and maintain it at a safe shutdown state. The UDGs do the same but for station black out and total loss of AC power (i.e. including the loss of the EDGs).

The diesel generators are safety classified equipment (class 1) and are required to be nuclear qualified to ensure that their safety critical components and systems meet relevant quality standards (RCC-E) [51]. These standards include availability and reliability rates, which need to be confirmed by the relevant qualification tests as well as proven operational use.

The functionality criteria of the EDGs and UDGs is described in Section 2.2.1 and they will be designed to have fast start up times, run at low loads for an extended

period, meet high load demands and provide rapid response to changing load demand. The diesel generators will also be required to work reliably and efficiently under seismic conditions and extreme temperature.

The diesel generators will be based on an existing model with good experience feedback in terms of reliability in response to demand and in operation and time to repair, and with characteristics in compliance with standard ISO 8528-2 Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets — Part 2: Engines [52].

In addition, the diesel generators will not be used for long periods of time. The operating regimes are discussed in Section 2.2.2. The nuclear qualified generators are safety equipment designed to provide back-up to emergency electrical systems on the SZC site so that the Nuclear Unit can be secured, and the reactor cooled. None of the generators are used to directly generate electricity. This infrequent operation over relatively short time periods will result in minimal emissions to air. The level of use will be determined by test and maintenance requirements and unplanned (emergency) events (60 hours per year per diesel generator has been assumed as a worst case for testing and maintenance).

The cost to classify an alternative diesel generator with reduced NO_x emissions (if this is even possible to meet the availability and reliability requirements) would be grossly disproportionate to the benefit.

Due to the low frequency of operation, the fitting of abatement equipment to the diesel generators has not been considered for the reference design and is not thought to be justified. The following Sections 3.5.2 to 3.5.5 consider potential control systems for the generation of NO_X, SO_2, PM, CO_2, CO, VOCs, Halogens and Dioxins including primary control measures, control through engine design and secondary abatement techniques that are available to control NO_x emissions from diesel generators. BAT assessments are also provided for design and operational (and secondary) abatement techniques for the EDGs and UDGs.

3.1.2 Potential Abatement Options for NO_X Emissions

Primary Measures for NO_X Control

The most important NO_X with respect to releases from combustion processes are nitric oxide (NO), nitrogen dioxide (NO_2) (i.e. NO_X) and nitrous oxide (N_2O). Nitric oxide forms over 95% of the total NO_X in emissions from most types of combustion plant.

There are three recognised NO_X formation mechanisms:

- "Fuel NOX" by conversion of chemically bound nitrogen in the fuel with oxygen in the combustion air;

- "Thermal NOX" by fixation of nitrogen in the combustion air; and

- "Prompt NOX" by a mechanism in which molecular nitrogen is converted to NO via intermediate products in the early phase of the flame front with hydrocarbons participating in the reactions.

The first two mechanisms are the only ones of major importance in most combustion plant. Compression ignition (CI) engines operate differently to those where fuel is injected over a flame/burner arrangement. Unlike petrol engines (SI) diesel generators have no spark plug. The diesel generator takes air and compresses it, then injects the fuel directly into the combustion chamber (direct injection). It is the heat of the compressed air that ignites the fuel in a diesel generator. The diesel generator has four stages of operation (hence the name four stroke engine). These are:

- Intake stroke - The intake valve opens up, letting in air and moving the piston down;

- Compression stroke - The piston moves back-up and compresses the air;

- Combustion stroke - As the piston reaches the top, fuel is injected at just the right moment and ignites, the expanding gases forcing the piston back down; and

- Exhaust stroke - The piston moves back to the top, pushing out the exhaust gases created from the combustion out of the cylinder via the exhaust valve.

Fuel NO_X formation depends on the oxygen level in the vicinity of the flame. Reducing oxygen levels reduces fuel NO_X. For the CI engine above, it is clear that this aspect is less important as diesel has a relatively low fuel nitrogen content (however regular maintenance is required to ensure that the air feeds do not change as this can lead to a rise in NO formation).

Thermal NO_X formation requires temperatures greater than 1,000°C. Reducing peak temperatures reduces thermal NO_X formation. The thermal NO_X formation route is the most important source of NO_X in emissions from oil and gas fired plant but is less relevant in diesel generators as the compressed air combusts at roughly 550°C at the point the diesel is injected. The diesel combusts in excess air meaning that all the fuel nitrogen is oxidised. However, this excess of air also fully oxidises the carbon to CO_2 producing lower levels of CO.

Baseline NO_X emissions from unabated internal combustion engines vary with engine size and speed (Revolutions Per Minute). Larger, lower speed engines will produce more NO_X than smaller high-speed engines.

Reducing the level of excess air can reduce NO_X emissions by optimising the oxygen levels for combustion therefore minimising the levels of excess oxygen available to oxidise any nitrogen present. CO must also be controlled so there must be sufficient oxygen to allow full complete oxidisation of the carbon. PM emissions may also increase, and thermal efficiency may be affected by incorrect combustion settings. All new plant should be designed with combustion control equipment to take account of these concerns (this is discussed further in Section 3.4).

Control Through Engine Design

The principal technique used to reduce NO_X emissions is lean burn technology, where the fuel content of the charge is less than stoichiometric. This reduces local temperatures by dilution and ensures there is ample oxygen for good hydrocarbon conversion.

Low NO_X emissions from compression ignition engines can also be achieved by combustion modification. The following techniques can be considered for reducing emissions, although their specific applicability is limited by engine design, plant operation and certain fuel parameters. The suitability and choice of a primary measure may not be directly transferable from one engine to another (or between SI – CI engines):

- Reduction of flame temperature by the addition of water (CI engines). This reduces NOX, but is impractical in most circumstances;
- Tuning for NOX (ignition timing). Reducing the timing angle reduces NOX emissions but it also reduces engine efficiency and increases levels of CO and VOCs;
- Fuel/air mixing improvements (CI engines) is generally an option only for new engines such as is the case at SZC;
- Reduction of air manifold temperature. Increased after-cooling may reduce the temperature of the air charged into the cylinders and reduce NOX levels. This technique should be applicable to both existing and new engines; and
- Exhaust Gas Recirculation (EGR). Recycling exhaust gas into the air inlet feeds more inert mixture into the engine and reduces NOX emission. This method of NOX reduction is not recommended for lean burn engines.

All techniques listed above (except lean burn engines) have the drawbacks of reduced efficiency and increased emissions of CO and VOCs. The effective control of combustion conditions is therefore essential if they are used. In addition, any modifications that increase downtime and reduce availability are not acceptable for plant that is safety related and where reliability is crucial.

Many of the BAT options to provide NO_X control, relative to management of the burner arrangements, are not applicable in compression ignition engines such as those proposed for the SZC installation.

Optimisation of the diesel generator management with regards to NO_X control will be considered at the engine procurement phase as reflected in the design specification. However, these considerations will be considered against equipment reliability, which is the priority for diesel generators.

In addition to optimisation at the design and procurement stages, NO_X control will also be addressed by the maintenance programme applied to the diesel generators (EDGs and UDGs) to ensure optimum performance.

The maintenance of the EDG and UDG will be addressed in the Operator's Maintenance Policy, which will specify the work programme required to maintain the diesel generators in the best possible standby state to ensure optimum engine availability. This work programme will be based on engine running hours and manufacturer's recommendations. It should be noted that following maintenance activities, which can significantly affect the engine performance, specific tests, such as stack testing, could be performed following completion of the work if deemed necessary.

Secondary Abatement Measures to Control NO_X

End-of-pipe flue gas technologies to reduce NO_X emissions are generally not a practical cost-effective consideration for applications of this type where the plant is only operated on an infrequent basis. In addition, it is not possible to seismically qualify this plant. During a seismic event, this plant would likely be inoperable and if physically damaged, could present a risk of damage to the diesel generators if, for example, the kit collapsed onto it. However, for completeness, a summary of such techniques is included.

These techniques rely on the injection of ammonia, urea or other compounds to react with the NO_X in the flue gas and reduce it to molecular nitrogen. They can be divided into:

- Selective catalytic reduction (SCR); and
- Selective non catalytic reduction (SNCR).

SCR reduces NO and NO_2 to N_2 by the addition of ammonia or urea solution into the exhaust gas which can be injected at various locations in the flue gas stream. It may also be positioned after exhaust gas de-sulphurisation, although this arrangement would normally require an exhaust gas reheating stage, which may take up as much as 2% of the electrical capacity. This measure typically removes between 80% and

90% of the NO_X. The use of SCR requires the storage of liquid ammonia or ammonia solution and produces an additional effluent stream.

SNCR reduces NO_X emissions by chemically reducing it to nitrogen and water through the injection of NH_2-X compounds into the combustion chamber. SNCR is operated without a catalyst at a temperature of 850°C to 1,100°C. The temperature window and residence time can strongly influence the reagent used (ammonia or urea). Ammonia tends to give rise to lower nitrous oxide formation, but urea may be more effective over a slightly larger temperature window and is easier to handle. Abatement efficiencies of up to 80% have been claimed, although efficiencies of 30-50% are more typical.

SNCR also requires a sufficient retention time for the injected reagents to react with NO. Reagent distribution/injection must be optimised and computational fluid dynamics modelling may be useful (and is essential for all new plant) to show reagent behaviours in the combustion chamber.

Considering the very low number of annual running hours, there is no installed end of pipe NO_X abatement plant on the proposed reference design for the EDGs/UDGs. It is likely that any abatement plant will require steady operating conditions to function effectively and none of the diesel generators would operate within a suitable regime. Therefore, any abatement plant would rarely function effectively and be non-operational for most of the year. Both options will also produce an additional effluent stream which would require impact assessment.

Nevertheless, the necessity for a NO_X abatement plant on the installation will be examined once the emissions inventory, impact assessment and a review of abatement techniques applicability have been performed. The environmental impact (as required by the EP Regulations) associated with the operation of the EDGs is considered in Section 4.

Indicative BAT Requirements for the Abatement of Emissions of NO_X

Table 3.4 below outlines the indicative BAT for NO_X control and the proposals to be adopted at the SZC site.

Table 3.4: Indicative BAT Requirements for the Abatement of Emissions of NO_X

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
Emissions of NO_X should be controlled in plant by a combination, as applicable, of:	
EPR 1.01: Combustion control systems	The Operator shall control through periodic test and maintenance that EDGs and UDGs reliability is maximised to ensure that, under emergency conditions, they will be able to function in order to safely shut down the nuclear reactors. The maintenance and servicing regime shall ensure routine engine and injection system maintenance and some performance monitoring on the EDGs and UDGs but keeping the running time reasonably low; Due to the low operating frequency of the diesel generators the gains to be made from installing advanced combustion control equipment may be proportionally small when compared to the technical difficulty, practicalities and cost of implementing and maintaining such systems. In addition, the type of testing following maintenance activities (which can significantly affect the engine performance), will be considered and revised as operational experience is gained and commissioning data is produced. For smaller plant (described as < 100 MW or regulated by aggregation of smaller plant), the sector guidance states that the use of combustion modification techniques may be sufficient in the consideration of BAT for the control of NO_X. The individual EDGs and UDGs are considered “small” by this definition, and in addition will only be operated approximately <1% of the year. These periods of operation are to ensure their efficient and reliable operation in support of the nuclear power station safety case and to comply with best practice for the maintenance of such plant. The characteristics of the standby diesel generators combustion control systems will be further considered at the procurement stage, and a balance between technical feasibility, environmental benefit and cost will be assessed with reliability being a crucial factor.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EPR 1.01: Combustion temperature reduction	Systems of combustion temperature reduction will be studied with the manufacturer. However, SZC Co. already has the following information: The engines are designed to operate within defined temperature ranges and the injection is optimised to have the NO_X emission as low as possible with a minimised fuel oil consumption; The installation of advanced temperature control systems would lead to limited environmental gains. For this reason, installing such a system has not been incorporated in the design. Engines are liquid cooled (via radiators) and therefore rely on ambient temperature to provide adequate cooling of components. Advanced gas cooling is unlikely to yield net environmental benefits, given the requirements to draw energy to circulate and cool the gases.
EPR 1.01: For coal and oil-fired plant, low NO_X burners are required where applicable	Compression ignition engines do not require burners.
EPR 1.01: Over fire air	Not applicable for liquid-fuelled plant.
EPR 1.01: Flue/exhaust gas recycling (FGR)	FGR is most effective on gas or oil systems where the NO_X is derived from combustion air rather than the fuel (as in coal fired systems). FGR can offer 10-20% NO_X reduction on oil burning systems but this may result in an increase in PM emissions. Given the small reduction in NO_X emissions compounded by the limited running times and the significant technical/engineering complexities in implementing this process, the addition of FGR is not considered to be BAT for the diesel generators.
EPR 1.01: Reburn	Not considered appropriate to the standby essential diesel generators.
EPR 1.01: Selective Catalytic Removal or Selective Non-Catalytic Removal for smaller plant (< 100 MW) is considered BAT where required to meet air quality standards or other environmental standards.	The addition of end of pipe abatement equipment is not considered BAT given the creation of an additional effluent stream, the chemical storage requirements and the predicted environmental impact (see Section 4). In addition, the proposed plant will be operational for only limited hours annually (60 hours per year).
LCP BATc 7. In order to reduce emissions of ammonia to air from the use of SCR and/or selective non-catalytic reduction (SNCR) for the abatement of NOx emissions, BAT is to optimise the design and/or operation of SCR and/or SNCR (e.g. optimised	SCR and/or SNCR can be relied upon where appropriate although the installation is not an LCP installation. In addition, SCR is not considered applicable to combustion plant operated <500 hours/year (the standby plant will typically be operated for <60 hours/year).

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>reagent to NOx ratio, homogeneous reagent distribution and optimum size of the reagent drops).</td><td></td></tr>
<tr><td>LCP BATc 8: In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.</td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation. In addition, this is not considered relevant as there are no active abatement systems proposed.</td></tr>
<tr><td>LCP BATc 32. In order to prevent or reduce NO_X emissions to air from the combustion of heavy fuel oil and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below:

<table><tr><th>Technique</th><th>Applicability</th></tr><tr><td>Low-NO_X combustion concept in diesel engines</td><td>Generally applicable.</td></tr><tr><td>EGR</td><td>Not applicable to four-stroke engines</td></tr><tr><td>Water/steam addition</td><td>Applicable within the constraints of water availability. The applicability may be limited where no retrofit package is available</td></tr><tr><td>SCR</td><td>Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr></table></td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.

NNB has identified suitable NOx control measures for the EDGs and UDGs, which will include lean burn technology, optimised fuel/air mixing and tuning (cycle optimisation).

Exhaust-gas recirculation, water/steam addition and SCR are not applicable.</td></tr>
<tr><td>EP Technical Note 1/1 (18) 4.1.2: BAT is to use one or a combination of the primary techniques for NO_x reduction:

<table><tr><th>Technique</th><th>Applicability</th></tr></table></td><td>NNB has identified suitable NOx control measures for the EDGs and UDGs including lean burn technology, optimised fuel/air mixing and tuning (cycle optimisation).

However, the primary measures for NOx abatement were deemed to not be technically or economically feasible. In addition, the aggregated rated thermal input of the proposed plant is >50 MW therefore the</td></tr>
</table>

<table>
<tr><th colspan="2">Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td colspan="2"><table>
<tr><td>Choice of fuel</td><td>The switch from liquid to gaseous fuels may be restricted by the design of the burners in the case of existing plants.</td></tr>
<tr><td>Staged combustion</td><td>Applicability may be restricted by space availability when upgrading small plants, thus limiting the retrofit of fuel/air staging without reducing capacity.</td></tr>
<tr><td>Flue-gas recirculation (internal and external)</td><td>For existing plants, the applicability may be restricted by their design.</td></tr>
<tr><td>Low-NOx burner and ultra-low-NOx burner</td><td>For existing plants, the applicability may be restricted by their design.</td></tr>
<tr><td>Use of inert diluents</td><td>Generally applicable</td></tr>
</table></td><td>EP technical note 1/1 (18) is not applicable and the LCP BAT conclusions are applicable.</td></tr>
<tr><td colspan="2">EP Technical Note 1/1 (18) 4.1.3: BAT is to use one of the secondary techniques given below for NO_x reduction:<table>
<tr><td>Technique</td><td>Applicability</td></tr>
<tr><td>SCR</td><td>Applicability to existing plant may be restricted by space availability</td></tr>
<tr><td>SNCR</td><td>Applicability to existing process furnaces/heaters may be restricted by the temperature window (900-1,050oC) and the residence time needed for the reaction.</td></tr>
</table></td><td>SCR is not technically or economically feasible given that the plant will be operated <500 hours/year. In addition, the aggregated rated thermal input is >50 MW, therefore the EP technical note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.</td></tr>
</table>

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>BM BAT: The following abatement measures for NOx were identified for diesel engines:

<table><tr><td>Technique</td><td>Applicability</td></tr><tr><td>Water Injection</td><td>Not applicable to combustion plants operated <45 – 90 hours per year</td></tr><tr><td>Energy optimisation for low NOx</td><td>Generally applicable</td></tr><tr><td>EGR</td><td>Not applicable to four-stroke engines and engines operated < 50-75 hours per year</td></tr><tr><td>SCR</td><td>Not applicable to combustion plants operated < 500 h/yr. SCR is not considered as it is not technically feasible for reciprocating engines operating in the balancing market as it must be warned and can’t operate in the first 30 mins of operation</td></tr></table></td><td>Systems for combustion temperature reduction will be investigated with the manufacturer. However, SZC Co. already has the following information:

The engines are designed to operate within defined temperature ranges and the injection is optimised to have the NO_X emission as low as possible with a minimised fuel oil consumption.

The installation of advanced temperature control systems would lead to limited environmental gains. For this reason, installing such a system has not been incorporated in the design.

The remaining secondary measures for NOx abatement were not technically or economically feasible for plant operating in the balancing market.</td></tr>
<tr><td>Specified Generators: Where secondary abatement is required to ensure compliance with the requirement in paragraph (a), the emission limit value for nitrogen oxides is met—

(i) in the case of a Tranche A generator or a Tranche B generator which was, but has ceased to be, a Tranche A generator, within 20 minutes of the specified generator commencing operation, or

(ii) in the case of any other Tranche B generator, within 10 minutes of the specified generator commencing operation and, in every case, emissions must be monitored at least every three years.</td><td>Secondary abatement is not required to comply with the emission limit value for nitrogen oxides given that the diesel generators are excluded generators due to their defined nuclear safety role, and they are not required to comply with the emission limit value. In addition, given the low running hours and the time it would take to reach the ideal temperature for the abatement to work, secondary abatement is not technically or economically feasible.</td></tr>
</table>

3.1.3 Potential Abatement Options for SO_2 Emissions

As stated in EPR 1.01 [6] the abatement techniques, such as end of pipe desulphurisation techniques are BAT for large coal or oil fired plant, whilst the use of low sulphur fuels is a primary BAT measure for all plant. In addition the LCP BAT conclusions document [10], EP TN 1/1/ (18) [13] and the balancing market BAT report [14] identify that that use of low sulphur fuels (SCOLF compliant diesel, 0.1% sulphur) is considered BAT for the control of SO_2 emissions. FGD and sorbent injection are not considered appropriate for the diesel generators, which operate less than 500 hours a year.

The source of sulphur, in emissions to air from combustion processes, is the fuel. Combustion management cannot be used to reduce SO_2 releases. During combustion the major oxide of sulphur produced is SO_2. Sulphur trioxide (produced in smaller quantities during combustion) is adsorbed and reacts with particles in the flue gases. Sulphur trioxide is more likely to pose a problem with low ash fuels (e.g. fuel oils) and its presence is an important contributing factor in acid smutting. Measures used to control SO_2 will also result in lower emissions of hydrogen chloride and hydrogen fluoride.

The diesel generators will use a low sulphur fuel oil, which will ensure low emissions of SO_2. Fuel oil will contain a maximum of 0.1% sulphur by weight, as required under the SCOLF Regulations 2007 [4] (or the requirements of future legislation). The use of low sulphur fuels (i.e. less than 0.1%) may be sufficient in the consideration of BAT for the control of oxides of sulphur emissions.

Indicative BAT Requirements for the Abatement of Emissions of SO_2

Considering the very low number of annual running hours of the standby EDGs, it is considered that BAT will be achieved by complying with the primary requirement of using low sulphur fuel. **Table 3.5** summarises the assessment of EDGs and UDGs against the indicative BAT requirements for the abatement of emissions of SO_2.

Table 3.5: Indicative BAT Requirements for the Abatement of Emissions of SO_2

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EPR 1.01: Use of low sulphur fuels is a primary measure.	The installation will operate in line with the SCOLF Regulations. The current limit is 0.1% sulphur maximum by weight. The diesel generators will use fuel oil, which complies with the specification BS 2869:2017 or standards applicable at time of procurement and operation. EPR 1.01, LCP BATc and balancing market BAT report states that the use of low sulphur fuels is considered to be BAT.

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>LCP BATc 8: In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.</td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.
Not relevant as no active abatement systems are proposed.</td></tr>
<tr><td>LCP BATc 34: In order to prevent or reduce SO_X emissions to air from the combustion of gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below:
<table><tr><td>Technique</td><td>Applicability</td></tr><tr><td>Fuel choice</td><td>Applicable within the constraints associated with the availability of different types of fuel</td></tr><tr><td>Duct sorbent injection</td><td>Not applicable to combustion plants operated < 500 h/yr</td></tr><tr><td>Wet flue-gas desulphurisation (wet FGD)</td><td>Not applicable to combustion plants operated < 500 h/yr.</td></tr></table></td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.
The installation will use low sulphur fuels in line with SCOLF Regulations. FGD and sorbent injection are not considered appropriate for small scale standby plant operating less than 500 hours a year.</td></tr>
<tr><td>EP Technical Note 1/1 (18): In order to prevent or reduce SO_2 emissions to air from combustion plants, BAT is to use a fuel with a low sulphur content</td><td>The installation will use low sulphur fuels in line with SCOLF Regulations.</td></tr>
<tr><td>Balancing market BAT: Fuel switching to low sulphur fuel to reduce SO_2 emissions.</td><td>The installation will use low sulphur fuels in line with SCOLF Regulations.</td></tr>
</table>

3.1.4 Potential Abatement Options for PM Emissions

There is no PM abatement plant planned for the diesel generators. However, filtering of fuel could be carried out to lower PM emissions in the unlikely event that PM emissions from the diesel generators become environmentally significant.

The installation's performance is assessed against indicative BAT requirements for abatement of PM emissions in **Table 3.6**.

The combustion sector guidance EPR 1.01 [6] indicates that abating PM, especially the finer fractions, is a significant method of controlling the release of heavy metals, dioxins and polycyclic aromatic hydrocarbons. However, such techniques are

considered to be more appropriate for large solid fuel and oil-fired plant. The particulate abatement techniques identified in the combustion sector guidance [6], and listed below, are considered in the following sections of this submission:

- Electrostatic precipitators (ESPs);
- Fabric filters;
- Ceramic filters;
- Wet scrubbers; and
- Cyclones.

It is concluded that the use of such techniques is not BAT for the combustion plant planned for SZC. In addition, the LCP BAT conclusions document [10] identifies bag filters and ESPs as potentially applicable abatement techniques. Although these techniques can be relied upon where appropriate, the installation is not an LCP installation. In addition they would not be applicable to the diesel generator's operation <500 hours per year The balancing market BAT report [14] concludes that no primary measures for particulate control were identified and secondary measures for particulate control were not technically or economically feasible for plant operating in the balancing market.

The EP Technical Note 1/1 (18) [13] concludes that in order to prevent or reduce dust emissions to air from the diesel generators, BAT is to initially use fuel with a lower pollution potential and use high pressure to reduce the droplet size of liquid fuel and then to use cyclones, electrostatic precipitators, bag or fabric filters and ceramic or metal filters. However, given that the aggregate rated thermal input is 50 MW or more then the BAT referenced in the EP Technical Note 1/1 (18) [13] is not applicable and the LCP BAT conclusions [10] should be relied upon.

Electrostatic Precipitators

Electrostatic precipitators are used in both solid and liquid fuelled combustion plant, they are available for small and large-scale plant and can consistently achieve particulate levels of 50mg/m^3. Given the size of the diesel generators, the operating regime (<500 hours per year) and the use of high-quality fuel, compliant with British Standards, it is not considered proportional to use electrostatic precipitators.

Fabric Filters

Bag (fabric) filters when correctly operated and maintained provide reliable abatement to below 10mg/m^3 and are likely to be the appropriate measure for many applications. They cannot generally be used at temperatures over 250°C. Given the

size of the diesel generators, the operating regime (<500 hours per year) and the use of fuel, compliant with British Standards, it is not considered proportional to use fabric filters.

Ceramic Filters

Ceramic filters are available for small combustion plant and are being developed for larger plant. They can normally achieve reliable levels below 10mg/m^3 and have low maintenance requirements. Ceramic filters are able to withstand high temperatures around 800-900°C and offer the same level of protection as fabric filters. Given the size of the diesel generators, the operating regime and the use of fuel compliant with British Standards, it is not considered proportional to use ceramic filters.

Wet Scrubbers

In a wet scrubber, the flue gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the PM. New CI engines (such as those to be employed on the SZC site) should be capable of achieving the given unabated release levels through efficient combustion. This is further validated by the impact assessment provided in Section 4 of this submission.

Cyclones

Cyclones provide a method of removing larger particulates from a flue gas stream. The general principle of inertia separation is that the particulate-laden gas is forced to change direction. As gas changes direction, the inertia of the particles causes them to continue in the original direction and be separated from the gas stream. The walls of the cyclone narrow toward the bottom of the unit, allowing the particles to be collected in a hopper. The cleaner air leaves the cyclone through the top of the chamber, flowing upward in a spiral vortex, formed within a downward moving spiral. New CI engines (such as those to be employed on the SZC site) should be capable of achieving the given unabated release levels through efficient combustion. This is further validated by the impact assessment provided in Section 4 of this submission.

Summary

The impact assessment for PM in Section 4 shows that PM emissions are insignificant, and emissions will be adequately controlled without the need for secondary abatement plant. In addition, it is noted that the use of particulate abatement on standby generation plant is undesirable in any case, when the intermittent, short duration, operating regime is considered, together with the adverse effect on reliability, which would be introduced by the use of particulate filters, due to the risk of blockage. The type of fuel and optimised combustion will be primary measures.

Indicative BAT Requirements for the Abatement of Emissions of PM

EPR 1.01 [6] guidance, LCP BAT conclusions document [10], the EP technical note 1/1 (18) [13] and the balancing market BAT report [14] provides a table of indicative BAT requirements (Section 2.2.4) for the control of PM to air, these are discussed in **Table 3.6**Table 3.6.

Table 3.6: Indicative BAT Requirements for the Abatement of Emissions of PM

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>EPR 1.01: Where particulate abatement is required, the options include:
ESPs;
Fabric filters; or
Ceramic filters.</td><td>The installation will use fuel oil compliant with British Standards in the standby diesel generators. Therefore, emissions of PM originating from the input fuel will be minimised.
Following detailed dispersion modelling, the installation of such abatement (e.g. fabric filter) to reduce PM emissions is not considered BAT. Should actual operating emissions be environmentally significant, this approach will be reassessed.</td></tr>
<tr><td>LCP BATc 8: In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.</td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.
Not relevant as no active abatement systems are proposed.</td></tr>
<tr><td>LCP BATc 35: In order to prevent or reduce dust and particulate-bound metal emissions from the combustion of gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below:
<table>
<tr><th>Technique</th><th>Applicability</th></tr>
<tr><td>Fuel choice</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>Electrostatic precipitator (ESP)</td><td>Not applicable to combustion plants operated < 500 hours per year</td></tr>
<tr><td>Bag filter</td><td>Not applicable to combustion plants operated < 500 hours per year</td></tr>
</table></td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.
Use of low sulphur fuels will be a primary measure. Bag filters and ESPs are not applicable as the plant operates <500 hours per year.</td></tr>
</table>

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>EP Technical Note 1/1 (18) 4.1.4 and 4.1.5: In order to prevent or reduce dust emissions to air from combustion plants, BAT is to use one or a combination of the techniques given below:
<table>
<tr><td>Technique</td><td>Applicability</td></tr>
<tr><td>Optimised combustion</td><td>Generally applicable</td></tr>
<tr><td>Choice of Fuel</td><td>For existing plant, the switch from one type of fuel to another may be restricted by the design of the plant.</td></tr>
<tr><td>Atomisation of liquid fuels</td><td>Applicable to liquid fuels.</td></tr>
<tr><td>Cyclones / Multi-cyclones</td><td>Solid fuel combustion plant</td></tr>
<tr><td>Electrostatic precipitator</td><td>Solid fuel combustion plant</td></tr>
<tr><td>Bag or fabric filter</td><td>Liquid and / or solid fuel combustion plant.</td></tr>
<tr><td>Ceramic or metal filter</td><td>Liquid and / or solid fuel combustion.</td></tr>
</table></td><td>Use of low sulphur fuels and optimised combustion will be a primary measure. The aggregate rated thermal input is 50 MW or more and therefore the EP technical note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.</td></tr>
<tr><td>EP Technical Note 1/1 (18) 4.1.6: In order to prevent or reduce dust emissions to air from fuel, BAT is to use one or a combination of the techniques given below:
<table>
<tr><td>Technique</td><td>Applicability</td></tr>
<tr><td>Dust arrestment</td><td>Silos</td></tr>
<tr><td>Dust suppression</td><td>Fuel stockpiles</td></tr>
<tr><td>Appropriate siting</td><td>Outdoor operations</td></tr>
</table></td><td>Diesel will be stored internally. Diesel combustion does not produce ash, therefore there is no requirement for ash handling at the installation. The aggregate rated thermal input is 50 MW or more and therefore the EP technical note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.</td></tr>
</table>

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
<table><tr><td></td><td></td></tr><tr><td>Wind dynamics management</td><td>Outdoor operations</td></tr><tr><td>Site and process design</td><td>Fuel stockpiles</td></tr></table>	
Balancing market BAT: No primary measures for the abatement of PM were identified.	Secondary measures for particulate control are not technically feasible for plant operating in the balancing market and no primary measures for particulate control were identified for plant operating in the balancing market.

3.1.5 Other Releases

CO_2, CO and VOCs

The operation of diesel generators results in emissions of CO_2, CO and VOCs.

- All measures to reduce fuel use will also reduce CO2 emissions and fuel with a low ratio of carbon content to calorific value reduces CO2 emissions;
- Elevated CO and VOC emissions indicate poorly controlled combustion and may also indicate higher releases of other pollutants. As CI engines burn fuel in an excess of air, CO is minimised through increased oxidation. Excess oxygen, can however lead to increased NOX generation, highlighting the importance of controlling the air feeds into the process (and therefore available oxygen). Good combustion control is required to minimise releases; and
- Where necessary, the use of catalytic oxidation in the exhaust gas stream will reduce CO emissions to less than 100mg/m3.

It is recognised in EPR 1.01 [6] that, at the present stage of research development, the only means of abatement of CO2 emission is to minimise the operation of the diesel generators. This is currently the case as the plant will only be operated for test and maintenance purposes to ensure reliability.

The impact assessment for CO in Section 4 shows that CO emissions are insignificant, and emissions will be adequately controlled without the need for secondary abatement plant. In addition, the LCP BAT conclusions [10] and Environmental Permitting (EP) technical note 1/1 (18) [13] recommend optimised combustion, maintenance, advanced control systems, good design, and/or a suitable fuel choice. The LCP BAT conclusions [10] also identifies that catalytic oxidation in

the exhaust stream may be feasible in small stationing diesel generators. However, due to the low running hours of the diesel generators (<500 hours per year), there would be limited environmental benefit in using catalytic oxidation. In addition, given that the aggregate rated thermal input is 50 MW or more, then the BAT referenced in the EP technical note 1/1 (18) [13] is not applicable and the LCP BAT conclusions [10] should be relied upon (although the installation is not an LCP installation). Therefore, the minimisation of CO and VOCs will be addressed by plant maintenance to ensure efficient and reliable combustion, which will in turn ensure minimised releases. No abatement is proposed.

Table 3.7: Indicative BAT Requirements for the Abatement of Emissions of CO

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>LCP BATc 6. In order to improve the general environmental performance of combustion plants and to reduce emissions to air of CO and unburnt substances, BAT is to ensure an optimised combustion and to use an appropriate combination of the techniques given below.

<table><tr><td>Technique</td><td>Applicability</td></tr><tr><td>Fuel blending and mixing</td><td>Generally applicable</td></tr><tr><td>Maintenance of the combustion system</td><td>Generally applicable</td></tr><tr><td>Advanced control system</td><td>The applicability to old combustion plants may be constrained by the need to retrofit
the combustion system and / or control command system.</td></tr><tr><td>Good design of the combustion equipment</td><td>Generally applicable to new combustion plants.</td></tr><tr><td>Fuel Choice</td><td>Applicable within the constraints associated with the availability of different suitable types of fuel with
a better environmental profile as a
whole.</td></tr></table></td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.

No blending of fuel is proposed to be undertaken at site as
the engines are configured to use gas oil only.

The proposed reciprocating engines are considered to be the most appropriate and suitable combustion equipment for the site, having an electrical efficiency in line with that specified within the BAT conclusions.

All installed plant and equipment will be maintained in line with manufacturer’s guidelines and site procedures.

Process controls will be implemented on site to cover the operation of the proposed plant.</td></tr>
<tr><td>LCP BATc 8: In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.</td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.

Not relevant as no active abatement systems are proposed.
Following detailed dispersion modelling, the installation of abatement systems to reduce CO emissions is not considered BAT. Should actual operating emissions be environmentally significant, this approach will be reassessed.</td></tr>
</table>

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>LCP BATc 33. In order to prevent or reduce CO emissions to air from the combustion of gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below:

<table><tr><td>Technique</td><td>Applicability</td></tr><tr><td>Combustion optimisation</td><td>Generally applicable</td></tr><tr><td>Oxidation catalysts</td><td>Not applicable to combustion plants operated < 500 h/yr. The applicability may be limited by the sulphur content of the fuel</td></tr></table></td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.

Combustion optimisation will be utilised. The use of catalytic oxidation is not applicable to combustion plants operated < 500 hours per year.</td></tr>
<tr><td>EP Technical Note 1/1 (18) 4.1.1: BAT is to ensure optimised combustion achieved by good design and operation of the equipment, including optimisation of the temperature and residence time in the combustion zone, efficient mixing of the fuel and combustion air, and combustion control. Combustion control is based on the continuous monitoring and automated control of appropriate combustion parameters (e.g. O2, CO, fuel to air ratio and unburnt substances).</td><td>Combustion optimisation will be utilised. The aggregated rated thermal input is 50 MW or more and therefore the EP technical note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.</td></tr>
</table>

Halogens and Dioxins

Halogens (hydrogen chloride and hydrogen fluoride) are produced during the combustion of coal and oil and some biofuels and waste derived fuels. Techniques used for abating SO_2 will also reduce these gases.

Dioxins can potentially be formed by the combustion of any carbon containing fuel in the presence of trace quantities of chloride. Dioxins are usually present in both the particulate and vapour phases and accordingly measures to reduce PM emissions will also significantly reduce emissions of these compounds. FGD systems can enhance dioxin removal as can some SCR systems employed for NO_X reduction. These systems should not be relied upon as primary measures to abate dioxins (which should be minimised through combustion control and fuel quality), to concentrations below or close to the limits of current measurement and analysis techniques. The prevention of conditions that favour the formation of dioxins and furans immediately following combustion is important. This is achieved by the following design specifications:

- Reduction of post-combustion gases by cooling them quickly from higher

temperatures through the temperature range of approximately 400°C down to 250°C, to avoid prolonged exposure in the temperature range known to favour dioxin and furan formation; and

- Minimise the presence of PM and chloride bearing metal impurities that are known to facilitate dioxin and furan formation.

On the SZC installation, gases will be discharged directly after combustion thus ensuring a rapid cooling. The combustion process will operate at around 550°C. Due to the low chlorine levels in the fuel and operating regime (i.e. limited hours), no additional abatement is proposed for dioxin abatement.

Indicative BAT Requirements for the Control of Point Source Emission to Air

The installation's performance is assessed against indicative BAT requirements for point source emissions to air in **Table 3.8**.

Table 3.8: Indicative BAT Requirements for the Control of Point Source Emission to Air

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EPR 1.01: VOC and dioxins - these should be minimised through good combustion control.	In general, the plant will only be run for testing, post maintenance checks and during periodic nuclear safety tests, in order to ensure availability during emergency conditions. Combustion control will be kept within normal operational ranges through engine servicing and Operator checks.
EPR 1.01: The benchmark values for point source emissions to air, listed in Section 3.2.1, should be achieved unless alternative values are justified and agreed with the Regulator.	This will be the responsibility of the Operator at the site-specific stage. Validation testing will be carried out as part of the commissioning programme.
EPR 1.01: The main chemical constituents of the emissions should be identified, including VOC speciation where practicable.	Main emissions are NO_x, SO_2, CO, and particulate matter. VOCs (methane equivalent carbon) will be tested and reported in accordance with the permit when issued. VOCs are not anticipated to be a significant component of the exhaust gases and, as such, speciation is not considered to be necessary to demonstrate BAT.
LCP BATc 8: In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.	These techniques can be relied upon where appropriate although the installation is not an LCP installation. Not relevant as no active abatement systems are proposed.

This approach is consistent with other standby diesel plant operated by EDF in France and in UK where combustion control is used as the main control measure to minimise pollutants. Secondary abatement techniques are not considered BAT due to the operating profile.

3.1.6 Point Source Emissions to Water

A Drainage Strategy has been prepared for SZC (Ref: SZC-SZ0100-XX-SEO-REP-100000, Version 1.0, Dated March 2018) [53] to confirm the detailed strategy for the provision of any drainage which is required to effectively drain the permanent power station and manage flows which leave the site.

Full details of the drainage strategy for the installation will be developed at the detailed design phase, however the anticipated process emissions from the installation and their management are discussed below. The finalised drainage drawings with detail on the drainage routes and emission points from the site will be supplied to the Environment Agency prior to commissioning of the installation. This will be provided to the Environment Agency as part of the FAP (Refer to Section 6 – FAP Ref. 1).

SZC Co. envisages no, or minimal, point source emissions to water from the diesel generators themselves. There is the potential for point source emissions to water from uncontaminated surface water drainage from within the installation boundary and there is also the potential for point source emissions to water from associated plant (i.e. out with the installation). The main sources are:

- Rainwater draining from roofs in the installation boundary and collected at the bottom of the UDG stack (the EDG stack has been designed so that rain will not enter) will be kept free of contamination and will drain, along with the clean rain water from the rest of SZC to the outfall (with the cooling water). A connection manhole will be provided for each building that generates surface water from roofs;

- Cooling system losses or replacement (water/glycol mix) will be collected over hardstanding (outside of the combustion activities installation boundary) and disposed off-site as hazardous waste, this is a closed loop system (14.2m3 per EDG and 15.8m3 per UDG) and these are expected to be minor (the drainage system for the area housing the cooling circuit has not yet been designed and as part of the FAP this scenario will be considered and appropriate mitigation such as spill kits put in place to prevent the fluid reaching the surface water drains);

- There will be surface water run-off and potentially contaminated drainage from oil storage. On-site storage of diesel would be within the diesel buildings in bunded rooms. The tanks will be alarmed and any leaks from the tanks will

accumulate in the sump, which will also have a level alarm. There will be no internal drains within the diesel rooms and any spills would be captured in a sump and pumped out and disposed off-site as hazardous waste. Forecourt oil/water separators (Class 1 BS-EN-858) are to be provided at all locations where fuel handling will take place. Penstocks are to be provided at the point of discharge to all forebays. All operations will comply with the Oil Storage Regulations, Environment Agency guidance on oil storage regulations for businesses, BS 5410 Code of practice for oil firing and CIRIA advice where relevant. All oily water drains on site will be routed through an oil/water separator (Class 1 BS-EN-858) and discharged with the cooling water via the outfall (this will be covered in detail under the operational water discharge environmental permit application);

- Compressor condensate will be collected within leak pans over hardstanding and disposed of using a licensed waste disposal facility;
- Cleaning chemicals used for housekeeping purposes may be used within the installation and minor volumes of washings generated but these are not process related;
- Firefighting run off will be considered as a site-wide issue (the diesel buildings comprise a minor area of the site) and is considered in the Operational Water Discharge EP Application. Fire water capacity calculations will be provided to the Environment Agency as part of the FAP (Refer to Section 6 – FAP Ref. 1); and
- Accidental releases are discussed separately in Section 5.

Indicative BAT Requirements for the Control of Point Source Emission to Water

The installation's performance is assessed against indicative BAT requirements for point source emissions to water in **Table 3.9**.

Table 3.9: Indicative BAT Requirements for the Control of Point Source Emission to Water

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
Environment Agency guidance to control and monitor emissions for your environmental permit: The guidance lists the following steps to prevent pollution to surface or groundwater: • Make sure that your site surfaces, including roofs, hard standing, working areas, any	Rainwater run-off and cooling water will be handled using dedicated closed drainage systems, which combine with the cooling water and discharge via the outfall. Drainage from site areas where oil handling activities occur will be designed to ensure that appropriate controls (e.g. Class 1 BS-EN-858 oil/water separators) are introduced to ensure that

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
containment structures required by your permit, such as bunds or other secondary containment measures, and your site drainage infrastructure will prevent pollution to surface water and groundwater. • Consider collection capacities, surface thicknesses, strength and reinforcement, falls, materials of construction and permeability. • You must make sure any rainfall collection systems are kept separate from areas of the site which are or may be contaminated. • Make sure your surfaces and containment or drainage facilities are resistant to spilled chemicals. Your management system must include a plan about how you will inspect and maintain your surfaces and containment facilities. • The following are needed to prevent contaminated run off polluting groundwater or surface waters: - a waterproof surface - spill containment kerbs - sealed construction joints	no contaminated water is discharged to controlled waters. Separators (Class 1 BS-EN-858) and penstock valves are provided on the forecourts and oily water drains. Cooling system losses and replacement (outside the installation) and compressor condensate would be collected over chemical/oil resistant hardstanding with sealed joints and disposed of using a licensed waste disposal facility.
EPR 1.01: BAT is to: Oil Storage • Fit a high-level alarm to oil tanks. • Drain decanted water from oil storage tanks and storm water from bunded areas to a water treatment plant, or direct it to an appropriate disposal facility. You should deal with liquid effluents generated during periodic tank cleaning in a similar way. • Use oil removal facilities such as partition chambers or plate separators for water contaminated with oil. Cleaning liquids • Neutralise or treat wash waters and cleaning-out solutions to produce an acceptable waste before discharge or disposal. • Boiler cleaning wastes require appropriate disposal. Site drainage including rainwater • Use an efficient oil/water separation/interceptor system. Further treatment may be required to remove dissolved hydrocarbons.	The oil storage measures identified in Section 3.5.6 together with the use of oil interceptors address indicative BAT. Tanks will be fitted with high level alarms. Diesel and oils will be collected and disposed of off-site using a licensed waste disposal facility. Cleaning liquids will be collected and disposed of off-site. Measures will be taken to reduce the generation of oily wastewater and oil interceptors (Class 1 BS-EN-858) will be used which will be subject to inspection and maintenance programs as part of the IMS.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Direct discharge to controlled waters will only be allowed where discharges will meet discharge requirements under all conditions.	
LCP BATc 13: In order to reduce water usage and the volume of contaminated wastewater discharged, BAT is to use the techniques given below: Water Recycling — Residual aqueous streams, including run-off water, from the plant are reused for other purposes. The degree of recycling is limited by the quality requirements of the recipient water stream and the water balance of the plant.	The water requirements for the proposed plant are expected to be negligible, with the majority of the water use required for welfare facilities, which is outside the remit of the Environmental Permitting regime. Operational requirement for water is anticipated to only be for replacement or replenishment of water in the cooling circuit, which is expected to be infrequent. The Operator will make all efforts to minimise water use and recycle water as much as reasonably practicable.
LCP BATc 14: In order to prevent the contamination of uncontaminated wastewater and to reduce emissions to water, BAT is to segregate wastewater streams and to treat them separately, depending on the pollutant content.	Rainwater run-off and cooling water will be handled using dedicated drainage systems. Drainage from site areas where oil handling activities occur will be designed to ensure that appropriate controls (Class 1 BS-EN-858 oil/water separators and penstock valves) are introduced to ensure that no contaminated water is discharged to controlled waters.
LCP BATc 15: In order to reduce emissions to water from flue-gas treatment, BAT is to use an appropriate combination of the techniques, and to use secondary techniques as close as possible to the source in order to avoid dilution.	Not applicable. Due to application of primary controls in the proposed plant, it is not proposed to carry out secondary flue gas treatment.

3.1.7 Emissions to Land

There are no planned releases to land from the installation. All waste arisings will be handled with appropriate consideration given to waste hierarchy and disposed of off-site using licensed contractors. Predicted waste arisings and the associated management arrangements are described in Section 5.

3.1.8 Fugitive Emissions

A fugitive emission is an emission to air, water or land from an activity from a localised or diffuse source which is not controlled by an emission or background limit. Fugitive emissions are generally taken to include dust, VOCs, litter and fugitive releases to water and ground.

Fugitive Emissions to Air

Given the nature of the installation (i.e. no combustion of solid fuel or waste) the discussion of fugitive emissions to air only considers emissions of VOCs and does not consider dust or litter.

Environment Agency guidance to control and monitor emissions for your environmental permit [26] lists the following steps to prevent emissions of VOCs and vapour and fluid emissions including:

- enclose any containers on your site;
- fit equipment to capture VOCs on any vents on your site (such as scrubbers or filters);
- install sealed transfer (vapour balance) systems;
- use sub-surface filling via (anti-syphon) filling pipes extended to the bottom of the container;
- use floating roof tanks and bladder roof tanks;
- use tank vent systems that minimise breathing losses, for example pressure/vacuum valves, and fit knock-out pots where necessary;
- managing inventories;
- preventing leaks from any pipework or fluid transport systems; and
- using white paint, insulation and active temperature controls to reduce the temperature in any storage tanks.

The EP Technical Note 1/1 (18) [13] also includes techniques to control emissions from storage and handling of fuels. The diesel fuel will be stored in tanks therefore most of the techniques listed above can be discounted. There will be small emissions to air of fuel oil vapour, a saturated hydrocarbon VOC emission, from the vents of the fuel oil storage tanks. During tanker filling operations, vapour will be displaced from the main storage tanks supplying the diesel generators. There will also be emissions associated with the transfer to day storage tanks from the main tanks. The EDG and UDG diesel fuel tanks will be ‘closed’ vessels equipped with vents for safety purposes. This is considered to be BAT with regards to the abatement of fugitive emissions to air.

There is the potential for fugitive emissions from the emergency generator crankcase fume extract system. This emission will consist of air with traces of lubricating oil fumes. The fumes from the EDG crankcase fume extract system will be discharged at roof level, whilst those from the UDGs will be recovered into the air intake. Abatement could be installed in the form of a coalescer filter, however, this is not considered reasonably practicable due to the limited operational hours. If, during operation, this is considered problematic, the situation will be reviewed.

Indicative BAT Requirements for Fugitive Emission to Air

Table 3.10 assesses indicative BAT requirements for fugitive emissions to air.

Table 3.10 Indicative BAT Requirements for Fugitive Emission to Air

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
VOCs	
Environment Agency Guidance to control and monitor emissions for your environmental permit: The guidance lists the following steps to prevent emissions of VOCs and vapour and fluid emissions including: • enclose any containers on your site; • fit equipment to capture VOCs on any vents on your site (such as scrubbers or filters); • install sealed transfer (vapour balance) systems; • use sub-surface filling via (anti-syphon) filling pipes extended to the bottom of the container; • use floating roof tanks and bladder roof tanks; • use tank vent systems that minimise breathing losses, for example pressure/vacuum valves, and fit knock-out pots where necessary; • managing inventories; • preventing leaks from any pipework or fluid transport systems; and • using white paint, insulation and active temperature controls to reduce the temperature in any storage tanks.	The fuel oil used for the standby generator will be diesel, which is not considered to be a particularly volatile liquid and is less volatile than other fuel oils (with the exception of heavy fuel oil). The delivery of diesel to the installation should be an infrequent occurrence due to the limited use of the EDGs and UDGs. The diesel fuel tanks will be closed tanks, situated inside ventilated buildings, which will allow minimum evaporation. There is the potential for fugitive emissions during filling operations and storage. Pressure relief and vacuum valves will be fitted as standard. The EDG and UDG diesel fuel tanks will be 'closed' vessels equipped with vents for safety purposes. This is considered to be BAT with regards to the abatement of fugitive emissions to air. There is also the potential for fugitive emissions from the crankcase fume extract system, however these will be either be discharged at roof level or recovered into the air intake. Abatement could be installed in the form of a coalescer filter, however, this is not considered reasonably practicable due to the limited operational hours. If, during operation, this is considered problematic, the situation will be reviewed. The potential for fugitive emissions will be regularly reviewed as part of the IMS environmental aspect and impact identification procedures. The installation will also have procedures for management of emergencies and accidental releases at the site.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EP Technical Note 1/1 (18) 4.3: Techniques to control emissions from storage and handling of fuels and ash • When delivering, moving or removing materials, loading to and from stockpiles should be carried out so as to prevent emissions to the air; • The transport and handling of dusty materials within the site should be carried out by methods which prevent emissions to the air. External above – ground conveyors carrying dusty materials should be fitted with protection against wind whipping. Transfer point extraction should be ducted to suitable arrestment equipment to meet the limit values in Section 5 • All vehicles transporting dry, dusty materials to or from a site should be totally enclosed or adequately sheeted to prevent escape of particulate matter to the air. • All dusty materials should be stored in covered containers, purpose-built silos or undercover whenever practicable • Stockpiles of dusty, or potentially dusty, materials should be stored so as to prevent wind whipping e.g. by covering, screening or dampening • Bulk fuel storage and silos should be fitted with a high-level alarm or volume indicator to warn of and thereby prevent overfilling. For example, for chipped fuels. - The high-level alarm should be electronically interlocked with the fuel delivery system in order to prevent overfilling. - Deliveries of chipped fuels should be supervised at all times. • Silos for the storage of solid fuels should be vented to air through suitable arrestment equipment, to meet the emission concentration limits specified in Section 5 of the EP Technical Note. • All arising's of ash and other dusty materials should be stored in closed containers or buildings or stored in a wet state pending removal from site. • All on-site fuel processing activities such as chipping, shredding, pulverising or screening should be conducted so as to minimise releases	There are no dusty materials (including ash) handled and stored in relation to the operation of the diesel generators. The fuel oil used for the standby generator will be diesel, which is not considered to be a particularly volatile liquid and less volatile than other fuel oils (with the exception of heavy fuel oil). The diesel storage tanks will be alarmed and any leaks from the tanks will accumulate in the sump, which also has a level alarm. The diesel fuel tanks will be closed tanks, situated inside ventilated buildings, which will allow minimum evaporation. There is the potential for fugitive emissions during filling operations and storage. Pressure relief and vacuum valves will be fitted as standard. The EDG and UDG diesel fuel tanks will be 'closed' vessels equipped with vents for safety purposes. In addition, the nearest residential receptor is located 1km south (a transient receptor (Sandlings Walk Path) is located 180m north). This is considered to be BAT with regards to the abatement of fugitive emissions to air. The diesel tanks will be situated within the diesel generator buildings in bunded rooms. There are no internal drains within the diesel rooms and any spills would be captured in a sump and pumped out and disposed off-site as hazardous waste. Forecourt separators (Class 1 BS-EN-858) are to be provided at all locations where fuel handling takes place. Penstocks are provided at the point of discharge to all forebays, which discharge with the cooling water via the outfall. All operations will comply with the Oil Storage Regulations, Environment Agency guidance on oil storage regulations for businesses, BS 5410 Code of practice for oil firing and CIRIA advice where relevant. There will be spill prevention and response procedures.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
of dust to air. Such activities should take place inside a building. • Bulk storage tanks for liquid fuels should wherever practicable be back vented to the delivery tank during filling. Where this is impracticable, displaced air vents should be sited in such a way as to prevent the arising of offensive odour, as perceived by the local enforcing authority inspector at or beyond the site boundary. • Above-ground fuel storage tanks should be completely contained by bunding which is impervious and resistant to the fuels in storage and capable of holding 110% of the capacity of all storage tanks within the bund. • Adequate provision should be made for the containment of liquid and solid spillages. All spillages should be cleared as soon as possible and in the case of solid materials this should be achieved by the use of vacuum cleaning, wet methods or other appropriate techniques. Dry sweeping should not be permitted.	

Fugitive Emissions to Surface Water, Sewer and Groundwater

There are no fugitive releases to surface water, sewer or groundwater identified as a result of normal operations.

As a result of abnormal or emergency operations, there are number of sources that could cause emissions to surface waters or sewer. There are no pathways to groundwater as the installation and the wider site will be covered in competent hardstanding and the drains will be newly installed as part of a contained drainage system.

The main sources are:

- Loss of containment of antifreeze/cooling fluid;
- Loss of containment from fuel tanks;
- Oil leaks from engines and pipelines;
- Loss of containment of lubricating oil; and

- Loss of containment from a fuel tanker and flexible hose during delivery.

These issues are discussed in detail in Section 5.

In order to reduce the probability and hazard of these scenarios occurring, commitments have been made by SZC Co. to comply with best practice in the management, maintenance and control of these potential fugitive releases. Unlike other UK reactor sites, the fuel tanks for the diesel generators will be housed in the same building as the engines. In order to reduce the impact of a spillage, the tanks will be located in a self-contained impermeably lined area of the diesel building which will significantly reduce the potential of a release to the environment. There are no internal drains within the diesel rooms and any spills would be captured in sumps and pumped out and disposed off-site as hazardous waste.

The consideration of environmental interactions at the design stage has ensured that risks posed by the permitted plant have been engineered out. This engineered approach also applies to the inventories of coolant/antifreeze and lubricating oil that is used in the generators. The exact design for the diesel buildings will be provided to the Environment Agency (if required) once it has been confirmed, this will also include the arrangements for pumping out any spillages from the diesel building basements. SZC Co. will also ensure that the interior of the building is appropriately lined or coated to prevent any egress of oil as a result of longer-term leaks or spills (given the design life of the plant is 60 years, this is an important aspect).

Full details of the drainage strategy for the installation will be developed at the detailed design phase and also provided to the Environment Agency (if required) once it has been confirmed. Forecourt separators are to be provided at all locations where fuel handling takes place. Penstocks are provided at the point of discharge to all forebays. All oily water drains on site will be routed through a Class 1 oil/water separator to the forebays, which then discharge with the cooling water via the outfall (this will be covered in detail under the Operational Water Discharge EP Application). The drainage system will be inspected during construction. Planned preventative maintenance and regular inspections will be carried out as part of the requirements of the IMS.

Consistent with other UK sites and best practice, areas associated with frequent handling of lubricating oil will have oil spillage kits available at the point of handling and on-site staff operating the installation will be appropriately trained. Tanker deliveries will take place adjacent to the diesel buildings and Class 1 forecourt oil/water separators are to be provided.

Key points that SZC Co. will address during the design and construction of the diesel buildings are:

- Engineering systems to minimise leakages from pipes and ensure swift detection if they do occur;

- Provide leak detection for any sub-surface pipework (all pipework will be internal to the building), sumps and storage vessels;
- Tanks and pipelines designed to comply with the Environment Agency guidance on oil storage regulations for businesses [37], BS 5410 code of practice for oil firing [48] and CIRIA advice [16] where relevant.
- Ensure that surfacing and containment of drainage facilities are adequate for all operational areas, taking into consideration collection capacities, surface thicknesses, strength/reinforcement, falls, materials of construction, permeability, resistance to chemical attack, and inspection and maintenance procedures; and
- The development of an inspection and maintenance programme for impervious surfaces and containment facilities (as part of the IMS).

For tanker delivery operations, the risk shall be assessed, and consideration will be given to the installation of the following measures to minimise risk to the environment from spillage:

- An impervious surface;
- Spill containment kerbs;
- Sealed construction joints;
- Permanent pipework systems which are corrosion resistant and avoidance of below surface pipework;
- Isolation (Penstock) Valves;
- Connection to a sealed drainage system; and
- Class I full retention oil/water interceptors.

Key guidance documents that SZC Co. will consider are:

- Environment Agency (2018) Oil storage regulations for businesses ‘How to store oil, design standards for tanks and containers, where to locate and how to protect them, and capacity of bunds and drip trays’ [37];
- Environment Agency (2016) Control and monitor emissions for your environmental permit, https://www.gov.uk/guidance/control-and-monitor-

emissions-for-your-environmental-permit [26];

- CIRIA. C736, Walton, I L W. (2014), Containment systems for the prevention of pollution. Secondary, tertiary and other measures for industrial and commercial premises [16];
- CIRIA C741, Charles, P., Edwards, P. (2015), Environmental good practice on site guide. 4th edition [17];
- The Control of Pollution (Oil Storage) (England) Regulations 2001 [47] – are generally applicable to the external storage of any potentially polluting liquid; and
- BS 5410:2014 Code of practice for oil firing [48].

Generally, where structures are designed to work without secondary containment (in this case a subsurface building), maintenance and regular inspections will be provided to a level that will provide equivalent protection.

Indicative BAT Requirements for Fugitive Emissions to Surface Water, Sewer and Groundwater

The design of the reference diesel generators includes protection against fugitive emissions, which could impact on land, water and groundwater. Compliance with the indicative BAT requirements for fugitive emissions to water, listed in **Table 3.11**, will be addressed at the site specific detailed design stage. When produced, the IMS will include procedures relating to the inspection of the surfaces and sumps, where needed, under the responsibility of the Operator.

Table 3.11: Indicative BAT Requirements for Fugitive Emissions to Surface Water, Sewer and Groundwater

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EPR 1.01: BAT is to: Oil Storage • Fit a high-level alarm to oil tanks. • Drain decanted water from oil storage tanks and storm water from bunded areas to a water treatment plant, or direct it to an appropriate disposal facility. You should deal with liquid effluents generated during periodic tank cleaning in a similar way.	The main diesel tanks will be located in a fully bunded room to capture any potential spills. There are no internal drains within the diesel rooms and any spills would be captured in sumps and pumped out and disposed off-site as hazardous waste All pipework will be internal to the building to ensure that the engineered bund in the building is not compromised. When the internal layout of the diesel buildings is finalised, this will detail all pipework and sumps. This

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Use oil removal facilities such as partition chambers or plate separators for water contaminated with oil. Cleaning liquids • Neutralise or treat wash waters and cleaning-out solutions to produce an acceptable waste before discharge or disposal. • Boiler cleaning wastes require appropriate disposal. Site drainage including rainwater • Use an efficient oil/water separation/interceptor system. Further treatment may be required to remove dissolved hydrocarbons. • Direct discharge to controlled waters will only be allowed where discharges will meet discharge requirements under all conditions.	will be provided to the Environment Agency as part of the FAP (Refer to Section 6 – FAP Ref. 1). As part of the development of the IMS, a maintenance programme will be developed. Cleaning liquids will be collected and disposed of off-site. Measures will be taken to reduce the generation of oily wastewater. Tanker deliveries will take place adjacent to the diesel buildings. Forecourt separators (Class 1) are to be provided at all locations where fuel handling takes place. Penstocks are provided at the point of discharge to all forebays. All oily water drains on site will be routed through an oil/water separator to the forebays, prior to discharge with the cooling water to the outfalls (this will be covered in detail under the Operational Water Discharge EP Application). Oil interceptors will be subject to inspection and maintenance programs as part of the IMS. The oil storage measures identified in Section 3 together with the use of oil interceptors address indicative BAT.
Environment Agency Guidance to control and monitor emissions for your environmental permit: The guidance lists the following steps to prevent fugitive emissions to surface water, sewer and groundwater: Leaks from containers: • Prevent leaks or accidental release of liquids that could cause pollution from tanks, sumps, containers and bunds. • Use bunds around tanks to capture anything that leaks from them. Piping and drainage: • Prevent leaks from underground structures and ensure that any leaks can be detected quickly. • Keep a record of the route of any underground drains or pipework on your site. • Fit and maintain oil separators to surface water drainage systems to prevent discharges being contaminated by oil.	All the fuel storage tanks will be housed within the diesel buildings and are discussed under point 1 of this table. Regular housekeeping will be carried out across the installation; this will include periodic inspections of the diesel buildings for leaks and the integrity of the bund and sealant/liner. Diesel deliveries will be supervised by trained personnel. All pipework will be internal to the building to ensure that the engineered bund in the building is not compromised. As-built location and routing of sub-surface structures will be recorded and be available to the Environment Agency. The basement area and any engineered sumps (to contain spillages) will be resistant to the fuel oil stored. The sumps will not be connected to the site drainage systems effectively isolating and bunding the tanks. Forecourt separators are to be provided at all locations where fuel handling takes place. Penstocks are provided at the point of discharge to all forebays. All oily water drains on site will be routed through an oil/water separator (this will be

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
Containment: • Provide containment (bunding) for underground pipework, sumps and storage vessels. Fit a leak detection system, for example if you're carrying out your activity in a groundwater Source Protection Zone. • Keep records of any underground sumps or storage vessels. • Sumps and bunds must be: - waterproof - resistant to any materials you're going to store in them • Sumps and bunds should not become contaminated or blocked as this may cause them to leak. - check that sumps and bunds are working correctly, for example that there are no cracks - hydraulically test any sump or bund if you're worried it is not working correctly - fit a high-level probe to any sumps or bunds that you cannot check with an alarm to alert you before waste begins to escape containment • Bunds must also have a capacity larger than both of the following: - 110% of the largest tank the bund is protecting - 25% of the combined volume of all the tanks the bund is protecting • Bunds must have no outlets (for example drains or taps), drain to a blind (completely enclosed) collection point or have self-contained pipework that is separate from the container pipework • Tanker connection points should be within the bund or designed to capture any leaks. • drain to a blind (completely enclosed) collection point or have self-contained pipework that is separate from the container pipework	covered in detail under the Operational Water Discharge EP Application). All wastes and raw materials used on the installation will be stored in dedicated facilities outside the installation boundary. These areas are not considered directly associated to the proposed installation as their primary purpose is to serve the reactor building, the storage of lubricating and waste oils from the diesel generators will comprise a minor portion of the volumes handled. These areas will be designed in line with best practice.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Tanker connection points should be within the bund or designed to capture any leaks. Storage areas for intermediate bulk containers, drums, bags • Bund or kerb any area where environmentally harmful substances are stored (for example lubricating oils and coolant). • Store substances separately if it may be risky to store them too near each other, for example because they're flammable or if 2 substances spilled and mixed could cause an explosion or harmful fumes. • Locate storage areas away from watercourses, sensitive groundwater areas such as Source Protection Zone 1, unprotected drainage systems and sensitive boundaries, for example near areas where people live or nature reserves • Clearly mark your storage areas, and any containers and packages in them • Define the maximum storage capacities for each of your storage areas and containers and stick to them • Store containers, including empty containers, with lids, caps and valves secured and in place • Inspect your containers, drums and small packages at least once a week to check they're not damaged or leaking and put a procedure in place to replace or repair damaged or leaking containers	

Where information on the design of the diesel buildings has not yet been developed, this will be recorded in the FAP (Refer to Section 6 - FAP Ref. 1) and a programme of work provided.

3.2 Odour

3.2.1 Sources

The diesel generators are not considered to have a significant odour related environmental impact, the potential sources of odour are:

- Diesel vapour vented during tank filling operations;

- Combustion gases from plant operations (maintenance runs and periodic nuclear safety tests); and
- Crankcase fume extract system venting from the EDGs.

Annual diesel use (per plant) is estimated to be 240m^3 and 56m^3 for the EDGs and the UDGs respectively. Diesel has a longer chain carbon than some alternative fuels making it less volatile and having a higher energy value (requiring less fuel to be used). For the EDGs (the main potential source of odour), this equates to less than one full refill of the main storage tanks per year though it is recognised that regular refilling will take place to maintain the tanks at a level consistent with the safety case requirements. Under a worst-case scenario, if the tanks are refilled after use, then each tank would be topped up once a month. However, each filling operation would be very brief (likely to be less than half an hour) and the nearest residential receptor is located 1km south (a transient receptor (Sandlings Walk Path) is located 180m north).

Combustion gases will be vented from the stack at a height of 27.2 metres. This stack height has been determined to give an optimum dispersion in relation to compliance with air quality standards and will also disperse any odour associated with the combustion process. The combustion process will be set up and maintained correctly to ensure the complete combustion of the fuel, which, will reduce any potential odour. The diesel operations will be kept to a minimum as they will only be run for test and maintenance purposes.

The crankcase fume extract system releases only occur from the EDGs (the UDG crankcase vent is to be recovered into the intake air). As part of the safety case, the two diesel generators have to be of a different type to prevent a common fault affecting all of the standby plant (this is why the recovery of the crankcase vent is not possible on the EDGs). The releases from the EDGs will be vented at the roof level of the diesel buildings. Each diesel generator will run for under 1% of the year. Experience across the EDF Energy fleet has shown crankcase vent releases do not cause an odour problem.

3.2.2 Complaints History

Based on experience of operating the combustion plant at Hinkley Point B (HPB) and SZB, the SZC installation is not expected to cause odour related environmental impact. This position is consistent with that observed at the other operational reactor sites managed by EDF Energy. The nearest residential receptor is located 1km south (a transient receptor (Sandlings Walk Path) is located 180m north). In addition, the diesel generators are operated infrequently and, in the event that, the plant is needed to safely operate or shut down the reactor operations, any associated odour release would be of minor concern.

However, if odours are considered problematic or if complaints of odour are received when operating, an assessment of the source and impacts will be carried out in line with the Environment Agency guidance to control and monitor emissions for your environmental permit [26], the H4 horizontal guidance on odour management [34] and the BAT conclusions for the large combustion plant [10].

Indicative BAT Requirements for Odour Control

Compliance with the indicative BAT requirements for odour control is given in **Table 3.12**.

Table 3.12: Indicative BAT Requirements for Odour Control

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
Environment Agency Guidance to control and monitor emissions for your environmental permit: The guidance lists the following measures to control and prevent odour emissions: • Restrict raw materials that are likely to cause odour. • Minimise quantities and storage times for odourous or potentially odourous materials. • Managing materials and processes in ways which minimise the production of odourous chemicals. • Working within the effective operating capacity of the site. • Providing effective containment and abatement for odourous materials and abatement. • Develop an odour management plan if your site causes odour pollution.	The diesel fuel tanks will be closed tanks, situated inside temperature-controlled buildings to reduce volatilisation. The only potential for fugitive (odorous) emissions arises during filling operations from the vent. Pressure relief and vacuum valves will be fitted as standard. SZC will develop an odour management plan if substantiated complaints are received.
H4 Odour management: The requirements for odour control will be installation-specific and depend on the sources and nature of the potential odour. The guidance lists the following measures to control odour: • Compliance with the conditions within the environmental permit • Managing inventory of odourous substances • Controlling evaporation • Containment and abatement • Dispersion • Reducing impacts	The diesel fuel tanks will be closed tanks, situated inside temperature-controlled buildings to reduce volatilisation. The only potential for fugitive (odorous) emissions arises during filling operations from the vent. Pressure relief and vacuum valves will be fitted as standard. SZC will develop an odour management plan if substantiated complaints are received.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Monitoring • Complaints	
LCP BATc 1: In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates an odour management plan for the combustion of malodourous substances.	N/A (an IMS will be implemented and an odour management plan will only be applicable if an odour issue is identified).

3.3 Noise and Vibration

Nuclear power stations emit sound during normal operation. Sources include systems such as back-up diesel generators, transformers, turbine generator units, heating, ventilation, And conditioning systems and pumps. The sound sources associated with the operation of the reactor are beyond the scope of this submission.

The diesel generators will be located within buildings. The primary sound sources from the back-up diesel generator building are as follows:

- Exhaust stacks on the roof (3 stacks per building, one per generator);
- Two fresh-air intakes at mid-level, one either side of the building (per generator), therefore a total of six per generator building; and
- Two fresh-air in/warm air out louvres per generator at higher level, therefore a total of six per generator building.

Additional sources from normal operations include tanker deliveries (fuel pumping) and the operation of mobile plant (in the form of small generators or compressors during outage periods).

Until final manufacturing and test data of the equipment for the UK EPR™ are available, each sound source has been assigned an acoustic sound power level based on similar sources for which data is available from similar operational reactors in France.

There is the potential for vibration from the equipment used for the combustion activities, however there are not considered to be any vibration issues associated with operations within the installation. The equipment will be mounted on appropriately designed anti-vibration mounts and located within the large concrete diesel generator buildings within the SZC Power station. Any vibration away from the development site is likely to be negligible and is not expected to give rise to

nuisance or damage to the closest residential properties (the nearest residential receptor from SZC is located 1km south (a transient receptor (Sandlings Walk Path) is located 180m north)).

Table 3.13 contains a list of the sound sources and their associated sound power levels within the installation.

Table 3.13: Diesel Generator Building Sound Source Levels

Building		Sound Sources	Sound Power Level (dB(L_{WA}))
Diesel Generator Buildings	HDA & HDB (Reactor 1)	Fresh air in/warm air out louvre (high-level)	90 per opening
		Generator fresh air intake (mid-level)	105 per opening
		Generator exhaust stack	105 per opening
	HAD & HDB (Reactor 2)	Fresh air in/warm air out louvre (high-level)	90 per opening
		Generator fresh air intake (mid-level)	105 per opening
		Generator exhaust stack	105 per opening

A sound level assessment of the potential impacts of the installations has been completed and is presented in Section 4.1.6.

At this stage in the development programme, from the available information, it is not possible to discount the possibility that during their operation, the combustion activities have the potential to disturb sensitive receptors in the proximity of the site. However, the risk is minimised due to the following factors:

- The standby (or back-up) diesel generators will be housed in concrete buildings which offers significant attenuation of the sound generated through combustion operations;
- The back-up diesel generators will be part of the site routine maintenance programme, and, as such, will be maintained to a high standard that is reflective of the operational control required at a nuclear power station;
- When operating, the back-up generators would be continuous, however this would be for less than 1% of the year. Where periodic tests and maintenance are required, they will be planned within daylight hours where possible, to minimise potential disturbance to local residents; and

- The nearest residential receptor is located 1km south (a transient receptor (Sandlings Walk Path) is located 180m north).

In the event that environmental noise complaints were to arise, then SZC Co. will respond in accordance with the enquiries and complaints requirements and noise management strategies set out in the relevant Code of Operational Practice to address these types of measure.

Indicative BAT Requirements for Noise

Table 3.14 discusses the installation's performance in relation to the indicative BAT requirements for noise.

Table 3.14: Indicative BAT Requirements for Noise

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
LCP BATc 17: In order to reduce noise emissions, BAT is to use one or a combination of the following techniques: • Appropriate location of equipment and buildings. Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens. These include: - Improved inspection and maintenance of equipment; - Closing of doors and windows of enclosed areas, if possible; - Equipment operated by experienced staff; - Avoidance of noisy activities at night, if possible; and - Provisions for noise control during maintenance activities. • Low-noise equipment. This potentially includes compressors, pumps and disks • Noise abatement noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings Noise-control equipment This includes: • Noise-reducers;	All plant and equipment in the proposed diesel generator plants are located around the central part of the overall power station and will be located inside concrete buildings to minimise the escape of noise. All equipment to be used in the proposed plant will be new and selected to be low-noise models as far as is reasonably practicable. Diesel deliveries are anticipated to be restricted to daytime hours. A noise assessment was undertaken for the proposed diesel generators (see Appendix E of the Application supporting document) which shows that when compared against the existing background noise levels, the expected noise levels from the proposed development will not result in significant adverse impacts). All maintenance activities at the proposed plant will be scheduled such that minimum disturbance occurs from any resultant noise. In the event that environmental noise complaints were to arise, then SZC Co. will respond in accordance with the enquiries and complaints requirements and noise management strategies set out in the relevant Code of Operational Practice to address these types of measure. Rotating items of plant will be mounted on appropriately specified anti-vibration mounts.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Vibration or acoustic insulation, or vibration isolation; • Enclosure of noisy equipment; and • Soundproofing of buildings.	
LCP BREF Note: Noise Reduction Program • Noise Assessment • Evaluation of noise abatement techniques • Identification of the most cost-effective combination of techniques that ensures compliance with the legal requirements such as noise zoning; • Verification of the programme efficiency and monitoring of noise emissions at regular intervals Operational and management techniques in buildings containing noisy equipment: • Improved inspection and maintenance of equipment to prevent excessive wear and failures leading to higher noise generation (e.g. in blowers and bearings); • Closing of doors and windows of covered areas; • Equipment operation by experienced staff; • Avoidance of noisy activities at night-time; and • Provision for noise control during maintenance activities • Careful orientation and location of noise-emitting machinery, also taking into consideration the change of frequency of the sound • Use of Low Noise Equipment • Installation of noise-reducers (e.g. mufflers, high level flue gas silencers) on equipment and ducts • Vibration insulation of machinery, good design and decoupled arrangement of noise sources and potentially resonant components such as compressors and ducts (such as anti-vibration supports and interconnections for equipment). • Enclosure of noisy equipment (e.g. compressors, feed pumps) in separate structures such as buildings or soundproofed	Refer to LCP BATc 17 above for additional compliance measures. If noise is considered problematic or if complaints of noise are received when operating, an assessment of the source and impacts will be carried out in line with the Environment Agency guidance to control and monitor emissions for your environmental permit, the H3 Part 2 horizontal guidance on noise assessment and control and the BAT conclusions for the large combustion plant. Diesel generators will be inspected and maintained as per the IMS. Routine testing of the diesel generators will take place during the day and for approximately 60 hours per annum. The detailed design of the buildings will ensure that a high level of attention is paid to ensuring that the potential for sound leakage through openings and penetrations in the building envelopes is minimised.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
cabinets with an internal lining made of absorbent material. Soundproofing of buildings to shelter any noisy operations. Protection walls, embankments and buildings are inserted between the emitter and the receiver.	
Environment Agency H3 Part 2 Noise Assessment and Control: Noise control at the planning stage • Selection of inherently quiet plant or "low–noise options"; • Site layout to maximise natural screening, screening by buildings and separation distances; • Orientation of directional noise sources away from sensitive receivers; and • Noise barriers and bunding. Noise Management Techniques • Routine maintenance of plant • Good operational site practices • Restricting operating hours	Refer to LCP BATc 17 above for additional compliance measures. There are no available alternative processes involving inherently quieter plant that could provide the required emergency backup electrical generation capability.

3.4 Monitoring

3.4.1 Sources of Monitoring Guidance

There are a number of sources of guidance in determining the appropriate monitoring equipment and techniques to be applied at a permitted installation. Those potentially relevant to this installation include:

- Environment Agency combustion sector guidance EPR 1.01 [6];
- BAT Reference Document for Large Combustion Plants (LCP) (2010/75/EU, European Commission, 2017) [7];
- Establishing Best Available Techniques (BAT) Conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for Large Combustion Plants, July 2017 [10];

- Directive (EU) 2015/2193 of The European Parliament and of the Council on the Limitation of Emissions of Certain Pollutants into the Air from Medium Combustion Plants (Medium Combustion Plant Directive) [11];
- Directive (EU) 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control [8];
- Environment Agency (2018) Environmental Permitting Technical Note 1/1 (18) Reference document for combustion plant of 20 to 50 MW thermal capacity [13];
- Environment Agency, Technical Guidance Note (Monitoring) M1 Sampling requirements for stack emission monitoring, Version 8, August 2017 [54];
- Environment Agency, Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air, Version 12, August 2017 [55];
- Environment Agency, Technical Guidance Note (Monitoring) M3 How to assess monitoring arrangements for emissions to air in EPR permit application, Version 2, January 2016 [56];
- Environment Agency, Technical Guidance Note (Monitoring) M5 Monitoring of stack gas emissions from medium combustion plants and specified generators, Version 1, September 2018 [57];
- Environment Agency, Technical Guidance Note (Monitoring) M8 Ambient monitoring strategy Version 2, May 2011 [58];
- Environment Agency, Technical Guidance Note (Monitoring) M15 Monitoring PM10 and PM2.5, Version 2, July 2012 [59];
- Environment Agency, Technical Guidance Note (Monitoring) M16 Monitoring VOCs in stack gas emissions, Version 5, November 2016 [60];
- Environment Agency, Technical Guidance Note (Monitoring) M20 quality assurance of continuous emissions monitoring systems, Version 4, July 2018 [61];
- Environment Agency, Technical Guidance Note (Monitoring) M22 Measuring stack gas emissions using FTIR instruments, Version 3, March 2012 [62]; and

- BS/EN TS 14793 Stationary source emissions. Demonstration of equivalence of an alternative method with a reference method [63].

Consideration has been given to this guidance in the determination of BAT for the diesel emissions. Where monitoring is performed, it will be consistent with the Environment Agency MCERTS.

3.4.2 Emissions Monitoring

The installation comprises 12 diesel generators in four separate buildings (two EDGs and one UDG per building), the air emissions from which discharge through 12 separate stacks with each stack emitting combustion gases for as assumed maximum of 60 hours per year. This figure is based on operating experience of SZB and the most recent French 'N4' type nuclear power station (and closest operational comparison with the UK EPR™) and is likely to be conservative (the required time of testing being 20 hours per engine). This bounding scenario equates to less than 1% of the year for each combustion plant and would therefore mean that any monitoring equipment would lay dormant for over 99% of the year.

It is proposed that there will be no continuous emissions monitoring equipment fitted to the diesel exhaust stacks but that monitoring ports are incorporated into the design to allow extractive monitoring to be carried out. It should be noted that there will be monitoring of process variables CO, temperature and oxygen (Section 3.4.4). Monitoring of the diesel emissions will be carried out as part of the commissioning programme of work and a review of NO_X generation by the diesel engines will be carried out during the operational phase. Given that LOOP events lasting 24 hours or more are extremely rare events and cannot be predicted, no monitoring of the diesel emissions is proposed during LOOP scenarios.

There are no emissions to controlled waters either directly or indirectly from the installation with the exception of uncontaminated surface water drainage from within the installation boundary and there is also the potential for point source emissions to water from associated plant (i.e. out with the installation).

Monitoring methods and locations will be agreed with the Environment Agency prior to commencement of commissioning as part of the FAP (Refer to Section 6 - FAP Ref. 5i) to allow developments in monitoring methods between the point of application and the start of commissioning to be incorporated. The environmental permit will specify the applicable analytical requirements for emissions monitoring and emission limits.

Monitoring of Emissions to Air

The combustion of diesel produces a gaseous emission containing five main pollutant parameters:

- NOX;
- SO2;
- CO;
- PM; and
- VOCs.

Monitoring will be performed in accordance with the Environment Agency's MCERTS. Where available, monitoring standards should be used including Comité European de Normalization (CEN) monitoring standards, ISO standards, or national or international standards where they provide data of equivalent scientific quality. M2 Monitoring Guidance Note [55] provides guidance on different approaches to monitoring stack emissions, sampling strategies and choice of technique, method and equipment. In addition, BS/EN TS 14793 [63] also provides alternative methods.

These will be reviewed prior to monitoring being carried out to ensure the most relevant standards are applied. It is envisaged that any monitoring requirements of the permit will be met through the use of external contractors who will use MCERTS accredited facilities, methods and staff.

In the event that in-house facilities or equipment is used, then the same standards and methods will be applied, and detailed procedures produced to document the methods and techniques used.

The design of sampling ports will be consistent with Environment Agency Technical Guidance Note M1 [54] and BS EN 15259:2007 [64]. For the sampling of PM, the location of the port in relation to the dispersion across the profile of the stack will also be considered in line with BS ISO 9096:2017 [65] (or appropriate). Continuous emissions monitoring and permanently installed monitoring systems are not proposed for the reasons already stated (with the exception of continuous monitoring of process variables CO, temperature and oxygen (Section 3.4.4)).

The point source emissions to air from the installation are detailed in Section 3.1 of this submission (**Table 3.1**). **Table 3.15** and **Table 3.16** below detail the expected pollutants for each release point and the methods to be applied to monitoring.

Table 3.15: Point Source Emissions to Air - Monitoring Requirements

Reference	Description	Discharges	Monitoring
A1, A2, A4, A5, A7, A8, A10, A11	EDG emissions	NO_X, SO_2, VOC, CO, PM	TBC
A3, A6, A9, A12	UDG emissions	NO_X, SO_2, VOC, CO, PM	TBC

Table 3.16: Monitoring Arrangements for Point Source Emissions to Air

Substance or Parameter	Monitoring Point	Monitoring Frequency	Monitoring Method[11]	Other Specifications
NO_X (as NO_2)	A1-A12	TBC	A range of extractive methods are available. Monitoring Standard BS EN 14792:2017 [66] should be applied.	M2 [55], M22 [62] and BS/EN TS 14793 [63]
SO_2	A1-A12	TBC	Various methods include BS EN 14791:2017 [67] and TGN M22 [62].	M2 and BS/EN TS 14793 [63]
PM	A1-A12	TBC	BS EN 13284-1:2017 [68] (if <50 mg/m^3) or BS ISO 9096:2017 [65] (if > 50 mg/m3) depending on the concentration	Isokinetically to the requirements of BS ISO 9096:2017 [65] or future appropriate standard.
CO	A1-12	TBC	A range of extractive methods are available. Monitoring Standard BS EN 15058:2017 [69] should be applied	M2 [55], M22 [62] and BS/EN TS 14793 [63]
VOC	A1-12	TBC	Various extractive methods, standards include PD CEN/TS 13649:2014 [70] and M22 [62].	US EPA Method 18 [71]

Emission Limit Values

The following sources of benchmarks and emissions limits have been considered in preparing proposed limits for the installation:

Table 3.17: Benchmarks and Emissions Limits

Benchmarks	Emission Limits
Industrial Emissions Directive [8]	Chapter III Article 29 of the IED only applies to combustion plants if they release their emissions via a common stack. Specifically relevant to the combustion activities installation is the requirement for "separate combustion plants which are installed in such a way that, taking technical

11. Methods outlined are consistent with Section 2 – Periodic Sampling Standards of the Environment Agency, Technical Guidance Note (Monitoring) M2 Monitoring of Stack Emissions to Air [55].

Benchmarks	Emission Limits
	and economic factors into account, their waste gases could in the judgment of the competent authority, be discharged through a common stack, are to comply with the EU-wide emission limit values and monitoring requirements laid down in Annex V of the IED". However, the diesel generators have a separate independent operated stack for nuclear safety reasons and a shared stack would potentially restrict this ability if the stack were to be compromised in any way. It is therefore considered that the ELVs defined within the IED are not applicable to the combustion activities installation.
LCP BAT conclusions [10]	The LCP BAT conclusions document applies only to combustion plants with a total rated thermal input of 50 MW or more (the LCP BAT conclusions definition of combustion plants is in line with the IED Article 29 (1) definition, so it includes single technical apparatus and units which share a common stack). As the standby generation plant (EDGs and UDGs) do not contain individual units, or units, which share a common stack, over 50 MW_{th}, the BAT conclusions and BAT-AELs do not apply to the power station standby generation plant. It is further noted that many of the BAT conclusions relating to operating techniques specifically exclude standby plant and plant operating less than 500 hours a year.
Medium Combustion Plant Directive (MCPD) [11]	The MCPD applies to all combustion plant with a rated thermal input of equal to or greater than 1 MW_{th} and less than 50MW_{th} regardless of the type of fuel used. Due to the very limited duration of these emissions (<60 hours) these are exempt from the ELVs applicable to the MCPD and associated regulations as the specified ELVs are not applicable to combustion plant that operate for less than 500 hours/year (over a five-year averaging period). SZC intends to operate each standby generator for significantly less than 500 hours a year and seeks to make use of this exemption for the standby generators.
EPR 1.01 combustion sector guidance [6]	The Environment Agency combustion sector guidance was withdrawn in August 2018 and replaced with the LCP BREF and BAT conclusions document. The Environment Agency noted that the combustion sector guidance is still current, however some of the documents referred to in the guidance have been withdrawn and replaced with new versions. Although EPR 1.01 covers combustion plants which aggregate to over 50 MW_{th}, the emissions benchmarks set out in EPR 1.01 Annex 1 are all specified for a combustion plant with a rated thermal input greater than 50 MW_{th}. These benchmarks are therefore not directly applicable to the EDGs and UDGs.
Specified generator guidance [12]	The specified generator guidance applies to generators that generate electricity and that are between 1 and 50 MW_{th} (or to two or more generators that aggregate to a capacity over 1 MW_{th} but less than 50 MW_{th}). However, the EDGs and UDGs do not fall under the specified generator guidance as the generators are operating with a defined nuclear safety role under a nuclear site licence issued by the ONR and are used as back-up generators operated for the purpose of testing (< 50 hours per year).

Benchmarks	Emission Limits
Environmental permitting technical note 1/1(18) for combustion plant of 20 to 50 MW_{th} [13]	This reference document was issued by the UK Government and applies to combustion plant of 20 to 50 MW_{th}. The EDGs fall within this range, although the UDGs fall below this range. However, the reference document states that it does not apply to combustion plant sites where the aggregated thermal input capacity of the combustion plant is over 50 MW_{th}, and the BAT conclusion for large combustion should be used.
Developing BAT for combustion plants operating in the balancing market [14]	The Department for Energy and Climate Change commissioned a review of combustion plant over 2 MW_{th} operating in the balancing market, in order to establish an evidence base to assist in the definition of BAT for plant used for this purpose. The scope of the review included plant operating less than 1,500 hours a year, producing electricity for commercial supply purposes (this included compression ignition diesel-fired engines). The review did not cover standby plant used for emergency on-site electricity supply, however, the review report does provide some information on emissions and abatement techniques from a small selection of diesel engines used in the balancing market and has therefore been considered as a source of benchmarking information with some relevance to standby plant.

Source of the Pollutants Emission Concentration

In the absence of defined ELVs for the specific combustion activities installation activities, it has been conservatively assumed for the purposes of assessment, that pollutant emissions of CO and PM for the EDGs will be at emission limit values which have been taken from environmental benchmark values for a compression ignition engine running on liquid fuel, published in Annex 1 of the Environment Agency EPR 1.01 combustion sector guidance [6], where applicable.

Pollutant Emission Concentrations for NO_x and SO_2 for the EDGs has been derived from current design information and the SCOLF Regulations 2007 [4] respectively.

The pollutant emission concentrations for NO_x are above the benchmarks and limits in the BAT guidance documents. Given that the diesel engines will be operating in standby mode, for which secondary abatement is not appropriate, they will produce significantly higher emissions compared to engines run in continuous mode. As discussed above, the benchmarks and limits in the BAT guidance will not apply to the diesel generators given that the air emissions will not share a common stack, the diesel generators will operate for <60 hours a year and they will be used as a back-up generator.

ELVs for the UDGs have been derived from design information.

Table 3.18 details the benchmark values from EPR 1.01 combustion sector guidance [6].

Table 3.18: EPR 1.01 Benchmark Values for Liquid Fuelled Compression Ignition Engines

Pollutant	Compression Ignition Benchmark Value (mg/m^3)
PM	50
SO_2	66
NO_x	150
CO	150

Monitoring of Emissions to Water and Sewer

No emissions are proposed to be made from the installation to controlled water or to sewer. Although there are expected to be some emissions to drains/sewer from the release of surface water run off; these releases are not process related.

Monitoring of Waste Emissions

Waste from the EDGs and UDGs will be recorded as a contribution to the total waste generated from the wider installation activities. This record will be maintained as part of the overall management of the power station, under the Operator's responsibility (waste management and handling are discussed further in Section 5).

Indicative BAT for Monitoring of Emissions

The indicative BAT requirements for monitoring provided in the IPPC combustion SGN [15], LCP BAT conclusions [10], specified generator guidance [12] and EP technical note 1/1 (18) [13] are shown below and a comparison with the proposed activities at the installation is provided.

Compliance with the indicative BAT requirements for monitoring is given in **Table 3.19**.

Table 3.19: Indicative BAT for Monitoring

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
Specified Generator Guidance: You must monitor emissions at least every 3 years where secondary abatement is fitted or every 1,500 hours if you are operating under the 500 hour per annum exemption.	Secondary abatement is not required to be fitted to meet the ELV as the diesel generators are excluded generators.
IPPC SGN Combustion: Monitoring should generally be undertaken during all phases of operation (i.e. commissioning, start-up, normal operation and shutting-down) unless the Regulator agrees that it is inappropriate.	For EDGs and UDGs, the engines start-up and shut down within a very short period of time, and monitoring is therefore not considered necessary, unless explicitly required. Monitoring will be carried out as part of the commissioning programme and operational monitoring will be carried out in line with the environmental permit.
IPPC SGN Combustion: Continuous monitoring (or at least sampling in the case of water) and recording are likely to be required under the following circumstances: • Where the potential environmental impact is significant, or the concentration of substance varies widely; • Where a substance is abated continuous monitoring of the substance is required to show the performance of the abatement plant. For example, continuous monitoring of dust is needed after a fabric filter to show the effectiveness of the filter and indicate when maintenance is needed, or sampling BOD from an effluent treatment plant; and • Where other control measures are required to achieve satisfactory levels of emission (e.g. material selection)	Continuous monitoring of air emissions is not considered to be appropriate at the installation due to the intermittent and limited operation of the plant. Continuous Emission Monitors would be unused for much of the year (>99%) whilst the EDGs and UDGs are in stand-by mode. Discharges to water from the site will be intermittent and due to run off rather than process operations and as such continuous monitoring is not appropriate. No abatement is proposed for the diesel generators.
IPPC SGN Combustion: Where effective surrogates are available, they may be used to minimise monitoring costs.	This may apply to the calculation of SO_2 emissions. As sulphur releases are directly related to fuel throughput, the rate of sulphur (and therefore SO_2) release can be accurately calculated.
IPPC SGN Combustion: Where monitoring shows that substances are not emitted in significant quantities, it may be possible to reduce monitoring frequency.	Not considered to be applicable.
Monitoring and Reporting of Emissions to Air	
IPPC SGN Combustion: Where appropriate, periodic visual and olfactory assessment of releases should be undertaken to ensure that all final releases to air should be essentially colourless, free from persistent trailing mist or fume and free from droplets.	Visual and olfactory assessments will be carried out as part of the maintenance process. These assessments will be recorded as part of the site integrated management system.
LCP BATc 4. BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international	Given the occasional planned operation of the diesel generators (<500 hours), continuous monitoring is not considered appropriate (with the exception of process variables), and periodic monitoring is proposed.

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>standards that ensure the provision of data of an equivalent scientific quality.

<table>
<tr><th>Substance/ Parameter</th><th>Fuel/ Process/ Type of Combustion Plant</th><th>Combustion Plant Total Rated Thermal Input</th><th>Standard(s)</th><th>Minimum Monitoring Frequency</th><th>Monitoring associated With</th></tr>
<tr><td>NO_x</td><td>Natural-gas fired boilers, engines and turbines</td><td>All sizes</td><td>Generic EN Stds</td><td>Continuous</td><td>BAT 42
BAT 43</td></tr>
<tr><td>CO</td><td>Natural-gas fired boilers, engines and turbines</td><td>All sizes</td><td>Generic EN Stds</td><td>Continuous</td><td>BAT 49
BAT 56</td></tr>
<tr><td>CH_4</td><td>Natural-gas fired boilers, engines and turbines</td><td>All sizes</td><td>Generic EN Stds</td><td>Once every year</td><td>BAT 45</td></tr>
<tr><td colspan="6">Notes: (1) For gas turbines, periodic monitoring is carried out with a combustion plant load of >70 %.</td></tr>
</table>
</td><td>Monitoring of the diesel emissions will be carried out as part of the commissioning programme of work. This data will be used to validate (or revise) the dispersion modelling carried out. Monitoring of the flue gases will be in accordance with relevant British Standards and Environment Agency technical guidance notes.</td></tr>
</table>

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>EP Technical Note 1/1 (18): BAT for emissions testing is:
4.5.1 Where annual emission testing is required it is essential that the Operator has sufficient monitoring locations for testing. Guidance on testing locations can be found in the Environment Agency's Technical Guidance Note (Monitoring) M1: Sampling requirements for stack monitoring or appropriate regulator's guidance. It is also advisable for the Operator to employ the services of an emissions testing company before they apply for a permit to determine if emissions monitoring can be undertaken.
4.5.2 Where emissions monitoring is required but cannot be safely or correctly undertaken the regulator should refuse the permit.
4.5.3 If considered necessary the regulator should include permit conditions detailing the requirements needed, (e.g. design, access, etc.) to undertake periodic emissions testing.</td><td>Monitoring would be required every 5 years. However, the aggregate rated thermal input is 50 MW or more and therefore the EP technical note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.</td></tr>
<tr><td>EP Technical Note 1/1 (18) 5.1.1: Emissions of carbon monoxide, dust, oxides of nitrogen, sulphur dioxide and smoke should be controlled.</td><td>The diesel engines are to be used infrequently and emissions will only be generated during commissioning, routine testing and LOOP scenarios.
Diesel engines will be maintained to ensure optimum thermal and electrical efficiency and to minimise emissions generation as part of the site IMS.
Emissions monitoring will be carried out as part of the commissioning programme of work. Monitoring of the flue gases will be in accordance with relevant British Standards and Environment Agency technical guidance notes.
Visual and olfactory assessments will be carried out as part of the maintenance process. These assessments will be recorded as part of the site IMS.</td></tr>
<tr><td>EP Technical Note 1/1 (18) 5.1.2: BAT is to monitor emissions to air according to the standard and with at least the minimum frequency specified below:<table><tr><th>Substance/ Parameter</th><th>Standard(s)</th><th>Minimum Monitoring Frequency</th></tr><tr><td>Carbon Monoxide</td><td>EN 15058</td><td rowspan="2">Once every year *</td></tr><tr><td>Dust</td><td>EN 13284-1</td></tr></table></td><td>Monitoring would be required every 5 years. However, the aggregate rated thermal input is 50 MW or more and therefore the EP Technical Note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.</td></tr>
</table>

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
<table><tr><td>Oxides of Nitrogen (NO and NO_2, expressed as NO_2)</td><td>EN 14792</td><td></td></tr><tr><td>Sulphur Dioxide</td><td>EN 14791</td><td></td></tr><tr><td>Smoke (Ringlemann)</td><td>BS 2742:2009</td><td>Daily when in operation</td></tr></table> * For plants which operate for less than 500 hours per year, the minimum monitoring frequency is once every 500 operating hours or once every 5 years, whichever comes first.	
EP Technical Note 1/1 (18) 5.1.3 to 5.1.7: BAT is the following for emissions monitoring: • For newly permitted plant, the first measurements shall be carried out within four months of the grant of a permit or of the date of the start of the operation, whichever is the latest. • In determining whether more frequent monitoring than that set out in Tables 5.2 to 5.5 or continuous monitoring is required. The regulator should have regard to the following factors: – the level of risk to local air quality or other sensitive receptors; – variability in operating conditions, e.g. waste types and feed rate; – absence of secondary dust abatement or reliance on cyclones; and – Final Draft EPR Technical Note 1/1(18) Page 16 of 22 In the case of continuous measurements, the automated measuring systems shall be subject to checking by means of parallel measurements with the reference methods at least once per year and the Operator shall inform the regulator about the results of those checks. • During each measurement, the plant shall be operating under stable conditions at a representative even load. In this context, start-up and shut-down periods shall be excluded. • Whether sampling on a continuous or non-continuous basis care is needed in the design and location of sampling systems in order to	Emissions monitoring will be carried out as part of the commissioning programme of work. Monitoring of the flue gases will be in accordance with relevant British Standards and Environment Agency Technical Guidance Notes. Given the occasional planned operation of the diesel generators (<500 hours), continuous monitoring is not considered appropriate, and periodic monitoring is proposed The aggregate rated thermal input is 50 MW or more and therefore the EP Technical Note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
obtain representative samples for all release points. – Sampling points on new plant should be designed to comply with the British or equivalent standards, see paragraph above. – The Operator should ensure that relevant stacks or ducts are fitted with facilities for sampling which allow compliance with the sampling standards	
EP Technical Note 1/1 (18) 5.3.1 to 5.3.3. BAT is the following for Compliance with Emission Limit Values: • Compliance monitoring can be carried out either by use of a continuous emission monitor (CEM), or by periodic extractive measurements. • In the case of periodic measurements, the emission limit values shall be regarded as having been complied with if the results of each of the measurements or of the other procedures do not exceed the relevant emission limit value. • In the case of continuous measurements, the emission limit values shall be regarded as having been complied with if the evaluation of the measurements results indicates, for operating hours within a calendar year, that all of the following conditions have been met: – (a) No validated monthly average value exceeds the relevant emission limit values; – (b) No validated daily average values exceed 110% of the relevant emission limit values; – (c) In cases of combustion plants composed only of boilers using coal, no validated daily average value exceeds 150% of the relevant emission limit values; – (d) 95% of all the validated hourly average values over the year do not exceed 200% of the relevant emission limit values. • The validated hourly and daily average values shall be determined from the measured valid hourly average values after having subtracted the value of the confidence interval specified below.	Emissions monitoring will be carried out as part of the commissioning programme of work. Given the occasional planned operation of the diesel generators, continuous monitoring is not considered appropriate (with the exception of process variables), and periodic monitoring is proposed. The aggregate rated thermal input is 50 MW or more and therefore the EP Technical Note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• At the emission limit value, the values of the 95% confidence intervals of a single measured result shall not exceed the following percentages of the emission limit values: – Carbon monoxide 10% – Sulphur dioxide 20% – Nitrogen dioxide 20% – Dust 30% • Any day in which more than three hourly average values are invalid due to malfunction or maintenance of the automated measuring system shall be invalidated. If more than 10 days over a year are invalidated for such situations the regulator shall require the Operator to take adequate measures to improve the reliability of the automated measuring system.	
EP Technical Note 1/1 (18) 5.4.1 to 5.4.4. BAT is the following for Other Emissions to Air: • 5.41 Emission from combustion processes, including gas turbines should, in normal operation, be free from visible smoke. • 5.4.2 During start-up and shut-down combustion emission of smoke should not exceed the equivalent of Ringelmann Shade 1. • 5.4.3 For gas turbines, a monitor for visible emissions should be calibrated to sound an audible alarm in the event of smoke emissions exceeding the equivalent of be recorded. • 5.4.4 All other releases to air other than condensed water vapour, including emission from materials handling operations, should be free from persistent visible emissions.	Visual and olfactory assessments will be carried out as part of the maintenance process. These assessments will be recorded as part of the site IMS. The diesel engines are to be used infrequently and emissions will only be generated during commissioning, routine testing and LOOP scenarios. Diesel engines will be maintained to ensure optimum thermal and electrical efficiency and to minimise emissions generation as part of the site IMS. The aggregate rated thermal input is 50 MW or more and therefore the EP Technical Note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.
EP Technical Note 1/1 (18) 5.5.1. Higher emissions may occur during start-up and shutdown of a process. These emissions can be reduced, by minimising, where possible, the number of start-up and shut-downs and having adequate procedures in place for start-up, shut-down and emergency shut-downs	The diesel engines are to be used infrequently and emissions will only be generated during commissioning, routine testing and LOOP scenarios. Diesel engines will be maintained to ensure optimum thermal and electrical efficiency and to minimise emissions generation as part of the site integrated management system. The aggregate rated thermal input is 50 MW or more and therefore the EP Technical Note 1/1 (18) is not applicable and the LCP BAT conclusions should be relied upon.
EP Technical Note 1/1 (18)5.6.1 to 5.6.6 BAT is the following for Reporting and Notifications:	The aggregate rated thermal input is 50 MW or more and therefore the EP Technical Note 1/1 (18) is not

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
5.6.1 Communication between the Operator and the regulator is essential for an effectively regulated installation. 5.6.2 Where an Operator undertakes periodic emissions monitoring, the Operator should notify the regulator, sufficiently in advance, of the monitoring exercise taking place to allow the regulator to witness the testing. 5.6.3 Subsequently the Operator should submit the results of any periodic emission testing to the regulator once they have received the results. This submission should be within a timescale and format agreed with the regulator. Notwithstanding the requirements of paragraph 5.6.5, where an Operator undertakes continuous emissions monitoring, the Operator should report all results (including the results of parallel measurements using the relevant reference method) at least annually, or more frequently if required by the regulator. This submission should be within a timescale and format agreed with the regulator. 5.6.4 Where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported as well as an estimation of the error involved. 5.6.5 In the event of any non-compliance with any emission limit value, or malfunctions and breakdown of the plant that leads to abnormal operating conditions or complaints about odour and / or smoke; the Operator shall take the measures necessary to ensure that compliance is restored within the shortest possible time. This action should include but is not limited to: a) Notify the regulator within 24 hours of receiving the information to agree: a) the investigation of the issue. b) Undertake the agreed investigation. c) Adjust the process or activity to minimise those emissions. d) If applicable re-test to demonstrate compliance as soon as possible. e) Promptly record the events and actions taken. f) Submit to the regulator the report and updates as agreed. 5.6.6 The Operator should inform the regulator, without undue delay, of any proposed changes to the plant which could affect the applicable emission limit values. This notification should be sufficiently in	applicable and the LCP BAT conclusions should be relied upon.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
advance of those changes coming into effect for the regulator to make the necessary assessments with a view to varying the permit as appropriate.	
Monitoring and reporting of emissions to water and sewer	
IPPC SGN Combustion: For combustion plants co-incinerating waste and operating air pollution control equipment with an aqueous discharge, Operators should comply with Article 8 or Annexes III and IV of the Waste incineration Directive (WID).	Not applicable to the diesel generator installation.
IPPC SGN Combustion: The Operator should also have a fuller analysis carried out covering a broad spectrum of substances to establish that all relevant substances have been taken into account when setting the release limits. This should cover the substances listed in Schedule 5 of the Regulations, unless it is agreed with the Regulator that they are not applicable. The need to repeat such a test will depend upon the potential variability in the process and, for example, the potential for contamination of raw materials. Where there is such potential, tests may be appropriate.	Not applicable to the diesel generator installation.
IPPC SGN Combustion: Any substances found to be of concern, or any other individual substances to which the local environment may be susceptible and upon which the operations may impact, should also be monitored more regularly. This would particularly apply to the common pesticides and heavy metals. Using composite samples is the technique most likely to be appropriate where the concentration does not vary excessively.	Not considered to be applicable.
Monitoring and reporting of waste emissions	
IPPC SGN Combustion: For waste emissions, the following should be monitored and recorded: • The physical and chemical composition of the waste; • Its hazard characteristics; and • Handling precautions and substances with which it cannot be mixed.	Waste from the EDGs and UDGs will be recorded as a contribution to the total waste generated from the site activities. This record will be maintained as part of the overall management of the power station, under the Operator's responsibility.

3.4.3 Environmental Monitoring

Environmental Monitoring

As discussed, monitoring of the diesel emissions will be carried out as part of the commissioning programme of work as part of the FAP (Refer to Section 6 - FAP Ref. 5ii) and a review of NO_X generation by the diesel engines will be carried out during

the operational phase as part of the environmental performance review as part of the FAP (Refer to Section 6 - FAP Ref. 5iii). Given that LOOP events lasting 24 hours or more are extremely rare events and cannot be predicted, no monitoring of the diesel generator emissions is proposed during LOOP scenarios. This data will also be used to validate (or revise) the dispersion modelling carried out. The availability of plant due to manufacturer's maintenance requirements and periodic nuclear safety tests will also affect the number of running hours (and is likely to reduce this significantly). If necessary, a revised impact assessment will be provided. It is noted that the highest priority remains the nuclear safety purpose of the generators

The results of the noise assessment (refer to Section 4) indicate that there is no requirement for noise monitoring at receptors beyond the installation boundary.

Based on experience of operating the combustion plant at HPB and SZB, the SZC installation is not expected to cause odour related environmental impact. This position is consistent with that observed at the other operational reactor sites managed by EDF Energy.

As the procurement programme develops and equipment is purchased, indicative plant specific releases will become available to refine the current impact assessments and where significant impacts are identified, a review of the approach to monitoring and environmental protection will be required.

Indicative BAT Requirements for Environmental Monitoring

Table 3.20 provides a comparison of the indicative BAT requirements against the proposed operations on the SZC installation.

Table 3.20: Indicative BAT Requirements for Environmental Monitoring (Beyond installation)

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
IPPC SGN Combustion: Describe the proposed measures for monitoring emissions, including any environmental monitoring, and the frequency, measurement methodology and evaluation procedure proposed.	Emissions monitoring will be carried out as part of the commissioning process (Refer to Section 6 – FAP Ref. 5ii). This will be described in detail in the Commissioning Plan. Emissions monitoring will also be carried out during the operational phase as part of the environmental performance review (Refer to Section 6 – FAP Ref. 5iii) If emissions are considered problematic or if complaints are received when operating, an assessment of the source and impacts will be carried out in line with Environment Agency guidance.
IPPC SGN Combustion: The Operator should consider the need for environmental monitoring to assess the effects of emissions to controlled water,	The emissions from the installation will be intermittent and probably of limited environmental impact. Nevertheless, this has to be confirmed during the

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
groundwater, air or land, or emissions of noise or odour.	commissioning stage by a detailed impact assessment. The processes operated at the installation are inherently non-odorous, and therefore monitoring of the odour beyond the site boundary is expected not to be considered appropriate. This will be assessed in more detail when the plant is commissioned. Although combustion engines do generate noise, the location and containment of the engines within solid structures and buildings maintains an effective barrier between the source and the receptor. Routine noise monitoring is therefore not expected to be required although as noted in Section 4 this will be confirmed at the commissioning stage.
IPPC SGN Combustion: Environmental monitoring may be required, for example, when: • There are vulnerable receptors; • The emissions are a significant contributor to an Environmental Quality Standard (EQS) that may be at risk; • The Operator is looking for departures from standards based on lack of effect on the environment; and • To validate modelling work.	Emissions monitoring will be carried out as part of the commissioning process (Refer to Section 6 – FAP Ref. 5ii). This will be described in detail in the Commissioning Plan.
IPPC SGN Combustion: The need should be considered for: • Groundwater, where it should be designed to characterise both quality and flow and take into account short- and long-term variations in both. Monitoring will need to take place both up-gradient and down-gradient of the site; • Surface water, where consideration will be needed for sampling, analysis and reporting for upstream and downstream quality of the controlled water; • Air, including odour; • Land contamination, including vegetation, and agricultural products; • Assessment of health impacts; and • Noise.	Discussed above.
IPPC SGN Combustion: Where environmental monitoring is needed, the following should be considered in drawing up proposals: • Determination to be monitored, standard reference methods, sampling protocols;	Emissions monitoring will be carried out as part of the commissioning process (Refer to Section 6 – FAP Ref. 5ii). This will be described in detail in the Commissioning Plan.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Monitoring strategy, selection of monitoring points, optimisation of monitoring approach; • Determination of background levels contributed by other sources; • Uncertainty for the employed methodologies and the resultant overall uncertainty of measurement; • Quality assurance and quality control protocols, equipment calibration and maintenance, sample storage and chain of custody/audit trail; and • Reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information for the Regulation.	

3.4.4 Monitoring of Process Variables

The management of the installation once operational is expected to include the monitoring of a limited range of process variables that may affect emissions to the environment through plant operation or direct discharge (nominally CO, temperature and oxygen to control the combustion process). Operational monitoring will be carried out to record process variables such as:

- Hours of operation;
- Consumption of diesel; and
- Fuel Sulphur Content.

This level of information will be used to look for any longer-term trends in operations such as increased fuel consumption or waste generation.

Indicative BAT for Process Variables

Indicative BAT for monitoring process variables is outlined in **Table 3.21** along with the proposed approach for SZC.

Table 3.21: Indicative BAT for Process Variables

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EPR 1.01: Some process variables may affect the environment, and these should be identified and monitored as appropriate. Examples might be:	Fuel to be used in diesel generator engines must contain less than 0.1% sulphur (in line with the SCOLF Regulations). This will limit the

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>• For solid and liquid fuel fired plants, fuel feedstock should be sampled and analysed at a frequency and manner appropriate to the type of plant concerned;
• Differential pressure across abatement equipment which can indicate removal efficiency, filter failures, etc.
• Potential difference across EP plates;
• Reagent injection or feed rates; and
• Oxygen content of flue gas.</td><td>amount of sulphur released to the atmosphere during combustion and therefore reduces the environmental impacts associated with higher SO_2 concentrations in the environment.
The flue gas temperature of the EDGs will be monitored during testing to ensure combustion efficiency therefore reducing the likelihood of higher pollutant concentrations, particularly CO, PM and VOCs.</td></tr>
<tr><td>LCP BATc 2: BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the combustion units by carrying out a performance test at full load, according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.</td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.
The total fuel used by the diesel generators and the operational hours will be recorded and reported routinely, in line with regulatory requirements.
As a good practice measure, periodic operational performance tests will be undertaken in accordance with applicable BE EN standards.
The actual electrical efficiency of the proposed units will be determined and compared against that reported by the manufacturer, and applicable industry standards once the engines are installed in line with relevant ISO standards. This will be undertaken as part of the plant commissioning process.</td></tr>
<tr><td>LCP BATc 3: BAT is to monitor key process parameters relevant for emissions to air and water including those given below.

<table><tr><td>Stream</td><td>Parameter(s)</td><td>Monitoring</td></tr></table></td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.
The flue gases from the installation will be monitored for flow, CO, temperature and</td></tr>
</table>

<table>
<tr><th colspan="3">Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td colspan="3"><table>
<tr><td>Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr>
<tr><td></td><td>Oxygen content, temperature, and pressure</td><td>Periodic or continuous determination</td></tr>
<tr><td></td><td>Water vapour content</td><td>Periodic or continuous measurement</td></tr>
<tr><td>Wastewater from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr>
</table></td><td>oxygen to control the combustion process.
All monitoring will be undertaken using appropriate sample methods and standards aligned with the requirements of MCERTS.
The new combustion plant will be maintained to ensure optimum thermal and electrical efficiency and to minimise emissions generation.
The proposed plant is not anticipated to have any process emissions to controlled waters.
There are no flue gas treatment measures which will generate wastewater, so monitoring of waste water from flue gas treatment is not applicable.
The specific monitoring regime for the proposed installation will be developed prior to the installation is operational.</td></tr>
<tr><td colspan="3">LCP BATc 4. BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.
<table>
<tr><th>Substance/ Parameter</th><th>Fuel/ Process/Type of Combustion Plant</th><th>Combustion Plant Total Rated Thermal Input</th><th>Standard(s)</th><th>Minimum Monitoring Frequency</th><th>Monitoring associated With</th></tr>
<tr><td>NH_3</td><td>When SCR and/or SNCR is used</td><td>All sizes</td><td>Generic EN Standards</td><td>Continuous[3]</td><td>BAT 7</td></tr>
</table></td><td>These techniques can be relied upon where appropriate although the installation is not an LCP installation.
Given the occasional planned operation of the diesel generators (<500 hours), continuous monitoring is not considered appropriate, and periodic monitoring is proposed.
The diesel generators will operate for less than 60 hours per year. No flue gas treatment will be used in the proposed engine units.</td></tr>
</table>

Indicative BAT from Guidance						How the Installation Activities Address Indicative BAT
NO_x	Gas Oil Fired Engines	All sizes	Generic EN Standards	Continuous[3]	BAT 32	
CO	Gas Oil Fired Engines	All sizes	Generic EN Standards	Continuous[3]	BAT 33	
SO_2	Gas Oil Fired Engines	All sizes	Generic EN standards and EN 14791	Continuous[3]	BAT 34	
SO_3	When SCR is used	All sizes	Generic EN Standards	Once every year	-	
Dust	Gas Oil Fired Engines	All sizes	Generic EN standards and EN 13284-1 and EN 13284-2	Continuous[3]	BAT 35	
Notes: (3) In the case of plants with a rated thermal input of < 100 MW operated < 1 500 h/yr, the minimum monitoring frequency may be at least once every six months. For gas turbines, periodic monitoring is carried out with a combustion plant load of > 70 %.						
LCP BATc 5: BAT is to monitor emissions to water from flue-gas treatment in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.						These techniques can be relied upon where appropriate although the installation is not an LCP installation. Not applicable. No flue gas treatment will be used in the proposed engine units.
LCP BATc 11: BAT is to appropriately monitor emissions to air/or to water during Other Than Normal Operating Conditions (OTNOC).						These techniques can be relied upon where appropriate although the installation is not an LCP installation. All emissions from the new diesel generators will be monitored during commissioning and periodically as advised in the response to BATc 3 to ensure

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
	that the plant does not lead to pollution of the receiving environment. The proposed monitoring regime for the development is also shown in Section 5 of the application supporting document. Given the nature of the equipment installed and the adherence to the manufacturer advised maintenance programme OTNOC events are considered unlikely. Should such events occur, additional spot sampling of emissions could be commissioned if required.

3.4.5 Monitoring Standards (Standard Reference Methods)

Until the details of appropriate monitoring are developed, any monitoring standards cannot be described. However, **Table 3.22** outlines the indicative BAT requirements for any such monitoring.

Table 3.22: Indicative BAT Requirements for Monitoring Standards (Standard Reference Methods)

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
IPPC SGN Combustion: As far as possible, Operators should ensure their monitoring arrangements comply with the requirements of MCERTS where available, for example using certified instruments and equipment, and using a stack testing organisation accredited to MCERTS standards. Where the monitoring arrangements are not in accordance with MCERTS requirements, the Operator should provide justification and describe the monitoring provisions in detail. See MCERTS approved equipment for future information on MCERTS and a listing of MCERTS equipment.	Any monitoring arrangements will be consistent with the requirements of MCERTS. **Table 3.16** outlines the current preferred methods for monitoring however it is recognised that these methods may change by the time the plant is operational and a review will be carried out prior to any monitoring taking place. It is likely that this will be through the use of external contractors.
Sampling and Analysis Standards	
IPPC SGN Combustion: The analytical methods given in Appendix 1 of the guidance should be used. If other substances need to be monitored the standard should be selected in the order of priority as given in the guidance. • Bureau's Reference Document on the General Principles of Monitoring. This order is: • CEN; and • ISO.	The monitoring methods outlined in **Table 3.16** have been taken from updated Environment Agency Technical Guidance Note (M2) [55]. This document reflects the hierarchy in monitoring methods, and this will be reflected in any monitoring carried out.
IPPC SGN Combustion: If the substance cannot be monitored using CEN or ISO standards then a method can be selected from any one of the following: • American Society for Testing and Materials; • Association Française de Normalisation ; • British Standards Institution (BSI); • Deutsches Institute fur Normung; • United States Environmental Protection Agency (US EPA); and • Verein Deustcher Ingenieure.	All of the parameters emitted from the diesel generators can be monitored using either CEN or ISO standards.
IPPC SGN Combustion: If the substance cannot be monitored using any of the standards above then other methods may be adapted for use, following the requirements for validation in ISO 17025. For stack emission monitoring the following occupational methods may be adapted: • Methods for the Determination of Hazardous Substances series published by the Health and Safety Executive; • National Institute for Occupational Safety and Health; and • Occupational Safety and Health Administration.	All the parameters emitted from the diesel generators can be monitored using either CEN or ISO standards.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
IPPC SGN Combustion: The intended application of the standard method must always be taken into account. For example, a CEN method may be less suitable than another less rigorously validated standard method if the application is not one for which the CEN method was developed. Operators should be expected to be able to demonstrate compliance with the above hierarchy and validate use of non-standard methods, in-house designed/developed methods, standard methods used outside their intended scope and modifications of standard methods to confirm that these methods are fit for purpose. These procedures will be formalised under forthcoming European standards.	All the parameters emitted from the diesel generators can be monitored using either CEN or ISO standards.
Further guidance on standards for monitoring gaseous releases relevant to the EP Regulations is given in monitoring guidance. A series of updated Technical Guidance Notes covering this subject is being prepared. This guidance specifies manual methods of sampling and analysis that will also be suitable for calibration of continuous emission monitoring instruments. Further guidance relevant to water and waste is available from the publications of the Standing Committee of Analysts.	

4 Environmental Impact assessment

4.1 Impact Assessment

This section of the application provides an assessment of the impact of all releases from the installation, undertaken in accordance with the requirements of the Environment Agency's guidance for risk assessments for your environmental permit [24]. In particular, the assessment considers the impact of releases to air and noise from the EDGs and UDGs, which are discussed in more detail in Section 4.1.2 and 4.1.5. The Habitats Regulations Assessment is discussed in Section 4.1.7.

4.1.1 Local Environment

The SZC power station is located approximately 1 km to the north of Sizewell Village and 3km east of the town of Leiston in the county of Suffolk. The centre of the SZC site is located at the following Ordnance Survey NGR co-ordinates:

- TM 47284 64085

A regional location map is provided in Figure 1 of Appendix A.

The installation is approximately 66 hectares in size and is located in a rural and comparatively remote coastal area that is relatively flat. The facility is bounded to the north by agricultural land, to the east by the North Sea, to the south by SZA and SZB power station and to the west by a car park and agricultural land. The nearest residential locations are farms and villages situated at least 1 km to the north, south and west and are shown in Figure 4.

Installation Site Layout

The layout of the installation is discussed in Sections 1 and 2 and presented in Figure 2 of Appendix A.

Important and Sensitive Receptors

Environment Agency guidance air emissions risk assessment for your environmental permit [31] details the ecological receptors and distances to be considered, these are:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar Sites within 10 km of the installation (or 15 km, where the installation accommodates coal- or oil-fired power station); and

- Sites of Special Scientific Interest (SSSIs), National Nature Reserves, Local Nature Reserves, local wildlife sites and ancient woodland within 2 km of the location of the installation.

Table 4.1 summarises information on sensitive receptors within 10 km of the installation, identified using the Magic[12] website. **Table 4.1** also includes County Wildlife Sites (CWS), which are considered to be of significance for their wildlife features in at least a County Context.

Full citations of European Sites within 10 km of the site and SSSIs within 2 km of the site, as required by the European Union (EU) Habitats Directive (92/43/EEC) [2] and Countryside and Rights of Way Act 2000 [72] procedures, have been obtained from Natural England's website (https://www.gov.uk/government/organisations/natural-england) and have informed the impact assessment. The international and national statutory designations around SZC site are provided in Figures 5 and 6 of Appendix A.

[12] Multi-Agency Geographic Information for the Countryside: Accessible online at: http://www.magic.gov.uk/website/magic/.

Table 4.1: Identification of Important and Sensitive Receptors

Receptor Name	Screening Category	Receptor Type	Reference	Emissions and Pathway for Potential Effect	Location of supporting information
Alde-Ore and Butley Estuaries	Special Area of Conservation (SAC) within 10 km	SAC	UK0030076	Emissions: discharges to air and water. Pathway - air: atmospheric dispersion and deposition to land and water. There are no process releases to water from the installation.	Refer to Section 4 Air Quality Modelling Report (Appendix C) and Shadow Habitats Regulations Assessment (Appendix D).
Alde-Ore Estuary	Special Protection Areas (SPA) within 10 km	SPA	UK9009112		
Alde-Ore Estuary	Ramsar site within 10 km	Ramsar site	862		
Minsmere to Walberswick Heaths and Marshes	SAC within 10 km	SAC	UK0012809		
Minsmere-Walberswick	SPA within 10 km	SPA	UK9009101		
Minsmere-Walberswick	SSSI within 2 km	SSSI	N/A		
Minsmere-Walberswick	Ramsar site within 10 km	Ramsar site	75		
Orfordness-Shingle Street	SAC within 10 km	SAC	UK0014780		
Outer Thames Estuary	SPA within 10 km	SPA	UK9020309		
Sandlings	SPA within 10 km	SPA	UK9020286		
Southern North Sea	SAC within 10km	SAC	UK0030395		
Sizewell Marshes	SSSI within 2 km	SSSI	N/A		
Leiston Aldeburgh	SSSI within 2 km	SSSI	N/A		
Leiston Common	CWS within 2 km	CWS	N/A		

Receptor Name	Screening Category	Receptor Type	Reference	Emissions and Pathway for Potential Effect	Location of supporting information
Aldringham to Aldeburgh Disused Railway Line	CWS within 2 km	CWS	N/A		
Dower House	CWS within 2 km	CWS	N/A		
Suffolk Shingle Beaches	CWS within 2 km	CWS	N/A		
Reckham Pits Wood	CWS within 2 km	CWS	N/A		
Sizewell Levels and Associated Areas	CWS within 2 km	CWS	N/A		
Minsmere South Levels	CWS within 2 km	CWS	N/A		

4.1.2 Approach to Impact Assessment for Emissions to Air

The point source emissions to air released from the proposed UK EPR™ units during the operational phase of the new build development are outlined below. The anticipated impacts on air quality resulting from the emissions to air from the installation's point sources have been determined using the Environment Agency's risk assessment for specific activities: environmental permits [25] and air emissions risk assessment guidance [31].

The emissions assessed include NO_X as NO_2, CO, SO_2, and PM below 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) as well as depositional impacts of acid and nitrogen associated with emissions of NO_2 and SO_2.

H1 Assessment

According to the Environment Agency's risk assessment for specific activities: environmental permits guidance methodology [25], it is possible to identify emissions that result in "insignificant" impacts and those emissions where further assessment is not required, based on the contribution to the appropriate Air Quality Strategy (AQS) Objective, Environmental Assessment Level (EAL) or critical level for each pollutant. Screening of the emissions is achieved using the simplified dispersion factors contained within the risk assessment guidance, which are applied through the effective stack height of the emission source and are used to estimate the ground level concentration per unit release of pollutant. The effective stack height is based on the relative height of the stack against buildings and structures in the vicinity of that stack.

Due to the relatively low effective stack height of the emission sources at the installation, it is considered unlikely that the Environment Agency's risk assessment access database tool would screen out any emissions from requiring detailed dispersion modelling. Furthermore, the screening stage using the Environment Agency's risk assessment tool was not deemed appropriate because of the distance of sensitive receptors, including human habitation and nature conservation sites, to the installation and the number of operational scenarios to be assessed. Detailed dispersion modelling has therefore been used as a precautionary approach, to predict the process contributions for the assessment of potential impacts.

Detailed Air Dispersion Modelling

Detailed air dispersion modelling has been carried out using ADMS v5.2. Full details of the dispersion modelling, including the assessment methodology, assessment criteria, detailed dispersion modelling and predicted results, are provided in the Air Quality Modelling Report (Appendix C).

Emissions to air from the installation point sources have been modelled to determine the likely worst-case process contributions. These have been added to the background pollutant concentrations to determine the overall predicted

environmental concentration at sensitive receptor locations, which have then been assessed against air quality standards. An assessment of the potential impacts at sensitive designated Habitat sites, including depositional impacts, has also been undertaken.

The predicted concentrations can then be compared with the appropriate AQS objective and EAL for human receptors or critical level for ecological receptors to determine the significance of the predicted impact. These are shown in **Table 4.2**.

Table 4.2: AQS Objectives, EALs and Critical Levels Used to Assess Impacts

Substance	Human Health AQS		Ecological AQS	
	Long Term ($\mu g/m^3$)	**Short Term ($\mu g/m^3$)**	**Long Term ($\mu g/m^3$)**	**Short Term ($\mu g/m^3$)**
NO_2	40 (annual average)	200 (99.8th percentile of 1-hour mean)		
NO_X			30 (annual average)[v]	75 (24-hour average)[v]
SO_2		266 (99.9th percentile of 15-minute mean) 350 (99.7th percentile of 1-hour mean) 125 (99.2th percentile of 24-hour mean)	20 (annual average - higher plants) 10 (annual average – lichens and bryophytes)	
CO		30,000 (1-hour 100th percentile) 10,000 (Maximum daily 8-hour rolling average)		
PM_{10}	40 (annual average)	50 (90.4 percentile of 24-hour average)	-	-
$PM_{2.5}$	20 (annual average (by 2015))			

v for the protection of vegetation and ecosystem. Other standards are for the protection of human health.

For most Habitat sites, critical loads are also specified for nutrient nitrogen and acid deposition impacts. Critical loads are determined for the protection of specific habitat features within the Habitat sites, and therefore the critical loads applied for the assessment can vary across the Habitat site being assessed, dependent on the different habitat features present.

Background Concentrations

The background concentrations shown below in **Table 4.3** were used to calculate the predicted environmental concentration.

Table 4.3: Defra Background Concentrations for 2028 and 2034 in the Vicinity of the Installation

Substance	2028 Background Concentrations (µg/m^3)	2034 Background Concentrations (µg/m^3)
SO_2	4.0	4.0
NO_2	5.9	5.8
NO_X	7.7	7.5
CO	92.1	92.1
PM_{10}	12.3	12.3
$PM_{2.5}$	7.7	7.5

AQS objectives and EALs are set for both short and long term averaging periods. It is unrepresentative to add the worst-case short term process contribution to the worst-case short term background concentration, since it is highly unlikely that the two will coincide at the same event. Therefore, the background concentration added to the short term process contribution is typically a multiple of the annual average concentration, rather than the short-term concentration over the equivalent averaging period.

Screening Assessment Methodology and Significant Criteria

Human Health Significance Criteria

The Environment Agency's risk assessment screening criteria for significance of the emissions have been applied to the outcome of the dispersion modelling. The predicted process contributions have been compared with the appropriate AQS or EAL to determine the significance of the pollutant emission.

The total pollutant emission is defined in the Environment Agency's risk assessment guidance as having an insignificant impact where:

- Process contributions less than 1% of the AQS or EAL, or the predicted environmental concentration is less than 70% of the AQS or EAL for long term releases; and

- Process contribution is less than 10% of the AQS or EAL, or the process contribution is less than 20% of the AQS minus twice the long term background

concentration, for short term releases.

The Environment Agency's risk assessment guidance indicates that where EU Air Quality Limits, national air quality objectives or target values are likely to be breached as a result of contributions from an installation, or where installation releases constitute a major proportion of the standard or objective, such releases are likely to be considered unacceptable.

Ecological Receptors Significance Criteria

For European sites (Special Protection Areas (SPA), Special Areas of Conservation (SAC) or Ramsar sites) an assessment is made as to whether the installation is "likely to have a significant effect", and whether this could lead to an "adverse effect on site integrity".

For Sites of Special Scientific Interest (SSSIs) the assessment needs to determine whether the installation is "likely to damage" the site.

The Environment Agency's risk assessment guidance screening criteria for significance of the emission have been applied to the outcome of the dispersion modelling for both European sites and SSSIs. The predicted process contributions have been compared with the appropriate critical level to determine the significance of the effect of the predicted process contributions.

The total pollutant emission is defined in the Environment Agency's risk assessment guidance as being insignificant where:

- Process contributions less than 1% of the Critical Level, or the predicted environmental concentration less than 70% of Critical Level for long term releases; and

- Process contributions less than 10% of the Critical Level for short term releases.

For all other nature conservation sites, i.e. County Wildlife Sites (CWS), the assessment needs to determine whether the installation will result in "significant pollution" i.e. where critical levels are exceeded. Therefore, if the long and short-term process contribution is less than 100% of the relevant standard, it is considered to be not significant.

The assessment against critical loads has been carried out in accordance with AQTAG06 'Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air' [73]. However, it should be noted that this does not provide definitive advice on interpreting the likely effects on different habitats of changes in air quality.

As with critical levels of atmospheric pollutants it has been agreed between the Environment Agency and Natural England, that process contributions of less than 1% of the critical load for pollutant deposition (nitrogen and acid) can be considered to be insignificant, and that process contribution greater than 1% have the potential to be significant, depending upon the context.

Emissions to Air

The main emissions to air from the installation are the products of combustion from the twelve diesel generators, comprising eight EDGs with an approximate thermal input rating of 23.1 MW_{th} each, and four 10.53 MW_{th} UDGs. The stack and emission parameters are provided in **Table 4.4**.

Emission rates for the diesel generators, including pollutant releases to air and exhaust gas flow rates and temperatures, are indicative. This information is based on the current understanding of the emissions sources and their potential locations within the power station, recognising that the design is only conceptual at this stage and therefore may be subject to change as the design develops.

The source of each pollutant's emission concentration is described below for the EDGs:

- NOx (as NO2): Emission concentrations based on current design information;
- SO2: Emission concentrations calculated based on the SCOLF Regulations 2007 maximum sulphur content in diesel of 0.1%;
- CO: Annex 1 of the Environment Agency's Environmental Permitting Regulations sector guidance for combustion activities for compression ignition engines, in the absence of other appropriate guidance; and
- PM: Annex 1 of the Environment Agency's Environmental Permitting Regulations sector guidance for combustion activities for compression ignition engines, in the absence of other appropriate guidance.

The pollutant emission concentration for the UDGs is from the manufacturer's technical specification.

Initial model runs showed that the level of impact at receptors is typically doubled for the EDG operation compared to the UDG operation. Therefore, only EDG emissions have been modelled in the assessment scenarios below, in order to provide a worst-case assessment. EDGs and UDGs would not operate concurrently.

Table 4.4: Emissions Inventory

Emission Point Reference	Grid Reference (X,Y)	Stack Height (m)	Stack Diameter (m)	Volume Flow (Nm^3/s)	Actual Flow (Am^3/s)	Efflux Velocity (m/s)	Temp (oC)	Substance	Release Concentration (mg/Nm^3)	Release Rate (g/s)
A1	647224, 264307	27.2	1.1	15.99[1]	27.50	28.9	375	NO_x	1,918	30.7
A2	647243,264307									
A4	647259, 264307							SO_2	66	1.1
A5	647223, 264132									
A7	647224, 264075							PM	50	0.8
A8	647243, 264074									
A10	647224, 263901							CO	150	2.4
A11	647243, 263900									
A3	647259, 264307	27.2	1.1	3.75[1]	7.85	8.3	515	NO_x	1,143	4.3
A6	647259, 264132							SO_2	0.3	0.001
A9	647259, 264074							PM	6.4	0.02
A12	647259, 263900							CO	194	0.73

[1] Normalisation based on actual flows at 12% oxygen and 8% H2O. Normalised to standard temperature and pressure, dry gas at 15% oxygen reference conditions

Stack Height

The diesel generator's stack height of 27.2m has been set through the nuclear design process for the proposed development. Consideration has also been given to construction and maintenance safety and engineering complexity, as in the case of a nuclear power station, would require seismically qualified stacks, which can affect the safety case. The diesel generators are located in close proximity to overhead power lines, therefore the stack height is restricted to allow a safe distance between the diesel generator stacks and the overhead power lines. The location of the diesel generator buildings and associated stacks are discussed in Section 2.1.

A stack height assessment was carried out with regards to BAT to determine what the optimised height would be if this were not constrained, giving due consideration to the minimisation of ground-level air quality impacts balanced against the visual impacts of a taller stack (Appendix C Air Quality Modelling Assessment). Dispersion modelling has been undertaken to determine the optimum stack height range, through comparison of the maximum impacts at human health and ecological receptors, and the proposed stack height identified through determination of a BAT curve. A BAT curve shows the reduction in ground level pollutant concentrations with increasing stack height, and the 'elbow' of the curve typically represents the most appropriate stack height that balances impacts with the height of the stack (i.e. it represents BAT for that emission point). A screening stack height range for the diesel generators was selected based on typical plant stack heights of 27 – 47m above finished ground level.

The 'elbow' of the curve can be clearly seen at 33m for the maximum concentrations for the model output for the annual average process contributions, however for the hourly average there is no clear elbow. At receptor locations, the process contribution concentrations show a very steady decrease with increased stack height, however no definitive 'elbow' can be seen. It is therefore considered that the selected height of 27.2m, which is considered to be the highest stack height that can be achieved enabling the clearance required for the overhead lines, represents BAT for the installation given the constraints in place.

Scenarios Considered

The operational scenarios assessed are summarised below in **Table 4.5**. Further justification for the scenarios considered is provided in Section 3.2 of the Air Quality Modelling Assessment in Appendix C.

Table 4.5: Scenarios for Modelling

Scenario	Duration of Impacts	Modelling Scenario	Operational Scenario being Simulated	Planned Actual Operation	Justification for Worst Case Assessment
Commissioning EPR™ Unit 1	Short term (hourly)	Operation of 4 x Unit 1 EDGs continuously throughout the year.	LOOP event testing	All Unit 1 EDGs will be tested simultaneously to simulate a LOOP scenario. LOOP testing is expected to have a maximum run time of 3 hours.	Assessed as continuous operation in case the 3 hours of LOOP testing coincides with the meteorological conditions which lead to maximum short-term impacts.
	Long term (annual)	Operation of 1 x Unit 1 EDG continuously throughout the year, with pro-rata emission rates.	Commissioning	Each of the 4 Unit 1 EDGs will be run for 242.5 hours during commissioning. Each of the 2 UDGs will be run for 738 hours. This is an aggregated total of 2,446 hours operation for the 12 months of commissioning.	It is not anticipated more than 1 diesel generator will be operational at any one time during the commissioning period, other than the LOOP commissioning test stipulated above.
Commissioning EPR™ Unit 2	Short term (hourly)	Operation of 1 x Unit 1 EDG continuously throughout the year and Operation of 4 x Unit 2 EDGs continuously throughout the year.	Routine testing Unit 1 LOOP event testing Unit 2	It is anticipated that only 1 diesel generator on Unit 1 would be undergoing routine annual testing during the LOOP commissioning of Unit 2 diesel generators.	Assessed as continuous operation in case the 5 hours of routine testing on Unit 1 and 3 hours of LOOP testing on Unit 2 coincides with the meteorological conditions which lead to maximum short-term impacts.
	Long term (annual)	Operation of 1 x Unit 2 EDG continuously throughout the	Commissioning	Each of the 4 Unit 2 EDGs will be run for 242.5 hours during commissioning. Each of the 2	It is not anticipated more than 1 diesel generator will be operational at any one time during the

Scenario	Duration of Impacts	Modelling Scenario	Operational Scenario being Simulated	Planned Actual Operation	Justification for Worst Case Assessment
		year, with pro-rata emission rates.		UDGs will be run for 738 hours. This is an aggregated total of 2,446 hours operation for the 12 months of commissioning.	commissioning period, other than the LOOP commissioning test stipulated above.
Routine Testing	Short term (hourly)	Operation of 1 EDG continuously throughout the year.	Routine testing	Each diesel generator will be run for 24 hours following a maintenance outage and 60 hours per year for routine testing.	Assessed as continuous operation in case operation coincides with the meteorological conditions which lead to maximum short-term impacts.
	Long term	Operation of 1 EDG continuously throughout the year, with pro-rata emission rates.	Routine testing	Routine testing is anticipated to be carried out for 60 hours per year for each of the 12 diesel generators, with an aggregated total of 720 operation hours per year.	It is not anticipated that more than 1 diesel generator will undergo routine testing at any one time.
LOOP Event (Loss of off-site power)	Short term (hourly)	Operation of 4 x Unit 1 EDGs throughout the year and, Operation of 4 x Unit 2 EDGs throughout the year.	LOOP event testing	A LOOP event represents emergency back-up operation only, and therefore is only applicable to short term impacts.	Assessed as continuous operation in case operation coincides with the meteorological conditions which lead to maximum short-term impacts.

Sensitive Receptors

Human health and ecological receptors are identified in **Table 4.1** and **Table 4.2** of the Air Quality Modelling Assessment in Appendix C. The specific human health receptors included in the dispersion modelling assessment are residential (farms, residences and villages) and transient receptors (local public footpaths). Ecological designated sites have been considered within the appropriate screening distances detailed in the Environment Agency's risk assessment guidance of 10km for internationally designated sites (i.e. SACs, (i.e. SACs, SPAs and Ramsar sites) and 2km for locally and nationally designated sites (i.e. SSSIs and non-designated CWS).

Results for Air Quality

A summary of the results of the modelling assessment is provided in the following tables:

- Table 4.6: impact on human receptors under the commissioning scenario, the impacts at the worst-case human health receptor only have been reported here, with the full results provided in Appendix C;
- Table 4.7: impact on ecological receptors under the commissioning scenario;
- Table 4.8: impact on human receptors under routine testing scenario;
- Table 4.9: impact on ecological receptors under routine testing scenario;
- Table 4.10: impact on human receptors under the LOOP scenario; and
- Table 4.11: impact on ecological receptors under the LOOP scenario.

Further details of the approach to modelling and results for all receptors are provided in Appendix C.

Table 4.6: ADMS Assessment: Commissioning Scenario: Human Receptors

Pollutant	National Air Quality Standard (NAQS) (µg/m^3)	Impact Location	PC (µg/m^3)	PC/ NAQS	PC < Insignificance Threshold?	BC	PC as % of headroom (PC/(NAQS-BC)	PC or PEC < Insignificance Threshold
NO_2 (Annual average)	40	Keepers Cottage	0.6	1%	Yes	-	-	-
NO_2 (99.8th percentile of 1-hour mean)	200	Keepers Cottage	170.63	85%	No	11.8	91%	No
SO2 (99.9th percentile 15-min mean)	266	Keepers Cottage	26.3	10%	Yes	-	-	-
SO2 (99.7th percentile 1-hr mean)	350	Keepers Cottage	15.9	5%	Yes	-	-	-
SO2 (99.2th percentile 24-hr mean)	125	Sizewell Village	6.0	5%	Yes	-	-	-
PM10 (annual average)	40	Keepers Cottage Sizewell Village	0.02	<0.1%	Yes	-	-	-
PM10 (90.4th percentile of 24-hr average)	50	Keepers Cottage	1.4	3%	Yes	-	-	-
$PM_{2.5}$ (annual average (by 2015)	20	Keepers Cottage	0.02	<0.1%	Yes	-	-	-

Pollutant	National Air Quality Standard (NAQS) (µg/m^3)	Impact Location	PC (µg/m^3)	PC/ NAQS	PC < Insignificance Threshold?	BC	PC as % of headroom (PC/(NAQS-BC)	PC or PEC < Insignificance Threshold
		Sizewell Village						
CO (Maximum Daily 8-hour, rolling average)	10,000	Keepers Cottage	28.6	0.3%	Yes	-	-	-
CO (1-hour 100th percentile)	30,000	Keepers Cottage	65.6	0.2%	Yes	-	-	-

Table 4.7: ADMS Assessment: Commissioning Scenario: Ecological Receptors

Pollutant	CL (µg/m^3)	Impact Location	PC (µg/m^3)	PC/ CL	PC < Insignificance Threshold?	BC	PEC/CL	PC or PEC < Insignificance Threshold
NO_x (Annual average)	30	Minsmere Sizewell Levels	13.5 13.3	45% 44.3	No No	7.7 7.7	71% 70%	No Yes
NO_x (Daily Average)	75							
SO_2 (Annual average – Higher Plants)	20	Minsmere Sizewell Levels	0.5	2%	Yes	-	-	-

Pollutant	CL (µg/m^3)	Impact Location	PC (µg/m^3)	PC/ CL	PC < Insignificance Threshold?	BC	PEC/CL	PC or PEC < Insignificance Threshold
SO_2 (Annual average – Bryophytes and Lichens)	10	Minsmere Sizewell Levels	0.5 0.5	4.7% 4.6%	Yes Yes	- -	- -	- -

Table 4.8: ADMS Assessment: Routine Testing Scenario: Human Receptors

Pollutant	NAQS (µg/m^3)	Impact Location	PC (µg/m^3)	PC/ NAQS	PC < Insignificance Threshold?	BC	PC as % of headroom (PC/(NAQS-BC)	PC or PEC < Insignificance Threshold
NO_2 (Annual average)	40	Keepers Cottage	0.2	<1%	Yes	-	-	-
NO_2 (99.8th percentile of 1-hour mean)	200	Keepers Cottage	41.6	21%	No	11.6	22%	No
SO2 (99.9th percentile 15-min mean)	266	Keepers Cottage Sandlings Walk (transient)	6.0 17.3	2% 7%	Yes Yes	-	-	-
SO2 (99.7th percentile 1-hr mean)	350	Keepers Cottage	3.6	1%	Yes	-	-	-
SO2 (99.2th percentile 24-hr mean)	125	Keepers Cottage	1.3	1%	Yes	-	-	-
PM10 (annual average)	40	Keepers Cottage	0.006	<0.1%	Yes	-	-	-
PM10 (90.4th percentile of 24-hr average)	50	Keepers Cottage	0.3	<1%	Yes			

Pollutant	NAQS ($\mu g/m^3$)	Impact Location	PC ($\mu g/m^3$)	PC/ NAQS	PC < Insignificance Threshold?	BC	PC as % of headroom (PC/(NAQS-BC)	PC or PEC < Insignificance Threshold
$PM_{2.5}$ (annual average (by 2015)	20	Keepers Cottage	0.006	<0.1%	Yes	-	-	-
CO (Maximum Daily 8-hour, rolling average)	10,000	Keepers Cottage	6.9	0.1%	Yes	-	-	-
CO (1-hour 100th percentile)	30,000	Keepers Cottage	15.5	<0.1%	Yes	-	-	-

Table 4.9: ADMS Assessment: Routine Testing Scenario: Ecological Receptors

Pollutant	CL ($\mu g/m^3$)	Impact Location	PC ($\mu g/m^3$)	PC/ CL	PC < Insignificance Threshold?	BC	PEC/CL	PC or PEC < Insignificance Threshold
NO_x (Annual average)	30	Minsmere Sizewell Levels	3.9 3.8	12.9% 12.7%	No No	7.5 7.5	38% 38%	Yes Yes
NO_x (Daily Average)	75	Sizewell Levels	320.7	428%	No	11.3	443%	No
SO_2 (Annual average – Higher Plants)	20	Minsmere Sizewell Levels	0.1	0.7%	Yes	-	-	-
SO_2 (Annual average – Bryophytes and Lichens)	10	Minsmere Sizewell Levels	0.1	1.3%	Yes	-	-	-

Table 4.10: ADMS Assessment: LOOP Scenario: Human Receptors (Short Term Only)

Pollutant	NAQS ($\mu g/m^3$)	Impact Location	PC ($\mu g/m^3$)	PC/ NAQS	PC < Insignificance Threshold?	BC	PC as % of headroom (PC/(NAQS-BC)	PC or PEC < Insignificance Threshold
NO_2 (Annual average)	40							
NO_2 (99.8th percentile of 1-hour mean)	200	Sizewell Village Keepers Cottage	198.2 256.8	99% 128%	No No	11.6 11.6	105% 1136%	No No
SO_2 (99.9th percentile 15-min mean)	266	Keepers Cottage Sandlings Walk Path (transient)	31.7 79.2	12% 30%	No No	7.9 7.9	12% 31%	Yes No
SO2 (99.7th percentile 1-hr mean)	350	Keepers Cottage	22.6	6%	Yes	-	-	-
SO2 (99.2th percentile 24-hr mean)	125	Keepers Cottage	9.3	7%	Yes	-	-	-
PM10 (annual average)	40							
PM10 (90.4th percentile of 24-hr average)	50	Keepers Cottage	2.4	5%	Yes	-	-	-
$PM_{2.5}$ (annual average (by 2015)	20							
CO (Maximum Daily 8-hour, rolling average)	10,000	Keepers Cottage	43.3	0.4%	Yes	-	-	-
CO (1-hour 100th percentile)	30,000	Crown Farm	77.1	0.3%	Yes	-	-	-

Table 4.11: ADMS Assessment: LOOP Scenario: Ecological Receptors (Short Term Only)

Pollutant	CL ($\mu g/m^3$)	Impact Location	PC ($\mu g/m^3$)	PC/ CL	PC < Insignificance Threshold?	BC	PEC/CL	PC or PEC < Insignificance Threshold
NO_x (Annual average)	30							
NO_x (Daily Average)	75							
SO_2 (Annual average – Higher Plants)	20							
SO_2 (Annual average – Bryophytes and Lichens)	10							

Summary and Conclusions

Dispersion modelling of emissions of identified pollutants from the diesel generators comprising the Part A permitted installation demonstrates that the impacts of all main pollutants are unlikely to results in significant environmental impacts when emitted at the proposed emission concentrations.

A number of worst-case assumptions were used in the assessment, including:

- Emissions at the proposed emission limit values or benchmark emission levels, when average emissions are likely to be below these values;
- Emissions from EDG sources only, where emissions from UDGs lead to significantly lower impacts.
- Assumption that 70% of NOx emissions are converted to NO2 in the stack vicinity in the long term and 35% conversion in the short term;
- Assumption that 100% of particulate emissions are PM10/ PM2.5 or smaller;
- Worst case results for all years of meteorological data assessed, for each species and averaging period; and,
- Inclusion of buildings within the model.

Human Health Receptors

The only predicted exceedance of air quality standards at human health receptors is for short term NO_2 Process Contributions during the LOOP Event. It is predicted that, in combination with the background concentrations, the hourly NO_2 AQS objective could be exceeded at Sizewell Village and Keepers Cottage which have predicted environmental concentrations of 105% and 136% respectively of the AQS. Short term impacts of the LOOP event have been assessed assuming continuous operation over 8,760 hours, in order to account for the meteorological conditions which could lead to the worst case impacts, however it is very unlikely that a LOOP event would occur when these worst case meteorological conditions are present and therefore the results presented in this assessment are conservative.

The 99.8th percentile specified in the short term Air Quality Objective allows for the exceedance of the AQS for 18 hours per year. As this scenario represents emergency shutdown of the EPR's, it is not possible to state how long an actual LOOP event would last. However, the scenario would therefore need to last longer than 18 hours to cause an exceedance of the objective.

The actual duration of LOOP events cannot be easily determined, however, the frequencies of LOOP events can be predicted and allocated to a significant range of durations. Frequency predictions are given on an 'per reactor year' basis, as they are based on the frequency over one year for a single reactor, no matter what the operational regime is. A review of the frequency of LOOP scenarios for the Hinkley Point C site and the SZC site has been carried out [74] and concluded that the frequency of the main conceived LOOP events for the SZC site may be as follows:

- Short LOOP - expected to occur a limited number of times during the lifetime of the plant; and
- Long LOOP - expected to occur about once in the lifetime of a fleet of nuclear sites.

Given the infrequency of LOOP events it was concluded that the emissions would not represent a significant effect for the human receptors.

All other impacts at human health receptors are unlikely to result in any exceedance of AQS objectives.

Ecological Receptors

For ecological receptors, the assessment has considered the impact relative to published critical levels and critical loads. Annual critical levels are not exceeded under permitted operating scenarios with the worst case impacts occurring during the commissioning phase at E2 (Minsmere – Walberswick Heaths), and E12 (Sizewell Levels), with process environmental conditions up to 71% of the critical level. Due to the conservative assumptions made in the assessment for running hours and EDG only emissions, it is considered likely that actual impacts would be below those reported in the assessment above. Commissioning operations will only occur for two years and the process contributions for the routine operating scenario are much lower, with the majority of the habitat sites experiencing impacts from process contributions that can be considered to be insignificant, with all predicted environmental concentrations below 71% of the annual average critical levels predicted during routine operations.

Although it is considered that the daily mean critical level is of lower importance than the annual mean critical level for the protection of the habitat as a whole, there are predicted exceedances of the daily mean NO_x critical level over a number of designated ecological sites within close proximity to the installation. It is considered that the assessment carried out to determine the daily mean NO_x impacts was very conservative, given that it was assumed that one diesel generator was operational throughout the year, when routine testing operations of each diesel generator is estimated to occur for 60 hours per year. Operation of all diesel generators will result in an estimated 720 hours of operation on an annual basis. Given that any exposure

to NO_x would therefore be comparatively short term, it is considered that the exposed habitats will have time to recover.

The zone of influence of exceedances of the daily NO_x critical level is confined to a relatively small area encompassing the southern end of the Minsmere to Walberswick SAC and SSSI and the northern end of the Sizewell Marshes SSSI (as discussed in Section 4.2 and in the Shadow HRA Report in Appendix D). This, and the conservative modelling assumptions used in the assessment, indicates that the predicted level of impact would be lower than predicted in the assessment.

Statistical analysis has been carried out on the daily NO_x impacts, which found that the probability of the daily NO_x critical level being exceeded, and the worst case met data occurring at the same time is a 1.6% chance.

Results for Nitrogen Deposition

During commissioning, nine of the habitat features are predicted to experience increases in nitrogen deposition of less than 1% of the critical load for that habitat. This increases to fourteen habitat features during routine operation. It is therefore considered that nitrogen deposition will have an insignificant effect on these receptors.

Ten of the Habitat features are predicted to experience impacts, which cannot be considered insignificant and further consideration of the results is required. It should be noted that the average background deposition rates at all these features are in excess of the lower end of the critical load range, and in some cases exceed the higher end of the critical load range.

Whilst an increase in the levels of nitrogen deposition is clearly predicted for a number of the habitats within the vicinity of the installation, it is important to note that the process contributions will be short-term and temporary (especially during commissioning operations) and are also set against a background of high chronic nitrogen deposition in the wider area. Therefore, even given the worst-case assumptions used in this assessment (such as the assessment of annual impacts against emissions at the emission limit values when they will be below this value) and the use of worst case model assumptions, the process contributions are considered unlikely to result in significant changes in species composition or habitat condition at any receptor.

The Shadow HRA Report (refer to Section 4.2) concluded that that conservation objectives of the European sites screened in the HRA would not be compromised and an adverse effect on the integrity of the European sites would not occur due to nitrogen deposition.

Results for Acid Deposition

Eight out of the sixteen habitat features experience acid deposition process contributions that are less than 1% of the critical load for that habitat during the commissioning phase, and, can therefore be considered insignificant. This increases to eleven sites during the operational phase.

For all the remaining habitat features, the majority of the critical loads are already being exceeded due to high background levels of acid deposition.

Since all of the sites identified in the assessment above are subject to background acid deposition that is generally above the lower critical load value (and often also the upper figure), any additional impact from the installation is likely to be relatively minor. Furthermore, given the high buffer capacity of the grazing marsh, the worst-case assumptions made in this assessment, the predicted process contributions to acid deposition are very conservative, and are likely to be lower than presented. Since even these worst-case process contributions represent only a small proportion of the critical loads, compared to the current background deposition, any acid deposition resulting from the commissioning and/or routine operation phases is very unlikely to result in significant impacts at these receptors.

The Shadow HRA Report (refer to Section 4.2) concluded that that conservation objectives of the European sites screened into the HRA would not be compromised and an adverse effect on the integrity of the European sites would not occur due to acid deposition.

Visible Plume

Given the high exhaust temperatures from the diesel generators (EDGs at 375°C and UDGs at 515°C), the formation of visible plumes from standby generator plant is highly unlikely and are not predicted to give rise to adverse amenity effects.

Nuclear Safety Function

The purpose of the EDGs is to provide a power supply to safety systems in the event of a loss of off-site power. The UDGs provide a power supply to a smaller number of safety systems in the event of a loss of both off-site power and the EDGs. In doing this, the EDGs and UDGs provide a critical nuclear safety function as their sole function. As such, the EDGs and UDGs are never used for commercial generation.

In order to fulfil their design safety function, the EDGs and UDGs must be tested in accordance with the specified testing requirements, which will primarily be based on the safety case requirements. In addition to the minimum test durations that will be detailed in the technical specifications for the EDGs and UDGs, extra test runs may be required following:

- failed technical specification test runs;

- failed return to service test runs (following planned or unplanned maintenance work); and
- major overhaul of an EDG or UDG (these may be extended duration test runs).

In essence, it is essential that the EDGs and UDGs are permitted to be tested for as long a duration (and as often) as necessary in order to guarantee their availability to perform their designated nuclear safety function. Operations and management procedures will reflect the outcomes of the air quality modelling by minimising the duration of testing, avoiding whole site tests, coordinating testing between adjacent sites and avoiding high ambient pollutant background levels.

Emissions Monitoring

Monitoring of the diesel emissions will be carried out as part of the commissioning programme of work as part of the FAP (Refer to Section 6 - FAP Ref. 5ii) and a review of NO_X generation by the diesel engines will be carried out during the operational phase as part of the environmental performance review as part of the FAP (Refer to Section 6 - FAP Ref. 5iii). This data will be used to validate (or revise) the dispersion modelling carried out. The availability of plant due to manufacturer's maintenance requirements and periodic nuclear safety tests will also affect the number of running hours (and is likely to reduce this significantly). If necessary, a revised impact assessment will be provided. No monitoring of the diesel emissions is proposed during LOOP scenarios given that LOOP events lasting 24 hours or more are extremely rare events and cannot be predicted.

4.1.3 BAT

Table 4.12 outlines the indicative BAT requirements for Air Quality, Dispersion and Dilution.

Table 4.12: Indicative BAT Requirements for Air Quality, Dispersion and Dilution

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EP Technical Note 1/1 (18) 4.4.1: Pollutants that are emitted via a stack require sufficient dispersion and dilution in the atmosphere to ensure that they ground at concentrations that are deemed harmless.	The resulting concentrations and deposition of pollutants were assessed against relevant assessment criteria and considered together with the probability of the operating scenario occurring. Given the infrequency of commissioning and routine testing, the low likelihood of the scenarios taking place during worst-case meteorological conditions and the worst-case assumptions it is considered unlikely that there would be adverse effects to human and ecological receptors with a stack height of 27.2 m.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EP Technical Note 1/1 (18) 4.4.2: Emissions to air should be free from dark smoke and from offensive odour outside the site boundary, as perceived by the regulator. Good combustion should achieve that aim.	Dark smoke is not anticipated to be emitted and the diesel generators will be maintained. The potential for fugitive emissions will be regularly reviewed as part of the IMS environmental aspect and impact identification procedures. The Installation will also have procedures for management of emergencies and accidental releases at the site to help prevent dark smoke and offensive odours. Diesel will be used as a fuel and the sources of odour (diesel vapour vented during tank filling operations, combustion gases from plant operations (maintenance runs and periodic nuclear safety tests), and crankcase fume extract system venting from the EDGs) are considered to be negligible. A bespoke maintenance management platform will be used to manage maintenance and will be integrated into the SZC Co. management systems.
EP Technical Note 1/1 (18) 4.4.3: All new installations should submit an air quality report which details the long term and short-term process contribution as part of their application. The process contribution can be calculated using the Environment Agency H1 guidance.	An Air Quality Modelling Report is provided in Appendix C, which details the short term and long-term process contributions.
EP Technical Note 1/1 (18) 4.4.4: Emissions from the permitted process or installation shall not contribute significantly to any exceedance of EU air quality limit values or objectives of the air quality strategy for England, Scotland, Wales and Northern Ireland for sulphur dioxide, oxides of nitrogen and particulate matter (PM_{10} and $PM_{2.5}$).	The Process Contributions for long term NO_2, SO_2, CO, PM_{10} and $PM_{2.5}$ do not exceed the air quality standards and are considered insignificant. The only predicted exceedance of air quality standards at human health receptors is for short term NO_2 Process Contributions, during the LOOP Event. Short term impacts of the LOOP Event have been assessed assuming continuous operation over 8,760 hours, in order to account for the meteorological conditions which could lead to the worst case impacts, however it is very unlikely that a LOOP Event would occur when these worst case meteorological conditions are present and therefore the results presented in this assessment are conservative. In addition, the 99.8th percentile specified in the short-term air quality objective allows for the exceedance of the AQS for 18 hours per year. As this scenario represents emergency shutdown of the EPR's, it is not possible to state how long an actual LOOP event would last. However, the scenario would therefore need to last longer than 18 hours to cause an exceedance of the objective. The actual duration of LOOP events cannot be easily determined, however,

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
	the frequencies of LOOP events can be predicted and allocated to a significant range of durations. For ecological receptors, annual Critical Levels are not exceeded under permitted operating scenarios with the worst-case impacts occurring during the commissioning phase for NO_x, with PECs up to 75% of the Critical Level. Given the highly conservative nature of the modelling scenario for daily NO_x (running hours and EDG only emissions) and the short term nature of the effect, taken together with the prediction that the PEC would not exceed the Critical Level, it is concluded that there would not be an adverse effect on the ecological receptors.
EP Technical Note 1/1 (18) 4.4.5: In areas where air quality standards or objectives are being breached or are in serious risk of breach and it is clear from the air quality report or detailed review and assessment (for existing installations) that the permitted process or installation itself is a significant contributor to the problem, it is likely that the regulator will impose tighter emission limits than those set out in Tables 5.2 to 5.6 of this Technical Note. The need for tighter emission limits might be offset, fully or in part, by increasing the stack height and/or exit velocity.	Refer to Section 4 Impact Assessment. The resulting concentrations and deposition of pollutants were assessed against relevant assessment criteria and considered together with the probability of the operating scenario occurring. Given the infrequency of commissioning and routine testing, the low likelihood of the scenarios taking place during worst-case meteorological conditions and the worst-case assumptions it is considered unlikely that there would be adverse effects to human and ecological receptors with a stack height of 27.2m. A stack height of 27.2m was assessed for the installation's combustion sources. The assessment has been based on this stack height, as a worst-case assessment, as it is considered that any increase in stack height would result in a reduction in predicted impacts from the installation.
EP Technical Note 1/1 (18) 4.4.6: The aim should be to ensure that the process contribution is no more than 1% of the relevant long term EQS and/or 10% of the relevant short term EQS at sensitive receptors, which could include designated Habitats and wildlife sites as well as residential locations. Where this cannot be demonstrated through simple calculation, (E.g. the Environment Agency's H1 methodology), the applicant will need to use computer-based air dispersion models (e.g. ADMS, AERMOD) or some form of intermediate screening tool. Where it cannot be shown to be no more than 1% of the long term EQS and/or 10% of the short term EQS, representative data on background levels of pollution will be needed to fully assess the impact of emissions. Note when assessing the impact of particulate emissions (PM10 and PM2.5), a first assumption will	Refer to EP TN 1/1 (18) 4.4.5

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
normally be to assume that all the dust emissions are PM10 or PM2.5. Data on particle size distribution of dust emissions may be needed where the process contribution cannot be shown to be no more than 1% of the long term EQS and/or 10% of the short term EQS at sensitive receptors using this initial assumption, as an alternative to, or in combination with more detailed assessment methodologies.	
EP Technical Note 1/1 (18) 4.4.7: Where necessary the regulator should include the minimum stack height and exit velocity within the environmental permit.	A stack height of 27.2m was assessed for the installation's combustion sources. The assessment has been based on this stack height, as the highest stack height achievable given the constraints in place on site.
EP Technical Note 1/1 (18) 4.4.8: In order to ensure dispersion is not impaired by either low exit velocity at the point of discharge, or deflection of the discharge, a cap, or other restriction, should not be used at the stack exit. However, a cone may sometimes be useful to increase the exit velocity to achieve greater dispersion.	The design of the stack will be confirmed and agreed with the Environment Agency prior to construction.

4.1.4 Assessment of the Impact of Emissions to Water

Preliminary Screening of Releases to Water

Emissions to water associated with the regulated activities undertaken at the installation are listed in Sections 2 and 3 of this submission. Both of these other Sections should be referred to for additional information and context relevant to the following discussion.

The only emissions to water from the installation will be uncontaminated surface water drainage, which will not give rise to adverse environmental effects. The pollution prevention measures identified in Section 5 will ensure that site surface water drainage is uncontaminated and will prevent pollution of groundwater.

As there are direct point source emissions to water arising directly from the process an impact assessment of releases to water has not been undertaken.

4.1.5 Assessment of the Impact of Emissions to Sewer

There will be no emissions of process effluent to sewer from the installation.

4.1.6 Assessment of the Impact of Noise & Vibration

An assessment of the potential sound levels has been completed and is presented in Appendix E. The assessment sets out the predicted impacts and effects associated with operation of the back-up diesel generators. BAT measures to control noise and vibration are discussed further in Section 3.

The sound level assessment includes the back-up diesel generator building sound sources, receptor locations and background sound levels, assessment methodology and criteria, predictive sound modelling, predicted sound levels at receptor locations, assessment details and BAT noise control.

The assessment methodology and sound level assessment criteria were established in accordance with BS 4142:2014+A1:2014 [75], BS 8233:2014 [76] and World Health Organisation (WHO, 1999) guideline values [77]. The sound level assessment was also prepared in accordance with the Environment Agency guidance for environmental permitting: H3 Part 2 noise assessment [32], Environment Agency guidance for noise impact assessments involving calculations or Modelling [33] and the BAT conclusions for large combustion plants [10].

The noise sources considered are the EDGs and UDGs within the installation. The operating scenarios considered reflect those considered in the air impact assessment, namely:

- Commissioning - one-off testing upon installation (worst case of 4 EDGs operating continuously throughout the test);
- Routine testing - to ensure generators are maintained in good operational condition (worst case of 1 EDG operating continuously throughout the test); and,
- LOOP - Emergency operation for up to 72 hours if the main station power supply should fail (worst case of 8 EDGs operating continuously until normal power supplies are restored).

The worst-case scenario in terms of sound sources operating would be during LOOP events when either two EDG's or one UDG is operating per generator building. In the condition where the EDG's are operable there would be ten sound sources per building as described above. Therefore, this scenario has been modelled to predict sound levels at receptor locations for both daytime and night-time assessment periods.

Vibration from the proposed back-up generator facilities has been considered, however receptor locations are not in close proximity. Vibration is not expected to be experienced off-site and has therefore been scoped out from further assessment.

Noise sensitive receptors were identified comprising residential receptors. Transient receptors consist of sensitive human receptors using public rights of way and are therefore defined as locations where people are unlikely to be present for extended time periods. These receptors have therefore not been included given the short time period of exposure at such receptors and that the closest transient receptors (Sandlings Walk Path and Suffolk Coast Path/Beach) would often be dominated by the sound of the sea on the shingle beach. The assessment of sound on ecological receptors is outside the scope of this assessment; information on the effects of noise at ecological receptors is included in the noise assessment undertaken as part of the ES which supports the DCO application and, the effects on European Designated Sites are reported in the Shadow Habitats Regulations Assessment (HRA) Report (see Appendix D) and within Section 4.2.

The results of baseline noise surveys are included within the sound level assessment in Appendix E. The majority of the receptors are characterised by low background sound levels during the daytime and night-time periods. Sizewell Village can be influenced by the wind and tide conditions at this coastal location where the sound of the sea on the shingle beach often dominates. Sound levels at Rosery Cottage include plant sound from the electrical sub-station facility close by and serving an offshore wind farm facility.

The sound level assessment concluded that the sound levels are predicted to achieve the Lowest Observable Adverse Effect Level (LOAEL) at most residential receptors in daytime and night-time assessment periods during commissioning and routine testing. At three receptors the LOAEL may be exceeded by up to 1 dB, but levels would be well below the Significant Observable Adverse Effect Level (SOAEL).

During LOOP events, sound levels would only just be above the LOAEL at three residential receptors but below the SOAEL. This impact would occur in emergency situations only and would be for a short duration while all practicable measures are employed to restore the normal power supply to the operational station. In addition, LOOP events are infrequent (and may never arise) and the assessment is conservative using the worst-case assumptions.

A BAT assessment was carried out in Section 3 and the current design proposals are considered effective in reducing potential adverse noise impacts and are in accordance with the requirements of BAT.

If noise is considered problematic or if complaints of noise are received when operating, an assessment of the source and impacts will be carried out in line with the Environment Agency guidance to control and monitor emissions for your

environmental permit [26], the H3 part 2 horizontal guidance on noise assessment and control [32] and the BAT conclusions for the large combustion plant [10].

For sites where a 'noise nuisance at sensitive receptors is expected or sustained', Section 1.1 of the BAT conclusion for the large combustion plant [10] states that the environmental management system should include a noise management plan. In the UK, the term 'noise nuisance' is commonly associated with 'statutory noise nuisance' as defined in the Environmental Protection Act [78]. However, in the context of this BREF, it is taken to mean any disturbance caused at local receptors as a result of noise.

For the reasons outlined above, operational noise associated with the combustion plant is not expected to cause a disturbance or nuisance, and therefore no Noise Management Plan is initially proposed. However, in the event that environmental noise complaints were to arise then SZC would prepare and action a noise management plan, which would address the following:

- Protocol for conducting routine noise monitoring and a noise reduction programme (as required);
- A protocol for response to noise incidents containing appropriate actions and timelines; and
- A review of historic noise incidents, corrective actions and dissemination of noise incident knowledge to the affected parties.

In addition, a code of operational practice, which will accompany the application for Development Consent, will set out the general principles by which operational noise will be managed.

4.1.7 Assessment of the Impact of Emission to Land and Groundwater

There are no anticipated process emissions to land or groundwater from the installation. The measures described in Section 4 represent BAT to prevent unplanned emissions from the proposed installation.

4.1.8 Assessment of the Impact of Odour

The Combustion Activity has a low potential to generate odour, and the measures identified in Section 3 and 5 to control odour are considered to be BAT for the proposed installation.

4.2 Habitat Regulations Assessment

The Conservation of Habitats and Species Regulations 2017 [9] and The Conservation of Offshore Marine Habitats and Species Regulations 2017 [79] are the principal means by which the Habitats Directive is transposed into domestic legislation in England and Wales.

The Habitats Regulations implement the EU Birds [80] and Habitats Directives [2], both of which aim to protect a network of sites in the UK that have rare or important habitats and species. The sites classified pursuant to the Birds Directive [80] are known as Special Protection Areas (SPAs), and aim to conserve the habitats that support regularly occurring migratory or certain rare or vulnerable birds, to ensure their survival and reproduction in their area of distribution. Prior to classification by the UK Government, the sites are known as potential SPAs (pSPAs). The Habitats Directive [2] establishes the process for the designation of Special Areas of Conservation (SACs); these are sites that support habitats and/or species, which are rare or threatened on a European scale. Before the SAC designation is ratified by the European Commission the sites are referred to as candidate SACs (cSACs). SPAs and SACs are collectively known as 'European sites' and form part of a European network known as Natura 2000.

As a matter of policy, the English Government also applies the HRA process to Ramsar Sites (wetlands of international importance designated under the Ramsar Convention 1971) Ramsar sites are also routinely included within the definition of European sites.

The EP Regulations [1] require that the Habitats Regulations are taken into consideration to determine whether the installation activity will have a significant effect on any of the sites protected under the Habitat Regulations. This section of the report provides a further assessment of whether the installation is likely to have a significant effect on a European site in the UK, and an assessment of the implications of the installation for the purposes of these Regulations.

The Shadow HRA Report for SZC is provided in Appendix D. The Shadow HRA Report assesses the potential effects on European sites of the combustion activities of the diesel generators to which this EP Application relates, alone and in-combination with all Project activities as well as other potentially relevant plans and projects.

As identified in Section 4.1.1 there are ten European sites within 10 km of the installation, which are listed below in **Table 4.13**, along with a description of their qualifying features, distance and direction from the installation and the summary of conclusions of the Shadow HRA.

Table 4.13: Summary of Conclusions of the HRA

Receptor Name	Distance from Site	Qualifying Interest Features	Conclusions of Shadow HRA	
			Stage 1 Likely Significant Effect Screening	**Stage 2 Appropriate Assessment**
Alde-Ore and Butley Estuaries SAC, UK0030076	5km	Estuaries are an Annex 1 habitat, which is a primary reason for selection of this site. Mudflats and sandflats not covered by seawater at low tide and Atlantic salt meadows (Glauco-Puccinellietalia maritimae) are Annex 1 habitat qualifying features.	No – Air Quality Modelling No - Noise Assessment	
Alde-Ore Estuary SPA, UK9009112	5km	This site qualifies under Article 4.1 and 4.2 of the Birds Directive (2009/147/EC) by: Supporting populations of European importance of species listed on Annex I of the Directive; Supporting populations of European importance of migratory species; Sea bird assemblage of international importance – regularly supporting at least 20,000 seabirds; and Refer to Table 4.2 in the Shadow HRA Report in Appendix D for the full list of qualifying features.	No – Air Quality Modelling No - Noise Assessment	
Alde-Ore Estuary Ramsar site, 862	5km	The site qualifies as a Ramsar for the following reasons: • Ramsar criterion 2 - the site supports a number of nationally scarce plant species and British Red Data Book invertebrates; • Ramsar criterion 3 - the site supports a notable assemblage of breeding and wintering wetland birds;	No – Air Quality Modelling No - Noise Assessment	

Receptor Name	Distance from Site	Qualifying Interest Features	Conclusions of Shadow HRA	
			Stage 1 Likely Significant Effect Screening	**Stage 2 Appropriate Assessment**
		• Ramsar criterion 6 - species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation); and • Refer to Table 4.2 in the Shadow HRA Report in Appendix D for the full list of qualifying features.		
Minsmere to Walberswick Heaths and Marshes SAC, UK0012809	Adjacent	Annex 1 habitats that are a primary reason for selection of this site: • Annual vegetation of drift lines; and • European dry heaths. Annex 1 habitats present as a qualifying feature, but not a primary reason for selection of this site: • Perennial vegetation of stony banks.	**Yes – Air Quality Modelling** No – Noise Assessment	<u>NO_x Critical Levels</u> Given the highly conservative nature of the modelling scenario, the relatively small zone of influence of exceedance of the daily NO_x Critical Level and the fact that longer term NO_x concentrations have greater potential to affect vegetation than short-term exceedances, it is concluded that there would not be an adverse effect on the integrity of the Minsmere to Walberswick Heaths and Marshes SAC or the SPA and Ramsar site due to the daily NO_x exceedance of the critical level during routine testing. <u>Nutrient Nitrogen and Acid Deposition Critical Loads</u> The SAC, SPA and Ramsar site are also predicted to experience increases in nutrient nitrogen and acid deposition of more than 1% of the critical load and the predicted environmental concentration is predicted to exceed 70% of the critical load due to the
Minsmere-Walberswick SPA, UK9009101	Adjacent	The site qualifies under Article 4.1 and 4.2 of the Birds Directive (2009/147/EC) by: • Supporting populations of European importance of species listed on Annex 1 of the Directive; • Supporting populations of European importance of migratory species; and • Refer to Table 4.2 in the Shadow HRA Report in Appendix D for the full list of qualifying features.	**Yes – Air Quality Modelling** No – Noise Assessment	
Minsmere-Walberswick Ramsar site, 75	Adjacent	The site qualifies as a Ramsar under the following criteria: Ramsar criterion 1 - the site contains a mosaic of marine, freshwater, marshland and associated habitats complete with transition areas in between. It also contains the largest continuous	**Yes – Air Quality Modelling**	

Receptor Name	Distance from Site	Qualifying Interest Features	Conclusions of Shadow HRA	
			Stage 1 Likely Significant Effect Screening	Stage 2 Appropriate Assessment
		stand of reedbed in England and Wales, and rare transition in grazing marsh ditch plants from brackish to fresh water; Ramsar criterion 2 - this site supports nine nationally scarce plants and at least 26 red data book invertebrates. It supports a population of the mollusc narrow-mouthed whorl snail *Vertigo angustior* (Habitats Directive Annex II; British Red Data Book Endangered), recently discovered on the Blyth estuary river walls; and Refer to Table 4.2 in the Shadow HRA Report in Appendix D for the full list of qualifying features.	No – Noise Assessment	installation. However, it should be noted that the background levels of nutrient nitrogen and acid deposition already exceed the critical load. The predicted process contributions associated with commissioning, routine testing and a LOOP event would be short-term and temporary (especially during commissioning operations) and, given the background rates of high chronic deposition (refer to Section 4.1.2), the process contributions are unlikely to result in significant changes in species composition or habitat condition. Consequently, it is very unlikely that the increases predicted would lead to significant changes in species composition or to noticeable damage to the constituent plants, including any lichens and bryophytes. In light of the above, it is concluded that the conservation objectives of the SAC, SPA (and Ramsar site) would not be compromised and an adverse effect on the integrity of these European sites would not occur.

Receptor Name	Distance from Site	Qualifying Interest Features	Conclusions of Shadow HRA	
			Stage 1 Likely Significant Effect Screening	**Stage 2 Appropriate Assessment**
Orfordness-Shingle Street SAC, UK0014780	8km	Annex 1 habitats which are a primary reason for site selection are the Coastal Lagoons, Annual vegetation of drift lines, and Perennial vegetation of stony banks.	No – Air Quality Modelling No - Noise Assessment	
Outer Thames Estuary SPA, UK9020309	<1km	The site qualifies under Article 4.1 of the Birds Directive (2009/147/EC) as it is used regularly by 1% or more of the Great Britain population of species listed in Annex I in any season. Refer to Table 4.2 in the Shadow HRA Report in Appendix D for the full list of qualifying features.	No - Air Quality Modelling No – Noise Assessment	
Sandlings SPA, UK9020286	1km	The site qualifies under Article 4.1 of the Birds Directive (2009/147/EC) by supporting populations of European importance of species listed on Annex I of the Directive. Refer to Table 4.2 in the Shadow HRA Report in Appendix D for the full list of qualifying features.	**Yes - Air Quality Modelling** No – Noise Assessment	Although the process contribution exceeds 10% of the critical level for daily NO_x at the Sandlings SPA, the predicted environmental concentration is predicted to be 49% of the critical level (i.e. the critical level would not be exceeded). As described for the Minsmere to Walberswick Heaths and Marshes SAC and Minsmere-Walberswick SPA and Ramsar site, given the highly conservative nature of the modelling scenario for daily NO_x and the short-term nature of the effect, taken together with the prediction that the predicted

Receptor Name	Distance from Site	Qualifying Interest Features	Conclusions of Shadow HRA	
			Stage 1 Likely Significant Effect Screening	**Stage 2 Appropriate Assessment**
				environmental concentration would not exceed the critical level, it is concluded that there would not be an adverse effect on the integrity of the Sandlings SPA due to the installation.
Southern North Sea SAC, UK0030395	<1km	The qualifying feature of the site is the Annex II species (harbour porpoise *Phocoena phocoena*).	No - Air Quality Modelling No – Noise Assessment	

Conclusion of the HRA

With reference to the potential effect criteria presented in **Table 4.13** and Section 5.3 and Section 6 of the Shadow HRA Report in Appendix D, it is concluded that the installation would not:

- Cause a reduction in the area of habitat or of any European site;
- Cause indirect change to the physical quality of the habitat within any European site;
- Cause ongoing disturbance to qualifying features of any European site;
- Alter community structure (species composition);
- Alter the vulnerability of populations to other impacts; and
- Affect restoration of a feature where this is a conservation objective.

Noise generated from the combustion activities is not likely have a significant effect due to the minimal predicted change relative to ambient noise levels at the European sites and, in the case of SACs, the fact that there is no pathway for effect (refer to the Shadow HRA Report in Appendix D). When compared with the noise disturbance thresholds, the predicted noise levels from the combustion activities are well below the level where disturbance effects may be expected.

The results of the air quality modelling confirm that likely significant effect cannot be excluded at four European sites; these sites were carried through to the Stage 2 appropriate assessment. It was concluded that the diesel generators are not predicted to result in adverse effects on the integrity of the qualifying features of any European site and/or supporting habitats, taking into account the predicted zone of influence of the combustion activities and the duration of the potential effects.

The shadow HRA undertaken for the Sizewell C Project as a whole assessed the potential for in-combination effects between the Sizewell C Project (including the potential construction and operational phase effects) and other plans and projects. With respect to predicted air quality effects, the in-combination assessment concluded that there were no other plans or projects that had the potential to act in-combination with the effects of the Sizewell C project to result in a likely significant in-combination effect. The above conclusion also applies when all other pathways for potential effect of the Sizewell C Project are assessed in-combination with the predicted effects of the CA.

5 Managing the Combustion Activities

5.1 Management Systems

As discussed in Section 2.2.1 the approach for the design of the diesel generators is based on the strategy for replication of HPC. This is aligned to the overall project strategy; to maximise the opportunity to derive value from a 'Next of a Kind' effect, duplicating the HPC detailed design and adopting a systematic approach to capturing, quantifying and applying lessons learned to SZC Co.. The replication strategy also extends to the adoption of management arrangements from the HPC project.

The SZC Management Systems Manual [81] explains how the management processes for SZC Co. are to be implemented. It describes the IMS which is the tool used to ensure SZC Co. is able to act as an intelligent customer to design, procure, construct, commission, operate and eventually decommission the Sizewell C nuclear power plant. This will be executed safely and reliably to quality, time and cost in accordance with the Company Manual [5], the Nuclear Baseline statement [5] and the Company Quality Policy [82].

In order for SZC Co. to demonstrate that it is a competent licensee, staff within the SZC team will be nominated as counterparts and provide Intelligent Customer 'ownership' of the process on behalf of the SZC team and be a 'shadow' of the author and owner within the HPC team. No divergence of process will normally be allowed.

The IMS will cover all on-site activities to ensure a holistic and consistent approach is taken; the IMS will also cover off-site activities where applicable (e.g. design, supply chain management etc.).

SZC Co. recognises that the development of effective management arrangements, integrated in the company management systems, are key to ensuring a high standard of environmental performance and ensuring regulatory compliance. In order to reflect the complexity of regulating sites with environmental permits, the Environment Agency has produced specific guidance on developing a management system [22]. The guidance recommends that management systems are based on a recognised standard such as ISO 14001:2015 [83], or BS 8555 [84] and independently checked by an accredited body such as United Kingdom Accreditation Service (UKAS).

SZC Co. will make every effort to ensure that the strategy for management systems fulfils the requirements laid down in these documents and guidance. Appropriate systems will be put in place for the construction, commissioning, operation and decommissioning phases, recognising the differences in systems necessary to manage environmental performance. A phased implementation of the systems will account for the development and maturity of the organisation and allow for the arrangements to remain proportional to the risk profile of the site. The process will include a period of testing and ensure users are appropriately trained.

The approach to the development of suitable management arrangements will be supported by the company's drive towards certification to a UKAS accredited environmental standard, once the management systems are mature.

Due to the long construction time associated with the building of the plant, it is feasible that certification may be obtained before the plant becomes operational. The systems implemented will be project wide and will include operations on the installation during the construction, commissioning, operations and decommissioning phases, recognising proportionality of arrangements for future phases. The environmental aspects will be part of a full IMS covering environment, health, safety and security arrangements.

The management systems and management arrangements will be developed in a phased manner according to the life cycle milestones of the project development (refer to Section 6 – FAP Ref. 2i). Specific management controls including procedures and instructions associated with managing the permitted combustion activities will be developed at the relevant project phase. All parties undertaking activities on behalf of the site licensee will be already qualified with recognised qualifications, before they undertake any activities. Management arrangements and capabilities will be defined and implemented at the most appropriate time in the project's development so that they are fit for purpose and SZC Co. is fully capable of complying with the relevant permit conditions at the appropriate time.

SZC Co. will adopt the EDF Energy Environmental Policy, as signed by the Chief Executive Officer, and all those working on behalf of the company will be required to comply with the environmental policy.

Arrangements will be in place for the identification and evaluation of the environmental aspects and impacts of SZC Co.'s project as well as compliance with legal and other requirements.

Objectives and targets will be set to ensure regulatory compliance and continual improvement in environmental performance. The installation's procedures will be developed and will include details for the applicable responsible personnel on site, and their roles and responsibilities. This will take into full consideration of all the regulatory and other requirements applicable to the business activities, which will be controlled through the company formal management of change arrangements and will be undertaken in consultation with the EA. All personnel on site will be competent for the activities, which they carry out. Records will be kept including security arrangements and management control of documentation will be developed.

Changes made to the SZC design configuration (RC0) will be managed through the SZC Co. 'No Change Committee' (refer to Section 6 – FAP Ref. 2i). This will protect the replication benefits between the SZC and HPC projects whilst maximizing the scope of common documentation and data and minimising the risk or rework and schedule over run. The 'No Change Committee' will screen and assess the significance of any design changes including site specific adaptation, procurement

change, construction change and regulatory change on the SZC project to ensure that the design and activities are consistent with the environmental permits and the incorporation of BAT formally into the design process. Arrangements will be developed for the identification of changes to legal requirements in a timely manner to enable SZC Co. to plan for any changes to compliance arrangements required.

SZC Co. will ensure that there are effective communications internally and externally to ensure compliance with permit conditions.

As part of the development of suitable integrated management arrangements a set of strategies and actions has been produced by SZC Co. which includes requirements for combustion activities. The action will include:

- A review of relevant technical guidance notes provided by the Environment Agency, including those in draft/consultation form at the time of writing;
- A review of existing EDF Energy documentation to understand the procedures and processes currently used at the existing sites;
- A specific review of NNB GenCo (Hinkley Point C) Ltd documentation and the procedures and processes being developed and implemented;
- Consultation with the key stakeholders within EDF Energy to gain an appreciation of their expectations for an integrated management system and ensure early engagement;
- Consultation with key stakeholders regarding the key organisational roles and responsibilities required to ensure compliance and ensure consistency with the organisation baseline;
- A review of the applicable EDF Energy and SZC Co. documentation, to identify procedures already developed that can be used to support the development of the integrated management system;
- Communication with all the parties involved in the development of the integrated management system; and
- A final review of the legislation and guidance to ensure compliance with the applicable regulations.

In addition, the lessons learnt from other EDF nuclear power stations and from bringing the first unit into operation will be recorded and used when undertaking activities for the second unit (refer to Section 6 – FAP Ref. 2iv).

At this stage in the development of the IMS, the operational organisational structure has not been defined. The management arrangements and structure of the company will be reviewed and revised at key points later in the project lifecycle to ensure SZC Co. have sufficient control of the combustion activity.

5.1.1 Management System Requirements

The Environment Agency develop a management system: environmental permits guidance note [22] requires consideration of the proposed management systems for the following aspects:

- Site operations;
- Site and equipment maintenance;
- Contingency plans;
- Accident prevention and management plan;
- A changing climate;
- Complaints procedure;
- Competence and training;
- Keeping records;
- Management system review; and
- Site closure.

5.1.2 Site Operations

An IMS, which includes arrangements for compliance with environmental permits and legislation, will be produced. This will include the environmental policy, management arrangements, technical specifications as well as working instructions. The technical specifications will include operating parameters to ensure that plant or processes are kept in a safe condition with optimal environmental performance and that waste and emissions are minimised through the application of BAT. These arrangements will also ensure that the plant is operated in accordance with the manufacturers operating manual.

To ensure that the arrangements are appropriate to the nature and scale of the activities being undertaken, as well as the regulatory requirements, they will be formally documented and controlled environmental aspects assessment

process. The basis of this process is likely to build on the present arrangements that are in place at the UK EDF Energy sites, the arrangements will be amended to ensure that they take full account of SZC Co. and the information and data that have been produced during impact assessments undertaken for the regulatory application processes.

For the development of the arrangements, consideration is being given to the approach that was taken for the SZB power station and to approaches being taken at other EPR™ units under construction, such as HPC, which includes utilisation of the Methodically Engineered Restructured and Improved Technical Specifications methodology (). From an environmental perspective, all guidance available to date and made available before the finalisation of the arrangements will be consulted and will underpin the development of management arrangements.

For the purposes of commissioning there are specific requirements under the NSL to ensure that the licensee has adequate arrangements to control all the testing, inactive and active commissioning of plant and systems that may affect safety on the nuclear licenced site. These will be developed to ensure appropriate environmental controls are in place as required under other permits and authorisations. The SZC Co. key stakeholders that will be consulted as appropriate during the production of all documentation and other supporting arrangements will include the Head of Environment. The commissioning documentation will ensure that environmental impacts are fully documented, taken into account and that there are appropriate arrangements, including suitably qualified personnel in place to ensure safe operation and appropriate environmental performance.

5.1.3 Indicative BAT Requirements for Plant Operations

Table 5.1 details the indicative BAT requirements from the Environment Agency EP Technical Note for Combustion Plant.

Table 5.1: Indicative BAT Requirements for Plant Operation from the Environment Agency EP Technical Note for Combustion Plant

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EP Technical Note 1/1 (18): 4.8.1 In order to minimise the risk of emissions during operation all plant should be operated in accordance with the manufactures operating manual. Where there is not a manufacturing operating manual the Operator should develop their own operating procedures that includes plant failures. 4.8.2 Only staff that are trained should be authorised to operate the plant	Plant will be operated in accordance with the manufacturers operating manual or SZC Co. will develop their own site-specific operating procedures based on original equipment manufacturer guidelines. Environmental Optimisation will be integrated into the IMS and considered holistically as part of the Design Process. Only trained and competent staff will be authorised to operate the plant.

5.1.4 Site and Equipment Maintenance

Maintenance systems will be developed as part of the appropriate operational management arrangements. A bespoke maintenance management platform will be used to manage maintenance and will be integrated into the SZC Co. management systems. The experiences of the EDF Energy Existing Nuclear sites will be important in developing suitable management arrangements for maintenance. Expertise of the parent company and plant vendors will also be key to developing appropriate maintenance management arrangements. Maintenance records will be held including testing, calibration, and planned preventative maintenance records (this is discussed further in Section 5.1.11).

Environmentally significant equipment will be identified and recorded within the Environmental Protection Function Register. This will implement a three-tiered system, where equipment is designated as Key Environment Protection Equipment, Environment Protection Equipment or No Environmental Protection Function. The maintenance schedule will take into consideration the designation of equipment within the register and apply more or less stringent requirements as appropriate.

Management arrangements will be developed to ensure that safety and environmental performance will be maintained during shut down for maintenance or any other reason. The key aims of these maintenance management arrangements are as follows:

- To ensure that all maintenance schedule activities that require unavailability of any plant or process to allow any examination, maintenance, inspection or testing to be performed are identified, planned, actioned, reviewed and recorded; and

- To ensure that procedures are in place to enable the safe shutdown, and subsequent safe re-start, of any plant or process to allow any examination, maintenance, inspection or testing to be performed.

Indicative BAT Requirements for Maintenance

Table 5.2 details the indicative BAT requirements from the Environment Agency EP Technical Note for Combustion Plant.

Table 5.2: Indicative BAT Requirements for Maintenance from the Environment Agency EP Technical Note for Combustion Plant

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EP Technical Note 1/1 (18): 4.7.1 Effective preventative maintenance and cleaning plays a key role in achieving compliance with emission limits. 4.7.2 Regular cleaning of the flues and ductwork should be undertaken to ensure that dispersion rates are not affected by a build-up of material 4.7.3 All aspects of the process including all plant, buildings and equipment should be maintained in line with manufactures recommendations. Where there are no manufacturers recommendations then the Operator should devise their own maintenance procedures	All plant and equipment at the installation will be regularly maintained. Maintenance works at the installation will be scheduled using appropriate systems and will be undertaken regularly by qualified maintenance contractors.

5.1.5 Contingency Plans

SZC Co. will minimise the impact on the environment of any breakdowns, enforced shutdowns and any other changes in normal operation, for example due to flooding or other extreme weather. These requirements are both embedded in the design as a principle and contained within the arrangements established at a local level (e.g. Risk Assessment Methodology Statements, maintenance schedules and re-fuelling procedures).

A Flood Risk Assessment has been completed to confirm any adverse flood risk impact of the SZC development [85].

5.1.6 Incident Prevention and Management Plan

Incident Management Plan

As part of the FAP, an Accident and Incident Management Plan will be developed (this is discussed further in Section 5.2).

A quantitative environmental risk assessment will be developed as part of the FAP and will provide details of the types of measures that may be implemented at the site to control and mitigate such events to achieve BAT (this is discussed in Section 5.2).

In addition to this, SZC Co. will generate a Major Accident Prevention Policy (MAPP) which will ensure that all measures necessary are implemented to prevent major accidents at SZC and limit any consequences to persons and the environment (this is discussed further in Section 5.2).

Incidents and Non-Conformances

Licence Condition 11 of the NSL, when granted, will require SZC Co. to have adequate arrangements in place for managing incidents and emergencies that could lead to an environmental impact.

A full set of management arrangements for the management of incidents and non-conformances will be in place at the latest 9 months prior to commencement of the phase (i.e. construction, commissioning, operation and decommissioning). Management arrangements for incidents and non-conformances are to ensure adequate response and reporting at this stage in the project. These arrangements are as follows:

- Procedure to prevent and react to incidents and non-conformances;
- Procedure for notification, recording, investigation and reporting of incidents;
- Identification of incidents that are to be reported to the regulator;
- Roles and responsibilities of those involved;
- Learning and improvements;
- Mitigation measures;
- Training; and
- Reporting to management.

This system will be developed in line with the key stages of the development of the nuclear power station. This means that suitable systems will be in place prior to the construction phase as well as prior to the commissioning phases. At the construction stage, detailed coverage for direct 'nuclear' incidents is not required; however, robust emergency arrangements will be put in place to prevent and react to any conventional industrial incidents, such as security, fire or medical, as well as specific plans to react to an Off-Site Nuclear Emergency from SZB. This will involve the creation of an evolving emergency response structure supported by an on-site command and control function to co-ordinate any required response and follow-on actions. Additional support will be provided by an off-site Incident Management Team made up of appropriate specialists who will be available to support the site's long-term recovery efforts.

In terms of operations, a system will be developed for notification, recording, investigation and reporting of incidents. This will include initial registration of incidents, their classification and investigation (with associated actions).

As with most of the management arrangements that will be in place at the installation it is intended to follow ONR and Environment Agency guidance and the practical experience of other licensees. There will be a single system for incidents and for unexpected or unusual occurrences.

The arrangements involving response to incidents will be part of a comprehensive system of management arrangements that includes:

- Document control;
- Communications with the Regulatory Authorities;
- Examination, Maintenance, Inspection and Testing (i.e. in the case of deficiency);
- Leakage and Escape of Waste (i.e. in the case of loss of containment);
- System for capturing and disseminating operating experience;
- Documents, Records, Authorities and Certificates;
- Organisational Learning; and
- Quality Assurance.

5.1.7 A Changing Climate

During the GDA process, SZC Co. undertook due consideration of how operations could be affected by a changing climate and thus mitigations were included within the UK EPR™ design to accommodate such changes. This included conditions such as rainfall, snow, wind, low and high ambient temperatures, frazil ice and freeze up, flooding, drought and rising sea levels.

SZC site data for external hazards that could affect Nuclear Safety is being reviewed further to support the SZC NSL application. This includes an assessment of climate change projections aligned with UK Climate Projections 2018 (UKCP18). This data will be collected, consolidated and summarised within a Site Data Summary Report specific to SZC site. Ultimately, this work will review and assess the adequacy of the HPC RC2 design against the SZC site requirements and will make up part of the SZC Pre-Construction Safety Report justification.

Given that SZC is anticipated to be operated for approximately 40 to 60 years it is considered likely to be risk from the impacts of climate change. A climate change risk assessment is provided below in **Table 5.3** aligned with the Environment Agency

guidance 'Adapting to climate change: risk assessment for your environmental permit [23].

Table 5.3: Climate Change Risk Assessment

Potential changing climate variable	A - Impact	B - Likelihood	C - Severity	D - Risk (B x C)	E - Mitigation (what will you do to mitigate this risk)	F - Likelihood (after mitigation)	G - Severity (after mitigation)	H - Residual risk (F x G)
1. Summer daily maximum temperature may be around 7°C higher compared to average summer temperatures now.	Failure of ventilation system	3	3	9	Consider additional cooling systems and building insulation at design stage.	3	1	3
2. Winter daily maximum temperature could be 4°C more than the current average.	No negative impact expected.	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3. The biggest rainfall events are up to 20% more intense than current extremes (peak rainfall intensity)	Surface water drainage system overloaded.	3	2	6	Consider surface falls at design stage.	2	2	4
4. Average winter rainfall may increase by 35% on today's averages.	Surface water drainage system overloaded.	3	2	6	Increase surface water storage capacity and consider surface falls at design stage.	2	2	4
5. Sea level could be as much as 0.6m higher compared to today's level.	Flooding of site	4	3	12	Flood Risk Assessment and plan for sea defence as appropriate	3	2	6
6. Drier summers, potentially up to 39% less rain than now.	No negative impact expected.	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Potential changing climate variable	A - Impact	B - Likelihood	C - Severity	D - Risk (B x C)	E - Mitigation (what will you do to mitigate this risk)	F - Likelihood (after mitigation)	G - Severity (after mitigation)	H - Residual risk (F x G)
7. At its peak, the flow in watercourses could be 35% more than now, and at its lowest it could be 80% less than now.	No negative impact expected.	N/A	N/A	N/A	N/A	N/A	N/A	N/A

5.1.8 Complaints Procedure

SZC Co. will develop a procedure to manage enquiries and complaints received in relation to activities on the Sizewell C Main Development Site and its associated developments. This will include activities which have a permit, or another permission, associated with them. The procedure ensures that SZC Co. will investigate and provide a considerate, informed response within a reasonable time-period to contact from local residents, occupiers and other interested parties.

The procedure activities include:

- Supporting the SZC Co. commitment to communicate openly and transparently with local communities and other interested parties;
- Ensuring that SZC Co. manage enquiries and complaints appropriately, helping to build trust with those local communities and facilitate SZC Co. management to respond and take appropriate action; and
- Ensuring that complaints are managed in a compliant way with PW18 Residential Amenity: Information Dissemination and Complaints Handling.

5.1.9 Competence and Training

A major part of the IMS development programme is to provide assurance that all staff, contractors and any other personnel who control supervise and/or carry out work associated with the project are fully trained for the tasks that they carry out. They need to be fully aware of the potential environmental issues associated with the activities that they carry out and they are fully competent for the roles that they undertake. This therefore applies to all duly authorised persons and other suitably qualified and experienced persons.

Further, the Operator will provide adequate instructions to all persons allowed on the site so they are aware of the risks and hazards associated with the plant and its operations, the precautions that must be taken to minimise the risks to the environment, themselves and others and the actions to be taken in the event of accident or emergency. Detail of the Compliance Arrangements and supporting documentation for instructions to persons on site are expected to change during the Station lifecycle, particularly at changeover points from construction, to commissioning, into operation and close of operations.

To this end, the Operator is progressively developing a system of procedures which will encompass:

- An integrated company policy which summarises how training arrangements will be implemented;
- A summary of environmental and safety roles and responsibilities;
- Organisational arrangements and responsibilities;
- Procedural documentation;
- Standards, manuals and guidance; and
- A fully developed compliance matrix.

Training arrangements that have been demonstrated to comply with required regulations are already implemented on UK operating (EDF Energy) sites. These will form the basis of training arrangements developed in subsequent life cycle phases. A review of these arrangements will be performed to determine whether they are appropriate for SZC Co. and to identify any gaps against operational and regulatory requirements. It has been noted that there will be aspects of these arrangements that will not be applicable on SZC Co. sites due to the different training requirements for new build sites. Conversely, the Operator recognises that since this is a new build site there are additional requirements which may not be relevant or are less relevant to established sites. The Operator will ensure that all those people on the project who carry out activities during design, construction, manufacture, commissioning, operation or decommissioning of the nuclear installation, combustion activities permit installation or who have responsibility for any action which may affect environmental performance or safety are adequately trained for that purpose. Assurance procedures are being developed so that the necessary training requirements are identified for each activity that individuals who carry out these activities can demonstrate that they have received such training. Records are kept to demonstrate that individuals have been trained.

It is envisaged that the system will be based on top down arrangements of which the requirements for training under the environmental permit for Schedule 1 Part A

combustion plant will be a part. The upper tier of these arrangements will be an overall integrated policy for training for activities that may impact on plant environmental performance and safety. The arrangements that will be developed will require the production of a comprehensive schedule or programme for each person or group of persons on the site, in which the training requirements for each role are specified and the training requirements of an individual are identified. However, responsibility for ensuring that persons are trained lies with their Manager.

The Head of Training is responsible for defining SZC Co.'s approach to compliance and has overall responsibility for the SZC Co. management arrangements related to training and competency management. The responsibility for implementing the requirements will lie with Department Managers and Heads of Section.

As part of every individual's annual appraisal, a review of training needs will be carried out and where an individual has an environmental responsibility, appropriate training will be provided. All needs including environmental ones will be recorded and appropriate measures taken to deliver the required training. This will be managed through the central training/HR process and is also applicable for contractors.

Indicative BAT Requirements for Training

Table 5.4 details the indicative BAT requirements from the Environment Agency EP Technical Note for combustion plant.

Table 5.4: Indicative BAT Requirements for Training from the Environment Agency EP Technical Note for Combustion Plant

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
EP Technical Note 1/1 (18): 4.8.2 Only staff that are trained should be authorised to operate the plant	Only trained and competent staff or contractors will be authorised to operate the plant. Only appropriately trained and qualified staff or contractors will be authorised to operate MCERT monitoring equipment.

5.1.10 Keeping Records

SZC Co. will ensure that all documents and records are managed through a defined life cycle from creation, use and maintenance through to completion and disposal such that documents and records. These will be readily available to team members with legitimate business requirements including during the design, construction, commissioning, operation and decommissioning of the plant.

SZC Co. will keep records to demonstrate the IMS is being implemented in line with the requirements of the developing project and the combustion activity permit and all documentation will be kept within the project's electronic document and records management system. The HPC project document management procedure will be

further developed for SZC and will include details of the documentation to be kept and for how long.

Records will be kept of:

- Environmental permits;
- Legal requirements;
- Risk assessment;
- Management system plans;
- Plans and drawings;
- Management plans required by the permit;
- Design information;
- Operating procedures;
- Staff competence and training;
- Emissions and any other monitoring records;
- Compliance checks, findings of investigations and actions taken;
- Complaints made, findings of investigation and actions taken;
- Audits of management system, findings (reports) and actions taken;
- Management reviews and changes made to the management system; and
- Where applicable, certification audit reports and any actions carried out.

5.1.11 Regulatory Interaction, Notification and Reporting

The IMS will clearly define the requirements for regulatory interaction, reporting and notification.

Arrangements will be developed for the interaction between SZC Co. and the Environment Agency and other regulatory stakeholders. It will guide the interfaces between SZC Co. and the Environment Agency to ensure they are professional, controlled, consistent and appropriately documented.

Event categorisation and off-site reporting and notification guidance will define how reportable incidents are notified and recorded in the Regulatory Correspondence log in accordance with the Manage Interfaces with Regulators procedure.

5.1.12 Management System Review

SZC Co. will implement a procedure for checking compliance with the permit, procedures and management system.

SZC Co. will review and update the management system:

- within defined review periods as appropriate;
- when changes are made to the site, operations or equipment that affect the activities covered by the permit;
- when a permit variation application is made;
- after any accident, complaint or breach of the permit; and
- whenever a new environmental problem or issue arises, and new control measures to control it have been implemented

Changes made to the management system will be recorded, such as implementation of new control systems.

Suitable management review will also be undertaken on a higher level, whereby the effectiveness of arrangements and performance will be reviewed.

Monitoring and measurement will be carried out of the key operational characteristics that can have significant impact(s) on the environment.

Audits and inspections will be carried out to ensure that permit activities are managed to meet the conditions of the environmental permit. In addition, audits will also take place of contractors and/or contractors will be required to share the results of their audits and inspections.

5.1.13 Site Closure

The site will be decommissioned in a sensitive manner, in order to minimise the potential for environmental impacts associated with the decommissioning, dismantling and demolition of the plant.

The nuclear power station will be designed and built for a 60-year operation period. Although it is not practicable to develop a precise decommissioning plan at this time, the plant has been designed to minimise environmental impacts associated with the decommissioning and dismantling activities.

Accordingly, arrangements for the shutting down and decommissioning of the water discharge activities will be incorporated into the SZC Decommissioning Plan for the whole site. When developed, appropriate information will be provided to the Environment Agency and management arrangements will be altered accordingly.

The Operator will also develop a Decommissioning Waste Management Plan for the installation during detailed design stage, as required by the Energy Act [86]. An EIA will be undertaken closer to Decommissioning, in line with the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations [87]. As part of the FAP, a Site Closure Plan will be developed (this is discussed further in Section 5.7). The Site Condition Report will be a key input during the development of this plan.

5.1.14 Indicative BAT Requirements for Environmental Management Systems

Table 5.1.5 details the indicative BAT requirements from the BAT conclusions for large combustion plant and Environment Agency EP technical note for combustion plant and provides a commentary on the proposed approach for the SZC installation. This recognises the limitation of the approach taken and the proposal to provide further data through the FAP (Refer to Section 6 – FAP Ref. 2i).

Table 5.5: Indicative BAT Requirements for Environmental Management Systems from BAT Conclusions for Large Combustion Plant (LCP)

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
LCP BATc 1: In order to improve the overall environmental performance, BAT 1 is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features: i. commitment of the management, including senior management; ii. definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation; iii. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; iv. implementation of procedures paying particular attention to: a) structure and responsibility b) recruitment, training, awareness and competence c) communication d) employee involvement e) documentation f) effective process control g) planned regular maintenance programmes h) emergency preparedness and response	**i to vi. General EMS Aspects** The SZC power station will be operated by SZC Co. Ltd under an IMS which will be developed in compliance with the EA's guidance to a recognised standard and independently checked by an accredited body. The IMS will comprise an environmental policy and management documents, which will be applicable to the installation during the life cycle (permit grant, construction, commissioning, operation and decommissioning). Clear accountability for compliance and assurance will be identified throughout the lifecycle phases of the project and a programme for developing management arrangements is underway. Arrangements will be in place for the identification and evaluation of the environmental aspects and impacts of SZC Co.'s business as well as compliance with legal and other requirements. Arrangements will be developed and implemented at the most appropriate time in the project's development. Objectives and targets will be set to ensure regulatory compliance and continual improvement in its environmental performance. The installation's procedures will be developed and will include details

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
i) safeguarding compliance with environmental legislation; v. checking performance and taking corrective action, paying particular attention to: a) monitoring and measurement (see also the Reference Report on Monitoring of Emissions to Air and Water) b) corrective and preventive action c) maintenance of records d) independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; vi. review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness; vii. following the development of cleaner technologies; viii. consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life; ix. application of sectoral benchmarking on a regular basis. Specifically, for this sector, it is also important to consider the following features of the EMS, described where appropriate in the relevant BAT: x. quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT 9); xi. a management plan in order to reduce emissions to air during other than normal operating conditions, including start-up and shutdown periods (see BAT 10 and BAT 11); xii. a waste management plan to ensure that waste is avoided, prepared for reuse, recycled or otherwise recovered including the use of techniques given in BAT 16; xiii. a systematic method to identify and deal with potential uncontrolled and/or unplanned emissions to the environment, in particular: a) emissions to soil and groundwater from the handling and storage of fuels, additives, by-products and wastes b) emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities; xiv. a dust management plan to prevent or, where that is not practicable, to reduce diffuse emissions from	for the applicable responsible personnel on site, and their roles and responsibilities. This will take into full consideration all of the regulatory and other requirements applicable to the business activities, which will be controlled through the company formal management of change arrangements and will be undertaken in consultation with the EA. All personnel on site will be competent for the activities, which they carry out. **v. Performance Monitoring and Corrective Actions** a. Monitoring and Measurement: – Emissions to Air: Emissions to air from the diesel generator buildings will be monitored, as specified within the BAT guidance and the environmental permit for the installation. – Emissions to Water: All emissions to waters will be included within the operational water discharge activity environmental permit application. – Maintenance Plan: All plant and equipment at the installation will be regularly maintained. Maintenance works at the installation will be scheduled using appropriate systems and will be undertaken regularly by qualified maintenance contractors. i. Corrective and Preventative Actions: – The Operator will have appropriate procedures in place for monitoring plant operation and various performance parameters, and actions to be taken if any abnormal operational scenarios are identified. ii. Records: – The IMS will clearly define the requirements for maintaining and storing records. iii. Auditing: – The IMS will be subject to regular review and update (as required) by the Operator. **vi. Management Review of EMS** Regular Management Review meetings will be undertaken at the installation covering all aspects of site operations, including the IMS. **vii. Development of Cleaner Technologies** It is considered that for the operation of the installation for backup power, the selected technology i.e. generators using diesel represents

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
loading, unloading, storage and/or handling of fuels, residues and additives; xv. a noise management plan where a noise nuisance at sensitive receptors is expected or sustained; xvi. for the combustion, gasification or co-incineration of malodourous substances, an odour management plan.	BAT. The Operator will regularly review the implementation of cleaner technologies, if available. **viii. Consideration of Decommissioning Impacts** The Operator will develop a decommissioning plan for the installation during detailed design stage that will include an assessment of impacts from decommissioning of the plant and equipment at the installation. **ix. Sectoral Benchmarking** The installation is being designed with consideration to the application of BAT for its operation. The installation will be designed and operated in line with relevant BAT guidance. **x. Fuel Quality Control** The installation will use diesel, which complies with BS 2869:2017 and the SCOLF Regulations 2007. This will ensure that the quality of fuel complies with the requirements of the applicable standards. **xi. OTNOC Management Plan** See response to BATc 10 and 11 (refer to Section 5.2.5). **xii. Waste Management Plan** The installation will have appropriate procedures in place outlining the management of waste generated on site. This will include the appropriate storage and subsequent treatment/ recycling/ disposal of the waste. xiii. Management of Uncontrolled or Unplanned Emissions • Site Protection: The installation will have a procedure in place describing the site protection and monitoring procedures at the site. The procedure will describe the programme for the installation to monitor the effectiveness of the pollution prevention infrastructure to prevent and/ or reduce any release of polluting substances to ground or groundwater (as far as practicable) and to facilitate an ongoing review and amendment of the inspection, testing and maintenance programme for pollution prevention infrastructure at the installation (if necessary) to ensure their continued integrity. • Fugitive Emissions: The potential for fugitive emissions will be regularly reviewed as part of the IMS environmental aspect and impact identification procedures. The installation will also have procedures for management of emergencies and accidental releases at the site.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
	xiv. Dust Management Plan Due to the inherent nature of the site operations, the potential for dust generation from the installation is minimal. Therefore, no specific dust management plan is proposed to be in place. **xv. Noise Management Plan** An assessment of noise and vibration emissions from the installation has been undertaken (see Section 3 & 4 and Appendix C & E). The assessment concludes that the impact of the potential noise emissions from the installation will be negligible and therefore does not require specific noise mitigation measures or a noise management plan. **xvi. Odour Management Plan** Diesel will be used as a fuel and the sources of odour (diesel vapour vented during tank filling operations, combustion gases from plant operations (maintenance runs and periodic nuclear safety tests), and crankcase fume extract system venting from the EDGs) are considered to be negligible; consequently, no Odour Management Plan is required.
EP Technical Note 1/1/ (18): 4.6.1 Effective management is central to environmental performance; it is an important component of BAT and of achieving compliance with permit conditions. It is therefore desirable that installations put in place some form of structured environmental management system that addresses the following areas. a) Cleaning and maintenance b) Training and plant operation c) Bottom ash disposal d) Emission monitoring e) Plant failures f) Record keeping If the Operator already has a published standard (i.e. ISO 14001) they do not need to set up a separate system. Regulators should use their discretion, in consultation with individual Operators, to agree the appropriate level of EMS dependent to the nature and size of the particular process.	The SZC power station will be operated by SZC Co. Ltd under an IMS which will be developed in compliance with an appropriate standard. The IMS will comprise an environmental policy and management documents, which will be applicable to the installation during the life cycle (construction, commissioning, operation and decommissioning). Clear accountability for compliance and assurance will be identified throughout the lifecycle phases of the project and a programme for developing management arrangements is underway.
EP Technical Note 1/1/ (18): 4.9.1 It is important that the Operator can prove their compliance with all permit conditions, so it is recommended that the Operator keeps records of: (a) All inspections both by external bodies and internal employees,	The IMS will clearly define the requirements for maintaining and storing records.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
(b) Maintenance including cleaning, maintenance undertaken by external contractors or internal personnel and breakdowns, (c) Operating procedures with subsequent training records, (d) Emission testing, periodic and Operator assessment and as well as details of any testing platforms. 4.9.2 In addition for medium combustion plants the Operator shall keep a record of: a) the type and quantities of fuels used in the plant b) information proving the effective continuous operation of secondary abatement equipment needed in order to meet the emission limit values; and, c) any malfunctions or breakdown of secondary abatement equipment. 4.9.3 Records must be kept for a minimum of 6 years.	
EP Technical Note 1/1 (18)5.6.1 to 5.6.6 BAT is the following for Reporting and Notifications: 5.6.1 Communication between the Operator and the regulator is essential for an effectively regulated installation. 5.6.2 Where an Operator undertakes periodic emissions monitoring, the Operator should notify the regulator, sufficiently in advance, of the monitoring exercise taking place to allow the regulator to witness the testing. 5.6.3 Subsequently the Operator should submit the results of any periodic emission testing to the regulator once they have received the results. This submission should be within a timescale and format agreed with the regulator. Notwithstanding the requirements of paragraph 5.6.5, where an Operator undertakes continuous emissions monitoring, the Operator should report all results (including the results of parallel measurements using the relevant reference method) at least annually, or more frequently if required by the regulator. This submission should be within a timescale and format agreed with the regulator. 5.6.4 Where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported as well as an estimation of the error involved. 5.6.5 In the event of any non-compliance with any emission limit value, or malfunctions and breakdown of the plant that leads to abnormal operating conditions or complaints about odour and / or smoke; the Operator shall take the measures necessary to ensure that	The IMS will clearly define the requirements for reporting and notifications.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
compliance is restored within the shortest possible time. This action should include but is not limited to: a) Notify the regulator within 24 hours of receiving the information to agree the investigation of the issue. b) Undertake the agreed investigation. c) Adjust the process or activity to minimise those emissions. d) If applicable re-test to demonstrate compliance as soon as possible. e) Promptly record the events and actions taken. f) Submit to the regulator the report and updates as agreed. 5.6.6 The Operator should inform the regulator, without undue delay, of any proposed changes to the plant which could affect the applicable emission limit values. This notification should be sufficiently in advance of those changes coming into effect for the regulator to make the necessary assessments with a view to varying the permit as appropriate.	

5.2 Incident Management Plan

This section will describe the mechanisms developed by the Operator to enable the identification, assessment, management and mitigation of hazards associated with the activities undertaken at the installation under normal operation and abnormal operating conditions.

The Control of Major Accident Hazards Regulations requirements are dealt with in a separate site-specific application.

As part of the operational incident management system, SZC Co. will generate a MAPP, which will ensure that all measures necessary are implemented to prevent major accidents at SZC and limit any consequences to persons and the environment. The MAPP will detail:

- Roles and responsibilities of those involved in the management of major hazards at all levels in the organization will be defined and training needs will be identified and provided. Co-operation of employees will be encouraged, and contractors will be selected to ensure that they are competent.

- Arrangements to identify and evaluate the potential for major hazards to arise from site activities and to prepare, test and review emergency plans in response to such emergencies. A management of change process will exist for the planning, design of new installation, processes and storages to ensure all health, safety & environmental requirements and BAT is met. Operating and maintenance procedures will be in place and procedures will be reviewed

and revised whenever a change occurs or as required. The integrity of safety and environmental equipment will be maintained through examination and planned preventative maintenance. Contractors will be managed and monitored to ensure an adequate standard of safe working.

- Arrangements for the investigation and corrective action in the event of failure to achieve the stated objectives, aims and standards. Procedures will be in place for the reporting of unsafe or hazardous conditions and for corrective action to correct these conditions and to follow up on the basis of lessons learnt.

The installation will implement a well-developed hazard and risk management systems and a philosophy of safe working practices to minimise the potential for environmental impacts as part of the IMS.

This section of the application requires a detailed quantified risk assessment of feasible incidents that can have an environmental impact. This analysis should cover accidents and their consequences, including spills and abnormal operation, taking into consideration the advice provided within LCP BAT conclusions document [10], Environment Agency develop a management system guidance [22], Environment Agency risk assessments for your environmental permit guidance [24] and the IPPC combustion sector guidance [15].

Due to the development of the overall programme of work, the detailed site design and layout has not yet been finalised and any procedural mitigation has not been produced.

Therefore, this section of the submission follows the overall approach taken to describe how the IMS will be developed and implemented to provide evidence that the Operator has adopted a robust approach to the identification, management and mitigation of environmental impacts. This section also provides details where appropriate, of the potential hazards that will be addressed in the Accident and Incident Management Plans. The Incident Management Plan will be developed in accordance with Environment Agency guidance and other relevant guidance as part of the IMS. In time, this will also operate to identify the roles and responsibilities of personnel in the management of accidents, arrangements for communication in such an event, how such incidents should be managed in the event of occurrence and an assessment of causes of event and changes to operations/procedures to prevent recurrence.

This section discusses the approach to be taken and highlight the main risks identified (based on the current design and experience from other sites). This section of the application therefore currently comprises a relatively high-level environmental risk assessment. As part of the FAP, a detailed Accident and Incident Management Plan will be provided.

The analysis already performed in both the Pre-Construction Environment Report (PCER) (Sub-chapter 3.3) [88] and the Pollution Prevention and Control (PPC) GDA document [38] includes the fuel oil tanks for the diesel generators.

Based on operating and permitting experience across the UK, typical abnormal / emergency events that will be addressed as the site design is developed are:

- Significant loss of diesel during delivery;
- Damage to the diesel tanks and bunds through accidental rupture or spontaneous failure of tank, leading to loss of (oil) tank contents;
- Loss of diesel from distribution system during transfer from the main storage tanks to the day storage tanks;
- Loss of diesel from distribution system during transfer from the day storage tanks to the engine;
- Loss of containment of lubricating oil;
- Fire/explosion of combustible materials, including diesel;
- Visible Plume;
- Loss of antifreeze during delivery/storage/dispensing;
- Mal-operation of the diesel generators;
- Flooding of the site and associated contamination of flood waters with chemicals/fuel stored on site; and
- Vandalism to plant, equipment and infrastructure and associated loss of fuel / chemicals from site.

Other scenarios may be identified as the design of the plant develops, together with the assessment of the associated environmental impacts.

5.2.1 Identification of Hazards

The identification of environmental hazards associated with the operation of the plant has informed the development of the PCER in the GDA, with further developments captured within the HPC Safety Case (PCSR3) and environmental permits applications.

When implemented, the management system will enable the identification of potentially adverse environmental impacts arising from operations under normal and abnormal conditions, by virtue of the following:

- Developments incorporated into the HPC RC2 design, where applicable;
- Plant risk assessments;
- The Schedule for the assessment and maintenance of plant and machinery that are identified as presenting a risk of potentially adverse environmental impacts;
- Operating procedures and work instructions, including training on use of spill kits;
- Plant modification/change management procedures; and
- The Environmental Aspects Register.

The development of these documents and compliance with the periodic review of the environmental aspects register and records of non-conformances with the management system and operational requirements, enables the Operator to characterise the significance and probability of potential adverse environmental impacts, and to implement, and where appropriate, to review the efficiency of the accident mitigation and management measures.

Details of the documentation referenced above are provided in the following sections.

Environmental Risk Assessment

A preliminary risk assessment carried out for the environmental permit application (and reflecting the level of detail available) has identified a number of typical hazardous events (accident scenarios) as listed above. These will be discussed further in Section 5.2.2.

Schedule of Inspections and Environmental Maintenance

A schedule of Inspections and Environmental Maintenance has not yet been developed. Once the detailed design of the plant has been finalised, a preliminary schedule can be prepared. This will be a dynamic document influenced by the commissioning process and ongoing operations. Where equipment is identified has having an environmental protection role, this will be recorded, and appropriate maintenance and inspection will be carried out. This will be recorded as a procedure within the site management system.

Operating Procedures/Job Instructions

Procedures will be developed to cover key operations on the installation. These will include the running of the diesel plant and delivery/refilling of the fuel tanks and will incorporate any actions required for environmental protection.

5.2.2 Environmental Risk Assessment

This section of the submission will provide a description of the procedures/methodology for identifying and assessing environmental risk. A quantified risk assessment has not been provided as the processes and mitigations are not sufficiently developed to either reflect the protection measures in place or to commit to specific measures. A full quantified risk assessment will be provided as part of the IMS.

The approach to the assessment of hazards with the potential for environmental impacts will be in accordance with the requirements of the Environment Agency risk assessments for your environmental permit guidance (January 2019) [24].

The identified hazards will be reviewed in accordance with the approach provided by the Environment Agency guidance [24] (along with any additional risks identified). To enable an accurate and meaningful quantitative assessment of the likelihood and environmental significance of the identified accident scenarios. The quantitative values and definitions of their meaning that will be applied are provided in the ranking matrix given in **Table 5.6**.

Table 5.6: Ranking Matrix for Risk Assessment

"S" Severity of environmental impact	
1. Minor	Nuisance onsite only (no off-site effects). No outside complaint.
2. Noticeable	Noticeable nuisance offsite, e.g. discernible odours. Minor breach of permitted emissions, but no environmental harm. One or two complaints from the public.
3. Significant	Severe and sustained nuisance, e.g. strong offensive odour or noise disturbance. Major breach of permitted emissions with possibility of prosecution. Numerous public complaints.
4. Severe	Hospital treatment required. Public warning & off-site emergency plan invoked. Hazardous substance releases into water course with ½-mile effect.
5. Major	Evacuation of local populace. Temporary disabling and hospitalisation. Serious toxic effect on beneficial or protected species.

"S" Severity of environmental impact	
	Widespread by not persistent damage to land. Significant fish kill over 5-mile range.
6. Catastrophic	Major airborne release with serious offsite effects. Site shutdown. Serious contamination of groundwater or watercourse with extensive loss of aquatic life.
"L" Likelihood of event	
1. Extremely unlikely	Incident occurs less than once in a million years.
2. Very unlikely	Incident occurs between once per million and once every 10,000 years.
3. Unlikely	Incident occurs between once per 10,000 years and once every 100 years.
4. Somewhat unlikely	Incident occurs between once per hundred and once every 10 years.
5. Fairly probable	Incident occurs between once per 10 years and once per year.
6. Probable	Incident occurs at least once per year.

This assessment methodology is presented in **Table 5.7**.

Table 5.7: Calibration of Risk Assessment Outputs 1 – Banded

Likelihood of Event		**Severity of Environmental Impact**					
		Minor	Noticeable	Significant	Severe	Major	Catastrophic
		1	2	3	4	5	6
Extremely Unlikely	1	1	2	3	4	5	6
Very Unlikely	2	2	4	6	8	10	12
Unlikely	3	3	6	9	12	**15**	**18**
Somewhat Unlikely	4	4	8	12	**16**	**20**	**24**
Fairly Probably	5	5	10	**15**	**20**	**25**	**30**
Probable	6	6	12	**18**	**24**	**30**	**36**

An inventory of the potential hazardous events has been developed by identifying scenarios for different events and activities on the site and recording the likelihood and the environmental significance of these events, should they occur.

The worst possible or maximum 'Environmental Consequence' by media of each event is listed, and the consequence has then been considered and allocated the appropriate numerical value (from Table 5.6) shown under 'S' for the severity of any

outcome, and 'L' for the likelihood of the event occurring. The risk is then calculated by multiplying the severity and likelihood numbers. The results of this are shown under the column 'R'.

S = Severity, L = Likelihood, R = Risk, (S x L = R)

Interpretation of the risk scores are provided at **Table 5.8**, which provides comments on the severity/acceptability of the hazard.

Table 5.8: Calibration of Risk Assessment Outputs 2 – Descriptive

Risk Score	Magnitude of Risk	Consideration
6 or less	Insignificant	Low or negligible levels of risk, low or negligible impacts. Adherence to good operational practices will adequately control these risks.
8 – 12	Acceptable	Lower level of possible impact, but major severity or high likelihood would require consideration of further actions to reduce risk.
15 - 20	Unacceptable	Combination of high likelihood or major impact would require further assessment and possible actions to reduce risk.
24 or more	Severe	Risk is unacceptable. Immediate resolution required.

5.2.3 Quantitative Risk Assessment

Table 5.9 provides an example of environmental risk assessment for the accidents identified in the hazard assessments for the standby generators at the SZC installation. The table does not provide a quantitative assessment of the hazards associated with the activities undertaken at the installation; this will be provided when detailed design data is available and will be calculated in accordance with the methodology described above. **Table 5.9** also provides details of the types of measures that may be implemented at the site to control and mitigate such events to achieve BAT.

The final column in **Table 5.9** contains a comment on the controls applied; it should be noted that the cause of the events has not necessarily been identified (e.g. for a fire, the specific source of ignition has not always been considered, rather a general assessment of the likelihood of the event and the types of precautions to be applied).

Table 5.9: Example Assessment of Accidents Identified and their Environmental Consequences at SZC

Hazardous Event	Potential Environmental Consequences by Media	Risk Assessment			Comments/Controls
		S	L	R	
Raw Material Delivery					
Significant loss of diesel during delivery (tankers) or transfer (by bowser).	Air: Short term localised air impact, some odour. Water: Spillage likely to be contained on site. Land: Unlikely impact on ground as operational area of site is likely to be new hard standing and all drains will be new. Key receptor: North Sea Pathway: Still to be determined but likely to be site drains.	TBC	TBC	TBC	Transfers of oils by tanker and bowser have sound primary containment; the need for secondary containment will be assessed as a part of the design risk assessment. Risks will be reduced by the design of the surface water system and procedures requiring spill mats to be placed over any local surface water drains. Forecourt separators are to be provided at all locations where fuel handling takes place. Penstock valves are provided at the point of discharge to all forebays. Procedures will also be developed for filling of main oil tanks, emergency and spill response. Training will be provided for relevant personnel All operations will comply with the Oil Storage Regulations, Environment Agency guidance on oil storage regulations for businesses, BS 5410 Code of practice for oil firing and CIRIA advice where relevant. Transfers will be supervised by appropriately trained and supervised site personnel (in addition to the vehicle drivers). Tanks will be checked for capacity before filling to prevent over filling and will have level indication/alarms and emergency cut-off switches. Any small spillage contained in delivery pipework will be managed through local containment. The site drainage system has still to be developed (as part of the FAP) and this process will consider the risks of tanker failure. Vehicle speeds will be controlled by site speed limits and all plant will be housed within the diesel building providing protection against vehicle damage.

Hazardous Event	Potential Environmental Consequences by Media	Risk Assessment			Comments/Controls
		S	L	R	
Raw Material Storage					
Diesel fuel storage. Damage to the diesel tanks and bunds through accidental impact, rupture or spontaneous failure of tank leading to loss of all tank contents.	Air: Short term localised air impact, some odour from building ventilation. Water: Spillage would be contained within the diesel building. Land: Unlikely as any spillage would be contained within the building.	TBC	TBC	TBC	The tanks are double-skinned and fully enclosed with the associated pipework within the diesel buildings which will act as an impermeable concrete bund. Any leaks or spills would be captured in sumps or holding tanks and pumped out and removed from site by tanker for offsite treatment and disposal. Any loss would be fully contained. Damage from accidental impacts (e.g. vehicles) is unlikely with the tanks being indoors. Tanks, valves, pipework and flange points will be inspected as part of the IMS. Emergency and spill response plans will be developed, and training provided to relevant personnel.
Raw Material Distribution Systems					
Loss of diesel fuel from the distribution system (pipework) during transfer from the bulk storage tanks to the combustion plant.	Air: Short term localised air impact, some odour from building ventilation, minor for smaller spills and unlikely to be noticeable off site. Water: Spillage would be contained within the diesel building.	TBC	TBC	TBC	All the pipework is fully contained within the diesel buildings. Any leaks or spills would be captured in sumps or holding tanks and pumped out and removed from site by tanker for off-site treatment and disposal. Any leaks (minor or major) would be fully contained. The internal structure of the basement will be finished in an impermeable material (either building material or oil resistant coating). Pipework, valves and flange points will be inspected as part of the IMS. Emergency and spill response plans will be developed, and training provided to relevant personnel.

Hazardous Event	Potential Environmental Consequences by Media	Risk Assessment			Comments/Controls
		S	L	R	
	Land: Unlikely as any spillage would be contained within the building.				
Fire					
Major fire and/or explosion of combustible materials, including diesel fuel.	Air: Significant local air quality impact from combustion products/ dust/ smoke, etc. Water: Fire water releases would arise and after filling the diesel building basement may overflow into the site drainage system. Land: Unlikely impact on ground due to the extensive hardstanding and new drainage system installed within the installation.	TBC	TBC	TBC	Although possible, fire/explosion is not likely (based on operational experience). Areas, which pose a significant threat of fire such as oil storage facilities, will be protected by dedicated installed fire prevention and mitigation systems. Extensive controls will be incorporated into the plant design to both prevent explosions and fires ('zoned' electrical equipment, alarms, automatic fire systems etc.) and minimise impact. The volume of the basement area of the diesel buildings is able to hold a significant volume of water. In addition, the fire water can then be discharged to a sump or holding tank and pumped out and removed from site by tanker for offsite treatment and disposal. A fire water management plan is to be completed to ensure that firewater can be collected and contained in the event of an emergency. The station may operate a fire team and (if so) will develop and maintain a fire plan to deal with minor incidents; the diesel buildings will be part of a site-wide fire plan. More significant fires will be dealt with in collaboration with Leiston Fire Brigade.
Operation of the Combustion Plant					
Visible plume	Air: Release of steam or water plume forming a visible plume	TBC	TBC	TBC	There is no steam cycle or wet cooling tower plume associated with the operation of the diesel generators and therefore condensing plumes are not

Hazardous Event	Potential Environmental Consequences by Media	Risk Assessment			Comments/Controls
		S	L	R	
	Water: No impact Land: No impact				expected to occur. The potential for visible plumes from the plant stacks is considered to be very low as a result of the water content and temperature of the flue gas.
Failure or mal operation of the diesel generators.	Air: Release of black smoke and PM Water: No impact Land: No impact	TBC	TBC	TBC	In order to monitor the quality of fuel combustion, basic process monitoring will be incorporated (e.g. oxygen, CO and temperature monitoring). The plant is only planned to be operated for maintenance purposes and periodic nuclear safety tests, during which the operations will be closely observed and recorded to demonstrate the reliability of the combustion plant (so any failure of mal operation will be noticed). If the combustion process is not operating as expected or may be causing off-site impacts the combustion plant will be shut down procedures relating to scenarios such as this will determine the specific actions required by the Operator.
Loss of containment of the cooling system (50% ethylene glycol).	Air: No impact. Water: Spillage would be contained within the diesel building. Land: Unlikely as any spillage would be contained within the building.	TBC	TBC	TBC	The drainage system for the area housing the cooling circuit has not yet been designed. As part of the FAP, this scenario will be considered, and appropriate mitigation put in place to prevent the fluid reaching surface water drains. The fluid will then be removed by a licenced contractor and disposed of as hazardous waste. Pipework, valves and flange points will be inspected as part of the IMS. Emergency and spill response plans will be developed, and training provided to relevant personnel.
Loss of containment of lubricating oil	Air: Short term localised air impact, some odour from building ventilation.	TBC	TBC	TBC	All the pipework is fully contained within the diesel buildings. Any leaks or spills would be captured in sumps or holding tanks and pumped out and removed from site by tanker for offsite treatment and disposal. The internal structure of the basement will be finished in an impermeable material (either building material or oil resistant coating).

Hazardous Event	Potential Environmental Consequences by Media	Risk Assessment			Comments/Controls
		S	L	R	
	Water: Spillage would be contained within the diesel building. Land: Unlikely as any spillage would be contained within the building.				Pipework, valves and flange points will be inspected as part of the IMS. Emergency and spill response plans will be developed, and training provided to relevant personnel.
Flooding of the site and associated contamination of flood waters with chemicals/fuel stored on site	Air: No impact. Water: Floodwater would be contained within the diesel building and/or enter the drainage system. Land: Floodwater would be contained within the diesel building and/or enter the groundwater via unsurfaced areas. Pathway: Flow by gravity/drainage systems/unsurfaced areas	TBC	TBC	TBC	The site will be protected against flooding from the sea by its elevation. This elevation of the platform on which the plant is to be constructed, will be created at 7.3 AOD. Although it will not ensure a dry site under all conditions, the elevation was determined as a solution that is ALARP. A Flood Risk Assessment took place, which took into consideration changes in extreme high-water levels due to reasonably foreseeable climate change through to the end of the station operational lifetime assessed using UKCP09 10,000-year return period at 95% confidence level. The site also benefits from drainage arrangements and buildings are design' so that standing water does not enter buildings.
Vandalism to plant, equipment and infrastructure and associated loss of fuel / chemicals from site	Negligible. Appropriate design and management action should prevent vandalism happening.	TBC	TBC	TBC	The site will be protected by high level security systems.

Indicative BAT Requirements for Accidents

Table 5.10 details the indicative BAT requirements from the BAT conclusions for large combustion plant, and Environment Agency guidance for risk assessments for your environmental permit and IPPC combustion section guidance note and provides a commentary on the proposed approach for the SZC installation. This recognises the limitations of the approach taken and the proposal to provide further data through the FAP (Refer to Section 6 – FAP Ref. 3).

Table 5.10: Indicative BAT Requirements for Accidents

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
LCP BATc 10: In order to reduce emissions to air and/or to water during OTNOC, BAT is to set up and implement a management plan as part of the environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements: • appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines); • set-up and implementation of a specific preventive maintenance plan for these relevant systems; • review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary; • periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.	Adequate arrangements in relation to OTNOC will be developed as part of the IMS.
LCP BATc 11: BAT is to appropriately monitor emissions to air/or to water during OTNOC.	Adequate arrangements in relation to OTNOC will be developed as part of the IMS.
Environment Agency guidance for risk Assessments for your environmental permit: develop an accident risk assessment - “Risk assessments for your EP” identifies the type of accidents which should be considered:	Adequate arrangements in relation to OTNOC will be developed as part of the IMS.
• transferring substances, for example loading or unloading vessels	Table 5.2.4 identifies the likely hazards associated with operations on the installation.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• overfilling vessels	Table 5.2.4 identifies the likely hazards associated with operations on the installation.
• plant or equipment failure	When determined, compliance with the site inspection and plant maintenance and testing schedules are considered to mitigate these hazards. Appropriate alarms to reduce the likelihood of overfilling or over pressurisation will be considered in the Procurement Phase.
• releasing an effluent before checking its composition	Not relevant for processes undertaken at the installation, there are no planned effluent releases.
• vandalism	The site will be protected by high level security systems.
• flooding	The site and installations are located within an area at risk of flooding (Flood Risk 3) as a result of rivers or seas without defences. The site will be protected against flooding from the sea by its elevation. This elevation of the platform on which the plant is to be constructed, will be created at 7.3 AOD. Although it will not ensure a dry site under all conditions, the elevation was determined as a solution that is ALARP. A Flood Risk Assessment took place, which took into consideration changes in extreme high-water levels due to reasonably foreseeable climate change through to the end of the station operational lifetime assessed using UKCP09 10,000-year return period at 95% confidence level. The site also benefits from drainage arrangements and buildings are design, so that standing water does not enter buildings.
• inadequate bunding around tanks	The main fuel storage tanks will be designed to protect the environmental and will be housed in an engineered bund within the diesel generator buildings. Actual tank specifications are not yet known but will be designed and specified in accordance with appropriate requirements and practice at the time e.g. tank material and manufacturers testing regime).
IPPC combustion sector guidance note 2.8: Assess the risks - having identified the hazards, the process of assessing the risks can be viewed as addressing six basic questions:	
• What is the estimated probability of their occurrence? (source and frequency);	Section 5.2.2 above provides an assessment of each of the identified hazards using the risk evaluation and classification matrix discussed above. A fully quantified risk assessment will be provided a part of the FAP.
• What gets out and how much? (Risk evaluation of the event);	
• Where does it get to? (Predictions for the emission – what are the pathways and receptors?);	

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• What are the consequences? (Consequence assessment – the effects on the receptors);	
• What are the overall risks? (Determination of the overall risk and its significance to the environment); and	
• What can prevent or reduce the risk? (Risk management – measures to prevent accidents and/or reduce their environmental consequences).	
IPPC combustion sector guidance note 2.8: The depth and type of assessment will depend on the characteristics of the installation and its location. The main factors which should be taken into account are:	
• The scale and nature of the accident hazard presented by the installation and the activities;	The methodology takes into account the presence of on and offsite receptors within the vicinity of the installation, and the sensitivity of the environmental setting of the area. Although the material remains the same, the extent of the hazard is significantly reduced by decreasing the likelihood and severity of an accident occurring through the consideration of environmental issues at the design stage. This is particularly evidenced through the housing within the diesel building and bunding of the tanks.
• The risks to areas of population and the environment (receptors); and	
• The nature of the installation and complexity or otherwise of the activities and the relative difficulty in deciding and justifying the adequacy of the risk control techniques.	
Identify the techniques necessary to reduce the risks including:	
• An inventory should be maintained of substances, present or likely to be present, which could have environmental consequences if they escape. It should not be forgotten that many apparently innocuous substances can be environmentally damaging if they escape (e.g. a tanker of milk spilled into a watercourse could destroy its ecosystem). The permit will require the Regulator to be notified of any changes to the inventory;	The management system implemented by the Operator will comply with this requirement.
• Procedures should be in place for checking raw materials and wastes to ensure compatibility with other substances with which they may accidentally come into contact;	The IMS to be implemented will cover this aspect. Refer to Section 5.3 for details of raw materials and Section 5.4 for details of wastes.
• Storage arrangements for raw materials, products and wastes should be provided to minimise risks to the environment;	Storage arrangements are considered to comply with the indicative BAT requirement.
• There should be automatic process controls backed-up by manual supervision, both to minimise the frequency of emergency situations and to maintain control during emergency situations. Instrumentation will include, where	The installation will have extensive systems for maintaining control in emergencies, and the standby systems discussed here are part of that.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
appropriate, microprocessor control, trips and process interlocks, coupled with independent level, temperature, flow and pressure metering and high or low alarms.	The operation of the standby plant will be undertaken only during maintenance or when essential and the systems are robustly engineered to ensure this availability with reliability being the crucial factor. The measures proposed at the installation are considered to constitute BAT.
• Physical protection measures, such as suitable barriers to prevent damage to equipment from the movement of vehicles, should be in place as appropriate;	All operations will be fully enclosed within the diesel buildings, including the main tanks, which will be contained in engineered bunds and are away from site traffic.
• Appropriate secondary containment should be provided, e.g. bunds and catch pots, building containment;	The building will act as secondary containment and will be impermeable to the diesel fuel stored inside.
• Techniques and procedures should be implemented to prevent overfilling of storage tanks (liquid or powder), e.g. level measurement, independent high-level alarms, high-level cut-off, and batch metering;	The tanks will incorporate appropriate alarms. Any overflow would be contained within the diesel building. The delivery/transfer system may also incorporate an emergency shut off system.
• Where the installation is situated in a floodplain, consideration should be given to techniques which will minimise the risk of the flooding causing a pollution incident or making one worse.	A Flood Risk Assessment has been completed to confirm any adverse flood risk impact of the SZC development.
• installation security systems to prevent unauthorised access should be provided as appropriate and should include maintenance arrangements where necessary;	The security to be employed will be typical of nuclear installations in the UK and appropriate maintenance arrangements will be developed.
• There should be formal systems in place for the logging and recording and recording of all incidents, near-misses, changes to procedures, abnormal events and findings of maintenance inspections;	Provision for the reporting and recording of the incidents will be provided as part of the IMS.
• Procedures should be established to identify, respond to and learn from such incidents;	Provision for this is provided as part of the IMS.
• Safe shutdown procedures should be in place;	The operating manual will make extensive provision for safe shutdown procedures, the diesel plant is a key part of the safety shutdown procedures.
• The roles and responsibilities of personnel involved in incident management should be identified;	These will be established and tested as part of a site-wide emergency testing regime.
• Communication channels with emergency services and other relevant authorities should be established, and available for use in case of emergency.	These will be established and tested as part of a site-wide emergency testing regime.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Appropriate control techniques should be in place to limit the consequences of an accident, such as isolation of drains, provision of oil spillage, alerting of relevant authorities and evacuation procedures.	These issues will be addressed as part of the site-wide incident management plan.
• Procedures should be in place to ensure that the composition of the contents of a bund sump, or sump connected to a drainage system, are checked before treatment or disposal;	Extensive provision, including work instructions will be made within the IMS for the monitoring of sump contents or spillages prior to discharge or disposal.
• Personnel training requirements should be identified and training provided;	This will be addressed through the central training programme.
• Drainage sumps should be equipped with a high-level alarm or sensor with automatic pump to storage (not to discharge); there should be a system in place to ensure that sump levels are kept to a minimum at all times;	Any leaks from the tanks will accumulate in the sump, which has a level alarm. This will be confirmed once the drainage system has been designed. The tanks are in the diesel building, any major spillage would be contained in the event of a sump overflowing. There will be no requirement to pump out rain water so a permanent sump pump is not required.
• High-level alarms etc. should not be routinely used as the primary method of level control;	Fuel deliveries will take place regularly to maintain the fuel stocks at a high level. On-site staff will have an estimate of the fuel required based on running hours and deliveries will be closely supervised. At the purchasing stage, tanks with a visual fill level indicator will be considered as will a fill level alarm (prior to the high level alarm).
• Adequate redundancy or standby plant should be provided with maintenance and testing to the same standards as the main plant;	This will be provided where required (the combustion/power system is completely dedicated to standby use and includes for contingency).
• Spill contingency procedures should be in place to minimise accidental release of raw materials, products and waste materials and then to prevent their entry into water	Spill contingency procedures will be determined following the design of the drainage in place as detailed within Section 5.
• Process waters, site drainage waters, emergency firewater, chemically contaminated waters and spillages of chemicals should, where appropriate, be contained and where necessary, routed to the effluent system, with provision to contain surges and storm-water flows, and treated before emission to controlled waters or sewer. Sufficient storage should be provided to ensure that this could be achieved. There should also be spill contingency procedures to minimise the risk of accidental emission of raw materials, products and waste materials and to prevent their entry into water. Any emergency firewater collection system should also take account of the	A Drainage Strategy has been prepared for SZC (Ref: SZC-SZ0100-XX-SEO-REP-100000, Version 1.0, Dated March 2018) [53] to confirm the detailed strategy for the provision of any drainage which is required to effectively drain the permanent power station and manage flows which leave the site. Full details of the drainage strategy for the installation will be developed at the detailed design phase however the anticipated process discharges from the installation and their management are discussed below. The finalised drainage drawings with detail on the drainage routes and emission points from the

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
additional firewater flows or fire-fighting foams. Emergency storage lagoons may be needed to prevent contaminated firewater reaching controlled waters (see Refs. 14 and 15); and	installation will be supplied to the Environment Agency prior to commissioning of the installation. SZC Co. envisages no, or minimal, point source emissions to water from the diesel generators themselves. There is the potential for point source emissions to water from uncontaminated surface water drainage from within the installation boundary.
• Consideration should be given to the possibility of containment or abatement for accidental emissions from vents and safety relief valves/bursting discs. Where this may be inadvisable on safety grounds, attention should be focused on reducing the probability of the emission.	The Diesel Building offers a complete bund for any spillages. The only pathway for release is through failure of the tank seals resulting in a minor release of hydrocarbon vapour.

5.3 Raw Materials

This section of the application considers the use of raw materials and water, the techniques implemented to minimise the use of these materials and their associated impact. The section will therefore consider:

- The characteristics and the environmental impacts associated with the raw materials to be used in the regulated activities;
- The measures implemented to reduce/optimise the efficient use of raw materials; and
- Measures in place to reduce the water requirement at the installation.

5.3.1 Raw Materials Selection

This section of the submission provides an inventory of the raw materials associated with the operation of the regulated activities, demonstrates that the environmental characteristics of the raw materials sourced are well understood and that these materials are managed in a way that minimises the potential for spillage and loss of containment.

The raw materials associated with the operation of the installation are:

Diesel Fuel: Fuel consistent with BS 2869:2017 (or relevant standards at time of procurement and operation) will be used for the all standby diesel generators (see Section 2.1). The approximate total fuel consumption for the 12-combustion plant (supporting both reactors) is estimated to be 1,280 tonnes per year; (based on EDG and UDG testing resulting in running for 60 hours per year for each engine). This is

based on operating experience of the most recent French 'N4' type nuclear power station (closest operational comparison with the UK EPR™) and is considered to be conservative.

Lubricating Oil: For the diesel generators; standard lubricating oil type SAE 40 is recommended. The amount of oil used per annum depends on the chemical analysis performed on samples that will be regularly taken, whose results may or may not lead to the replacement of oil at a frequency to be established. Each of the EDGs holds approximately 10,5600 kg of lubricating oil and each of the UDGs holds 1,000 kg. It should be noted that the maintenance programme for the diesel generator cooling system will help quantify actual consumption of lubricating oils and generation of waste oils.

Antifreeze: The proposed material used in the diesel generators cooling system is consistent with that detailed in the UK EPR™ reference design. The cooling liquid used for the dry air coolers (the heat produced by the diesel generators will be transferred to the cooling loop via a water/air heat exchanger) and the autonomous circuits is monoethylene glycol and is stored on site in drums. For EDG engines the cooling system capacity is approximately 14.2m^3 in total. The cooling system capacity for UDGs is approximately 15.8m^3 in total.

The cooling circuits are replenished with the antifreeze solution using a storage tank (approximately 1m^3), which is filled directly from drums; this tank and the drums are stored in a dedicated raw materials storage facility which serves the entire site. This storage facility is excluded from the scope of the installation (as a result of its prime purpose being to serve non-combustion plant). The total system volume will be replaced every 3 or 4 years as antifreeze and anticorrosion chemicals decompose over time. Cooling mixture drained from the cooling circuits during maintenance will be disposed of as a hazardous waste.

Batteries: These components are used to supply the speed governor of the UDGs. The demand for replacement batteries will be determined by the manufacturer's recommendations; as an estimate the batteries will be replaced annually (to ensure they continue to hold/provide power). On this basis, 4 batteries per UDG may be required per year.

Other materials that may be reasonably included but which are to be confirmed include:

- Detergents, cleaning chemicals and other additives for the combustion plant;
- Water for cleaning;
- Water for demineralisation to replace cooling fluid losses;
- Ignition gases (for engine start-up); and

- Maintenance spare parts.

Please note that there will not be any fluorinated greenhouse gases (F-gases) in the diesel generator buildings (there are no air conditioners or chillers).

This section of the application demonstrates that the Operator has a system in place to identify and understand the environmental characteristics of the raw materials it sources, and that, where appropriate, substitute raw materials with reduced environmental characteristics are used.

Typically, it may be possible to replace raw materials with alternatives with a reduced environmental impact. However, for the standby plant design, the selection of currently proposed raw material is considered justified, based on the following criteria:

- The use of diesel generators is based on options assessment provided in Section 2 of this submission, which has shown that this equipment is highly reliable and well-tried. Moreover, the use of compressed gaseous fuel with pipes would introduce new hazards to the site, the recent reduction in the sulphur content of diesel fuel under SCOLF Regulations 2007, means that compared with the benefit of using Class C2 kerosene, there is little difference. Diesel fuel also has a greater calorific value per unit and a lower volatility (than kerosene), thus reducing vent losses during filling operations (the justification for the choice of plant type and fuel is provided in Section 2);

- Lubricating oil is used in all engines to prevent the build-up of heat from friction, facilitate the smooth movement of parts and increase the lifetime of the plant. The type of lubricating oil to be used will depend on the manufacturer's specification for the diesel plant and the raw material demand will be determined by the maintenance regime and the frequency that the oil is to be replaced;

- The use of monoethylene glycol in cooling systems is an industry standard and is used in the currently operating EDF reactor sites. The cooling circuits are closed loop systems and will be topped up to degraded coolant as and when required; and

- There is no alternative to the use of batteries. The UDGs are present to restart the station in the event of a total blackout.

Table 5.11 provides an inventory of the raw materials requirement of the proposed installation as it is currently known. This will be updated as additional information is developed through the collation of further data from the following sources:

- Safety data sheets;

- The BS grade or class of raw material used;
- Appropriate substitutes to the raw materials currently used if applicable; and
- Justification for not using the alternative raw materials where appropriate.

Table 5.11: SZC Raw Materials Assessment

Raw Material and Application	Chemical Composition	Hazard Statement	Annual Usage in Combustion Plant	Fate of Raw Material in the Combustion Plant	Environmental Impact Potential	Alternative of Lower Environmental Impact	Reason for Use of Raw Material
Fuel Oil-Diesel As fuel for the diesel generators.	Hydrocarbon - BS 2869:2017 (or applicable standard at time of procurement and operation).	Health hazard (carcinogenic) Hazardous to the environment Flammable	Estimated as 1,280 tonnes for both reactors (130 tonnes per EDG and 60 tonnes per UDG)	Combustion of gas to air as exhaust gases.	Emission to air of NO_X, SO_2, CO_2, CO, VOCs and PM. Marine pollutant Small spillages to ground will biodegrade. Major spillage to ground will penetrate sub soils- risk of groundwater contamination. Spillages unlikely as all tanks are inside a building and fully bunded.	Natural Gas - lower level of PM and NO_x and small reduction in SO_2 emissions	Storage of pressurised gas and reliance of external piped supplies are discounted on safety and security of supply grounds
						Kerosene - lower level of PM and sulphur emissions. Lower sulphur containing grade of fuel oil	No major environmental benefit. The sulphur content of the grade of fuel is limited to 0.1%. Reliability and experience of operating diesel generators is a key factor.
Lubricating Oil Used for diesel generators	Assumed to be a mineral oil to SAE 40 - there will also be trace additives.	Health hazard (harmful if swallowed, harmful in contact with skin, causes	Annual usage on combustion plant is estimated as 3.5 tonnes (4,032 litres) (450 litres/year per	Waste oil from maintenance activities will be recycled	Marine pollutant Produces a hazardous waste. Degrades in soil over time.	None	Recommended by manufacturer.

Raw Material and Application	Chemical Composition	Hazard Statement	Annual Usage in Combustion Plant	Fate of Raw Material in the Combustion Plant	Environmental Impact Potential	Alternative of Lower Environmental Impact	Reason for Use of Raw Material
		serious eye damage, causes skin irritation and may cause respiratory irritation) Hazardous to the environment (very toxic to aquatic life; toxic to aquatic life with long lasting	EDG and 108 litres/year per UDG) for two UK EPR™ units.				
Antifreeze Used by diesel generators and small pumps	Monoethylene Glycol	Health hazard (harmful if swallowed)	Initial fill usage is estimated as 88m^3 by the diesel generators per UK EPR™ unit. After this, usage will be restricted to loss replacement.	100% to hazardous waste	Marine Pollutant	Considered to be no engine compatible alternative of lower environmental impact	No engine compatible alternative

Raw Material and Application	Chemical Composition	Hazard Statement	Annual Usage in Combustion Plant	Fate of Raw Material in the Combustion Plant	Environmental Impact Potential	Alternative of Lower Environmental Impact	Reason for Use of Raw Material
Batteries As UDG start up and air compressor start up	Unknown to be determined	Health hazard (harmful if swallowed, harmful in contact with skin, causes serious eye damage, causes skin irritation and may cause respiratory irritation)) Hazardous to the environment	Low – estimated 16 batteries/cells are replaced per annum	100% to hazardous waste	Corrosive and toxic	Compressed air systems	Certain scenarios will require battery start up

Indicative BAT Requirements for Raw Material Selection at SZC

Table 5.12 details the indicative BAT requirements from the IPPC combustion sector guidance to be taken for raw materials selection at the SZC installation.

Table 5.12: Indicative BAT Requirements for Material Selection at SZC

Indicative BAT	How the Installation Activities address Indicative BAT
IPPC combustion sector guidance 2.9: • The Operator should maintain a list of raw materials and their properties as noted above.	A register will be maintained as part of compliance with the Control of Substances Hazardous to Health (COSHH) Regulations, safety data sheets for all raw materials will be held in the station. These sheets will list the properties of all raw materials and branded products used on the site and provide toxicological and ecological data and information on suitable disposal routes.
• The Operator should have procedures for the regular review of new developments in raw materials and for the implementation of any suitable ones with an improved environmental profile	The review of materials is a requirement of the COSHH Regulations, and this is performed by a specialist contractor for the site. The priority for review is materials classed as COSHH Essentials with less frequent review for the less hazardous materials. The station will comply with the COSHH Regulations.
• The Operator should have quality-assurance procedures for controlling the impurity content of raw materials.	There are Company Specifications for major commodities, such as fuel oil, which specify permitted impurity contents; these will be applied to the HPC site where applicable. Manufacturer's recommendations will also be incorporated and local specifications for materials will be developed.
• The Operator should complete any longer-term studies needed into the less polluting options and should make any material substitutions identified.	No significant less polluting options for raw materials proposed for use on the combustion plant, have been identified in Section 5.3.1.

5.3.2 Raw Materials Handling and Storage

The only raw materials to be stored on the installation are the fuels, all other raw materials will be stored in dedicated site-wide facilities that are beyond the scope of the installation. During the design and operation of these facilities, BAT will be considered both from engineering and procedural perspectives.

Fuel Oil

The standby diesel generators on the installation will use diesel fuel oil with characteristics complying with the SCOLF Regulations 2007 and BS 2869:2017 (or standards applicable at time of procurement and operation). The design of the installation will allow the diesel supply to be delivered by road tanker and transferred into the main storage tanks, which are located inside the diesel buildings. The tanks will be all inside the building which will be made impermeable to the fuel and regularly

maintained and inspected. The tanker delivery arrangements and drainage system have not yet been designed; these arrangements will be provided as part of the FAP (Refer to Section 6 – FAP Ref. 1).

Oil storage areas of the installation will meet the requirements of the Control of Pollution (Oil Storage) (England) Regulations 2001 and the Environment Agency Oil Storage Regulations for Business.

A summary of the fuel storage and handling arrangements are given in **Table 5.13**.

Table 5.13: Fuel Oil Storage and Handling Arrangements for Diesel Generators at SZC

Diesel	Expected Annual Fuel Oil Usage	Fuel Oil Storage	Method of Delivery	Notes
EDGs	130 tonnes per EDG	One main storage tank per EDG, each of 226m^3 capacity. One day tank per EDG, each of 5.46m^3 capacity	By tanker to main storage tanks	Main and day tanks are located within bunded areas within the diesel building
UDGs	60 tonnes per UDG	One main storage tank per UDG, each of 137m^3 capacity One day tank per UDG, each of 3m^3 capacity	By tanker to main storage tanks	Main and day tanks are located within bunded areas within the diesel building

Lubricating Oil

The handling and storage of lubricating oil are associated with the operation of EDGs and UDGs.

Each EDG and UDG will have its own lubricating oil system; the specific oil to be used will be based on manufacturer's recommendations and is expected to be to SAE 40 standard. The main oil storage will consist of either the engine sump if this constitutes an oil reserve, or storage tank and oil return line. The EDGs' engine sump will hold approximately 1.8m^3 of oil, whilst the UDGs will hold approximately 0.335m^3 of oil. Dirty lubricating oil and waste oil from maintenance activities can be collected in sumps and transferred to the station waste oil tank for disposal, this is to be confirmed for the SZC site.

All storage of lubricating oil will be held outside the installation.

Water

The diesel generators are cooled by primary and secondary (high and low temperature) sealed cooling systems, which contain water and glycol. Therefore, there is no need for the handling or storage of water, top up from drums of a pre-mixed solution can be provided where required.

Drainage for floor washings will either be collected within hydrocarbon effluent system sumps or be connected to the oily water drainage system (penstock/isolation valves will be located on the oily water drainage system).

Miscellaneous Handling and Storage

The operations associated with the diesel generators involve minimal storage and handling requirements due to the use of site-wide facilities.

Fire Protection

The Diesel Building rooms will be protected by the station fire protection systems.

Antifreeze

The EDGs and UDGs are cooled by demineralised water in re-circulating systems, which contain antifreeze. The cooling systems will be initially filled with an approximate volume of 88m^3 of monoethylene glycol for each of the UK EPR^{TM} unit (14.2m^3 per EDG and 15.8m^3 per UDG). After this, usage will be restricted to loss and/or replacement. The total system volume will be replaced every 3 or 4 years as antifreeze and anticorrosion chemicals decompose over time.

5.3.3 Waste Minimisation Audit (Minimising the Use of Raw Materials)

As specified in the Combustion Sector guidance note EPR 1.01 [6], a waste minimisation audit is required at least every four years by the Operator. For a new station a first audit will have to be carried out within 2 years of the issue of the permit, this requirement will be captured in the site management system.

The raw materials in use on the installation (as detailed in **Table 5.11**) are:

- Diesel fuel;
- Lubricating oil;
- Antifreeze; and
- Batteries.

This raw material requirement will be determined by the plant operation and maintenance requirements leaving little scope for reducing the use.

Indicative BAT Requirements for Minimising the Use of Raw Materials at SZC

Table 5.14 shows the indicative BAT requirements from the IPPC combustion sector guidance for waste minimisation audits on the SZC installation based on the information available. Where additional information is required, this will be provided through the FAP.

Table 5.14: Indicative BAT Requirements for Minimising the Use of Raw Materials at SZC

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
IPPC combustion sector guidance 2.4.2: • The Operator should carry out a waste minimisation audit at least every 4 years. If an audit has not been carried out in the 2 years prior to submission of the application, and the details made known at the time of the application, then the first audit shall take place within 2 years of the issue of the permit. The methodology used and an action plan for reducing the use of raw materials should be submitted to the Regulator within 2 months of completion of the audit. The audit should be carried out as follows: • The Operator should analyse the use of raw materials, assess the opportunities for reductions and provide an action plan for improvements using the following three essential steps: – process mapping; – materials mass balance; and – action plan.	There are minimal raw materials planned to be used on the installation with the requirement being driven by manufacturer's recommendations to maintain the life of the plant. A waste minimisation audit will be carried out within 2 years of the plant operating under its permit. This will give the Operator time to generate data on raw materials and waste arisings and for a stable operating profile/regime to be established following commissioning.
• The use and fate of raw and other materials, including by-products, solvents and other support materials, such as fuels, catalysts and abatement agents, should be mapped onto a process flow diagram (see the Waste minimisation support references). This should be achieved by using data from the raw materials inventory and other company data as appropriate. Data should be incorporated for each principal stage of the operation in order to construct a mass balance for the installation.	Table 5.3.1outlines the raw materials proposed to be used and their fate. Fuel will be fully combusted, and oil and batteries will be recycled. The glycol will be in closed loop circuits and any accidental losses will be disposed of as hazardous waste.
• Using this information, opportunities for improved efficiency, changes in process and	There is little scope to improve the efficiency of the raw material use as the usage is driven by

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
waste reduction should be generated and assessed. An action plan should then be prepared for implementing improvements to a timescale approved by the Regulator.	maintenance requirements, periodic nuclear safety tests and manufacturer's recommendations rather than plant demand. This is due to the combustion plant being standby plant rather than in continuous use.

5.3.4 Water Use

As noted in Section 3.1.6, there is no use of water for the operation of the standby diesel generators. Minor volumes may be required for cooling system top-up and cleaning however this requirement is not significant (some water will also be used in the initial cooling system fill). No further assessment is required for the environmental permit application for the EDGs and UDGs.

Indicative BAT Requirements for Water Use at SZC

Table 5.15 details the indicative BAT requirements from the LCP BAT conclusions and the IPPC combustion sector guidance for water use at the SZC installation.

Table 5.15: Indicative BAT Requirements for Water Use at SZC

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>LCP BATc 13: In order to reduce water usage and the volume of contaminated wastewater discharged, BAT is to use the techniques given below:

<table><tr><td>Water Recycling</td><td>Residual aqueous streams, including run-off water, from the plant are reused for other purposes. The degree of recycling is limited by the quality requirements of the recipient water stream and the water balance of the plant.</td></tr></table></td><td>The water requirements for the proposed plant are expected to be negligible, with the majority of the water use required for welfare facilities. Operational requirement for water is anticipated to only be for replacement or replenishment of water in the cooling circuit, which is expected to be infrequent. The Operator will make all efforts to minimise water use and recycle water as much as reasonably practicable.</td></tr>
<tr><td>LCP BATc 14: In order to prevent the contamination of uncontaminated wastewater and to reduce emissions to water, BAT is to segregate wastewater streams and to treat them separately, depending on the pollutant content.</td><td>Rainwater run-off and cooling water will be handled using dedicated drainage systems. Drainage from site areas where oil handling activities occur will be designed to ensure that appropriate controls are introduced to ensure that no contaminated water is discharged to controlled waters. Separators and penstock valves are provided on the forecourts.</td></tr>
<tr><td>IPPC combustion sector guidance 2.4.3:
• The Operator should carry out a regular review of water use (water efficiency audit) at least every 4 years. If an audit has not been carried out in the</td><td>The installation does not have a process water requirement.</td></tr>
</table>

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
2 years prior to submission of the application and the details made known at the time of the application, then the first audit should take place within 2 years of the issue of the permit. – Flow diagrams and water mass balances for the activities should be produced; – Water-efficiency objectives should be established, with constraints on reducing water use beyond a certain level being identified (which usually will be installation-specific); – Water pinch techniques should be used in the more complex situations such as chemical plant, to identify the opportunities for maximising reuse and minimising use of water; and – Within 2 months of completion of the audit, the methodology used should be submitted to the Regulator, together with proposals for a time-tabled plan for implementing water reduction Improvements for approval by the Regulator.	
The following general principles should be applied in sequence to reduce emissions to water: • Water-efficient techniques should be used at source where possible; • Water should be recycled within the process from which it issues, by treating it first if necessary. Where this is not practicable, it should be recycled to another part of the process that has a lower water-quality requirement; and • In particular, if uncontaminated roof and surface water cannot be used in the process, it should be kept separate from other discharge streams, at least until after the contaminated streams have been treated in an effluent treatment system and been subject to final monitoring.	Cooling is provided by closed loop systems. Uncontaminated roof and surface water are not suitable for use in the cooling systems. There are no effluent arisings to be segregated from surface water arisings.
• Measures should be in place to minimise the risk of contamination of surface waters or groundwater by fugitive releases of liquids or solids	This is addressed in Section 3 (for normal operations) and in Section 5.2 for abnormal operations).
• The water-quality requirements associated with each use should be established, and the scope for substituting water from recycled sources identified and input into the improvement plan.	There are no process effluent releases from the installation.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• Less contaminated water streams, such as cooling waters, should be kept separate from more contaminated streams where there is scope for reuse - though possibly after some form of treatment. • Most wastewater streams will however need some form of treatment but for many applications, the best conventional effluent treatment can produce water that is usable in the process directly or when mixed with fresh water. Though treated effluent quality can vary, it can often be recycled selectively - used when the quality is adequate, discharged when the quality falls below that which the system can tolerate.	
• In particular, the cost of membrane technology continues to reduce, and they can be applied to individual process streams or to the final effluent from the effluent treatment plant, as appropriate. In some applications in some Sectors, they can supplement (or possibly completely replace) the ETP plant so that most water is recyclable and there is a greatly reduced effluent volume. Where the remaining, possibly concentrated, effluent stream is sufficiently small – and particularly where waste heat is available - further treatment by evaporation can lead to zero aqueous effluent. Where appropriate, the Operator should assess the costs and benefits of using membrane techniques to minimise water usage and effluent discharge.	N/A
• Water usage for cleaning and washing down should be minimised by: – vacuuming, scraping or mopping in preference to hosing down; – reusing wash water (or recycled water) where practicable; and – using trigger controls on all hoses, hand lances and washing equipment.	Housekeeping procedures will be developed prior to commencing operations. The indicative BAT requirements will be considered at this stage.
• Fresh water consumption should be directly measured and recorded regularly at every significant usage point - ideally on a daily basis.	Fresh water is not a process requirement during normal operations.

5.4 Avoidance, Recovery and Disposal of Waste

The requirements under this section are to:

- Demonstrate appropriate measures are in place to ensure that waste produced by the activities is avoided or reduced, or where waste is produced it is recovered wherever practicable or otherwise disposed of in a manner which minimises its impact on the environment;

- Review and record at least every 4 years whether changes to those measures should be made;

- Take any further appropriate measures identified by the review;

- Outline the techniques implemented for the storage, handling and transport of wastes at the site in order to minimise the associated environmental impacts, e.g. dust, release of VOCs, spillages, etc; and

- Detail the techniques implemented to minimise and optimise the recovery of wastes.

The storage of wastes from the installation will generally be carried out as a site-wide activity with dedicated facilities provided that are beyond the installation boundary. Site-wide procedures will cover the activities on the installation; these will be developed as part of the integrated management systems and will be provided as part of the FAP. In preparation, a site Integrated Waste Strategy (IWS) document will be produced to develop an approach to the management of all radioactive and non-radioactive waste types across the SZC site, including those on the installation.

The IWS document outlines the current strategy for managing radioactive and non-radioactive wastes arising from the site-preparation, construction, operation and decommissioning of the UK EPR™ nuclear power station at SZC; this incorporates the wastes generated by operations within the installation and is based on the expected waste and spent fuel generation and management practices throughout the lifecycle of the SZC site.

The IWS shows that there is a management strategy for all the waste streams to be produced on the installation and that they have been appropriately planned for. The IWS refers to a range of other documentation for SZC which provide more details on the waste management strategies for SZC and their development.

The document shows that waste management strategies have been developed taking into account all relevant factors and key principles including:

- Minimisation of waste via implementation of the waste hierarchy;

- Application of Best Available Techniques (BAT);

- Review and application of operational experience feedback in design,

operation and decommissioning;

- Delivery of compliance with relevant regulatory obligations (e.g. licence conditions, authorisations and permits) and Government policy and strategy objectives (e.g. a progressive reduction of UK radioactive discharges); and

- Consideration of a full range of health, safety, environmental, security, economic and social issues.

SZC Co. has developed a policy for environmental optimisation and a series of principles that support its application. These principles apply to all SZC Co. staff involved with the design, procurement, construction, commissioning, operation and decommissioning where the application and demonstration of BAT is required. The principles below apply to waste from the installation:

- Determine and implement appropriate techniques at the most appropriate stage (i.e. design, procurement, construction, commissioning, operation, decommissioning and site restoration) of the project lifecycle and promote opportunities for further optimisation during future phases of the project;

- Demonstrate the application of best practice, guidance and standards to select techniques and that where the application of best practice, guidance and standards is not possible, that a meaningful range of alternatives have been considered;

- Demonstrate that the selection of techniques employed to deliver optimised performance are recorded through a series of arguments that, when taken together and underpinned by demonstrable and defensible evidence, support the selection of the techniques; and

- Adopt a proportionate approach ensuring the efforts expended match the benefits expected or achieved through an open, transparent, inclusive process which is recorded and maintained.

5.4.1 Waste Handling

The main wastes generated across the installation are:

- Lubricating oil;

- Cooling fluid (water and ethylene glycol);

- Oily cloths/absorbent pads from minor spills/drips;

- Batteries (for starting the UDGs and air compressors); and

- Replaced parts as part of preventative or reactive maintenance.

Table 5.16 below identifies the individual waste streams and provides estimates of the annual arisings and containment measures in place. As these facilities have not yet been designed and are outside the scope of the installation, indications of the measures to be employed have been included.

Table 5.16: Wastes Handling Arrangements at SZC

Waste Stream	Estimated Annual Volume (m^3)	Primary Containment e.g. Skip, Drum	Secondary Containment e.g. Bund	Tertiary Containment e.g. Hardstanding
Lubricants	4 (based on 450 litres/year per EDG and 108 litres/year per UDG).	Waste lubricating oil will be stored in a bunded tank prior to transfer off site.	All oil tanks will employ secondary containment whether through bunding or building design.	Any oil will be stored on an area of competent hard standing.
Coolants	Replaced every 3-4 years. 14.2m^3 per EDG and 15.8m^3 per UDG	Coolant is only stored in the cooling system. There are no plans to store spent cooling fluid as they are closed loop systems.	Consideration will be given in the design of the drainage system to areas where the loss of coolant can enter drains.	Connection/fill points will be given specific consideration to hold any losses prior to pumping out for off-site disposal.
Oil contaminated wastes	N/A	Oily wastes will be stored in sealed containers prior to off- site disposal.	The storage containers will be indoors. Any loss of containment is unlikely to cause a problem as the waste will be absorbed by the cloths/pads.	Any oily wastes will be stored on an area of competent hard standing.
Batteries (used on the UDGs and air compressors only)	16 lead acid batteries. For this application it has been assumed that each UDG will have 4 lead acid batteries, which will be replaced on an annual basis.	Likely to be stored internally on pallets prior to transfer off site.	To be determined. Measures such as sloping floors, bunded pallets and isolated drainage will be considered.	The waste store will be an area of competent hard standing.

The IWS will incorporate arrangements for compliance with legal requirements for the storage, management and transfer of wastes from the installation and the Operator will implement best practices waste management across the site through the IMS.

The activities undertaken at the installation are expected generate a small range of waste streams. As detailed at **Table 5.16** above, wastes will be segregated and stored in appropriate facilities to minimise the potential for environmental impacts. The wastes will be stored within dedicated areas, which will contain appropriate pollution prevention measures. Although these are outside the installation, the indicative BAT requirements will still be considered to implement best practice.

Waste arising from the operation of the standby diesel generators will be handled together with the other non-radioactive waste arising from SZC activities site-wide, and will be subject to segregation, storage, recovery or disposal, as outlined in the SZC Co. IWS.

Indicative BAT Requirements for Waste Handling at SZC

Table 5.17 outlines the indicative BAT requirements from the IPPC combustion sector guidance and provides commentary in relation to the proposal for the SZC installation.

Table 5.17: Indicative BAT Requirements for Waste Handling at SZC

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
IPPC combustion sector guidance 2.5: • Characterisation and quantification of each waste stream, and description of measures for waste management, storage and handling.	See above (Section 5.4.1).
• A system should be in place and maintained which records the quantity, nature and origin of any waste that is disposed of or recovered. Also, where relevant, the destination, frequency of collection, mode of transport and treatment method for those wastes.	SZC Co. will implement and maintain an appropriate system for checking and retaining waste management duty of care documentation.
• Wastes should be segregated wherever practicable, and the disposal routes identified. Disposal should be as near to the point of generation as is practicable.	SZC Co. will segregate and store wastes securely within designated waste storage areas on site until disposed of at an appropriately permitted waste management facility. Disposal options will be chosen through application of the proximity principle and the waste hierarchy.
• Records should be maintained of any waste sent off-site (Duty of care).	SZC Co. will implement and maintain an appropriate system for checking and retaining waste management duty of care documentation.
• All appropriate steps should be taken to prevent emissions from waste storage or handling (e.g. liquid or solid spillage, dust or VOC emission, and odour).	The standby diesel generators will not produce waste streams having significant emissions, such as dust or odour. Training will be provided on the use of spill kits, which will be located in all oil handling areas and the waste storage area shall have containment for spills.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
• The remaining BAT requirements are considered to apply only to coal/heavy oil fired plant and are therefore not addressed herein.	N/A

5.4.2 Waste Recovery or Disposal

This section is required to demonstrate that the Operator has evaluated the opportunities to optimise the recovery of wastes from the regulated processes only and where technically and financially feasible, routes for the recovery of the waste streams generated at the site have been secured for all waste produced by the installation.

The IWS document outlines the approach to environmental optimisation with respect to waste arisings across the SZC site and the application of the waste hierarchy.

Environmental optimisation is another cornerstone of the development of the IWS. The application of BAT is the means by which environmental optimisation is achieved. Importantly, the application of BAT is a continuous and iterative process. For the ongoing application of BAT and optimisation of waste management strategies during the construction and operation (and ultimately decommissioning) of SZC, SZC Co. has adopted the approach based on the statement in Environment Agency's guidance on BAT that:

> *"The application of BAT is broadly equivalent to best practicable means" "and best practicable environmental option".*

It is through the application of BAT that many of the waste management principles are primarily demonstrated as part of the environmental optimisation process. The application of BAT is based on four key environmental principles, as set out in the IPPC Directive:

- The use of low-waste technology;
- The efficient use of resources;
- The prevention and reduction of the environmental impact of emissions; and
- The use of less hazardous substances.

This broad approach is consistent for both radioactive and non-radioactive waste arisings although the means of demonstration will vary depending on the regulatory regime. Not every waste management practice can achieve all of these principles, but consideration of them against the UK EPR™ design during the GDA process has

shown how the design for SZC has been optimised with the aim of reducing environmental impacts.

Table 5.18 details waste arisings and disposal methods to be employed across the SZC installation.

Table 5.18: Wastes for Recovery and Disposal at SZC

Waste Source	Waste Description	European Waste Catalogue (EWC)	Release Frequency	Annual Quantity - Combustion Plant	Containment	Disposal/Recovery Route
Diesel generator cooling circuits	Antifreeze	16 10 01* Aqueous liquid wastes destined for off-site treatment (aqueous liquids wasted containing hazardous substances)	Infrequent - during maintenance or spillage	<0.5 tonnes	Off-installation. To be stored in a dedicated facility pending off-site disposal.	To be determined (new glycol/water recycling technology now available). This will be reviewed nearer the time to see if processes exist in the UK.
Diesel generators	Lubricating Oil	13 02* Waste engine gear and lubricating oils. The exact type (and therefore full EWC code) is still to be determined.	Infrequent - during maintenance (possibly annual)	3.1 tonnes	Drummed at source and stored in the Oil Stores compound prior to transfer to road tanker.	Recovered.
Diesel generators	Diesel Fuel (unused)	13 07 01* Wastes of liquid fuels (fuel oil and diesel)	Infrequent (non-routine) - tank emptying activities and maintenance	Variable	Any large volumes moved directly by road tanker. Small volumes stored in drums prior to transfer to road tanker.	Recycled.

Waste Source	Waste Description	European Waste Catalogue (EWC)	Release Frequency	Annual Quantity - Combustion Plant	Containment	Disposal/Recovery Route
Diesel generators (UDGs only) and air compressors	Starter and other used batteries	16 06* Batteries and accumulators	Very infrequent - maintenance/routine replacement	Variable. For this application it has been assumed that each UDG will have 4 lead acid batteries, which will be replaced on an annual basis (16 in total).	Handled by designated personnel and stored in designated pallet box in bulk chemical store.	Recycled.
Plant areas	Oily Rags	15 02 Absorbents, filter materials, wiping cloths and protective clothing. Note: this waste may be hazardous by virtue of the proportion of oil in the waste.	Infrequent	Low	Designated lockable drums at source then drums are taken to the Oil Stores Compound.	To be determined.

Waste Source	Waste Description	European Waste Catalogue (EWC)	Release Frequency	Annual Quantity - Combustion Plant	Containment	Disposal/Recovery Route
Plant areas	General Mixed Waste	20 03 01 Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions (mixed municipal waste).	Infrequent	Very low, < 1 tonnes per annum	Designated bins to central skip.	Recycled or incinerated where possible with landfill only used where no other options available (in line with waste hierarchy).

Note: Within the EWC, * is used to denominate hazardous wastes

The non-radioactive solid waste management strategy is designed to comply with the requirements of the Waste Framework Directive [89] as implemented in the UK by the Controlled Waste Regulations (England and Wales) 2012 [90], Waste (England and Wales) Regulations 2011 [91], Control of Pollution (Amendment) Act 1989 [92] and Hazardous Waste (England and Wales) Regulations 2005 (Amended 2009 & 2016) [93] . By ensuring compliance with these regulations in terms of minimising waste production, storing and transferring waste responsibly, the requirements of the Waste Framework Directive will be met. Comprehensive waste management procedures will be implemented for all waste streams through the site IMS.

Indicative BAT Requirements for Waste Recovery or Disposal

Table 5.19 details the indicative BAT requirements from the IPPC combustion sector guidance for waste recovery or disposal at the SZC installation.

Table 5.19: Indicative BAT Requirements for Avoidance, Recovery and Disposal of Waste

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
LCP BATc 16: BAT In order to reduce the quantity of waste sent for disposal from the combustion and/or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account lifecycle thinking: a. waste prevention, e.g. maximise the proportion of residues which arise as by-products; b. waste preparation for reuse, e.g. according to the specific requested quality criteria; c. waste recycling; d. other waste recovery (e.g. energy recovery), by using appropriate techniques	The installation will have appropriate procedures in place outlining identification of waste streams and how they must be handled, including appropriate segregation and storage within designated waste storage areas on site. The Operator will apply waste hierarchy principles for the management of any waste produced on site. Due to the inherent nature of the site operations and fuel used, the installation is expected to produce minor quantities of waste, primarily from maintenance. Where possible, the waste generated on site will be sent off for recycling, with any hazardous waste streams sent off site for appropriate treatment and/or disposal.
EPR 1.01: You should where appropriate:	
1. Store, handle and transport all waste streams to prevent the release of waste, dust, VOC, leachate or odour.	The standby diesel generators will not produce waste streams having significant emissions, such as dust or odour. Spillage kits will be located in all handling areas and the waste storage area shall have containment for spills.
2. Store bottom ash and fly ash separately. This provides flexibility to re-use the different ash fractions.	Not Applicable

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
3. Where scale allows, store ash fractions and other dusty residues in closed silos fitted with high level alarms and dust abatement plant.	Not Applicable
4. Explore markets for waste streams, for example: • bottom ash for aggregate • PFA for cement manufacture and construction products • FGD gypsum and fused slags for construction products	Markets for off-site re-use and / or recycling / recovery of wastes (particularly, but not exclusively waste oils and fuels) will be investigated nearer the time the installation becomes operational.
5. Recycle materials back into the process whenever possible, e.g. re-using partially reacted lime.	Filters are fitted on the lubricating oil systems to prolong the life of the lubricating oil. The potential for treating stored diesel fuels through filters and desiccants will be investigated as a way of extending diesel fuel life. Fuels, oils and liquids will be treated and managed according to relevant waste legislation and regulations.
6. Where recycling or re-use is not possible, then consider regeneration of other materials or return to the manufacturer e.g.: • ion exchange resins • reverse osmosis membranes • molecular sieves • catalyst	No opportunities to regenerate materials used in the installation have been identified beyond the filtering of oils and fuels identified above. Potential to return unused materials, e.g. coolant to the manufacturers will be investigated. Otherwise, used materials will be appropriately treated and managed.
IPPC combustion sector guidance 2.5: • Waste should be recovered, unless it is technically or economically impractical to do so.	This guidance will be followed for all of the main waste streams from the installation. Only where no feasible recovery or reuse options can be identified, will the waste streams be disposed of to landfill.
• Where waste must be disposed of, the Operator should provide a detailed assessment identifying the best environmental options for waste disposal – unless the Regulator agreed that this is unnecessary. For existing disposal activities, this assessment may be carried out as an improvement condition to a timescale to be approved by the Regulator.	The only waste disposed of will be minor volumes of general waste (although this is still to be determined). In order to maximise the benefits from numerous smaller waste sources, the integrated waste strategy will look at wastes across the whole site rather than just the installation, this will increase the viability of smaller streams for recovery.
• For installations burning solid and some liquid fuels, ash will often be the major waste produced. Accordingly, the Operator should consider alternative technically and economically feasible uses, for these. For example, bottom ash can be used as an aggregate and PFA can be used in cement manufacture and for other construction products. Other by-product streams, such as	The combustion installation will not produce ash.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
FGD gypsum manufacture can also be used in the construction sector.	
• Where disposal occurs, the Operator should justify why recovery is technically or economically not feasible.	N/A
• The Operator shall regularly audit the waste disposal/ recovery routes to ensure that their waste is being properly handled and dealt with.	Regular audits of waste contractors will be carried out as part of the IMS.

5.5 General Energy Efficiency Measures

In accordance with the Environment Agency's energy efficiency standards for industrial plants guidance [28], this section of the application is required to demonstrate that the Operator uses the following general energy efficiency measures within the buildings:

- Design the installation to be energy-efficient using the techniques listed in Section 3 of the Reference Document on Best Available Techniques for Energy Efficiency; and
- Operate and maintain the installation within an energy management system like ISO 50001 or using the techniques in section 2 of the Reference Document on Best Available Techniques for Energy Efficiency (parts 2.1 to 2.8 and 2.10 to 2.17).

It is expected that the combustion activity on site will be permitted under the European Union Emissions Trading Scheme (EU ETS). At the time of submission this is consistent with the operating EDF Energy nuclear power stations in the UK; however, this may no longer be a requirement if the UK withdraws from the EU.

As standby plant, each plant will operate for less than 1% of the year and will be operated in a typical year for maintenance purposes during periodic nuclear safety tests. Energy efficiency is therefore of much less relevance than it would be to plant operating on a more frequent or continuous basis. SZC Co. will take steps to adopt relevant basic energy efficiency measures in the design, operation and maintenance of the EDGs and UDGs, as far as is practicable and consistent with the key design principles identified in Section 2.

Design

Given that the EDGs and UDGs will operate for less than 60 hours in a typical year, energy efficiency is of lesser importance in equipment selection. The prime requirements for the EDGs and UDGs are reliability, response time, independence and diversity of technology (different design of engine for EDG and UDG). SZC Co.

will take steps to adopt relevant basic energy efficiency measures in the design of the EDGs and UDGs, as far as is practicable, including:

- Modern design following current best practices in optimising efficiency;
- High efficiency motors and drives;
- The plant components have been sized appropriately for the design capacity of the plant, so that each element is operating optimally and efficiently; and
- Effective insulation of hot surfaces.

Energy Consumption

The volume of fuel to be used on the installation has been calculated on the basis of the fuel throughput (a total of 1,280 tonnes for each UK EPR™) and the number of operating hours (assuming 60 hours per diesel generator).

The electricity generated by the combustion plant in routine testing will be exported to the grid together with the power station generated output. The standby generation plant will not be operated to supply electricity to the balancing market, such as to supply the Short Term Operating Reserve.

The electrical efficiency of the generating plant is unknown however, estimated figures are provided which indicates a design efficiency of 40.4% for the EDGs and 34.2% for the UDGs based on the thermal input. This is slightly below the energy efficiency levels associated with the best available techniques (BAT-AEEL) set by the LCP-BATc [10] for reciprocating engines fuelled by gas oil fired operated for more than 1,500 hours a year. However, it should be noted that the diesel generators are excluded from compliance with the energy efficiency levels in the LCP-BATc as it is not intended to be operated for more than 1,500 hours annually.

Annual energy consumption information will be provided and reported to demonstrate compliance with the greenhouse gas emissions permit of the Operators if any.

Small quantities of electrical power may be used to operate the facilities including lighting, powering the air compressors and providing pre-heating. In regard to alternative energy sources for pe-heating it is not possible to utilise waste steam from the nuclear steam supply system (reactor and steam generators) as these systems will be shut down during a loop event. In addition, the complexity involved in routing steam from the turbine hall to the diesel generator buildings would be immense. The only other source of steam on site is the auxiliary boiler however this is also electrically powered and only operated for steam raising during start up and shutdown of the reactor units. Electrical use has not been quantified at this stage.

Table 5.20: SZC Energy Consumption

Energy source	Delivered				Generated (MWh)
	Delivered (Tonnes)	Delivered (MWh)	Primary (MWh)	% of total	
Diesel	1,280	15,289	15,289	40.4% EDGs 34.2% UDGs	5,019 980
Electricity used	N/A	N/A	N/A	N/A	N/A

Notes: There is no electrical information available.
Diesel energy is based on thermal input with each diesel generator operating for 60 hours.

Operating and Maintenance Measures

The energy consumption of the essential diesel generators will be minimised as they will be operated on the following basis only:

- To provide emergency power to the main plant (not part of normal operations);
- In accordance with the requirements of the periodic nuclear safety/manufacturers testing regime to prove reliability;
- Planned maintenance; and
- Qualification tests in case of modification.

The diesel generators will be serviced and maintained in accordance with the manufacturers' specifications.

The efficiency of the combustion process will be demonstrated by emissions testing, which this does not require the plant to be operated longer than is necessary. Due to the limited operational hours of the diesel generators, it is considered that the investment in any additional energy efficiency measures would be disproportionate and not considered to be BAT.

Energy Management Techniques

The diesel generators are designed to supply a specific standby or essential power need, and as such the plant are typically operational for the purposes of reliability testing only. For this reason, energy management techniques such as monitoring energy flows or targeting areas for reduction are not considered to be appropriate.

Indicative BAT Requirements for Energy Efficiency Measures

Many of the indicative BAT issues identified in the LCP BAT conclusions [10] and Environment Agency's energy efficiency standards for industrial plants guidance [30] are more appropriate to activities that consume power on a near continuous or batch basis (such as chemical plant or the iron and steel industry), rather than stand-by power generation. For consistency, however, the indicative BAT tables have been included in this energy section (Table 5.5.2). The following sections consider how energy consumption is minimised.

Indicative BAT Requirements for Energy Efficiency

Table 5.21 details the indicative BAT requirements for energy efficiency and provides a commentary on the approach to be employed on the SZC installation.

Table 5.21: Indicative BAT Requirements for Energy Efficiency

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td colspan="2">Monitoring electrical efficiency and/or the net total fuel utilisation</td></tr>
<tr><td>LCP BATc 2: BAT is to determine the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the combustion units by carrying out a performance test at full load, according to EN standards, after the commissioning of the unit and after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality</td><td>The total fuel used by the diesel generators will be recorded and reported routinely, in line with regulatory requirements. As a good practice measure, periodic operational performance tests will be undertaken in accordance with applicable BE EN standards.
The actual electrical efficiency of the proposed units will be determined and compared against that reported by the manufacturer, and applicable industry standards once the engines are installed in line with relevant ISO standards. This will be undertaken as part of the plant commissioning process.</td></tr>
<tr><td>LCP BATc 12: In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate combination of the techniques given below:

<table><tr><th>Technique</th><th>Applicability</th></tr><tr><td>Combustion Optimisation</td><td>Compliant (but not applicable due to operating hours)</td></tr><tr><td>Optimisation of the working Medium conditions</td><td>Not Applicable</td></tr><tr><td>Optimisation of the steam cycle</td><td>Not Applicable</td></tr><tr><td>Minimisation of energy consumption</td><td>Not Applicable</td></tr></table></td><td>Not applicable due to operating hours (60 hours per year) being < 1,500 hours per year.</td></tr>
</table>

<table>
<tr><th>Indicative BAT from Guidance</th><th>How the Installation Activities Address Indicative BAT</th></tr>
<tr><td>
<table>
<tr><td>Preheating of combustion air</td><td>Not Applicable</td></tr>
<tr><td>Fuel preheating</td><td>Not Applicable</td></tr>
<tr><td>Advanced control system</td><td>Not Applicable</td></tr>
<tr><td>Feed-water preheating using recovered heat</td><td>Not Applicable</td></tr>
<tr><td>Heat recovery by cogeneration (CHP)</td><td>Not Applicable</td></tr>
<tr><td>CHP readiness</td><td>Not Applicable</td></tr>
<tr><td>Flue-gas condenser</td><td>Not Applicable</td></tr>
<tr><td>Heat accumulation</td><td>Not Applicable</td></tr>
<tr><td>Wet stack</td><td>Not Applicable</td></tr>
<tr><td>Cooling tower Discharge</td><td>Not Applicable</td></tr>
<tr><td>Fuel pre-drying</td><td>Not Applicable</td></tr>
<tr><td>Minimisation of heat losses</td><td>Not Applicable</td></tr>
<tr><td>Advanced materials</td><td>Plant will be designed to current design standards.</td></tr>
<tr><td>Steam turbine upgrades</td><td>Not Applicable</td></tr>
<tr><td>Supercritical and ultra-supercritical steam conditions</td><td>Not Applicable</td></tr>
</table>
</td><td></td></tr>
<tr><td>LCP BATc 31: In order to increase the energy efficiency of gas oil combustion in reciprocating engines, BAT is to use an appropriate combination of the techniques given in BAT 12 and combined cycle.

BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of gas oil in reciprocating engines:
<table>
<tr><th>Type of Combustion Unit</th><th>BAT-AEELs Net Electrical Efficiency</th></tr>
<tr><td>Gas-oil-fired reciprocating engine – single cycle.</td><td>41,5–44,5</td></tr>
<tr><td>Gas-oil-fired reciprocating engine — combined cycle</td><td>> 48</td></tr>
</table>
</td><td>Not applicable due to operating hours (60 hours per year) being < 1,500 hours per year.</td></tr>
</table>

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
Environment Agency guidance energy efficiency standards for industrial plants: Operate under the following basic energy efficiency measures: 1. Design your installation to be energy-efficient using the techniques listed in section 3 of the Reference Document on Best Available Techniques for Energy Efficiency. 2. Operate your installation within an energy management system like ISO 50001 or using the techniques in section 2 of the Reference Document on Best Available Techniques for Energy Efficiency (parts 2.1 to 2.8 and 2.10 to 2.17). 3. Maintain your installation within an energy management system like ISO 50001 or using the techniques in section 2 of the Reference Document on Best Available Techniques for Energy Efficiency (part 2.9 only).	The plant procured for the SZC installation will be designed to be energy efficient. The performance and efficiency of the plant will be considered at the procurement stage however, because of the operating regime (99% inoperative), reliability, response time, independence and diversity of technology will be the primary factors. Following commissioning and when operational information has been produced, an assessment of the viability of any energy improvements will be carried out as part of an energy plan.

Further Energy-Efficiency Measures

It is proposed that the plant will be permitted under EU ETS; this approach is consistent with the nuclear power station standby diesel generators currently operated by EDF Energy (however this may no longer be a requirement if the UK withdraws from the EU).

The indicative BAT requirements for further energy efficiency requirements (as outlined in the Environment Agency's energy efficiency standards for industrial plants guidance [28]) are therefore not required.

5.5.1 Global Warming Potential

This section is based on guidance presented in the EA's assess the impact of air emissions on global warming [94].

Environmental emissions from the combustion of fuel oil (fuel usage is addressed in Section 4) can be predicted based on projected usage. As the electricity demand of the diesel is met by the reactor, there are no CO_2 releases to consider.

Based on an annual diesel use of 1,280 tonnes and assuming complete oxidation during combustion (based on a carbon content of 86.1% [95]); this equates to 4,041 tonnes[13] of CO_2 released as a result of maintenance of the diesel plant and operation

[13] Using the calculation 1280 (mass of diesel in tonnes) x 0.861 (proportion of diesel that is carbon) x 44/12 (mass increase of carbon to CO_2 based on the atomic weights of the elements).

during periodic nuclear safety tests. It is also likely that this figure will be significantly pessimistic as it is based on the worst-case year of an existing plant.

Environmental emissions from the electrical demand of the diesel generators are unknown however during normal operations, the power will be provided from the nuclear power station, which has a minimal carbon footprint in relation to the combustion of fossil fuels.

F-gases will not be used in the diesel generator buildings.

Detailed information can be provided once the procurement process has identified the specific diesel plant and associated equipment for the site.

5.6 Site Condition and Site Closure

5.6.1 Site Condition

The Site Condition Report has been prepared to reflect the proposed operations and is included as Appendix B of this document. The report is structured as per Section 2.0 of the SCR template provided in Environment Agency horizontal guidance note H5: “site condition report (guidance and templates) v3.0 April 2013 [96].

The overall purpose of the SCR is to describe and record the condition of the land and groundwater at the installation at the point of application for an environmental permit. The SCR is designed to be a live document which is maintained throughout the lifetime of operation of an installation, from permit application to permit surrender. It provides a centralised source for relevant data and site records; such as ongoing environmental and/or infrastructure monitoring/testing carried out during the lifetime of the installation and pollution prevention measures. At the point of permit surrender a Surrender SCR must be produced to demonstrate that the site is in a satisfactory state so that the Environment Agency can allow the permit to be surrendered. This allows a comparison to be made with the condition of the land prior to and during the permitted operations and at the point of permit surrender.

The IED [8] requires groundwater monitoring every 5 years and soil monitoring every 10 years during the permit lifetime, where there is a risk of pollution from hazardous substances and a baseline has been set. If a significant pollutant linkage is not identified during the additional investigation, then it is recommended that no further groundwater and soil monitoring be carried out unless there was a change in activities, or an incident occurred.

The Environmental Risk Assessment for the proposed operations (Section 5) and Relevant Hazardous Substances Risk Assessment (Appendix B), conclude that it is considered unlikely that the proposed operations and the proposed relevant hazardous substances would cause pollution of soil and groundwater given the physical and procedural measures in place to reduce the risk of releases. In addition,

the installation forms part of a nuclear facility which has rigorous physical and procedural measures in place to reduce the risk of releases.

In order to provide robust baseline data, it is proposed that additional baseline data be collected upon finalisation of the site layout and construction excavations (as discussed in Section 2 of the SCR). The suite of chemical analysis would include metals, hydrocarbons and other organic contaminants and would be tailored to assess the presence of hazardous substances proposed to be used at the installations (fuel, lubricating oil, mono-ethylene glycol and waste oils). This would form the basis of the updated SCR prior to any permitted activities commencing. The SCR will be updated with additional baseline data collected upon finalisation of the site layout and construction excavation, as detailed within the FAP (Refer to Section 6 – FAP Ref. 4i).

5.6.2 Permit Surrender/Closure

This section describes the measures that will be taken to ensure, that, on the surrender of the environmental permit, the site will be decommissioned in a sensitive manner, in order to minimise the potential for environmental impacts associated with the decommissioning, dismantling and demolition of the plant. The site will be returned to the specified end state, as defined in the decommissioning waste management plan, as per the requirements set out in 'Management of Radioactive Waste from Decommissioning of Nuclear Sites: Guidance on Requirements for Release from Radioactive Substances Regulation'.

As required by the Environmental Permitting Regulations, an EPR™ site surrender report should be submitted using the Environment Agency reporting template based on the findings of these investigations.

If contamination is encountered during these investigations, measures will be taken immediately to monitor and control it and continue such measures until a preferred management option has been identified and implemented based on risk assessment principles. Comprehensive records will be maintained of the nature and extent of contamination, the process of deciding on the management option for the contaminated land and the findings during the implementation and validation of the option.

The nuclear power station and diesel generators will be designed and built for a 60-year operation period. Although it is not practicable to develop a precise decommissioning plan for the standby generators at this time, the plant has been designed to minimise environmental impacts associated with the decommissioning and dismantling activities.

Accordingly, arrangements for the shutting down and decommissioning of the essential diesel generators will be incorporated into the SZC decommissioning plan for the whole site. When developed, appropriate information will be provided to the

Environment Agency as part of the FAP (Refer to Section 6 – FAP Ref. 4ii); this will be taken from the site-wide site closure plan.

5.6.3 Design and Build

This section will provide details of any measures undertaken to address the potential for pollution during the decommissioning of the plant. This is also considered in the Site Condition Report (Appendix B).

The key aspects for the decommissioning of the installation are the fuel tanks and the lubricating oil circuits (and associated pipework). The diesel buildings have been designed with a bunded impermeable basement to contain any spillages and hence minimise the extent of any ground contamination which might require remediation on (or before) closure.

5.6.4 Operations During the Lifetime of the Permit

As part of the IMS, the site will develop and implement a comprehensive register of incidents that will include leaks and spills. As the diesel generators are fully contained in concrete buildings, the potential for environmental pollution during operations is limited.

5.6.5 Site Closure Plan

The site decommission plan for the SZC installation has not yet been developed. The plant on the installation will provide safety related back-up power to the main reactor plant and as such will be part of a site wide decommissioning plan.

Key stages of decommissioning the diesel plant will be:

- Draining of the cooling fluid for off-site recovery/treatment;
- The removal of the fuels (for off-site re-use) and cleaning of the pipework and tanks; and
- The removal of the lubricating oil (for off-site recycling) and cleaning of the circuit.

All of these operations will take place in the diesel buildings which, by virtue of the sealed impermeable basement area, is designed to act as a large bund preventing any environmental impact. The diesel plant will be drained and cleaned in the diesel building prior to removal. This specific approach to be taken to these activities will be subject to on-going review and finalised/agreed with the Environment Agency prior to being implemented. The disposal route of the diesel generators, tanks and pipework will depend on the physical state of the individual plant items and the

building has been designed with large doors to allow the installation and removal of large plant items (as part of commissioning and decommissioning).

As part of the FAP (Refer to Section 6 – FAP Ref. 4ii) (and when sufficient information becomes available), a Decommissioning Plan will be produced and that portion pertaining to the installation will be provided to the Regulator. This will include (but not be limited to) consideration of the following:

- Stored materials suitable for re-use/recycling will be sold and taken from the site. Any other stored substances, hazardous and non-hazardous, will be removed from site for disposal;
- In accordance with normal operating procedures, water that is not contaminated or hazardous will be drained to a suitable outfall;
- The plant will be made safe for dismantling by draining or venting liquids and gases from vessels and pipework and then purging pipes and vessels of gases. Closed vessels, pipes and other equipment, which could contain hazardous gases, will be tested to ensure that they are safe before entry is permitted or they are dismantled;
- The plant will be permanently disconnected from sources of energy or danger, such as electricity, fuel, and water supplies;
- Once plant is completely disconnected, drained, purged and tested, as appropriate, it will be certified as being out of commission and safe for handing over to a competent contractor for dismantling and demolition;
- The plant will be made safe for dismantling and demolition work, in accordance with the normal safety procedures such as the issue of health and safety permits for work; and
- A competent contractor (or contractors) will be appointed to undertake dismantling, disposal and demolition. Lead contractors will be nominated who will produce safety plans and method statements for the work (for approval by SZC Co.).

Given the timescales involved with decommissioning, this approach may change. Changes will be communicated to the regulator as required by the environmental permit.

Indicative BAT Requirements for Closure

The indicative BAT requirements for site closure and the nature of information which will need to be included in the application are given in **Table 5.22**.

Table 5.22: Indicative BAT Requirements for Closure of SZC

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
IPPC combustion sector guidance Operations during the Lifetime of the Permit	
• Operations during the life of the permit should not lead to any deterioration of the site if the requirements of the other sections of this and the specific-sector notes are adhered to. Should any instances arise which have, or might have, impacted on the state of the site, the Operator should record them along with any further investigation or ameliorating work carried out. This will ensure that there is a coherent record of the state of the site throughout the period of the IPPC permit. This is as important for the protection of the Operator as it is for the protection of the environment. Any changes to this record should be submitted to the Regulator.	The condition of the proposed installation site will be described in the Site Condition Report. Given the pollution prevention measures proposed for the installation and the effective arrangements for environmental management, training and awareness, it is considered there is little likelihood of pollution associated with the regulated activities. In the event changes are proposed to the regulated activities, the potential for pollution associated with these activities will be assessed.
Steps to be taken at the design-and-build stage of the activities	
• Care should be taken at the design stage to minimise risks during decommissioning. For existing installations, where potential problems are identified, a programme of improvements should be put in place to a timescale agreed with the Regulator. Designs should ensure that: – underground tanks and pipework are avoided where possible (unless protected by secondary containment or a suitable monitoring programme); – There is provision for the draining and clean-out of vessels and pipework prior to dismantling; – Lagoons and landfills are designed with a view to their eventual clean-up or surrender; – Insulation is provided that is readily dismantled without dust or hazard; and – Materials used are recyclable (having regard for operational or other environmental objectives).	The consideration of environmental issues at the design stage has led to a process that has engineered out the main potential risks that are seen on sites of this nature across the UK. By housing the storage tanks and generators in an impermeable building, this also ensures that the decommissioning activities will be carried out in the confines of a bunded area. This will be formalised through production of a decommissioning plan.

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
The site-closure plan	
• A site closure plan should be maintained to demonstrate that, in its current state, the installation can be decommissioned to avoid any pollution risk and return the site of operation to a satisfactory state. The plan should be kept updated as material changes occur. Common sense should be used in the level of detail, since the circumstances at closure will affect the final plans. However, even at an early stage, the closure plan should include: – either the removal or the flushing out of pipelines and vessels where appropriate and their complete emptying of any potentially harmful contents; – plans of all underground pipes and vessels; – the method and resource necessary for the clearing of lagoons; – the method of ensuring that any on-site landfills can meet the equivalent of surrender conditions; – the removal of asbestos or other potentially harmful materials unless agreed that it is reasonable to leave such liabilities to future owners; and – methods of dismantling buildings and other structures, see Closure references which gives guidance on the protection of surface and groundwater at construction and demolition-sites testing of the soil to ascertain the degree of any pollution caused by the activities and the need for any remediation to return the site to a satisfactory state as defined by the initial site report.	The Decommissioning Plan will provide information to inform the development of the Site Closure Plan. This will be provided through the FAP (Refer to Section 6 – FAP Ref. 4ii).
• For existing activities, the Operator should complete any detailed studies, and submit the site closure plan as an improvement condition to a timescale to be agreed with the Regulator but, within the timescale given in Section 1.1. Note that radioactive sources are not covered by this legislation, but decommissioning plans should be coordinated with responsibilities under Schedule 23 of the Environmental Permitting	This is not an existing site. A decommissioning plan will be provided as part of the FAP (Refer to Section 6 – FAP Ref. 4ii).

Indicative BAT from Guidance	How the Installation Activities Address Indicative BAT
(England and Wales) Regulations 2010 (Radioactive Substances Regulation).	

5.7 Installation Issues

The EDGs and UDGs are plant dedicated to the SZC nuclear power station, the installation will be wholly owned and operated by SZC Co.. As described in Section 1.7.4 there are other environmental permits relating to the SZC nuclear power station, which will also be managed by SZC Co.. Management arrangements will be developed accordingly (refer to Section 5.1). There are no other permit holders and therefore no issues relating to the allocation of responsibility across the installation.

6 Forward Action Plan

6.1 Introduction

SZC Co. is planning to build and operate the proposed new nuclear power station adjacent to the existing SZA and SZB power stations near Leiston, Suffolk. SZC Co. are applying for a number of consents, licences and permits, including the combustion activity environmental permit for the associated back up diesel generators to allow operation of combustion plant with an aggregate rated thermal input > 50 MW_{th}.

SZC Co. has developed this submission so that it can be considered in parallel with the application to the Planning Inspectorate for a Development Consent Order. The information presented in this submission is consistent with that required by the Environment Agency for determining the application for a combustion activity environmental permit and outlines operational plant, management and controls that will deliver a good standard of environmental protection. The application for the combustion activity environmental permit is being made significantly in advance of the first permitted activities being undertaken.

On receipt of this application the Environment Agency, having assessed it to ensure it is complete, that it is duly made and having placed it on the public register, will invite comments as part of the consultation process. The Environment Agency may engage in additional consultation activities including consultation on the draft water discharge activity environmental permit and the decision document. The Environment Agency's approach is tailored to specific local circumstances.

6.2 Reference Plant

As discussed in section 1.7.1, the ONR and Environment Agency granted DAC and SoDA for the UK^{EPR} reactor design. Much of the information submitted to the regulators as part of the GDA process has been made accessible to the public via various websites.

The information provided in the GDA was used to support the combustion activities application for HPC which was duly made in September 2011 (HPC EPR/HP3238FH/A001). Additional information was received and through the Environment Agencies Decision Document the HPC combustion activities permit was determined in March 2013.

As discussed in Section 2.1.1, the design of the SZC combustion plant is based on the SZC replication strategy. The replication strategy is based on the replication of the final HPC design used for construction and erection activities (HPC Reference Configuration 2 (HPC RC2). The design configuration will be managed through the SZC No Change Committee in order to maximize the scope of common documentation and data which will be applicable on both sites without any changes.

6.3 Forward Action Plan (FAP)

Given the current stage of development of the site, this section includes a FAP. This defines the activities necessary to achieve compliance with all of the combustion activity environmental permit conditions prior to commissioning of the combustion plant at SZC. The FAP provides a route map of how SZC Co. will develop from a competent applicant to a competent combustion activity environmental permit holder and Operator in a timely fashion. This recognises the various stages of development of the project and the evolution of the organisation through design, construction, commissioning and operation. It is understood that these stages can occur in parallel (e.g. construction and commissioning of each EPR™ unit). The lessons learnt from other EDF nuclear power stations and from bringing the first unit into operation will be recorded and used when undertaking activities for the second unit.

SZC Co. will have a number of hold points as part of its management of the process of building and commissioning SZC. These hold points include a number of actions and requirements that must be satisfied in order for SZC Co. to proceed to the next phase of the project. These may be linked to certain regulatory, organisational or commercial requirements that must be completed prior to commencing to the next stage. Thus, the development of the project is controlled and co-ordinated. It is recognised that the Environment Agency may decide to implement pre-operational conditions as part of their combustion activity environmental permit determination. These could impose requirements that would necessitate the completion of specific activities prior to operation. This ensures that the necessary checks and balances are in place prior to commissioning and operation of the combustion plant.

SZC Co. recognises that many of the other permitting, consenting and licensing applications it plans to make over the next few years will require similar Forward Working Plan (FWP) commitments, and that these will need to be managed. SZC Co. is therefore developing a FWP and supporting processes to manage the delivery of all FWP elements (including the FAPs from the environmental permits for the combustion activities, water discharge activity, radioactive substances regulation activity and construction water discharge activity) and recognises that some commitments may be needed to address the requirements of one or more of these permits or permissions.

The FAP provides a clear summary of the commitments SZC Co. is making as part of this application. These commitments below have been proposed based upon learning from HPC and recognising cross cutting topics listed within the HPC combustion activity permit improvement programme and pre-operational measures. There are five of these high-level actions that cover a variety of topics that need to be delivered on different timescales: some relatively early on in the project phase, others that are required much later, including after several operational cycles. These high-level actions reflect topics considered important by SZC Co. as part of the progression towards being a competent Operator.

6.3.1 Summary of High-Level Forward Action Plan

Table 6.1 below, presents a summary of the high level FAP described above by SZC Co. for this SZC submission. The use of a FAP, as used in other regulatory regimes, does not preclude the Environment Agency developing additional requirements and using any of the available mechanisms, such as Pre-operational conditions, within the combustion activity environmental permit to ensure SZC Co. achieves the requirements necessary prior to operation. SZC Co., as part of the demonstration of being a competent applicant and a responsible Operator feels it is important to recognise those areas that require further attention and to provide a clear path of how and when we will deliver these. The FAP, along with the appropriate procedures and processes to manage it are the means by which SZC Co. will meet these obligations.

Table 6.1: Combustion Activity High-level Forward Action Plan

Ref.	Action	Timing	Justification
1	Design Description SZC Co. will provide a completed description of the plant and infrastructure, including a justification of how the final design prevents or minimises impacts on the environment. Specific information will be provided for the diesel buildings, site drainage arrangements and fire water capacity calculations.	6 months prior to installation at site	The detailed design of the diesel buildings and site drainage system has not yet been finalised. However, sufficient information has been provided for the Environment Agency to determine the application.
2	Integrated Management System SZC Co. will: (i) Develop an integrated management system to ensure that the environmental permit requirements are met. A review will be carried out prior to construction, commissioning and operation of the combustion installation to demonstrate that suitable management arrangements are in place.	9 months prior to construction, commissioning and operation of the installation at site	The integrated management system is in the early stages of development but will be developed to meet the indicative BAT requirements for management systems. Sufficient information has been provided for the Environment Agency to determine the application.
	(ii) Develop arrangements to manage improvement and/or pre-operational conditions as the requirements may be across one or more permits. Actions taken to address the improvement and/or pre-operational conditions will be provided to the EA.	Prior to the combustion activity environmental permit being granted	SZC Co. recognises that many of the other permitting, consenting and licensing applications it plans to make over the next few years will require similar FWP commitments, and that these will need to be managed

Ref.	Action	Timing	Justification
	(iii) Fully assess design changes to the permitted installation through the company's modifications assessment process.	Prior to the start of the construction phase or procurement of combustion plant and supporting equipment	The company's modifications assessment process is designed to screen and assess the significance of any design changes on the SZC project to ensure that the design and activities are consistent with the permit application and are BAT.
	(iv) Will develop arrangements to manage lessons learnt from other EDF nuclear power stations and from bringing the first unit into operation will be recorded and used when undertaking activities for the second unit.	Prior to the combustion activity environmental permit being granted	There will be continual lessons learnt from other EDF nuclear power stations. In addition, when the first EPR™ unit is being bought into production the stages of construction and commissioning of each EPR™ unit can occur in parallel.
	(v) Develop written Operating Instructions for the combustion activity operations, which may affect environmental (and safety) performance and that all these operations are undertaken in accordance with the instructions.	6 months prior to commissioning	Operations, which may affect safety or environmental performance, will be performed in accordance with approved Operating Instructions which include any instructions necessary to ensure that the conditions and limits of the Operating Rules will be implemented. Adequate arrangements will be made and implemented for the preparation, review and amendment of the Operating Instructions.
	(vi) Update the raw material register and supporting material safety data sheets.	6 months prior to commissioning	A register will be maintained as part of compliance with the Control of Substances Hazardous to Health Regulations, safety data sheets for all raw materials will be held in the station.
3	Operational Management Plans SZC Co. will develop a detailed accident and incident management plan for the combustion plant that provides a quantified risk assessment of hazards that take into account the engineering and procedural mitigation measures and addresses how environmental risks will be prevented and mitigated during commissioning and operation.	6 months prior to installation at site	Detailed engineering and procedural controls for the combustion plant have not yet been finalised. As more information becomes available it will be used to undertake and influence the environmental risk assessment to ensure that appropriate measures are in place to prevent and mitigate the consequences of accidents and incidents.
4	Site Closure and Decommissioning Plan SZC Co. will:		

Ref.	Action	Timing	Justification
	(i) Submit an updated SCR to the Environment Agency, which includes baseline data to describe the condition of ground and groundwater at the Combustion installation site at construction platform levels.	6 months after excavation	In order to provide robust baseline data, it is proposed that additional baseline data be collected upon finalisation of the site layout and construction excavations (much of the site will be subject to excavation during the preparatory works). This would form the basis of the updated SCR prior to any permitted activities commencing.
	(ii) Develop a site closure and decommissioning plan for the combustion plant	6 months prior to the end of commissioning the combustion plant at UK EPR Unit 1.	The design of the diesel building will include consideration of its eventual decommissioning. When further information is available, this will be used to prepare the site closure plan.
5	Environmental Performance SZC Co. will:		
	(i) provide final confirmation of the emissions to air and provide details of the monitoring techniques that will be used.	6 months prior to commissioning	The only emissions not fully described in this application are likely to be trivial (e.g. crankcase vents, diesel tank vents). This information will be provided once these emissions have been described in more detail in the designs.
	(ii) review emissions from the combustion plant to assess whether the emission levels are as anticipated in this document. Where the emissions are not as anticipated in this submission, then proposals will be made to improve performance without reducing the reliability of the generators and without grossly disproportionate cost with regard to the yearly operational time; and will confirm that impacts from actual emissions to air are acceptable or prompt a review of abatement requirements.	During commissioning	The assessment of impacts from emissions to air is dependent on information provided by the manufacturers. There is the possibility that actual emissions may not meet these requirements. Validation of the emissions will ensure that impacts from actual emissions to air are not unacceptable. Any options assessment on reduction of emissions will include an assessment against the reliability criteria of the diesel engines to ensure that their safety function is not affected in any way.
	(iii) review environmental performance to identify areas where further improvements could be made, including a review NO_X generation by the diesel engines noting that the highest priority remains the nuclear safety purpose of the generators and the	During the operational phase	The commissioning process will ensure that all combustion plant operates appropriately. However, further improvements may also be possible as operational familiarity with the plant grows, and the action reflects best practice. Any options assessment on reduction of emissions and energy

Ref.	Action	Timing	Justification
	development of an energy management and improvement plan.		consumption will include an assessment against the reliability criteria of the diesel engines to ensure that their safety function is not compromised and that it is not grossly disproportionate with regard to cost compared to the low yearly operation time of the engines.

6.4 Conclusion

SZC Co. believes this document contains sufficient information to enable the Environment Agency to determine whether a combustion activity environmental permit can be granted.

SZC Co. believes it has demonstrated that the proposed combustion plant at SZC represents the application of BAT and that impacts on the environment are minimised as far as reasonably practicable. SZC Co. undertakes regular reviews of technology and guidance so as to demonstrate the ongoing application of BAT.

SZC Co. is submitting this document to the Environment Agency so it can undertake a determination of this application, including a consultation on our submission. SZC Co. will respond to any requests for clarification and information from the regulator in a timely and efficient manner to enable it to complete its process.

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7 References and Acronyms

7.1 References

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[2] "Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (as amended)".
[3] "BS 2869:2017 Fuel Oils for Agricultural, Domestic and Industrial Engines and Boilers".
[4] "The Sulphur Content of Liquid Fuels (England and Wales) Regulations 2007 (SI 2007 No. 79)".
[5] NNB Generation Company (SZC) Ltd, Company Document Company Manual, Version 2, March 2020, Ref: 100200192.
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[7] "BAT Reference Document for Large Combustion Plants (LCP) (2010/75/EU, European Commission, 2017)".
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[13] "Environment Agency, Environmental permitting technical note 1/1(18) - Reference document for combustion plant of 20 to 50 MW thermal capacity, Revised: 2018".
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[15] "Environment Agency, SEPA, NIEHS, IPPC Sector Guidance Note Combustion Activities V2.03, 2005".
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[19] "Environment Agency (2018) Guidance for A1 installations: environmental permits".
[20] "Environment Agency (2009). Guidance note on combustion activities EPR 1.01".

[21] "Environment Agency (2019) Legal operator and competence requirements: environmental permits".
[22] "Environment Agency (2019) Environment Agency guidance, developing a management system (updated January 2019)".
[23] Environment Agency (2019) Adapting to climate change: risk assessment for your environmental permit.
[24] "Environment Agency (2016) Risk assessments for your environmental permit".
[25] "Environment Agency (2016) Risk assessments for specific activities: environmental permits".
[26] "Environment Agency (2016) Control and monitor emissions for your environmental permit".
[27] "Environment Agency (2016) Guidance for best available techniques: environmental permits".
[28] "Environment Agency (2016) Guidance for energy efficiency standards for industrial plants to get environmental permits".
[29] "Environment Agency (2018) Collection of technical guidance for regulated industry sectors: environmental permitting".
[30] "Environment Agency (2018) Energy efficiency standards for industrial plants to get environmental permits".
[31] "Environment Agency (2017), Air emissions risk assessment for your environmental permit".
[32] "Environment Agency (version 3.0, June 2004), H3 Part 2 Noise assessment and control – guidance for applicants".
[33] "Environment Agency Guidance (Published October 2018), Noise impact assessments involving calculations or modelling".
[34] "Environment Agency (March 2011), H4 Odour management – how to comply with your environmental permit".
[35] "Environment Agency (version 3.0, April 2013), H5 site condition report - guidance for applicants".
[36] "Environment Agency (2018) Monitoring emissions to air, land and water (MCERTS)".
[37] "Environment Agency (updated 3 January 2018), oil storage regulations for businesses 'how to store oil, design standards for tanks and containers, where to locate and how to protect them, and capacity of bunds and drip trays'".
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7.2 Acronyms

Acronym/Abbreviation	Definition
AELs	Associated Emission Levels
AQS	Air Quality Standard
BAT	Best Available Techniques
BREF/Bref	Best Available Technique Reference Documents
BSI	British Standards Institution
CEN	Comité Européen de Normalisation (The European Committee for Standardisation)
CI	Compression Ignition (Engine)
CIRIA	Construction Industry Research and Information Association
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COSHH	Control of Substances Hazardous to Health
CWS	County Wildlife Sites
DAC	Design Acceptance Confirmation
Defra	Department for Environment, Food and Rural Affairs
EAL	Environmental Assessment Level
EDG/EDGs	Essential Diesel Generator/s
EGR	Exhaust-gas recirculation
EIA	Environmental Impact Assessment
EP Regulations	Environmental Permitting Regulations 2010
EPR	European Pressurised Reactors
EQS	Environmental Quality Standard

Acronym/Abbreviation	Definition
ESPs	Electrostatic precipitators
EU	European Union
EU ETS	European Union Emissions Trading Scheme
EWC	European Waste Catalogue
FAP	Forward Action Plan
FGD	Flue Gas Desulphurisation
FGR	Flue/exhaust Gas Recycling
FWP	Forward Working Plan
GDA	Generic Design Assessment
GRRs	Management of Radioactive Waste from Decommissioning of Nuclear Sites: Guidance on Requirements for Release from Radioactive Substances Regulation
HPB	Hinkley Point B
HPC	Hinkley Point C
HRA	Habitat Regulations Assessment
IEEE	Institute of Electrical and Electronics Engineers
IMS	Integrated Management System
IPPC	Integrated Pollution Prevention and Control
IPPCB	Integrated Pollution Prevention and Control Bureau
ISO	International Standardisation Organisation
IWS	Integrated Waste Strategy
LCP	Large Combustion Plant
LOAEL	Lowest Observable Adverse Effect Level
LOOP	Loss Of Off-site Power

Acronym/Abbreviation	Definition
MAPP	Major Accident Prevention Policy
MCERTS	Environment Agency's Monitoring Certification Scheme
MCPD	Medium Combustion Plant Directive
MW	Megawatts
MW_e	Megawatts electrical
MW_{th}	Megawatts thermal
NAQS	National Air Quality Standard
N/A	Not Applicable
N_2O	Nitrous oxide
NGR	National Grid Reference
SZC Co.	NNB Generation Company (SZC) Limited
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_X	Oxides of Nitrogen
NSL	Nuclear Site License
ONR	Office for Nuclear Regulations
OTNOC	Other than normal operating conditions
PCER	Pre-Construction Environment Report
PM	Particulate Matter
PM_{10}	Particulate Matter with a Diameter < 10 µm
$PM_{2.5}$	Particulate Matter with a Diameter < 2.5 µm
PPC	Pollution Prevention and Control
PWR	Pressurised Water Reactor

Acronym/Abbreviation	Definition
RC0	Reference Configuration 0
RCC-E	Règles de Conception et de Construction des Matériels Electriques des Centrales Nucléaires (Design and Conception Rules for Electrical Equipment of Nuclear Islands)
SAC/cSAC	Special Area of Conservation/candidate Special Area of Conservation
SCOLF (Regulations 2007)	Sulphur Content of Liquid Fuels (Regulations 2007)
SCR	Selective Catalytic Reduction
SI	Spark Ignition (Engine)
SNCR	Selective Non Catalytic Reduction
SO_2	Sulphur Dioxide
SOAEL	Significant Observable Adverse Effect Level
SODA	Statement of Design Acceptability
SPA/pSPA	Special Protection Area/potential Special Protection Area
SSSI	Site of Special Scientific Interest
SZA	Sizewell A
SZB	Sizewell B
TBC	To Be Confirmed
TGN	Technical Guidance Note
TLAP	Total Loss of AC Power
UDG	Ultimate Diesel Generator
UKAS	United Kingdom Accreditation Service
USEPA	United States Environmental Protection Act
VOC	Volatile Organic Compound

Acronym/Abbreviation	Definition
WHO	World Health Organisation

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Appendix A: Site Maps, Plans and Drawings (No. 100207659)

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Appendix B: Site Condition Report (No. 100207661)

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Appendix C: Air Quality Modelling Assessment (No. 100207663)

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Appendix D: Shadow HRA (100207664)

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Appendix E: Noise Assessment (No. 100207665)

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Appendix F: Application Forms (Forms A, B2, B3 and F1) (No. 100207666)

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