Energy for generations

ESB Strategy, Innovation & Transformation

Summary Description for the Environmental Protection Agency (EPA)

Aghada 2.6 MW Edge Computing Modular Data Centre

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Change History of Report

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Contents

1. The Proposed Development

The proposed development will consist of development on a 0.81Ha site of a c. 2.6 MW capacity Edge Computing Modular Data Centre located within a secured compound, and will include:

a) 1 no. modular control building (c. 116 sq. m. and c. 4.1 m high).
b) Electrical and computing plant and equipment comprising:
    1. 20 No. IT modules (c. 45 sq. m. and c. 3.9 m high with additional roof mounted cooling units),
    2. 2 No. LV modules (c. 59 sq. m. and c. 3.8 m high),
    3. 2 No. Battery modules (c. 25 sq. m. and c. 3.8 m high),
    4. 1 No. MV module containing bunded and ventilated transformer (c. 29.7 sq. m. and c. 3.8m high) and
    5. 7 No. bunded standby generator units (c. 10 sq. m and 8.0m high (including 5.7 m high stack on top of generator unit which is 2.3m high from ground level)), surrounded by c. 2.6 m high palisade fencing and gates.
c) Ancillary site clearance and development works including provision of areas of hard standing, car park area, covered walkway linking all modules and connections to site services networks.

2. Rationale and Justification for the Proposed Development

The proposed Edge Computing Modular Data Centre will be located within the existing boundary of the ESB Aghada Power Station site. Edge computing is a distributed computing solution that brings computation and data storage closer to the location where it is needed, to improve response times and save bandwidth. ESB Aghada Power Station is a desirable location for an edge computing facility to serve Cork city and the surrounding region's IT infrastructural needs due to the proximity of the centre of population, commerce, industry, education and essential government services. The proposed project will use existing regional fibre optic communications and power infrastructure to serve the growing demand for online services in the Cork area. Edge computing requirements of primary economic cities like Cork are growing due to increased data requirements for applications such as offsite data storage, data analytics, business intelligence systems and cloud applications for both commercial and domestic use. The recent accelerated growth in remote working, online shopping, e-commerce, video conferencing and video-on-demand is putting additional demands on the existing infrastructure as Irish businesses, schools and homes go digital.

As part of ESB's Brighter Future Strategy, ESB is seeking to provide both cleaner energy solutions and smarter working and living options by providing better power and telecommunications infrastructure to all customers in Ireland. The proposed project will use a small part of the ESB Aghada Power Station site which was reserved for innovative projects that fit with this strategy.

The compact footprint of the modular design allows the 2.6MW rated facility to be located within a rectangular portion of the site to the south-east of the existing main power plant structures. The total area required for this new development represents less than 2% of the existing power station site area. The proposed site is currently bordered on 3 sides with mature hedgerows which will be retained as natural boundaries. The 4th side adjoins the existing internal site access road which will be used for construction and operational access thereafter. This side also has an aging chain fence which will be replaced as part of the new development.

The site was chosen from a number of options due to its preferable attributes:

a) access to electrical power infrastructure
b) access to fibre optic communication infrastructure
c) area of sufficient size to accommodate the project within the surrounding tree line which will not be affected during the build and remain intact upon completion
d) flat and level site which facilitates simple ground preparation
e) suitability to reuse existing access road within the overall ESB site

Construction activity on site will be minimised as the core IT modules will be fabricated in an Irish manufacturing facility and transported by road to the site for anchoring to the mounting points. The computing section of the facility will be contained within 20 No. IT modules and these will be supported by primary power, battery and medium voltage modules. The 20 No. IT modules contain computer servers and the noise will be minimal when compared to the background levels at the site boundary. It is the intention to fully comply with the IEL.

The facility will have its own integrated uninterruptible power source comprising battery system, which is intended to be the main back up power supply , and emergency standby diesel generators. These systems will be required in the unlikely event of mains power loss, allowing the facility to remain in continuous operation with no downtime.

While there are 7 No. standby generators proposed on-site, the maximum number of generators that would operate at any one time is 6. The 7th unit provides additional redundancy in case one generator fails to start in an emergency outage situation. All generators have an enclosed diesel tank and bund which will be fitted with an approved oil sensitive bund dewatering system and will be monitored as per IEL requirements from the Aghada station control room.

3. Environmental Considerations

Standby Generator Emissions

As previously mentioned, the standby generators will only be required in the event of loss of power supply to the data centre. For the air dispersion modelling it was conservatively assumed that the emergency back-up generators would only run up to a maximum of 500 hours. However, in practice it is expected that they will hardly run, with the exception of periodic testing to ensure that they would be available in the event of a power loss.

The contribution of emissions from the proposed backup generators and existing gas turbines at the Aghada Power Station to off-site ambient pollutant concentrations was assessed and the location and maximum of the worst-case ground level concentrations of NO2 identified.

Air dispersion modelling was carried out by Dr. Edward Porter (C Chem MRSC MIAQM) of AWN Consulting using the United States Environmental Protection Agency's regulatory model AERMOD (Appendix 2). The dispersion modelling study consisted of the following components:

- Review of emissions data and other relevant information needed for the modelling study.
- Summary of background nitrogen dioxide (NO2) concentrations.
- Dispersion modelling of emissions from the Aghada Power Station including the operation of the proposed backup generators.
- Determination of a minimum stack height for the proposed backup generators.

- Presentation of predicted ground level concentrations of pollutants emitted; and
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient air quality limit values.

Assessment Summary

The modelling results demonstrate that ambient pollutant concentrations (including background) beyond the site ownership boundary are well below the applicable ambient air quality limit values at all off-site receptors modelled for all scenarios assessed. The proposed stack height of 8 m for the backup generators does not result in any significant impacts on ambient air quality beyond the site boundary.

The physical stack information for the existing emissions points and proposed backup generator emission points is provided in Table 3 below. The process emission information used in the dispersion model for the modelling scenario described above is shown in Table 4.

Stack Reference	Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)
Proposed Backup Generators	8	0.20	0.031
A1-2 (Existing OCGT CT11) A1-3 (Existing OCGT CT12) A1-4 (Existing OCGT CT14)	65	5.7	25.5
A2-1 (Existing CCGT)	65	7.0	38.5

Table 3 Physical Stack Information for the Proposed Backup Generator Emission Points and Four Existing Gas Turbine Emission Points at Aghada Power Station

Scenario	Emission Point	Fuel Type	Temp (K)	Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	NO_x	
						Conc. (mg/Nm^3)	Mass Emission (g/s)
Conservative Operational	Backup Generators	Diesel Note 1	828.15	1,685	42.1	2,982 (at 5% O_2) 1,107 (at 15% O_2)	1.39
	Existing OCGTs (A1-2, A1-3, A1-4)	Natural Gas (Normal Operation) Note 3	600.00	985,000	40.2	250	68.4
		Natural Gas (Start-ups) Note 3	543.00	985,000	36.4	250	68.4
	Existing CCGT (A2-1)	Natural Gas (Normal Operation) Note 4	357.2	2,400,000	21.7	75	50.0

Note 1 Backup generators are conservatively assumed to operate for 500 hours per year.
Note 2 Data used to model emissions from diesel backup generators during scheduled testing assumed to occur one hour each month.
Note 3 Existing OCGTs are assumed to operate for 10 hours per week with 1 of those hours modelled as a start-up hour, every week of the year.
Note 4 Existing CCGT is assumed to operate for 18 hours per day with 2 of those hours modelled as start-up hours, every day of the year.

Table 4 Process Emissions Information for the Existing Emission Points and the Proposed Backup Generators Emission Points at Aghada Power Station

The NO2 modelling results at the worst-case receptors are detailed in Table below for the proposed backup generators and all existing emission points at Aghada. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO2.

Pollutant / Year	Background ($\mu g/m^3$)	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Predicted Environmental Concentration NO_2 ($\mu g/m^3$)	Standard ($\mu g/m^3$) Note 1
NO_2 / 2015	24	99.8th%ile of 1-hr means	106.2	130.2	200
	12	Annual Mean	7.3	19.3	40
NO_2 / 2016	24	99.8th%ile of 1-hr means	114.4	138.4	200
	12	Annual Mean	7.6	19.6	40
NO_2 / 2017	24	99.8th%ile of 1-hr means	107.9	131.9	200
	12	Annual Mean	8.7	20.7	40
NO_2 / 2018	24	99.8th%ile of 1-hr means	124.9	148.9	200
	12	Annual Mean	6.9	18.9	40
NO_2 / 2019	24	99.8th%ile of 1-hr means	107.1	131.1	200
	12	Annual Mean	8.0	20.0	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Table 5 NO_2 Dispersion Model Results at Worst-case Receptors – Backup Generators

MV Transformer

The MV power module/EHouse (See attached drawing) is a structural steel building. The EHouse includes built in bunded transformer with weather louvers on 3 sides and roof to prevent water ingress. The MV Module building houses the main MV Switch and Isolator. The transformer bund will be fitted with an approved oil sensitive bund dewatering system and will be monitored as per IEL requirements from the Aghada Station control room.

COMAH / Seveso Considerations

Having reviewed the MAPP, and the risk assessments relating to hazardous substances stored on site, ESB do not consider this to be a significant modification for the site from a COMAH perspective or have land use planning implications because of the nature of the development and its siting relative to the existing major accident hazard scenarios on site.

Site Services

- **Foul Water**

A foul system is proposed within the station to cater for the wastewater generated in the welfare facilities of the control building. The foul system will consist of an underground pipe network, foul manholes and a retention foul effluent storage tank. The tank will have an associated high-level alarm which will be connected to the control building. A foul holding tank to be maintained and emptied as required is the most preferable means of treating and disposing of foul waste from the site. The licensed contractor charged to empty and dispose of the waste will be the holder of a valid waste collection permit. The foul holding tank proposed will have adequate capacity which will be a multiple of the foul water generated over six months of normal operation. The foul holding tank will also be inspected by a suitably qualified person at the required intervals and records of the inspections will be held on site for inspection by the competent authority. The storage tank will be integrity tested as per the EPA guidance notes for Material storage and Transfer and be part of the station's ongoing testing regime. This will include testing prior to commissioning and every three years thereafter.

A freeboard in excess of 300 mm will be provided for and the foul holding tank will be fitted with a high-level alarm. The alarm will be connected back to the station control panel which is connected to a staffed control centre via the stations' Supervisory Control and Data Acquisition (SCADA) telecom relay system. This will allow for a non-scheduled maintenance and emptying of the tank between the regular six-month intervals in the very unlikely event that this is required.

The foul holding tank will also be vented to the atmosphere.

- **Surface Water**

Surface water drainage features are proposed for the impermeable surfaces associated with the car park. The 380 m^2 car park will discharge to a Kingspan-Klargester NSFA010 Class 1 Full Retention oil interceptor (or equivalent approved) in line with British European Standard EN 858, achieving a maximum oil discharge concentration of 5 mg/l. In line with BS EN 858-1 and Environment Agency Pollution Prevention Guideline PPG3 the separator shall be fitted with an oil level alarm system (monitored by Aghada Station control room), installed and calibrated by a suitably qualified technician so that it will respond to an alarm condition when the separator requires emptying. The treated water shall connect to a new underground pipe along the existing access road for approximately 400 m before connecting with the existing

surface water drainage system within the Aghada Complex at the existing fuel oil delivery interceptor outlet (Figure 1).

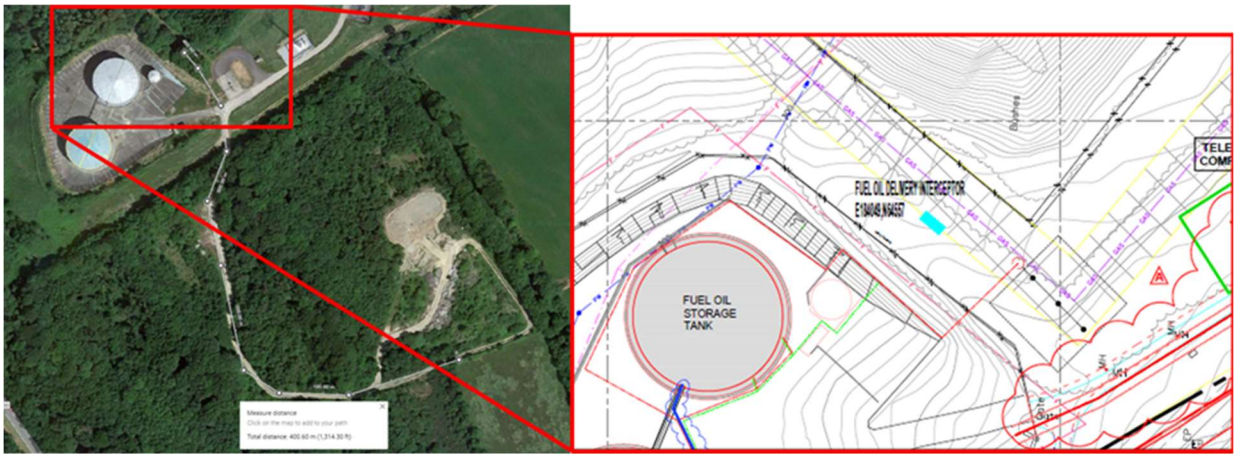

Figure 1 Connection from Data Centre to existing Aghada station drainage system

Existing surface water drainage route to the existing water point SW12

The fuel oil delivery interceptor connects to the process water drainage line and flows northward to the entrance of the power station (Figure 2).

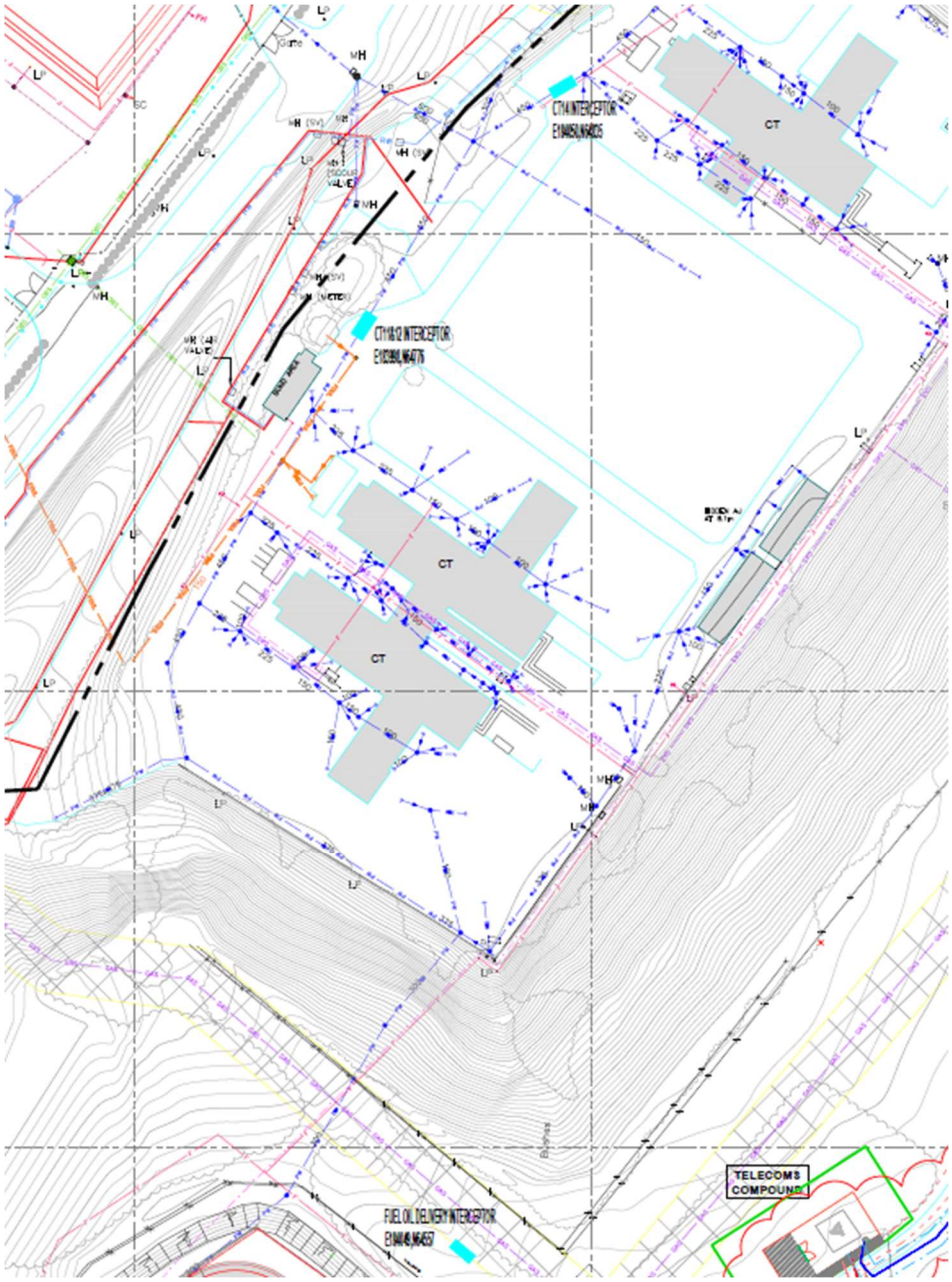

Figure 2 Connection from Fuel Oil Interceptor northward to power station entrance on R630

From here, the existing surface water route crosses underneath the R630 Regional Road and through the existing CT's interceptor (Figure 3). From there it is conveyed to discharge at the water emissions point SW12 in Cork Harbour (Figure 4).

Figure 3 Extract from archive services drawing '21085 REVISION A 18-05-2017 UNDERGROUND SERVICES Sheet 2 of 2' showing the existing connection to the outfall at SW12 water emissions point in Cork Harbour

Figure 4 Satellite view of Aghada Generating Station showing the proposed surface water connection to the existing surface water network. From here, surface water is conveyed to the outfall at the SW12 water emissions point in Cork Harbour via the existing CT'S interceptor.

The remainder of the Data Centre site will be surfaced with permeable stone and will only be exposed to rainwater. This permeable stone provides a means of attenuation of runoff and allows rainwater to infiltrate to ground as it would on a greenfield site. Rainwater falling on the control buildings is considered to be normal surface water and will runoff onto the permeable stone and infiltrate to ground. Greenfield conditions at the site are naturally favourable to infiltration of rainwater. According to the Geological Survey of Ireland, the soil is 'till overlain by well drained soil' (Figure 5). As such, it is not deemed necessary to install additional drainage features to manage risk of surface water ponding/waterlogging on site.

Figure 5 Groundwater recharge data for Aghada Data Centre (www.gsi.ie)

- **Water Supply**

The proposed development will require limited water supplies as it is an unmanned facility with only occasional use by technicians. Water will be supplied by connecting to the existing water supply network within the Aghada Complex.

- **Noise**

The 20 No. core IT modules contain computer servers and the noise impact will be minimal when compared to background levels at the site boundary. The Aghada site is licenced by the Environmental Protection Agency (EPA) under an Industrial Emissions (IE) Licence [Ref. P0561-05] and the site will continue to comply with noise requirements outlined in this licence.

- **AA Screening**

This Appropriate Assessment Screening Report (Appendix 1)has established that the proposed edge computing Datacentre at Aghada Generating Station, as detailed in this report, either alone or in-combination with other projects or plans, is not likely to give rise to significant effects on any European Site(s) in view of the site's conservation objectives.

- **Fire suppression**

INERGEN® is a mixture of 52% Nitrogen, 40% Argon and 8% CO2. It will be contained within cylinders located within the IT/LV and multi-use buildings on site. In terms of Gas volume there will be 2 cylinders per module so on the 2MW site with 23 modules containing INERGEN and each bottle containing 140l of gas, this will total approx. 6,440 litres of gas on the site.

Discharge of this gas will be in the event of a fire detection (via smoke detectors) in the module where the incident occurred and not the entire site for a single event. So, for any single module only approx. 280 litres of gas will be released.

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Appendix 1 - Appropriate Assessment Screening Report

Edge Computing Facility,
Aghada Generating Station, Whitegate, Co. Cork

Appropriate Assessment Screening Report

ESB

Date: July 2020

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Client / Recipient:	ESB	
Project Title:	Edge Computing Facility, Aghada Generating Station, Whitegate, Co. Cork	
Report Title:	Appropriate Assessment Screening Report	
Report No.:	N:\0099 Edge Computing Facility Aghada	
Revision No.:	000	
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Change History of Report

Date	New Revision	Author	Summary of Change

Contents

1 Introduction

1.1 Objective of this report

The Electricity Supply Board (ESB), is proposing to install an edge computing facility on a plot of land at Aghada Generating Station, Whitegate, Co. Cork. ESB Engineering and Major Projects (EMP) was engaged to carry out an Appropriate Assessment (AA) Screening in relation to a planning application for this development/project.

The proposed edge computing facility will be comprised of a number of discrete modules constructed off-site and subsequently delivered and connected in an array on the Aghada site.

This report presents the information required to facilitate the relevant Competent Authority in undertaking an Appropriate Assessment of the proposed development in accordance with the requirements of Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC).

The purpose of the report is to demonstrate whether the proposed development, either alone or in combination with other plans and projects, is likely to have significant effects on a European Site(s) in view of the site's conservation objectives.

1.2 Statement of competence

This report was prepared by Geoff Hamilton, Senior Ecologist with ESB Engineering and Major Projects. He has over 15 years' experience in the fields of ecological assessment and reporting, agri-environment scheme design and implementation, rural stakeholder consultation and environmental advocacy.

He has been involved in a wide range of infrastructure projects for local authorities and private commercial clients and has carried out a significant number of field surveys to inform Environmental Impact Assessments (EIA), Ecological Impact Assessments (EcIA), AA Screening Reports and Natura Impact Statements (NIS).

He has specific experience in the production of ecological reports relating to electricity infrastructure, particularly substations and underground cables. He holds a Master's degree in Zoology and is a Full Member of the Chartered Institute of Ecology and Environmental Management (CIEEM).

2 Regulatory context

The EU Habitats Directive 92/43/EEC provides legal protection for habitats and species of European importance through the establishment of a network of designated conservation areas known as the Natura 2000 Network. The Natura 2000 network includes sites designated as Special Areas of Conservation (SAC) under the EU Habitats Directive and Special Protection Areas (SPA) designated under the EU Birds Directive 79/209/EEC. These are collectively referred to as 'European Sites'.

The Habitats Directive was initially transposed into Irish national law in 1997, with the European Communities (Natural Habitats) Regulations, SI 94/1997. These Regulations have since been amended by SI 233/1998 & SI 378/2005. The European Communities (Birds and Natural Habitats) Regulations 2011 consolidate the European Communities (Natural Habitats) Regulations 1997 to 2005 and the European Communities (Birds and Natural Habitats) (Control of Recreational Activities) Regulations 2010.

The requirements for an Appropriate Assessment are set out under Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC which state:

6(3) Any plan or project not directly connected with or necessary to the management of the site (Natura 2000 sites) but likely to have significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the sites conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

6(4) If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.

Definitions of conservation status, integrity and significance used in this assessment are defined in accordance with 'Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (European Commission, 2018).

- The conservation status of a natural habitat is defined as the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species.

- The conservation status of a species is defined as the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its population.
- The integrity of a European Site is defined as the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified.
- Significant effect should be determined in relation to the specific features and environmental conditions of the protected site concerned by the plan or project, taking particular account of the site's conservation objectives.

2.1 Appropriate Assessment process

This assessment has been undertaken in accordance with the following legislation and best practice guidance:

- European Communities (Birds and Natural Habitats) Regulations 2011, as amended;
- Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities (Department of the Environment Heritage and Local Government, Revision 1, 2010);
- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, European Commission (2001); and
- Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (European Commission, 2018)

Key stages in the Appropriate Assessment process are set out below, as per the respective aforementioned guidance documents. Stages 1 and 2 relate to Article 6(3) of the Habitats Directive and Stages 3 and 4 relate to Article 6(4). The outcome of each successive stage determines if a further stage in the process is required.

Stage 1. Screening for Appropriate Assessment

The first step in the Screening process is to determine if the plan or project is directly connected to or necessary for the management of a European Site. The process then identifies whether a plan or project, either alone or in combination with other plans or projects, is likely to have significant effects on a European Site in view of its conservation objectives.

Stage 2. Appropriate Assessment

This stage considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a European Site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. A Natura Impact Statement (NIS) must be prepared as part of this stage of the process. The AA is carried out by the competent authority, and is supported by the NIS.

Stage 3. Alternative Solutions

If Stage 2 of the process concludes that there is likely to be significant effects to a European Site, Stage 3 then examines any alternative solutions or options that could enable the plan or project to proceed without adverse effects on the integrity of a European Site.

Stage 4. Imperative Reasons of Overriding Public Interest (IROPI)/Derogation

Stage 4 is the main derogation process of Article 6(4) which examines whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project that will have adverse effects on the integrity of a European Site to proceed in cases where it has been established that no less damaging alternative solution exists.

2.2 Conservation Status of habitats and species

Definitions of conservation status, integrity and significance used in this assessment are defined in accordance with 'Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC' (European Commission, 2000).

- The conservation status of a natural habitat is defined as the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species.
- The conservation status of a species is defined as the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its population.
- The integrity of a European Site is defined as the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified.
- Significant effect should be determined in relation to the specific features and environmental conditions of the protected site concerned by the plan or project, taking particular account of the site's conservation objectives.

Favourable conservation status

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

The maintenance of habitats and species within European Sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level. Article (1) of the Habitats Directive (92/43/EEC) describes favourable conservation status for habitats and species as follows.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

Favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

3 Methodology

3.1 Desk review

A desktop study was conducted to examine the potential zone of influence of the proposed development and to identify any nature conservation sites within that area which could be impacted.

Available information consulted in the preparation of this AA Screening report included:

- European Site Synopses, Conservation Objectives reports and supporting documents published (npws.ie);
- Conservation Status Assessment Reports (CSARs), Backing Documents and Maps prepared in accordance with Article 17 of the Habitats Directive;
- Relevant published and unpublished reports on protected habitats and species in the study area; and
- Existing ecological reports produced during the planning process for the existing Aghada Power Station facility and subsequent compliance monitoring documents as well as recent planning documents associated with other proposed developments within the Aghada site. An ecological appraisal of the overall Aghada site prepared by ESB International (ESBI) was also used for reference (ESBI 2007).

3.2 Potential zone of influence

The guidance states that '*A distance of 15km is currently recommended in the case of plans and derives from UK guidance (Scott Wilson et al., 2006). For projects, the distance could be much less than 15km and in some cases less than 100m, but this must be evaluated on a case-by-case basis….'* (DEHLG, 2010)

The potential zone of influence is defined as:

- Areas directly within the land take for the proposed development
- Areas which will be temporarily affected;
- Areas likely to be impacted by hydrological disruption; and
- Areas where there is a risk of pollution and disturbance (e.g. noise)

Given the relatively contained nature of the proposed development, its association with the developed industrial environment of Aghada Power Station and the fact the proposed development will not result in any new operational emissions to atmosphere or surface water, the potential zone of impact was determined to be within a 5 km radius. Therefore, all Natura 2000 sites within a 5 km radius of the development have been included for assessment in this report.

3.3 Site Visits

The Aghada Site has been subject to a number of ecological surveys in recent years, the most recent being on October 26th 2018, 30th January 2019 and 25th July 2019. The purpose of these visits was to establish a record of the habitats and species

within and adjacent to the various undeveloped areas of the overall Aghada site should such areas be targeted for development and assess any potential impact pathways to European Sites within the potential zone of influence. Habitats present at the site were classified according to ‘A Guide to Habitats in Ireland’ (Fossitt 2000).

4 Screening for Appropriate Assessment

4.1 Introduction

Screening determines whether appropriate assessment is necessary by examining:

1. Whether a plan or project can be excluded from AA requirements because it is directly connected with or necessary to the management of the site, and
2. The potential effects of a project or plan, either alone or in-combination with other projects or plans, on a European Site in view of its conservation objectives and considering whether these effects will be significant (DoEHLG, 2010).

The proposed development is not directly connected with or necessary to the management of any European Site.

Screening for AA involves the following:

1. Description of project
2. Identification of relevant European Sites and compilation of information on their qualifying interests and conservation objectives
3. Identification of effects – direct, indirect and cumulative and determination as to their likely significance
4. Conclusions of the Screening Report.

4.2 Description of project

4.2.1 Existing environment

The proposed development is located entirely within the boundary of the Aghada Power Station facility. The footprint of the proposed development relates to a former grassed sports pitch on the elevated ground adjacent to the eastern boundary of the site. This was formerly intensively managed but has been unused in recent years and is now only subject to occasional mowing during the summer. The site is bounded on three sides by a mature treeline of ash, birch and sycamore with an understory of bramble scrub. The western boundary is defined by a wire fence with a strip of bramble scrub and occasional immature beech trees; an existing site access track runs parallel to this eastern boundary.

The location of the proposed development is to the southeast of the existing Aghada Power Station infrastructure, the closest components being the 110 kV substation compound located approximately 300 m to the north and the fuel storage tanks 200 m to the northwest. The development site is located approximately 300 m from the shoreline of Whitegate Bay, in the eastern part of Cork Harbour; there is a change in elevation of approximately 25 m between the shore and the site of the proposed development.

Site photos are presented in **Appendix 1**.

Figure 1 – Photo of existing improved grassland habitat and bordering treelines at proposed site within Aghada Power Station boundary

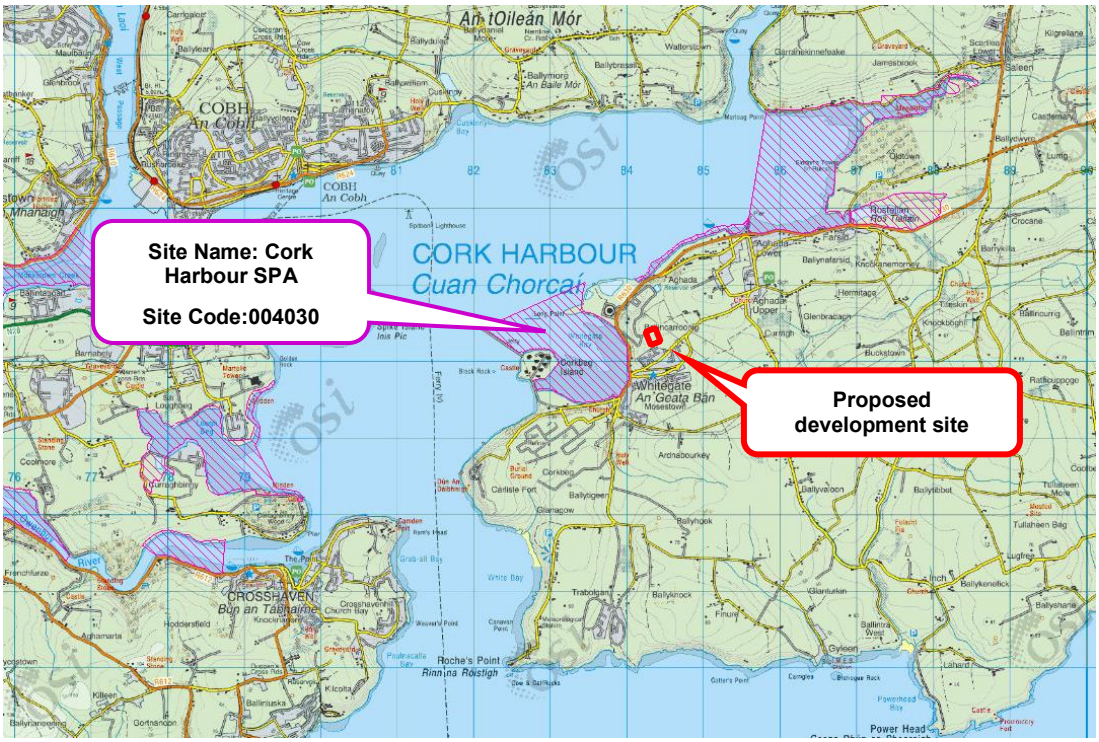

Figure 2 - European Sites within 5 km of the proposed development

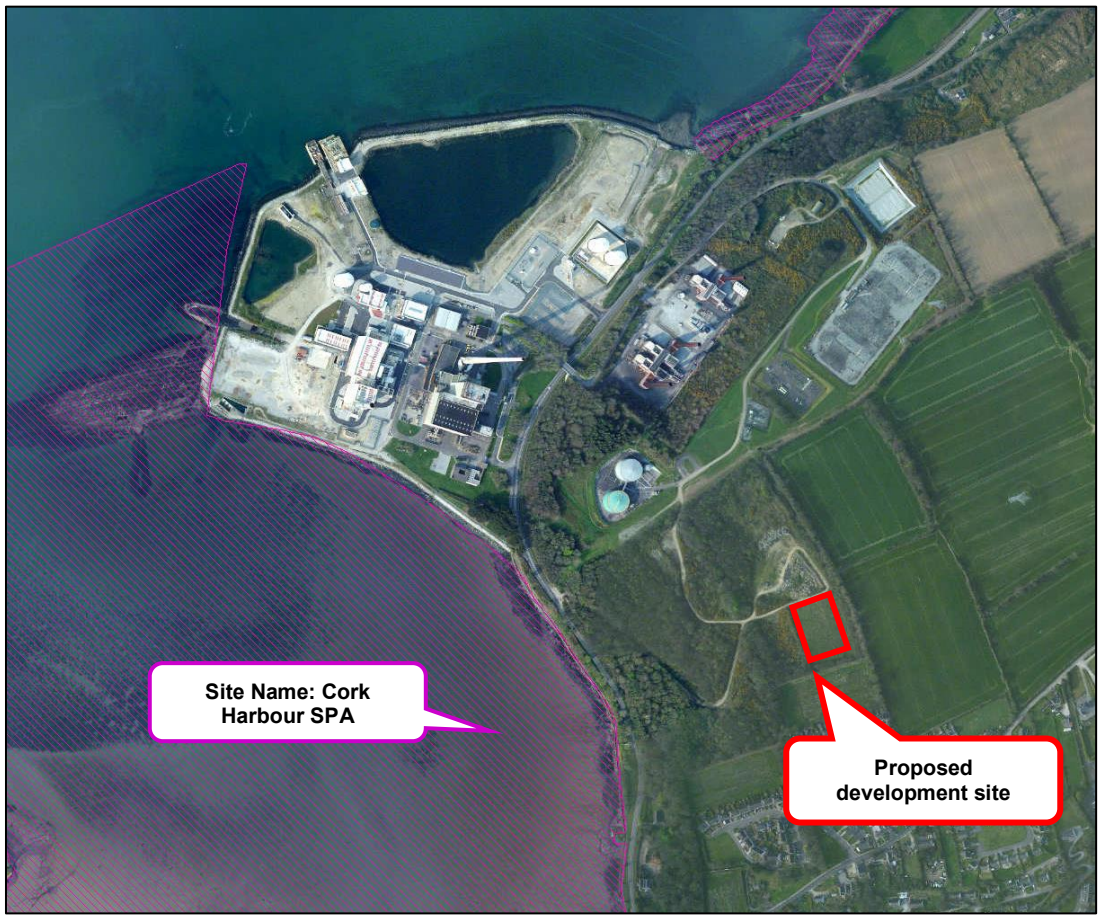

Figure 3 – Aerial image of habitats in locality of proposed development.

4.2.2 Overview of project

It is proposed to install an edge computing facility on lands at Aghada Power Station, Whitegate, Co. Cork. The facility will be developed using an array of self-contained modules, numbering 20 in total, as outlined in Figure 4.

The proposed facility will be manufactured off-site and delivered as a number of discrete modules. Due to the technical application each module is designed specifically to perform the required functions of the computing facility. In addition to the make-up required for operational performance the modules are designed to meet building and fire regulations.

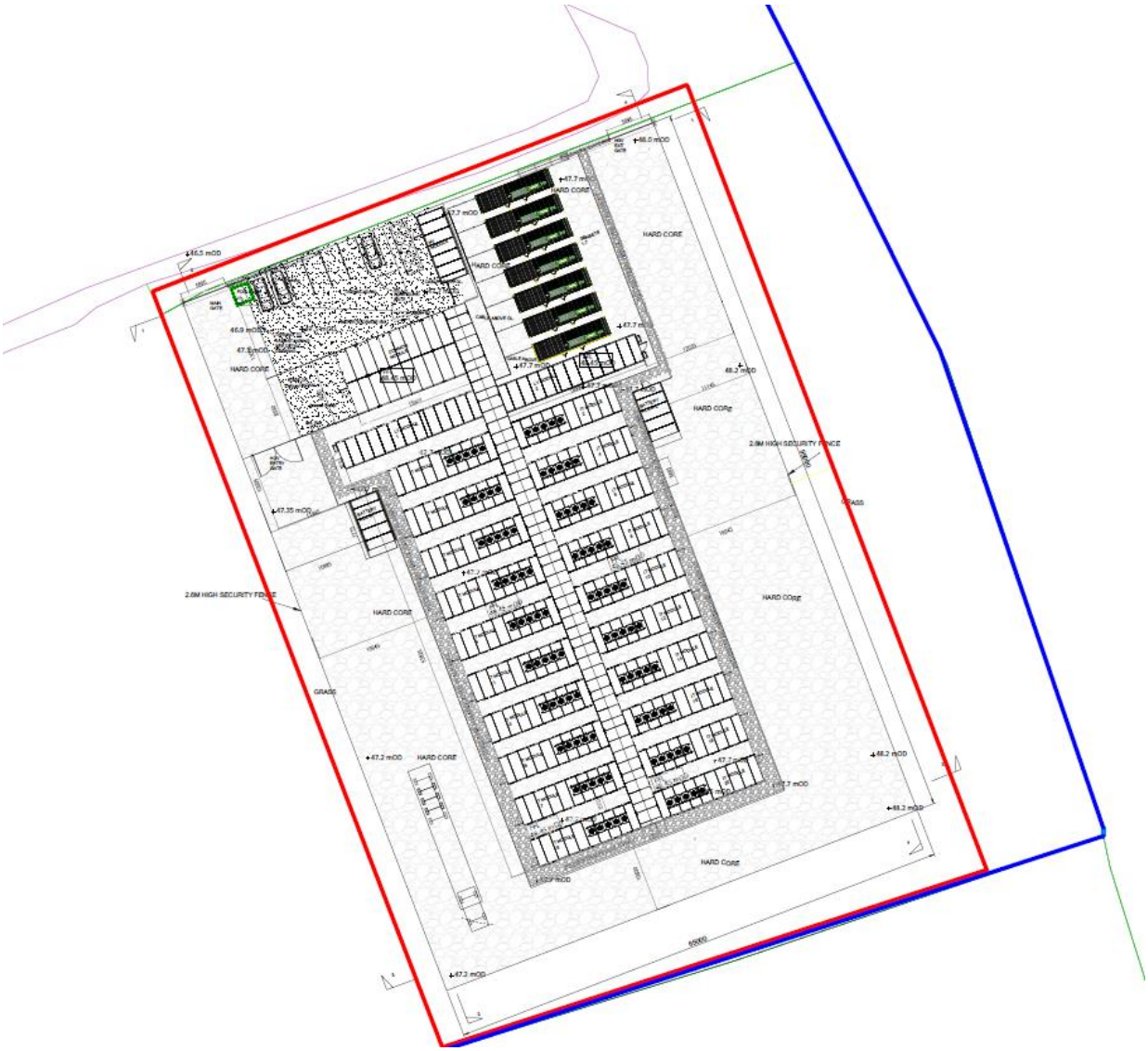

Figure 4 – Proposed layout

Each module is a free standing structure constructed as follows:

Base/Floor: Outer steel ring beam with steel cross members at intervals designed to suit the required loads. Under side galvanised steel sheet, rockwool insulation to fill the void and either steel chequer plate floor in the service rooms or computer room anti-static floor tiles in the IT spaces.

Walls: Outer walls are constructed using galvanised steel sheeting folded to create wall panels and welded to the structural frame. Walls are sealed and infilled with rockwool insulation. Internally the walls are sheeted with a composite fire rated panel delivering a clean room finish.

Roof/Ceiling: Outer steel ring beam with steel cross members at intervals designed to suit the required loads External roof is constructed from galvanised steel sheeting welded to the roof structural. Internally the ceiling is sheeted with a composite fire rated panel delivering a clean room finish.

External Finish: All external mild steel structural members are thermal sprayed and the entire unit is painted to RAL 9010 C5.

A temporary compound established within the main Aghada site will be used to accommodate the contractors' facilities during construction. The compound is expected to contain three portable site offices for the Contractors' and the Owner's Engineering staff, a meeting room, a canteen, drying room, portaloos and containerised storage units.

4.2.3 Detailed description of the project

4.2.3.1 Introduction

The Edge Computing Facility Compound will be contained within a 6,175m^2 area secured by a perimeter palisade fence. The site itself will have additional internal security fencing between the main car park and security building (Common Module 15m x 8.6m x 4.1m high) and the main site edge computing facility. The north end of the site will provide car park facilities to visitors. The modules are arranged in north south deployment along a central walkway, with modules east and west sides of the walkway.

The modules for the proposed facility will be manufactured off-site and delivered as discrete modules. To meet technical requirements each module is designed specifically to perform the required functions. 20 IT Modules to dimensions 14m x 3.7m x 3.9m high -5.1m high with roof mounted condenser, to house edge computing technology located along a central walkway and supporting electrical equipment infrastructure to the north of the site located in MV (9.2m x 3.5m x 3.8m high) , LV (19m x 3,6m x 3.8m high) /Battery (7.7m x 3.8m x 3.8m high) and generator (10m x 2.4 x 3m high + .8m for silencer) modules.

Modules provide internal integrated bunding requirements and oil filled transformer located on the MV module is enclosed in a weather proof louvered enclosure to allow maximum air circulation while preventing water ingress. In addition to the make-up required for operational performance, the modules are designed to meet building and fire regulations.

All modules are shown together on P0001-PP-S-2735-PROPOSED (proposed site plan) and P0001-PP-S-2735-PROPSEC (proposed site elevation views).

Utilising off site modular construction methods the facility will be deployed with 2 main work packages. Site works and off site modular construction carried out in an off site facility.

4.2.3.2 Construction Details

The construction method is outlined as follows with both headings treated separately.

On Site Civils Works

The primary purpose of on-site works is to create a site suitable for the installation of modules including ground levelling, providing a secure compound and bringing the site services to and from the facility, while maintaining the existing trees and tree line around the site.

The execution of site preparation is carried out by,

- Clearing the site of topsoil to a level required for backfilling. All modules are proposed to be on the same level which facilitates installation works. Levels identified in P0001-PP-S-2735-PROPSEC.
- The backfilling process is required to produce a strong stable base for the modules and facilitate drainage of the site. The back fill material is layers of graded stone. With foot path areas incorporating graded stone suitable for the walkway.
- Securing the compound will be by means of a palisade fence around the perimeter of the site. The site will have 2 sliding security gates for access and egress of HGVs during module delivery and will be used for maintenance purposes during site operation post construction.
- Site services will be carried out such that outside the Edge computing facility compound all services will be below ground. Site electrical and fibre optic connections will be carried out using underground ducting running along existing access roads and under land within the greater ESB site to the Edge computing facility compound. Site drainage and foul water handling will be contained within the compound itself. Mains water will be provided from the main ESB Aghada site.
- Primary access to the site will be via the existing access through the Aghada Power Station entrance and the internal Power Station roadway network.
- A temporary compound will be used to accommodate the contractors' facilities during construction. The compound is expected to contain portable site offices used for meeting rooms, canteen, toilet facilities and containerised storage units all located within the proposed site.
- Temporary Provision of Potable Water: A temporary water supply for construction works will be provided by means of the existing connection on site.
- Telecommunications: Existing telecommunications infrastructure will be utilised during the construction period. During operation, monitoring will be facilitated by an extension to the existing communications system. Mobile phones will also be used during the construction and operational periods.
- Power Supply: During the construction phase, electric power will be provided using diesel generators or a local supply.

Module Construction Details

Modular construction method greatly reduces on site building activity enabling greatly reduced building and site traffic.

The modular construction method is factory built steel modules to bespoke requirements. The quality control methods ISO 9001:2015 and EN 1090 execution class 2 and CE certification.

Each module is a free-standing structure constructed as follows:

- **Base/Floor**

Outer steel ring beam with steel cross members at intervals designed to suit the required loads. Under side galvanised steel sheet, rockwool insulation to fill the void and either steel chequer plate floor in the service rooms or computer room anti-static floor tiles in the IT spaces.

- **Walls**

Outer walls are constructed using galvanised steel sheeting folded to create wall panels and welded to the structural frame. Walls are sealed and infilled with rockwool insulation. Internally the walls are sheeted with a composite fire rated panel delivering a clean room finish.

- **Roof/Ceiling**

Outer steel ring beam with steel cross members at intervals designed to suit the required loads External roof is constructed from galvanised steel sheeting welded to the roof structural. Internally the ceiling is sheeted with a composite fire rated panel delivering a clean room finish.

- **External Finish**

All external mild steel structural members are thermal sprayed and the entire unit is painted to RAL 7033 C5.

4.2.4 Surface water drainage

Surface water proposals for the proposed development have been developed to mimic the natural drainage patterns of the site in accordance with the Best Management Practices (BMPs) of Sustainable Drainage Systems (SuDS). The surface water proposals replicate greenfield drainage conditions of the site where possible. Where surface water runoff is being discharged from site, the proposals ensure only high quality, treated runoff leaves the site at a controlled rate.

As per SuDS BMPs, the prevention of runoff generation was first considered for the proposed areas. Accordingly, the extent of impermeable area on the development was minimised.

Surface water drainage features are proposed for the proposed impermeable surfaces associated with the car park. The car park will discharge to a new underground surface water drainage network which will discharge to a proposed soakaway. The proposed soakaway will allow for infiltration of runoff into the ground. The sizing of the soakaway is subject to testing of the infiltration capabilities of the soil. The site currently has good natural drainage.

The rest of the site will be surfaced with permeable stone. This permeable stone provides a means of attenuation of runoff and allows rainwater to infiltrate to ground as it would on a greenfield site. Rainwater falling on the control buildings will runoff onto the permeable stone and infiltrate to ground.

4.2.5 Operational and maintenance stage

Traffic generated by the proposed development will be due to its maintenance, deliveries and meetings on site. During the operational phase, the facility will generally be unmanned but may have daily visits by security and/or maintenance personnel. There will also be sporadic occasions when staff will be on site for meetings, monitoring or testing purposes.

4.2.6 Decommissioning

On cessation of activities the plant will be redeveloped as a power related facility.

In the event of decommissioning the following will be implemented

- All plant equipment will be dismantled and either sold, recycled or disposed of through licenced waste contractors;
- All waste will be removed to a licenced facility by licenced waste contractors; and
- The site will be reinstated.

A Decommissioning Management Plan will be prepared, which will include details of decommissioning of all plant and equipment ensuring that there will be no environmental pollution.

5 Description of European Sites

5.1 Designated sites

The proposed development site is not within the boundaries of any European Sites. There is one European Site within 5 km of the proposed development site, namely Cork Harbour SPA, which in this locality relates to the intertidal habitats of Whitegate Bay to the south of the power station, and the northern shoreline of Aghada Lower. The SPA is mapped in Figure 1 and summarised in Table 1, along with its Special Conservation Interests (SCI).

Cork Harbour SPA (Site Code 004030) was first designated in 1994 by means of S.I. No. 349, and comprises a number of discrete areas, one of which is Whitegate Bay. The designation includes Whitegate Bay and Long Point, and excludes Aghada Power Station. Proposed extensions, totalling 132 ha, to the areas subject to SPA designation under the Birds Directive 79/409/EEC in Cork Harbour, were notified by the National Parks and Wildlife Service on 28 August 2008. A total of 1,568 ha of intertidal habitat within Cork Harbour is now designated as a SPA under the Birds Directive (79/409/EEC) and S.I. No. 237 of 2010. Ringabella Estuary, in the south western part of Cork Harbour, was added to the SPA designation of Cork Harbour in 2017.

Cork Harbour is of major ornithological significance, being of international importance both for the total numbers of wintering birds (i.e. > 20,000) and also for its populations of Black-tailed Godwit and Redshank. In addition, it supports nationally important wintering populations of 22 species, as well as a nationally important breeding colony of Common Tern. Several of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Little Egret, Golden Plover, Bar-tailed Godwit, Ruff, Mediterranean Gull and Common Tern. The site provides both feeding and roosting sites for the various bird species that use it. Cork Harbour is also a Ramsar Convention site and part of Cork Harbour SPA is a Wildfowl Sanctuary.

Table 1 - European Sites within 5 km of the proposed development site

Designated site	Conservation Objectives	Special Conservation Interests	Potential presence of SCI species in Whitegate Bay (based on I-WeBS data and monitoring surveys undertaken as part of Aghada Power Station IPPC Licence Condition 3.17)	Potential presence of SCI species within proposed development footprint
Cork Harbour SPA	To maintain the favourable conservation condition of the following species for which Cork Harbour SPA is designated:	Little Grebe (*Tachybaptus ruficollis*) [A004]	Not present	Not present (no suitable habitat)
		Great Crested Grebe (*Podiceps cristatus*) [A005]	Present	Not present (no suitable habitat)
		Cormorant (*Phalacrocorax carbo*) [A017]	Present	Not present (no suitable habitat)
		Grey Heron (*Ardea cinerea*) [A028]	Present	Not present, but a heronry is known to be present in mature woodland to east of CCGT site
		Shelduck (*Tadorna tadorna*) [A048]	Present	Not present (no suitable habitat)
		Wigeon (*Anas penelope*) [A050]	Present	Not present (no suitable habitat)
		Teal (*Anas crecca*) [A052]	Present	Not present (no suitable habitat)
		Pintail (*Anas acuta*) [A054]	Present	Not present (no suitable habitat)
		Shoveler (*Anas clypeata*) [A056]	Present	Not present (no suitable habitat)
		Red-breasted Merganser (*Mergus serrator*) [A069]	Present	Not present (no suitable habitat)
		Oystercatcher (*Haematopus ostralegus*) [A130]	Present	Not present (no suitable habitat)

		Golden Plover (*Pluvialis apricaria*) [A140]	Not present	Not present (no suitable habitat)
		Grey Plover (*Pluvialis squatarola*) [A141]	Not present	Not present (no suitable habitat)
		Lapwing (*Vanellus vanellus*) [A142]	Present	Not present (no suitable habitat)
		Dunlin (*Calidris alpina*) [A149]	Present	Not present (no suitable habitat)
		Black-tailed Godwit (*Limosa limosa*) [A156]	Present	Not present (no suitable habitat)
		Bar-tailed Godwit (*Limosa lapponica*) [A157]	Present	Not present (no suitable habitat)
		Curlew (*Numenius arquata*) [A160]	Present	Not present (no suitable habitat)
		Redshank (*Tringa totanus*) [A162]	Present	Not present (no suitable habitat)
		Black-headed Gull (*Chroicocephalus ridibundus*) [A179]	Present	Not present (no suitable habitat)
		Common Gull (*Larus canus*) [A182]	Present	Not present (no suitable habitat)
		Lesser Black-backed Gull (*Larus fuscus*) [A183]	Present	Not present (no suitable habitat)
	To maintain the favourable conservation condition of the wetland habitat in Cork Harbour SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.	Wetland and Waterbirds [A999]	Intertidal and shoreline habitats around Whitegate Bay	Not present

5.2 Assessment of likely effects

The favourable conservation conditions for the respective Special Conservation Interests (SCIs) for the SPA are presented in Conservation Objectives Series – Cork Harbour SPA 004030 (NPWS 2014a). For the wintering species occurring at the site, this relates to targets of stable or increasing long-term population trends and no significant decrease in the range, timing or intensity of use of areas by the respective species, other than that occurring from natural patterns of variation. The favourable conservation condition of the breeding population of common tern is defined by a more detailed range of attributes and targets relating to breeding population abundance, productivity rate, distribution, prey biomass, barriers to connectivity and disturbance to breeding sites.

5.2.1 Direct impacts

The proposed development is located on an elevated part of the Aghada site which is physically separated from the intertidal habitats of Whitegate Bay by a linear distance of over 300 m and an elevation change of approximately 25 m.

As the proposed development site is comprised exclusively of improved amenity grassland that is subject to occasional mowing, there are no habitats within the development boundary which may be utilised for breeding, foraging or roosting by SCI species for which the SPA is designated. Consequently there are no predicted direct impacts to the SPA.

5.2.2 Indirect impacts

Construction phase

It is noted that due to the existing level topography of the site and as a consequence of the modular nature of the development, construction activities to prepare the location for the installation of the facility are considered to be minimal. Due to the level topography of the development site and the physical separation distance from Whitegate Bay (over 300 m), the risk of anthropogenic polluting substances (e.g. sediment, fuels or oils) reaching Cork Harbour SPA via surface water pathways as a consequence of excavation works and/or spills/inappropriate storage on-site is considered to be negligible.

Construction activities also have the potential to cause indirect impacts on bird flocks as a result of disturbance and/or displacement; an increase in noise and visibility of personnel related to construction activities has the potential to result in the temporary loss of foraging and roosting habitats of the Special Conservation Interests of Cork Harbour SPA.

The nearest part of Cork Harbour SPA to the proposed development site is the intertidal habitats of Whitegate Bay which are located over 300 m to the west. Any potential impacts from construction noise and the increased frequency of human activity in the locality is considered to be insignificant as a consequence of this

separation distance and as the proposed development site is comprehensively screened from the habitats associated with Whitegate Bay by the extensive mature woodland to the west of the development site. Consequently there will be no significant disturbance to wintering bird flocks which are associated with Cork Harbour SPA.

With regard to any potential indirect impacts to grey heron which utilise the woodland close to Aghada Power Station, a survey carried out in July 2019 by the author of this report noted that (based on observations of nests) the likely focal centre of the heronry in the mature woodland adjacent to the R630 Whitegate to Midleton Road. Anecdotal evidence gathered from station staff indicate that herons are seen landing and heard calling from this precise location in the early spring; it is therefore concluded that it is likely that grey heron are using this section of the woodland for breeding. The recorded nest location (and by association the location of a larger heronry) is located approximately 400 m from the proposed site; given this large separation distance and existing natural screening between the development site and the heronry, potential indirect impacts to grey heron arising due to disturbance are considered to be not significant.

In conclusion , significant effects upon Cork Harbour SPA arising from construction activities at the proposed development site are not considered likely.

Operational phase

Regarding the operational phase, given that the proposed computing facility will be located at a site physically separated and well screened from Cork Harbour SPA, it is not envisaged that the standard operation of the facility will lead to any increased disturbance which would significantly impact upon the Special Conservation Interests of the SPA.

Surface water drainage features are proposed for the proposed impermeable surfaces associated with the car park. The car park will discharge to a new underground surface water drainage network which will discharge to a proposed soakaway. The proposed soakaway will allow for infiltration of runoff into the ground. The sizing of the soakaway is subject to testing of the infiltration capabilities of the soil. The site currently has good natural drainage.

The rest of the site will be surfaced with permeable stone. This permeable stone provides a means of attenuation of runoff and allows rainwater to infiltrate to ground as it would on a greenfield site. Rainwater falling on the control buildings will runoff onto the permeable stone and infiltrate to ground.

The station will continue to manage and monitor surface water discharges under the conditions of its IPPC licence (Reg No. P0561-05). No significant effects upon the Cork Harbour SPA are therefore considered likely as a result of the operational phase of the proposed development.

5.3 Potential in-combination effects

In order to take account of in-combination or cumulative effects, plans and projects that are completed, approved but uncompleted, or proposed (but not yet approved) should be considered in this context (European Commission, 2001). This assessment has had regard to the threats and pressures to Cork Harbour SPA as noted in the NPWS site synopsis and data forms.

To consider potential in-combination effects, a review of the Cork Harbour SPA Special Conservation Interests, key supportive ecological conditions and threats was carried out, based on the Birdlife International datasheets for the respective species (Birdlife 2019[1]). These are summarised in Table 2 below.

Of the identified threats in Table 2, only *Water Pollution* and *Human disturbance including construction* were identified as potential impacts arising as a consequence of the development and operation of the proposed facility.

Planned developments at Aghada Power Station are considered in Section 5.3.1, while other developments around Cork Harbour are considered in Section 5.3.2.

Table 2: Supporting ecological conditions and threats to Special Conservation Interests of Cork Harbour SPA

Special Conservation Interest	Supporting ecological habitats and conditions	Threats
• Redshank *Tringa totanus* • Great Crested Grebe *Podiceps cristatus* • Cormorant *Phalacrocorax carbo* • Shelduck *Tadorna tadorna* • Wigeon *Anas penelope* • Gadwall *Anas strepera* • Teal *Anas crecca* • Northern Pintail *Anas acuta* • Northern Shoveller *Anas clypeata* • Red-breasted Merganser *Mergus serrator* • Oystercatcher *Haematopus ostralegus* • Lapwing *Vanellus vanellus* • Dunlin *Calidris alpine* • Black-tailed Godwit *Limosa limosa* • Curlew *Numenius arquata* • Greenshank *Tringa nebularia* • Grey heron *Ardea cinerea*	Food availability (intertidal & pastoral fauna, and fish in marine waters) Flooding regime of coastal grasslands. Availability of undisturbed coastal roosting sites close to feeding areas. Availability of unpolluted coastal waters for foraging	• Climate change altering breeding/wintering habitat and feeding resources • Habitat loss (particularly reclamation of coastal areas) • Flood alleviation measures leading to changes in tidal regime • ***Water pollution*** • Coastal barrage construction • ***Human disturbance including construction, vehicles, walkers and dogs*** • Over-fishing • Soil erosion • Extreme weather events and cold temperatures • Hunting • Windfarm collisions • Avian Botulism

[1] BirdLife International (2019) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 30/07/2019

		• Persecution by aquaculture industry (Cormorant & Grey Heron); • Over-fishing of Benthic shellfish (Oystercatcher).
• Common Tern *Sterna hirundo*	Availability of nest sites safe from predation by corvids, gulls or mammals.	Thinning of egg shells due to chemical pollution

5.3.1 Operation and developments at Existing Aghada Power Station

Potential in-combination impacts associated with the ongoing operation of Aghada Power Station predominantly relate to aquatic discharges arising from the site. Aghada Power Station is currently compliant with the terms of its IPPC licence (Reg No. P0561-05). The station discharges chlorinated cooling water into Whitegate Bay toward the outer section of Long Point but mainly from a long outfall about 400 m west of the power station. There has been a reduced discharge at this location since the commissioning of the new CCGT generating plant at Aghada. The generating unit that discharges cooling water is currently used occasionally as back-up generating plant.

Ecological assessments of the Whitegate Bay intertidal and subtidal habitats and bird populations are carried out as part of the monitoring conditions for the IPCC licence.

The most recent assessment of wintering waterbird populations and their feeding use of Whitegate Bay (Mayes 2017) concludes that there is no evidence of adverse impacts of cooling water discharge, or of more recent reduced cooling water discharge, on the numbers and distribution of wintering waterfowl in Whitegate Bay. Waterbird population trends in Whitegate Bay appear to be broadly consistent with trends in Cork Harbour.

The report outlining the findings of assessments of the Whitegate Bay intertidal and subtidal habitats undertaken in 2016/17 (Aquatic Services Unit 2017) concluded that there is no evidence of change in the hard or soft substrate benthos community structure within Whitegate Bay during the course of the monitoring programme. All taxa identified are common in Irish coastal waters and also in Cork Harbour. The communities within the intertidal zone show distributions and zonation patterns typical for the exposure and sedimentary conditions of the shoreline. The development of the proposed facility will not result in any operational changes to facilitate power generation at the site. No in-combination effects with the ongoing operation of Aghada Power Station are therefore envisaged.

With regard to permitted developments at the Aghada site, a 159 MW Battery Energy Storage System (BESS) has been granted permission on a 3.2 hectare plot 100 m to the north of the proposed development site (Cork Co. Co. Planning Ref: 19/4631). The 159 MW BESS comprises an array of 89 battery container units and associated infrastructure. A second smaller 19 MW BESS has also been granted permission at a 1.8 hectare site 500 m north of the proposed site (Cork Co. Co. Planning Ref:

20/4294). These BESS developments have the potential to be constructed at the same time as the proposed facility, and would operate concurrently for a period of their respective project lifespans. Both BESS sites are also comprehensively screened from the intertidal habitats of Cork Harbour SPA by existing mature vegetation and infrastructure within the power station property and will not require any percussive piling or other significant noise sources; consequently there will be no significant cumulative disturbance to bird species associated with the SPA. The respective NIS reports submitted with the BESS planning applications note specific mitigation measures to prevent water pollution-related impacts to Cork Harbour SPA. In-combination effects are therefore considered to be negligible.

An additional permitted project within the Aghada Power Station boundary relates to a 55 MW thermal peaking plant (Cork Co. Co. Planning Ref: 19/05411), as granted on November 12th 2019. The thermal peaking plant (referred to as Flexible Generation, or 'FlexGen') will be sited between the existing open cycle turbine buildings (350 m north of the development site) and will comprise a gas turbine and associated switchgear equipment. It also has the potential to be constructed at the same time as the proposed facility, and would operate concurrently during their respective project lifespans. The proposed peaking plant location is also comprehensively screened from the intertidal mudflats in Whitegate Bay by existing mature vegetation and infrastructure within the power station property. The NIS submitted with the FlexGen application notes specific mitigation measures to prevent water pollution-related impacts to Cork Harbour SPA. In-combination effects are therefore considered to be negligible.

There are no other significant plans or projects associated with the Aghada Power Station site which will temporally overlap with the development of the proposed facility. The operational phase of the facility is expected to have negligible ecological impact.

5.3.2 Other developments and pressures

The Cork Harbour SPA Conservation Objectives Supporting Document (NPWS 2014b) indicates that pressures to Cork Harbour SPA primarily relate to water pollution and recreational activities. Currently, minimal treatment is applied to sewage within the Whitegate/Aghada agglomeration before discharging to the harbour. Irish Water is currently at the design and planning stage to upgrade these facilities; this is expected to have a beneficial impact upon water quality in Whitegate Bay. Recreational activities around Whitegate Bay are generally limited to small boat activity in the harbour and walkers along the harbour front in Whitegate village which may temporarily disturb flocks of wintering birds. Given the absence of any substantial impact pathways between the edge computing facility development site and Whitegate Bay, interactions with any of the aforementioned negative pressures are not envisaged. In-combination effects are therefore considered not to be significant.

A comprehensive review of planning records for projects with the potential to cause comparable impacts to the broader Cork Harbour SPA was carried out. Projects were

considered in the context of their scale, nature of construction and likelihood of discharges to Cork Harbour. The search was limited to the five year period preceding the date of issue of this report (due to the typical five-year lifetime of planning permission). The projects identified are presented in Table 3 below. Potential for interaction with the proposed edge computing facility was considered in the context of the likelihood of the aforementioned impacts of the other developments, mitigation proposed as part of their respective planning applications and overall feasibility of impact interactions as a consequence of proximity to the Aghada site and the nature of any potential impact pathways.

Table 3: Potential in-combination projects/activities

Development name, location and description	Nature of potential interaction	Assessment of potential interaction
Cork Lower Harbour Main Drainage Scheme Project consists of new wastewater treatment plant, 14 new pumping stations, approximately 30km of new sewers and a drilled crossing under the estuary.	Development works associated with the Drainage Scheme in areas around Lower Cork Harbour, in Cobh, Carrigaline (including Crosshaven), Passage West/Monkstown (including Glenbrook) and Ringaskiddy (including Shanbally and Coolmore) County Cork. Works relate to existing and new wastewater infrastructure which drains to Lower Cork Harbour.	This project will significantly enhance the water quality in Cork Harbour. Currently, wastewater from Cobh, Carrigaline, Passage West/Monkstown and Ringaskiddy is discharged untreated into the Harbour. This is expected to have a net benefit for Cork Harbour SPA. Works are currently ongoing and are expected to run until 2021. The NIS submitted with the planning application noted the potential for deterioration of water quality and disturbance effects to SCI species as a consequence of construction works. The NIS lays out a comprehensive suite of mitigation measures, predominantly related to protecting water quality. Based on the of these measures, no significant residual effects upon terrestrial ecology or ornithology were predicted. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Ringaskiddy East Tip Remediation Project involves contaminated land remediation using an	Coastal development sited in Lower Cork Harbour, circa 4.5 km	An EIS and NIS were submitted with the planning application which concluded that there was no potential for significant negative impacts upon the integrity of Cork Harbour SPA arising either alone or in combination with any other plans or

Development name, location and description	Nature of potential interaction	Assessment of potential interaction
engineered capping system on top of the waste and a perimeter engineered structure around the waste body.	west of Aghada site.	proposals, from the proposed East Tip Remediation Project at Haulbowline Island, after the implementation of proposed mitigation measures. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Ringaskiddy Port Redevelopment Redevelopment of existing port facilities incorporating: Ringaskiddy East (Container berths and Multi-Purpose berth), Ringaskiddy West (Deepwater Berth Extension), Paddy's Point amenity area, Road improvements and external road works, Associated development works	Coastal development sited in Lower Cork Harbour, circa 4.5 km west of Aghada site.	AA Screening and NIS submitted with application identified that the proposed redevelopment had the potential to impact on bird species during operation with the potential for direct and indirect loss of habitat and food resources, visual and noise disturbance, increased predation risk and pollution. The NIS lays out a comprehensive suite of mitigation measures, predominantly related to protecting water quality. Based on the implementation of these measures, no significant residual effects upon ornithological receptors were predicted. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Indaver Waste to Energy Development of a Waste to Energy Facility for the treatment of up to 240,000 tonnes per annum of residual household, commercial, industrial, non-hazardous and suitable hazardous waste.	Coastal development sited in Lower Cork Harbour, circa 4.5 km west of Aghada site.	An NIS was submitted as part of the Strategic Infrastructure Development application to An Bord Pleanala. In relation to potential disturbance or displacement of birds, the NIS submitted with the application, based on the implementation of proposed mitigation measures, concluded that in relation to construction activities, no significant adverse impact on birds listed as qualifying interests for the Cork Harbour SPA will occur. The level of impact from operational activities on species identified with the SPA was similarly considered by the NIS as insignificant in the long term,

Development name, location and description	Nature of potential interaction	Assessment of potential interaction
		taking account of the existing noise environment and the predicted impact of the proposed development. With regard to water quality, mitigation measures during construction are outlined in the NIS covering control of water discharge including in the event of a fire during the construction phase, dust suppression and control and also the management of waste, materials and machinery. Risk of spillage to receiving waters is considered low and the receiving water have major dilution capacity. The NIS therefore considers that there will not be an adverse effect on the integrity of the Cork Harbour SPA, even in the event of a highly unlikely accidental release from the site during the construction period. The NIS also considered potential impacts upon piscivorous birds arising from bioaccumulation from atmospheric emissions and concluded that these were not considered to be significant. All the aforementioned conclusions were supported by the Inspector at the Oral Hearing for the development. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Whitepoint Marina, Cobh Installation of 74 berth marina with access platform and gangway, underground water treatment unit and associated infrastructure.	Coastal development sited in Lower Cork Harbour, circa 4.75 km west of Aghada site.	The NIS for the marina development was concludes no significant impact on European sites given the small footprint of the proposed project, the use of a point anchoring system and no overall increase in boating activity in the harbour. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to

Development name, location and description	Nature of potential interaction	Assessment of potential interaction
		adversely affect the Special Conservation Interests of Cork Harbour SPA.
GE Lifesciences Biopark, Raheen The proposed BioPark consists of no. 2 storey biomanufacturing buildings, 4 no. 2 storey administration / laboratory buildings with roof top plant room, and ancillary storage and administration buildings	Extensive construction activity at existing industrial development in surface water catchment of Lower Cork Harbour.	The AA Screening submitted with the planning application concluded that the SCI species for Cork Harbour SPA are not expected to be present at or reliant on the habitats and resources available within the footprint or adjacent to the development site and the risk of disturbance to wintering birds feeding or roosting within the Cork Harbour SPA is low. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Janssen Biologics Facility Several planning applications for minor building extensions, parking and ancillary developments	Minor construction activity at existing industrial development in surface water catchment of Lower Cork Harbour.	Proposed works are at established licensed facilities comprising a suite of environmental controls. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Novartis Laboratory Campus Several planning applications for minor building extensions, storage and ancillary developments	Minor construction activity at existing industrial development in surface water catchment of Lower Cork Harbour.	Proposed works are at established licensed facilities comprising a suite of environmental controls. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Monkstown Marina (a) Construction of a marina to provide 285 number berths, (b) construction of a three-storey over basement	Coastal development sited in Lower Cork Harbour, circa 7 km west of Aghada site	Proposal submitted with NIS that concluded no impact on the Special Conservation Interests of Cork Harbour SPA, based on the evidence that the development would not result in the loss of any feeding areas or roosting sites for wintering waterfowl or

Development name, location and description	Nature of potential interaction	Assessment of potential interaction
marina building to include cafe/bar/restaurant, gym, provision shop, public toilets, changing room, chandlery, marine training room, boat sales office, marina management office, public toilets, (c) dedicated gated rowing club, (d) 174 car parking spaces, (e) rock armour protection, (f) diesel and petrol refuelling facilities, (g) reclamation of foreshore to provide for the above, and (h) associated site works to include landscaping, pilling and underground bunded fuel tanks.		waders, and that the marina would be principally used outside of the overwintering season. A coastal process modelling assessment submitted with that application also showed that there would be no effect on the coastal processes with no change in tidal levels and the effect on the tidal currents restricted to the project area with changes of not greater than 0.04 m/s. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Dairygold Speciality Cheese Plant Expansion Expansion to existing facility at Mogeely, including the construction of a new 13.6 km wastewater pipeline to the existing Midleton Main Drainage Outfall at Rathcoursey.	Discharge of treated effluent to Ballynacorra River, part of the Cork Harbour SPA, 5.5 km northeast of Aghada site.	The NIS submitted with the planning application noted the potential for deterioration of water quality and disturbance effects to SCI species as a consequence of construction works. The NIS lays out a comprehensive suite of mitigation measures, predominantly related to protecting water quality. Based on the of these measures, no significant residual effects upon or ornithological receptors were predicted. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Raffeen Quarry – Ballyhemiken Continuation of quarrying activities to include processing of aggregates,	Discharge of surface water to Great Island component of the Cork Harbour SPA,	Ongoing quarry operations will be regulated by planning conditions. This includes attenuation of water run-off to the Glounatouig stream which is a tributary of Cork Harbour SPA.

Development name, location and description	Nature of potential interaction	Assessment of potential interaction
landscaping, restoration and associated works under existing permission.	6.5 km north of Aghada site.	It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Temporis Solar Farm A solar photovoltaic panel array consisting of up to approximately 68,000 m2 of solar panels on ground mounted steel frames with ancillary services and grid connection located at Barryscourt, Carrigtwohill.	Development located adjacent to Great Island component of Cork Harbour SPA. The site is located circa 70m east of 'Slatty's Pond' portion of the SPA and comprises a number of streams which discharge to the SPA. Site is located 7 km northwest of Aghada site.	NIS submitted with planning application (and sequentially revised under Further Information requests) noted the potential for deterioration of water quality and disturbance effects to SCI species as a consequence of construction works; water quality risks relating to horizontal directional drilling will be undertaken under the Foaty Stream were particularly focused upon in the final NIS revision. The revised NIS lays out a comprehensive suite of mitigation measures, related to protecting water quality. Residual impacts to water quality are consider to be negligible. The revised NIS also concluded that there is no important roost site within the footprint of the development. Also, construction and maintenance activities will not disturb birds at nearby roost sites. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Pfizer Ireland Pharmaceuticals The construction of a 1 storey water treatment & electrical building and a 2 storey electrical room extension to the existing finished goods building at the production facility.	Minor construction activity at existing industrial development in surface water catchment of Lower Cork Harbour.	Proposed works are at established licensed facilities comprising a suite of environmental controls. AA Screening carried put for proposed development which concluded no likely significant effects. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.

Development name, location and description	Nature of potential interaction	Assessment of potential interaction
DePuy Ireland The demolition of a 107 square metre single storey timber framed structure and cladded canopy within the loading bay area to the north of the existing production facility, the construction of 1 no. single storey extension within the loading bay area to the north and 1 no. single storey extension to the north west of the existing production facility and all associated modifications and site development works.	Minor construction activity at existing industrial development on opposite shore of Lower Cork Harbour from Aghada Power Station.	Proposed works are at established licensed facilities comprising a suite of environmental controls. AA Screening carried put for proposed development which concluded no likely significant effects. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.
Irving Oil Whitegate Refinery The construction of an extension to an existing containment basin and all ancillary development works at their existing oil refinery facility. Ancillary site works to include a temporary stockpile, gabion wall along the northern boundary of the proposed catchbasin slope and pipe rack for an existing pipeline.	Construction activity at existing industrial development approximately 1 km from the proposed development, also directly abutting Whitegate Bay component of Cork Harbour SPA	Proposed works are at established licensed facilities comprising a suite of environmental controls. An NIS was carried out for the proposed development which concluded no adverse effects to Cork Harbour SPA, assuming the implementation of a comprehensive suite of mitigation measures outlined therein. It is not considered that there are any feasible pathways of additive effect for significant cumulative or in-combination effects acting with the proposed development which can be considered to adversely affect the Special Conservation Interests of Cork Harbour SPA.

On the basis of the collated information above, it is concluded that no proposed, permitted or operational projects in the identified Zone of Influence have the potential to interact to a sufficient degree with the proposed edge computing facility (as a consequence of an absence of interaction pathways or the absence of impacts from the identified projects within the Zone of Influence) that could significantly impact upon the Cork Harbour SPA.

5.4 Conclusion of the Screening Report

This Appropriate Assessment Screening Report has established that the proposed edge computing facility at Aghada Generating Station, as detailed in this report, either alone or in-combination with other projects or plans, is not likely to give rise to significant effects on any European Site(s) in view of the site's conservation objectives.

Therefore, it is considered that (Stage 2) Appropriate Assessment is not required for the proposed development.

6 References

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NPWS (2014a) Conservation Objectives: Cork Harbour SPA 004030. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2014b) Conservation Objectives Supporting Document for Cork Harbour Special Protection Area. National Parks and Wildlife Service.

NPWS (2015) Site Synopsis: Cork Harbour SPA. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Appendix 1 – Site Photos

Site Photo 1: Amenity grassland within footprint of proposed site

Site Photo 2: Scrub and immature treeline along western fenceline boundary and access track

Site photo 3: Natural screening provided by mature woodland to west of proposed site

Site Photo 4: Whitegate Bay to south of Aghada Power Station (proposed facility site on elevated ground to right of image)

Appendix 2 – NPWS Site Synopsis

SITE NAME: CORK HARBOUR SPA

SITE CODE: 004030

Cork Harbour is a large, sheltered bay system, with several river estuaries - principally those of the Rivers Lee, Douglas, Owenboy and Owennacurra. The SPA site comprises most of the main intertidal areas of Cork Harbour, including all of the North Channel, the Douglas River Estuary, inner Lough Mahon, Monkstown Creek, Lough Beg, the Owenboy River Estuary, Whitegate Bay, Ringabella Creek and the Rostellan and Poulnabibe inlets.

Owing to the sheltered conditions, the intertidal flats are often muddy in character. These muds support a range of macro-invertebrates, notably *Macoma balthica*, *Scrobicularia plana*, *Hydrobia ulvae*, *Nepthys hombergi, Nereis diversicolor* and *Corophium volutator*. Green algae species occur on the flats, especially *Ulva* spp. Cordgrass (*Spartina* spp.) has colonised the intertidal flats in places, especially where good shelter exists, such as at Rossleague and Belvelly in the North Channel. Salt marshes are scattered through the site and these provide high tide roosts for the birds. Some shallow bay water is included in the site. Rostellan Lake is a small brackish lake that is used by swans throughout the winter. The site also includes some marginal wet grassland areas used by feeding and roosting birds.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Little Grebe, Great Crested Grebe, Cormorant, Grey Heron, Shelduck, Wigeon, Teal, Mallard, Pintail, Shoveler, Red-breasted Merganser, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Greenshank, Black-headed Gull, Common Gull, Lesser Black-backed Gull and Common Tern. The site is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl. Of particular note is that the site supports internationally important populations of Black-tailed Godwit (1,896) and Redshank (2,149) - all figures given are five year mean peaks for the period 1995/96 to 1999/2000. Nationally important populations of the following 19 species occur: Little Grebe (57), Great Crested Grebe (253), Cormorant (521), Grey Heron (80), Shelduck (2,009), Wigeon (1,791), Teal (1,065), Mallard (513), Pintail (57), Shoveler (103), Red-breasted Merganser (121), Oystercatcher (1,809), Golden Plover (3,342), Grey Plover (95), Lapwing (7,569), Dunlin (9,621), Bar-tailed Godwit (233), Curlew (2,237) and Greenshank (46). The Shelduck population is the largest in the country (over 10% of national total). Other species using the site include Mute Swan (38), Whooper Swan (5), Pochard (72), Gadwall

(6), Tufted Duck (64), Goldeneye (21), Coot (53), Ringed Plover (73), Knot (26) and Turnstone (113). Cork Harbour is an important site for gulls in winter and autumn, especially Black-headed Gull (3,640), Common Gull (1,562) and Lesser Black-backed Gull (783), all of which occur in numbers of national importance. Little Egret and Mediterranean Gull, two species which have recently colonised Ireland, also occur at this site.

A range of passage waders occurs regularly in autumn, including such species as Ruff (5-10), Spotted Redshank (1-5) and Green Sandpiper (1-5). Numbers vary between years and usually a few of each of these species over-winter.

Cork Harbour has a nationally important breeding colony of Common Tern (102 pairs in 1995). The birds have nested in Cork Harbour since about 1970, and since 1983 on various artificial structures, notably derelict steel barges and the roof of a Martello Tower. The birds are monitored annually and the chicks are ringed.

Cork Harbour is of major ornithological significance, being of international importance both for the total numbers of wintering birds (i.e. > 20,000) and also for its populations of Black-tailed Godwit and Redshank. In addition, it supports nationally important wintering populations of 22 species, as well as a nationally important breeding colony of Common Tern. Several of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Little Egret, Golden Plover, Bar-tailed Godwit, Ruff, Mediterranean Gull and Common Tern. The site provides both feeding and roosting sites for the various bird species that use it. Cork Harbour is also a Ramsar Convention site and part of Cork Harbour SPA is a Wildfowl Sanctuary.

21.1.2015

Energy for generations

Appendix 2 – Air Dispersion Modelling of proposed Data Centre

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AIR DISPERSION MODELLING OF PROPOSED DATA CENTRE AT AGHADA POWER STATION, CO. CORK

Technical Report Prepared For

ESB Engineering
&
Major Projects

Technical Report Prepared By

Dr. Edward Porter C Chem MRSC MIAQM

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EXECUTIVE SUMMARY

AWN Consulting was instructed by ESB Engineering & Major Projects (E&MP) to conduct an air modelling study to assess the impact to ambient air quality from the seven proposed diesel generators associated with a proposed data centre at Aghada Power Station in County Cork. The proposed generators will operate as backup generators in the event of an interruption to the power supply to the data centre with a maximum of six generators operating at any one time.

The contribution of emissions from the proposed backup generators and existing gas turbines at the Aghada Power Station to off-site ambient pollutant concentrations was assessed and the location and maximum of the worst-case ground level concentrations of NO_2 identified.

Air dispersion modelling was carried out using the United States Environmental Protection Agency's regulatory model AERMOD. The dispersion modelling study consisted of the following components:

- Review of emissions data and other relevant information needed for the modelling study;
- Summary of background nitrogen dioxide (NO_2) concentrations;
- Dispersion modelling of emissions from the Aghada Power Station including the operation of the proposed backup generators;
- Determination of a minimum stack height for the proposed backup generators;
- Presentation of predicted ground level concentrations of pollutants emitted; and
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient air quality limit values.

Assessment Summary

The modelling results demonstrate that ambient pollutant concentrations (including background) beyond the site ownership boundary are well below the applicable ambient air quality limit values at all off-site receptors modelled for all scenarios assessed. The proposed stack height of 8 m for the backup generators does not result in any significant impacts on ambient air quality beyond the site boundary.

CONTENTS Page

1.0 INTRODUCTION

AWN Consulting was instructed by ESB Engineering & Major Projects (E&MP) to conduct an air modelling study to assess the impact to ambient air quality from the seven proposed diesel generators associated with a proposed data centre at Aghada Power Station in County Cork. The proposed generators will operate as backup generators in the event of an interruption to the power supply to the data centre with a maximum of six generators operating at any one time.

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- Presentation of predicted ground level concentrations of pollutants emitted; and
- Evaluation of the significance of these predicted concentrations, including consideration of whether these ground level concentrations are likely to exceed the relevant ambient air quality limit values.

Information supporting the conclusions has been detailed in the following sections. The assessment methodology and study inputs are presented in Section 2.0. The dispersion modelling results and assessment summaries are presented in Section 3.0. The model formulation is detailed in Annex 1.

2.0 ASSESSMENT METHODOLOGY

Emissions from the proposed backup generators and from three existing open cycle gas turbine units and one combined cycle gas turbine at Aghada Power Station have been modelled using the AERMOD dispersion model (Version 19191) which has been developed by the U.S. Environmental Protection Agency (USEPA)[(1)] and following guidance issued by the EPA[(2)]. The model is a steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources and has replaced ISCST3[(3)] as the regulatory model by the USEPA for modelling emissions from industrial sources in both flat and rolling terrain[(4-6)]. The model has more advanced algorithms and gives better agreement with monitoring data in extensive validation studies[(7-11)]. An overview of the AERMOD dispersion model is outlined in Annex 1.

The air dispersion modelling input data consisted of information on the physical environment (including existing and proposed building dimensions and terrain features), five years of appropriate hourly meteorological data and process emissions data for the four existing gas turbines as well as estimated emissions data for the proposed backup generators. Using this input data the model predicted ambient

ground level concentrations beyond the site boundary for each hour of the modelled meteorological years. The model post-processed the data to identify the location and maximum of the worst-case ground level concentration. This worst-case concentration was then added to the background concentration to give the worst-case predicted environmental concentration (PEC). The PEC was then compared with the relevant ambient air quality limit value to assess the significance of impacts associated with the proposed emissions from the site.

Throughout this study a worst-case approach was taken. This will most likely lead to an over-estimation of the levels that will arise in practice. The worst-case assumptions are outlined below:

- Maximum predicted concentrations were reported in this study, even if no residential receptors were near the location of this maximum;
- Conservative background concentrations were used;
- A conservative in-stack NO_2/NO_x ratio of 0.1 was applied to the proposed backup generators and to the four existing gas turbines for the purpose of this study even though the in-stack ratios are likely to be lower in reality;
- The effects of building downwash, due to on-site and any nearby off-site buildings, has been included in the model;

2.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health- or environmental-based levels for which additional factors may be considered. The applicable limit values in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC (see Table 1).

These limit values have been used in the current assessment to determine the potential impact of NO_2 emissions from the facility on air quality. Particulate and SO_2 emissions have not been included within this assessment as the emissions of particulates and SO_2 associated with the proposed backup generators and the existing gas turbines running on natural gas (which is the primary fuel used for normal operations at the Aghada Power Station) are negligible.

Pollutant	Regulation [Note 1]	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3 NO_2
		Annual limit for protection of human health	40 µg/m^3 NO_2
		Critical level for protection of vegetation	30 µg/m^3 NO + NO_2

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Table 1 Air Quality Standards 2011 (Based on Directive 2008/50/EC)

2.2 Background Concentrations Of Pollutants

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities[12,13]. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2019"[13], details the range and scope of monitoring undertaken throughout Ireland. As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes[13]. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, Aghada in County Cork is categorised as Zone D[13].

NO_2 monitoring was carried out at two rural Zone D locations in recent years, Emo and Kilkitt and in two urban areas, Enniscorthy and Castlebar[13]. The NO_2 annual average in 2019 for both rural sites, Emo and Kilkitt was 4 µg/m^3 and 5 µg/m^3, respectively; with the 2019 results for the urban station in Castlebar averaging 8 µg/m^3. Hence long-term average concentrations measured at all locations were significantly lower than the annual average limit value of 40 µg/m^3. The average results over the last five years at a range of Zone D locations suggests an upper average of no more than 10 µg/m^3 as a background concentration (see Table 2). Based on this information, a conservative estimate of the current background NO_2 concentration, for the region of Aghada Power Station is 12 µg/m^3.

Year	Castlebar	Kilkitt	Emo	Enniscorthy
2015	8	2	3	9
2016	9	3	4	10
2017	7	2	3	-
2018	8	3	3	-
2019	8	5	4	-
Average	8	3	3	10

Table 2 Annual Mean NO_2 Concentrations In Zone D Locations 2015 - 2019 (µg/m^3)

In summary, existing baseline levels of the pollutants based on extensive long-term data from the EPA are below ambient air quality limit values in the vicinity of the proposed backup generators.

In order to ensure a robust assessment and conservative predictions, the Plume Volume Molar Ratio Method (PVMRM) was used to model ambient NO_2 concentrations. The PVMRM is a regulatory option in AERMOD which assumes that the amount of NO converted to NO_2 is proportional to the ambient ozone concentration[14,15]. The PVMRM uses both plume size and ozone (O_3) concentration to derive the amount of O_3 available for the reaction between NO and O_3. NO_X moles are determined by emission rate and travel time through the plume segment. The concentration is usually limited by the amount of ambient O_3 that is entrained in the plume. Thus, the ratio of the moles of O_3 to the moles of NO_X gives the ratio of NO_2/NO_X that is formed after the NO_X leaves the stack. In addition, it has been assumed that 10% of the NO_X in the stack gas is already in the form of NO_2 (NO_2/NO_X in-stack ratio of 0.1) before the gas leaves the stack (in reality the levels will be lower). The model has also assumed a final equilibrium ratio for NO_2/NO_X of 0.90 which again is pessimistic and more likely to be in the range 0.7 - 0.8. The equation used in the algorithm to derive the ratio of NO_2/NO_X is:

$$NO_2/NO_X = (\text{moles } O_3/ \text{ moles } NO_X) + 0.10$$

A conservative ozone value of 75 µg/m^3 was used in the assessment based on the maximum annual average levels recorded over a 5-year period (2015 – 2019) at EPA Zone D locations.

In relation to the annual averages, the ambient background concentration was added directly to the process concentration. The short-term peak concentrations of NO_2 were assumed to have an ambient background concentration of twice the annual mean background concentration.

2.3 Air Dispersion Modelling Methodology

The United States Environmental Protection Agency (USEPA) approved AERMOD dispersion model has been used to predict the ground level concentrations (GLC) of compounds emitted from the proposed backup generators and the four existing gas turbines at Aghada Power Station.

The modelling incorporated the following features:

- Three receptor grids were created at which concentrations would be modelled. Receptors were mapped with sufficient resolution to ensure all localised "hot-spots" were identified without adding unduly to processing time. The receptor grids were based on Cartesian grids with the site at the centre. The inner grid measured 1.5 km x 1.5 km with concentrations calculated at 25m intervals. The medium grid measured 4 km x 4 km with concentrations calculated at 50m intervals and the outer grid measured 10 km x 10 km with concentrations calculated at 250m intervals. Boundary receptor locations were also placed along the boundary of the site at 20m intervals.
- All on-site buildings and significant process structures were mapped into the computer to create a three dimensional visualisation of the site and its emission points. Buildings and process structures can influence the passage of airflow over the emission stacks and draw plumes down towards the ground (termed building downwash). The stacks themselves can influence airflow in the same way as buildings by causing low pressure regions behind them (termed stack tip downwash). Both building and stack tip downwash were incorporated into the modelling.
- Detailed terrain has been mapped into the model using SRTM data with 30m resolution. The site is located in an area of coastal terrain. All terrain features have been mapped in detail into the model using the terrain pre-processor AERMAP[17].
- Hourly-sequenced meteorological information has been used in the model. Meteorological data over a five year period (Cork Airport Meteorological Station, 2015 – 2019) was used in the model (see Figure 1).
- The source and emissions data, including stack dimensions, gas velocities, emission temperatures and pollutant emission rates have been incorporated into the model.
- A stack height determination study was also undertaken for the proposed backup generators as part of the air dispersion modelling study to ensure that ambient levels of pollutants beyond the site boundary are below the maximum allowable process contribution (PC). A stack height of 8m above local ground level was deemed sufficient to ensure no exceedance of the ambient air quality standards.

2.4 Terrain

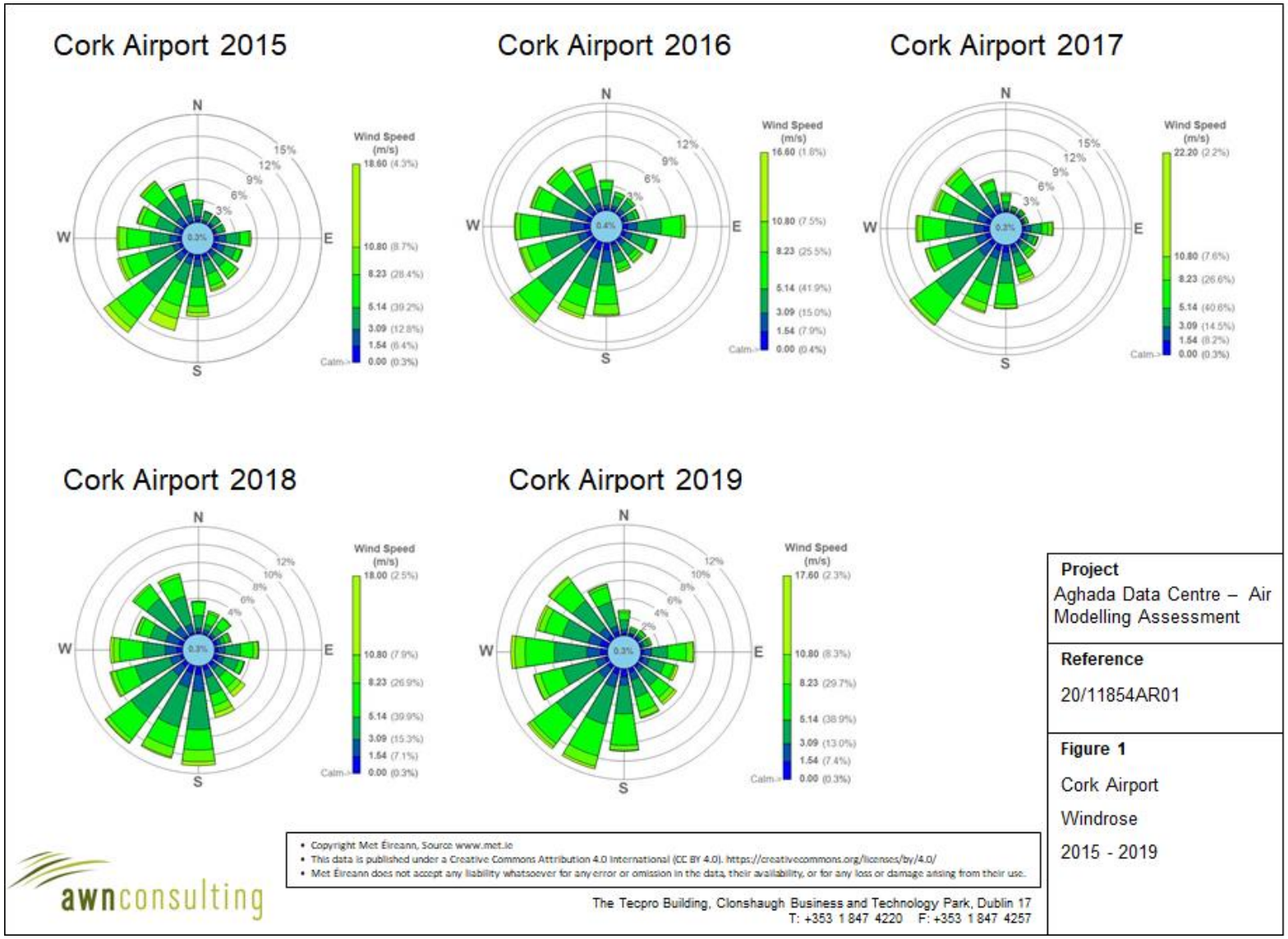
The AERMOD air dispersion model has a terrain pre-processor AERMAP[17] which was used to map the physical environment in detail over the receptor grid. The digital terrain input data used in the AERMAP pre-processor was obtained from SRTM. This data was run to obtain for each receptor point the terrain height and the terrain height scale. The terrain height scale is used in AERMOD to calculate the critical dividing streamline height, Hcrit, for each receptor. The terrain height scale is derived from the Digital Elevation Model (DEM) files in AERMAP by computing the relief height of the DEM point relative to the height of the receptor and determining the slope. If the slope is less than 10%, the program goes to the next DEM point. If the slope is 10% or greater, the controlling hill height is updated if it is higher than the stored hill height.

In areas of complex terrain, AERMOD models the impact of terrain using the concept of the dividing streamline (Hc). As outlined in the AERMOD model formulation[1] a plume embedded in the flow below Hc tends to remain horizontal; it might go around the hill or impact on it. A plume above Hc will ride over the hill. Associated with this is a tendency for the plume to be depressed toward the terrain surface, for the flow to speed up, and for vertical turbulent intensities to increase.

AERMOD model formulation states that the model “captures the effect of flow above and below the dividing streamline by weighting the plume concentration associated with two possible extreme states of the boundary layer (horizontal plume and terrain-following). The relative weighting of the two states depends on: 1) the degree of atmospheric stability; 2) the wind speed; and 3) the plume height relative to terrain. In stable conditions, the horizontal plume "dominates" and is given greater weight while in neutral and unstable conditions, the plume traveling over the terrain is more heavily weighted”[1]. The site is generally located in an area of relatively flat and gentle terrain.

2.5 Meteorological Data

The selection of the appropriate meteorological data has followed the guidance issued by the USEPA[5]. Cork Airport meteorological station, which is located approximately 17 km west of the site, collects data in the correct format and has data capture collection of greater than 90% for the required parameters. Long-term hourly observations at Cork Airport meteorological station provide an indication of the prevailing wind conditions for the region (see Figure 1). Results indicate that the prevailing wind direction is from a south-westerly direction over the period 2015 - 2019. The mean wind speed is 5.4 m/s over the period 1981 – 2010. The data is provided by Met Éireann (source www.met.ie).


Cork Airport 2015
Cork Airport 2016
Cork Airport 2017
Cork Airport 2018
Cork Airport 2019
N
E
S
W
Wind Speed (m/s)
Calm
Project
Aghada Data Centre – Air Modelling Assessment
Reference
20/11854AR01
Figure 1
Cork Airport
Windrose
2015 - 2019
awnconsulting
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T: +353 1 847 4220 F: +353 1 847 4257

2.6 Geophysical Considerations

AERMOD simulates the dispersion process using planetary boundary layer (PBL) scaling theory[1]. PBL depth and the dispersion of pollutants within this layer are influenced by specific surface characteristics such as surface roughness, albedo and the availability of surface moisture. Surface roughness is a measure of the aerodynamic roughness of the surface and is related to the height of the roughness element. Albedo is a measure of the reflectivity of the surface whilst the Bowen ratio is a measure of the availability of surface moisture.

AERMOD incorporates a meteorological pre-processor AERMET[18] to enable the calculation of the appropriate parameters. The AERMET meteorological preprocessor requires the input of surface characteristics, including surface roughness (z_0), Bowen Ratio and albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. The values of albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use type was carried out to a distance of 10km from the meteorological station for Bowen Ratio and albedo and to a distance of 1km for surface roughness in line with USEPA recommendations[18,19].

In relation to AERMOD, detailed guidance for calculating the relevant surface parameters has been published[20]. The most pertinent features are:

- The surface characteristics should be those of the meteorological site (Cork Airport Meteorological Station) rather than the installation;
- Surface roughness should use a default 1km radius upwind of the meteorological tower and should be based on an inverse-distance weighted geometric mean. If land use varies around the site, the land use should be sub-divided by sectors with a minimum sector size of 30º;
- Bowen ratio and albedo should be based on a 10km grid. The Bowen ratio should be based on an un-weighted geometric mean. The albedo should be based on a simple un-weighted arithmetic mean.

AERMOD has an associated pre-processor, AERSURFACE[19], which has representative values for these parameters depending on land use type. The AERSURFACE pre-processor currently only accepts NLCD92 land use data which covers the USA. Thus, manual input of surface parameters is necessary when modelling in Ireland. Ordnance survey discovery maps (1:50,000) and digital maps such as those provided by the EPA, National Parks and Wildlife Service (NPWS) and Google Earth® are useful in determining the relevant land use in the region of the meteorological station. The Alaska Department of Environmental Conservation has issued a guidance note for the manual calculation of geometric mean for surface roughness and Bowen ratio for use in AERMET[20]. This approach has been applied to the current site.

2.7 Building Downwash

When modelling emissions from an industrial installation, stacks which are relatively short can be subjected to additional turbulence due to the presence of nearby buildings. Buildings are considered nearby if they are within five times the lesser of the building height or maximum projected building width (but not greater than 800m).

The USEPA has defined the "Good Engineering Practice" (GEP) stack height as the building height plus 1.5 times the lesser of the building height or maximum projected building width. It is generally considered unlikely that building downwash will occur when stacks are at or greater than GEP[21].

When stacks are less than this height, building downwash will tend to occur. As the wind approaches a building it is forced upwards and around the building leading to the formation of turbulent eddies. In the lee of the building these eddies will lead to downward mixing (reduced plume centreline and reduced plume rise) and the creation of a cavity zone (near wake) where re-circulation of the air can occur. Plumes released from short stacks may be entrained in this airflow leading to higher ground level concentrations than in the absence of the building.

The Plume Rise Model Enhancements (PRIME)[8,9] plume rise and building downwash algorithms, which calculates the impact of buildings on plume rise and dispersion, have been incorporated into AERMOD. The building input processor BPIP-PRIME produces the parameters which are required in order to run PRIME. The model takes into account the position of each stack relative to each relevant building and the projected shape of each building for 36 wind directions (at 10º intervals). The model determines the change in plume centreline location with downwind distance based on the slope of the mean streamlines and coupled to a numerical plume rise model[9]

2.8 Process Emissions

The proposed backup generators will operate as backup generators in the event of an interruption to the power supply to the data centre. The worst-case scenario modelled for the cumulative assessment includes emergency operation of the generators for 500 hours per year calculated according to USEPA protocol. Batch testing once per month of all generators on site was also included in the worst-case scenario. USEPA Guidance suggests that for emergency operations, an average hourly emission rate should be used rather than the maximum hourly rate[4]. As a result, the maximum hourly emission rates from the emergency generators were reduced by $\frac{500}{8760}$ and the generators were modelled over a period of one full year. In reality, the emergency generators are likely to run for only 48 hours per year; however it is not advisable to assume less than 500 hours per year using the USEPA method as this would not be a sufficiently conservative approach.

A second methodology has recently been published by the UK Environment Agency. The consultation document is entitled "*Diesel Generator Short-Term NO_2 Impact Assessment*"[22]. The methodology is based on considering the statistical likelihood of an exceedance of the NO_2 hourly limit value (18 exceedances are allowable per year before the air standard is deemed to have been exceeded). The assessment assumes a hypergeometric distribution to assess the likelihood of exceedance hours coinciding with the operational hours of the back-up generators. The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined. The guidance suggests that the 98th percentile confidence level should be used to indicate if an exceedance is likely. The guidance suggests that the assessment should be conducted at the nearest residential receptor or at locations where people are likely to be exposed and that there should be no running time restrictions on these generators when providing power on site during an emergency.

Both the methodology advised in the USEPA guidance as well as the approach described in the UK EA guidance have been applied in this study to ensure a robust cumulative assessment of predicted air quality impacts from the back-up generators.

The batch testing assumes that once per month, 2 generators are tested each hour until all seven generators on the site have been tested e.g. Hour 1 - Generators 1 and 2, Hour 2 - Generators 3 and 4 and so on until all generators on site have been tested.

The emissions from three existing open cycle gas turbines (OCGT) and one combined cycle gas turbine (CCGT) at the Aghada Power Station have also been included in all modelling scenarios. Emission point A1-1 (also referred to as “Unit 1”, a conventional gas-fired boiler) has been decommissioned at the Aghada Power Station and is therefore not included in the air dispersion modelling.

The physical stack information for the existing emissions points and proposed backup generator emission points is provided in Table 3. A stack height of 8 metres above ground level was assumed for the proposed backup generators stacks. The process emission information used in the dispersion model for the modelling scenario described above is shown in Table 4.

Stack Reference	Height Above Ground Level (m)	Exit Diameter (m)	Cross-Sectional Area (m^2)
Proposed Backup Generators	8	0.20	0.031
A1-2 (Existing OCGT CT11) A1-3 (Existing OCGT CT12) A1-4 (Existing OCGT CT14)	65	5.7	25.5
A2-1 (Existing CCGT)	65	7.0	38.5

Table 3 Physical Stack Information for the Proposed Backup Generator Emission Points and Four Existing Gas Turbine Emission Points at Aghada Power Station

Scenario	Emission Point	Fuel Type	Temp (K)	Volume Flow (Nm^3/hr)	Exit Velocity (m/sec actual)	NO_X	
						Conc. (mg/Nm^3)	Mass Emission (g/s)
Conservative Operational	Backup Generators	Diesel Note 1	828.15	1,685	42.1	2,982 (at 5% O_2) 1,107 (at 15% O_2)	1.39
	Existing OCGTs (A1-2, A1-3, A1-4)	Natural Gas (Normal Operation) Note 3	600.00	985,000	40.2	250	68.4
		Natural Gas (Start-ups) Note 3	543.00	985,000	36.4	250	68.4
	Existing CCGT (A2-1)	Natural Gas (Normal Operation) Note 4	357.2	2,400,000	21.7	75	50.0

Note 1 Backup generators are conservatively assumed to operate for 500 hours per year.
Note 2 Data used to model emissions from diesel backup generators during scheduled testing assumed to occur one hour each month.
Note 3 Existing OCGTs are assumed to operate for 10 hours per week with 1 of those hours modelled as a start-up hour, every week of the year.
Note 4 Existing CCGT is assumed to operate for 18 hours per day with 2 of those hours modelled as start-up hours, every day of the year.

Table 4 Process Emissions Information for the Existing Emission Points and the Proposed Backup Generators Emission Points at Aghada Power Station

3.0 RESULTS & DISCUSSION

3.1 Nitrogen Dioxide (NO_2) – Backup Generators

The NO_2 modelling results at the worst-case receptors are detailed in Table 5 for the proposed backup generators. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 74% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 52% of the annual limit value at the worst-case receptor.

Pollutant / Year	Background (µg/m^3)	Averaging Period	Process Contribution NO_2 (µg/m^3)	Predicted Environmental Concentration NO_2 (µg/m^3)	Standard (µg/m^3) Note 1
NO_2 / 2015	24	99.8th%ile of 1-hr means	106.2	130.2	200
	12	Annual Mean	7.3	19.3	40
NO_2 / 2016	24	99.8th%ile of 1-hr means	114.4	138.4	200
	12	Annual Mean	7.6	19.6	40
NO_2 / 2017	24	99.8th%ile of 1-hr means	107.9	131.9	200
	12	Annual Mean	8.7	20.7	40
NO_2 / 2018	24	99.8th%ile of 1-hr means	124.9	148.9	200
	12	Annual Mean	6.9	18.9	40
NO_2 / 2019	24	99.8th%ile of 1-hr means	107.1	131.1	200
	12	Annual Mean	8.0	20.0	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Table 5 NO_2 Dispersion Model Results at Worst-case Receptors – Backup Generators

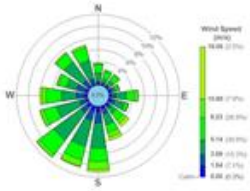
3.2 Nitrogen Dioxide (NO_2) – Backup Generators And Existing Emission Points

The NO_2 modelling results at the worst-case receptors are detailed in Table 6 for the proposed backup generators and all existing emission points. The results indicate that the ambient ground level concentrations are below the relevant air quality standards for NO_2. For the worst-case year, emissions from the site lead to an ambient NO_2 concentration (including background) which is 74% of the maximum ambient 1-hour limit value (measured as a 99.8th%ile) and 52% of the annual limit value at the worst-case receptor. The geographical variations in the 1-hour mean (99.8th%ile) and annual mean NO_2 ground level concentrations are illustrated as concentration contours in Figures 2 and 3.

Pollutant / Year	Background (µg/m^3)	Averaging Period	Process Contribution NO_2 (µg/m^3)	Predicted Environmental Concentration NO_2 (µg/m^3)	Standard (µg/m^3) Note 1
NO_2 / 2015	24	99.8th%ile of 1-hr means	106.2	130.2	200
	12	Annual Mean	7.5	19.5	40
NO_2 / 2016	24	99.8th%ile of 1-hr means	114.4	138.4	200
	12	Annual Mean	7.8	19.8	40
NO_2 / 2017	24	99.8th%ile of 1-hr means	108.4	132.4	200
	12	Annual Mean	8.9	20.9	40
NO_2 / 2018	24	99.8th%ile of 1-hr means	124.9	148.9	200
	12	Annual Mean	7.1	19.1	40
NO_2 / 2019	24	99.8th%ile of 1-hr means	107.1	131.1	200
	12	Annual Mean	8.2	20.2	40

Note 1 Air Quality Standards 2011 (from EU Directive 2008/50/EC and S.I. 180 of 2011)

Table 6 Cumulative NO_2 Dispersion Model Results at Worst-case Receptors – Backup Generators And Existing Emission Points



Background Mapping from Google Earth

99.8th%ile of 1-Hour NO_2 concentrations (µg/m^3) (excluding background)

Maximum Concentration 124.9 µg/m^3

Boundary Of Facility

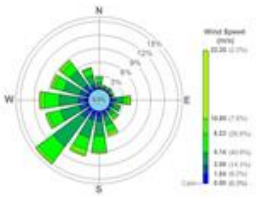
N

Project
Aghada Data Centre – Air Modelling Assessment

Reference
EP/20/11854AR01

Figure 2
99.8th%ile of 1-Hour NO_2 concentrations (µg/m^3)
(Year 2018)

awnconsulting
The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17
T: +353 1 847 4220 F: +353 1 847 4257



Background Mapping from Google Earth

Annual Mean NO_2 concentrations ($\mu g/m^3$) (excluding background)

Maximum Concentration 8.9 $\mu g/m^3$

Boundary Of Facility

N

Project
Aghada Data Centre – Air Modelling Assessment

Reference
EP/20/11854AR01

Figure 3
Annual Mean NO_2 concentrations ($\mu g/m^3$)
(Year 2017)

awnconsulting
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T: +353 1 847 4220 F: +353 1 847 4257

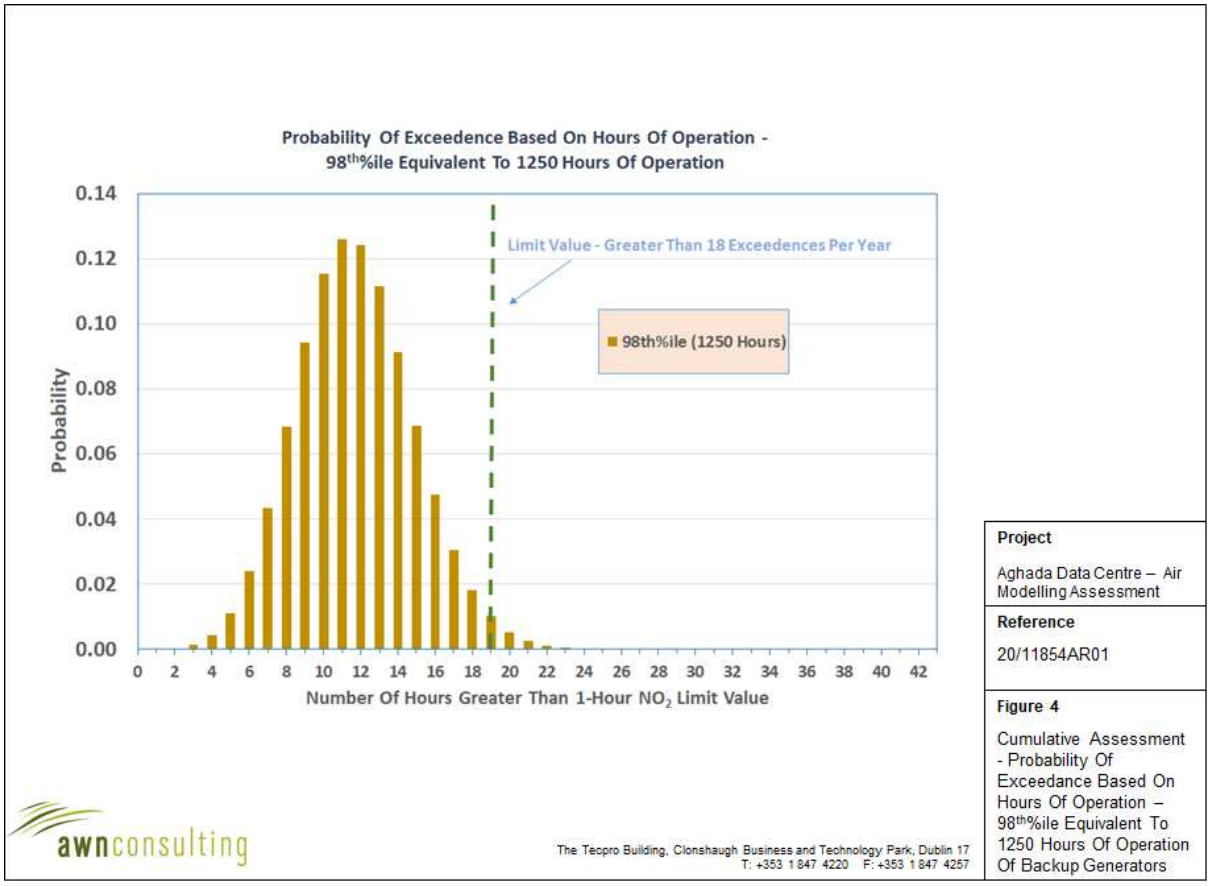
3.3 UK EA Methodology Results – Backup Generator And Existing Emission Points

The methodology, based on considering the statistical likelihood of an exceedance of the NO_2 hourly limit value assuming a hypergeometric distribution, has been undertaken at the worst-case receptor for the backup generator and existing emission points scenario. The cumulative hypergeometric distribution of 19 and more hours per year is computed and the probability of an exceedance determined as outlined in Table 7. The results have been compared to the 98th percentile confidence level to indicate if an exceedance is likely at various operational hours for the back-up diesel generators. The results indicate that in the worst-case year, the backup generators can operate for up to 1,250 hours per year before there is a likelihood of an exceedance of the ambient air quality standard (at a 98th percentile confidence level) as shown in Figure 4.

Pollutant / Meteorological Year	Hours of operation (Hours) (98th%ile) Allowed Prior To Exceedance Of Limit Value	UK Guidance – Probability Value = 0.02 (98th%ile)[Note 1]
NO_2 / 2015	2,030	**0.02**
NO_2 / 2016	2,360	
NO_2 / 2017	2,030	
NO_2 / 2018	1,250	
NO_2 / 2019	1,315	

Note 1 Guidance Outlined In UK EA publication "Diesel Generator Short-term NO_2 Impact Assessment" (EA, 2016)

Table 7 Hypergeometric Statistical Results at Worst-case Receptor – NO_2



3.4 Summary of Modelling Results

The modelling results demonstrate that ambient pollutant concentrations (including background) beyond the site ownership boundary are well below the applicable ambient air quality limit values at all off-site receptors modelled for all scenarios assessed. The proposed stack height of 8 m for the backup generators does not result in any significant impacts on ambient air quality beyond the site boundary.

References

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(22) UK EA (2016) Diesel Generator Short-term NO_2 Impact Assessment (Consultation Draft)

ANNEX 1

Description of the AERMOD Model

The AERMOD dispersion model has been recently developed in part by the U.S. Environmental Protection Agency (USEPA)[1]. The model is a steady-state Gaussian model used to assess pollutant concentrations associated with industrial sources. The model is an enhancement on the Industrial Source Complex-Short Term 3 (ISCST3) model which has been widely used for emissions from industrial sources.

Improvements over the ISCST3 model include the treatment of the vertical distribution of concentration within the plume. ISCST3 assumes a Gaussian distribution in both the horizontal and vertical direction under all weather conditions. AERMOD with PRIME, however, treats the vertical distribution as non-Gaussian under convective (unstable) conditions while maintaining a Gaussian distribution in both the horizontal and vertical direction during stable conditions. This treatment reflects the fact that the plume is skewed upwards under convective conditions due to the greater intensity of turbulence above the plume than below. The result is a more accurate portrayal of actual conditions using the AERMOD model. AERMOD also enhances the turbulence of night-time urban boundary layers thus simulating the influence of the urban heat island.

In contrast to ISCST3, AERMOD is widely applicable in all types of terrain. Differentiation of the simple versus complex terrain is unnecessary with AERMOD. In complex terrain, AERMOD employs the dividing-streamline concept in a simplified simulation of the effects of plume-terrain interactions. In the dividing-streamline concept, flow below this height remains horizontal, and flow above this height tends to rise up and over terrain. Extensive validation studies have found that AERMOD (precursor to AERMOD with PRIME) performs better than ISCST3 for many applications and as well or better than CTDMPLUS for several complex terrain data sets[6].

Due to the proximity to surrounding buildings, the PRIME (Plume Rise Model Enhancements) building downwash algorithm has been incorporated into the model to determine the influence (wake effects) of these buildings on dispersion in each direction considered. The PRIME algorithm takes into account the position of the stack relative to the building in calculating building downwash. In the absence of the building, the plume from the stack will rise due to momentum and/or buoyancy forces. Wind streamlines act on the plume leads to the bending over of the plume as it disperses. However, due to the presence of the building, wind streamlines are disrupted leading to a lowering of the plume centreline.

When there are multiple buildings, the building tier leading to the largest cavity height is used to determine building downwash. The cavity height calculation is an empirical formula based on building height, the length scale (which is a factor of building height & width) and the cavity length (which is based on building width, length and height). As the direction of the wind will lead to the identification of differing dominant tiers, calculations are carried out in intervals of 10 degrees.

In PRIME, the nature of the wind streamline disruption as it passes over the dominant building tier is a function of the exact dimensions of the building and the angle at which the wind approaches the building. Once the streamline encounters the zone of influence of the building, two forces act on the plume. Firstly, the disruption caused by the building leads to increased turbulence and enhances horizontal and vertical dispersion. Secondly, the streamline descends in the lee of the building due to the reduced pressure and drags the plume (or part of) nearer to the ground, leading to higher ground level concentrations. The model calculates the descent of the plume as a function of the building shape and, using a numerical plume rise model, calculates the change in the plume centreline location with distance downwind.

The immediate zone in the lee of the building is termed the cavity or near wake and is characterised by high intensity turbulence and an area of uniform low pressure. Plume mass captured by the cavity region is re-emitted to the far wake as a ground-level volume source. The volume source is located at the base of the lee wall of the building, but is only evaluated near the end of the near wake and beyond. In this region, the disruption caused by the building downwash gradually fades with distance to ambient values downwind of the building.

AERMOD has made substantial improvements in the area of plume growth rates in comparison to ISCST3[(1)]. ISCST3 approximates turbulence using six Pasquill-Gifford-Turner Stability Classes and bases the resulting dispersion curves upon surface release experiments. This treatment, however, cannot explicitly account for turbulence in the formulation. AERMOD is based on the more realistic modern planetary boundary layer (PBL) theory which allows turbulence to vary with height. This use of turbulence-based plume growth with height leads to a substantial advancement over the ISCST3 treatment.

Improvements have also been made in relation to mixing height[(1)]. The treatment of mixing height by ISCST3 is based on a single morning upper air sounding each day. AERMOD, however, calculates mixing height on an hourly basis based on the morning upper air sounding and the surface energy balance, accounting for the solar radiation, cloud cover, reflectivity of the ground and the latent heat due to evaporation from the ground cover. This more advanced formulation provides a more realistic sequence of the diurnal mixing height changes.

AERMOD also contains improved algorithms for dealing with low wind speed (near calm) conditions. As a result, AERMOD can produce model estimates for conditions when the wind speed may be less than 1 m/s, but still greater than the instrument threshold.

Energy for generations

Appendix 3 – Fire Suppression Inergen Data Sheet

INERGEN Safety Data Sheet

EU regulation 1907/2006, 1272/2008, 453/2010

Section 1: Identification

- Product — Gas mixture, 52% Nitrogen, 40% Argon, 8% CO2
  IG541, INERGEN
- Supplier — Fire Eater
  Vølundsvej 17, 3400 Hillerød, Denmark
  www.fire-eater.com, email: info@fire-eater.com
- Emergency response — +45 7022 2769
- Product use — Fire Extinguishing Systems

Section 2: Hazard(s) Identification

- OSHA/HCS status — This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)
- Classification of the substance or mixture
  GASES UNDER PRESSURE – Compressed gas
  H280, Full text of H-phrases: see section 16
- 67/548/EEC (DSD) or 1999/45/EC (DPD)
  Not classified
- Adverse physicochemical, human health and environmental effects
  No additional information available

GHS Label elements

- Hazard pictograms (CLP)

- Signal word — Warning
- Hazard statement — H280 – Contains gas under pressure; may explode if heated
  OSHA-H01 - May displace oxygen and cause rapid suffocation.

Precaution statements

- General — Read and follow all Safe Data Sheets (SDS's) before use.
- Storage — P403 – Store in a well-ventilated place.
  P410 - Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F.
- Disposal — Not applicable

Section 3: Composition/Information on Ingredients

- Mixture

Name	Product identifier	%	Classification Directive 67/548/EC	Classification Regulation 1272/208 (CLP)
Nitrogen	CAS No 7727-37-9 EC No 231-783-9 REACH No ANNEX IV	52	Not classified	H280: Contains gas under pressure; may explode if heated
Argon	CAS No 7440-37-1 EC No 231-147-0 REACH-No ANNEX IV	40	Not classified	H280: Contains gas under pressure; may explode if heated
Carbon dioxide	CAS No 124-38-9 EC No 204-696-9 REACH No ANNEX IV	8	Not classified	H280: Contains gas under pressure; may explode if heated

- REACH Registration: All components are listed in Annex IV of Regulation EC 1907/2006 (REACH) and are exempted from registration in accordance with article 2(7)(a). Contains no other components or impurities which will influence the classification of the product.

Section 4: First-Aid Measures

Description of necessary first-aid instructions

- Inhalation: Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
- Skin contact: Adverse effects not expected from this product.
- Eye contact: Adverse effects not expected from this product.
- Ingestion: As this product is a gas, refer to inhalation section.

Most important symptoms and effects, both acute and delayed

- No additional information available

Indication of any immediate medical attention and special treatment needed

- None.

Section 5: Fire-Fighting Measures

Extinguishing media

- Suitable extinguishing media:
  Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media :
  Non known.

Special hazards arising from the substance or mixture

- No reactivity hazards other than the effects described below

Advice for firefighters

- Firefighting instructions:
  Depressurize the cylinders by releasing the fire extinguishing system if connected in this.
  Do not activate the release valve if cylinder is not securely fastened.
  Remove ignition source if safe to do so.
  Move containers from fire area if this can be done without risk.
  Use water spray to keep fire-exposed containers cool.
- Protection during firefighting:
  Compressed gas: asphyxiant, suffocation hazard by lack of oxygen.
- Special methods: Use fire control measures appropriate for the surrounding fire.
  Exposure to fire and heat radiation may cause gas receptacles to rupture. Cool endangered receptacles with water spray jet from a protected position.

Section 6: Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

- Non-emergency personnel:
  No action shall be taken involving any personal risk or without suitable training.
  Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering.
  Avoid breathing gas.
  Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
  Stay upwind.
- Emergency responders:
  Monitor oxygen level to determine concentration of released product.
  Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
  Ensure adequate air ventilation.
  Act in accordance with local emergency plan.
- Environmental precautions:
  None

Methods and materials for containment and cleaning up

- Clean-up procedures: Ventilate with fresh air

Section 7: Handling and Storage

Precautions for safe handling

- General

Put on appropriate personal protective equipment (see Section 8).
Contains gas under pressure. Do not puncture or incinerate container.
Use equipment rated for cylinder pressure.
Protect cylinders from physical damage; do not drag, roll, slide, or drop.
Use a suitable hand truck for cylinder movement. Do not use valve cap for lifting.

Conditions for safe storage

- Storage

Store in accordance with local regulations.
Store away from direct sunlight in a dry, cool and well-ventilated area. Keep container tightly closed and sealed until ready for use.
Cylinders can be stored horizontal or vertical.
Valve cap/guard must be fitted to the cylinder and only to be removed when the cylinder is securely fastened.
Cylinders are always to be firmly secured to prevent falling or being knocked over.
Cylinder temperatures should not exceed 65 °C (150 °F).

Section 8: Exposure Controls/Personal Protection

- General:

All components are exempted from REACH registration in accordance with article 2(7)(a). Annex IV of Regulation EC 1907/2006 (REACH)
Contains no other components or impurities which will influence the classification of the product.

Occupational exposure limits

- General:

Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Nitrogen	52%	Oxygen Depletion [Asphyxiant]	
Argon	40%	Oxygen Depletion [Asphyxiant]	
Carbon dioxide	8%	OSHA PEL: 5.000 ppm ACGIH TLV (2012) TWA: 5.000 ppm STEL: 30.000 ppm	

- Appropriate engineering controls:

Oxygen detectors should be used when asphyxiating gases may be released.
Provide adequate general and local exhaust ventilation.
Systems under pressure should be regularly checked for leakages. Ensure exposure is below occupational exposure limits (where available).

- Thermal hazard protection:

None necessary.

- Environmental exposure controls :

None necessary.

- Other information :

Wear safety shoes while handling containers. Standard EN ISO 20345 - Personal protective equipment - Safety footwear.

Section 9: Physical and Chemical Properties

Appearance:

- Physical state: Gas
- Color: Colorless
- Odor: Odorless
- Flammability: Non flammable, does not sustain combustion
- Molar mass 34.08 g/mol
- Vapor density: 1.416 kg/ m^3 (t = 20°C, p = 1.0132 bar)
- Relative density: 1.18 (@t= 20°C, p = 1.0132 bar)

Section 10: Stability and Reactivity

- Reactivity: No specific test data related to reactivity available for this product or its ingredients.
- Chemical stability: The product is stable
- Possible hazardous reactions:
  Under normal conditions of storage and use, hazardous reactions will not occur.
- Hazardous decompositions products:
  None
- Hazardous polymerization:
  None

Section 11: Toxicological Information

- General: All components are exempted from REACH registration in accordance with article 2(7)(a). Annex IV of Regulation EC 1907/2006 (REACH)
  Contains no other components or impurities which will influence the classification of the product.
- Information on toxicological effects

Acute toxicity:	None
Irritation/corrosion:	None
Sensitization:	Stimulate the respiratory system to increase breathing
Mutagenicity:	None
Carcinogenicity:	None
Reproductive toxicity:	None
Teratogenicity:	None

- Specific target organ toxicity (single or repeated exposure) None
- Aspiration hazard: Stimulate the respiratory system to increase breathing
- Potential acute health effects

Eye contact:	None
Inhalation	Increased breathing
Skin contact	None
Ingestion	See Inhalation

Symptoms related to the physical, chemical and toxicological characteristics

- None

Delayed and immediate effects and also chronic effects from short and long term exposure Eye contact

- None

Long term exposure **None**

Potential chronic health effects **None**

Numerical measures of toxicity **None**

Section 12: Ecological Information

- Toxicity None
- Persistence and degradability Not relevant
- Bio accumulative potential: Not relevant
- Soil/water partition Coefficient): Not relevant
- Ecological effects: No known ecological damage caused by this product.

Section 13: Disposal Considerations (non-mandatory)

- Disposal methods: May be vented to atmosphere in a well ventilated place.
  Do not discharge into any place where its accumulation could be dangerous.
  Refer to the code of practice of EIGA (www.eiga.org).
  Container must be disposed of in a safe way.
  Do not puncture or incinerate container

Section 14: Transport Information (non-mandatory)

- UN number: UN 1956

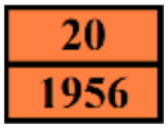
Labeling

- ADR, IMDG, IATA, DOT, TDG.

2.2

ADR (road transport)

- Shipping Name: COMPRESSED GAS, N.O.S. (Nitrogen, Argon)
- H.I. nr: 20
- Transport hazard class: 2
- Classification code 1A
- Packing Instructions: P200
- Special provision: 274, 655
- Limited quantity: 120ml
- Exempted quantities: E1
- Transport category: 3
- Hazard identification (Kemler No)
  20
- Orange plates:



- Tunnel Restriction: E: Passage forbidden through tunnels of category E
- EAC code: 2TE

ICAO-Ti/IATA-DGR

- Shipping Name: Compressed gas n.o.s. (Nitrogen, Argon)
- Class: 2.2
- Passenger and Cargo Aircraft
  Allowed
  Packing Instructions: P200
- Cargo Aircraft only
  Allowed
  Packing Instructions: P200

IMDG (Sea transport)

- Shipping Name: COMPRESSED GAS, N.O.S. (Nitrogen, Argon)
- Class: 2.2
- Emergency Schedule (EmS)
  Fire: F-C
  Spillage: S-V
- Packing Instructions: P200
- Special provisions: 274
- Limited quantites: 120 ml
- Excempted quantities: E1
- Stowahe category: A

Section 15: Regulatory Information (non-mandatory)

EU-Regulation

- REACH — All components are exempted from REACH registration in accordance with article 2(7)(a). Annex IV of Regulation EC 1907/2006 (REACH)
  Contains no other components or impurities which will influence the classification of the product.
- Contains no substances with Annex XVII restriction

Wassenaar Arrangement

- No ECCN number as all components are free to export without any restrictions.

Section 16: Other Information

- Training: INMON0001
- This Safety Data Sheet has been established in accordance with the applicable European Union legislation.
  Classification in accordance with calculation methods of regulation (EC) 1272/2008 CLP / (EC) 1999/45 DPD.
- This SDS is issued 2018-11 and replace revision 2016-11

END OF SAFETY DATASHEET