enzygo environmental consultants

Environmental Risk Assessment EPR/XP3131VK

Deeside Power Station Permit Variation

Deeside Power (UK) Limited

CRM.343.005.PE.R.005

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Environmental Risk Assessment

Project:	Deeside Power Station Permit Variation
For:	Deeside Power (UK) Limited
Status:	FINAL
Date:	February 2025
Author:	Daniel Mills, Senior Permitting Consultant
Reviewer:	Peter Cumberlidge, Senior Director

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1.0 Introduction

1.1 Introduction

1.1.1 This Environmental Risk Assessment (ERA) has been prepared to support a permit variation application to Natural Resources Wales (NRW) for a variation to environment permit reference EPR/XP3131VK/V002 at Deeside Power Station, Weighbridge Road, Deeside Industrial Park, Deeside, Flintshire, CH5 2UL (the 'Facility').

1.1.2 The Operator of the Facility will remain unchanged from Deeside Power (UK) Limited, however their registered office address has changed to; Saltend Power Station, Saltend Chemicals Park, Hedon Road, Hull, East Riding of Yorkshire, England, HU12 8GA. The company registration number remains as 08887001.

1.1.3 The permit for the Facility was originally for the combustion of natural gas in a Combined Cycle Gas Turbine (CCGT) process. The Facility originally consisted of two Alstom 13E2 gas turbines each with dry low NOx burners, two CMI Heat Recovery Steam Generators (HRSG) and an Alstom steam turbine. The HRSG's and Alstom steam turbine have not been operational since 2018 while the gas turbines have been converted into synchronous compensators which do not burn any fuel and are back powered from the overhead lines, providing inertia and reactive power to the National Grid since January 2020 under a 6 year contract. This activity will continue under this permit variation. The existing diesel generator used to provide backup power in the event of the full grid losing power will also remain.

1.1.4 The Operator is now proposing to supply electricity to the National Grid and grid stability services via 11no. individually contained gas reciprocating engines for a maximum of 2000 hours per annum. The total net rated thermal input of the previous plant was 927MWth the new plant is proposed to have a total net rated thermal input of 109MWTh. The new plant will produce electricity only. The HRSG's and steam turbine have been decommissioned and removed from site.

1.1.5 As above, it's proposed that the engines be operational for a maximum of 2000 hours per year as a rolling average and when called on to supply electricity by the National Grid. The operation of the gas turbines to provide inertia and reactive power to the National Grid while continue to operate continuously.

1.1.6 This ERA has been prepared in response to Question 6 on NRW's Part C2 application form.

1.2 Scope of Assessment

1.2.1 A number of assessments have been carried out to determine the environmental risks posed by the Facility and to identify whether the level of risk is considered acceptable. The assessment has considered NRW Guidance 'How to carry out a risk assessment for an Environmental Permit', 17 July 2024 and 'How to comply with your environmental permit guidance', October 2014.

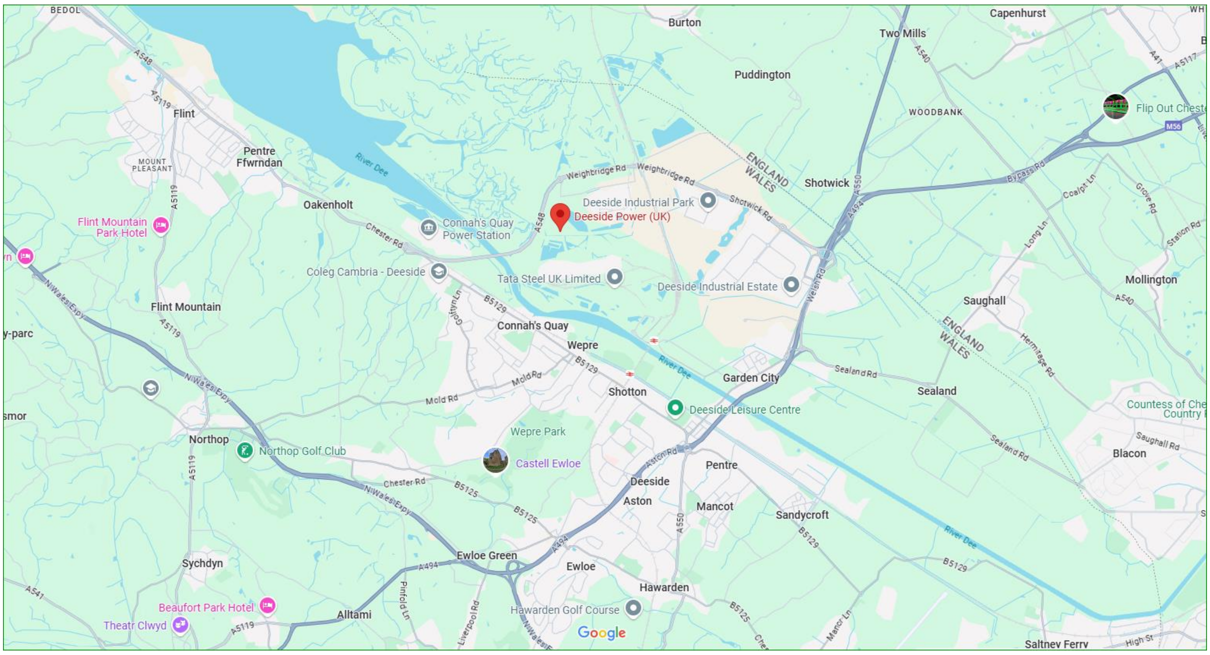
1.2.2 This report also contains justification for all risk assessments screened out of requiring further consideration and provides an overall assessment of the acceptability of the proposed Schedule 1, Part 2 Section 1.1 Part (A) (1) (a) Combustion Facility.

1.3 Facility Location and Environmental Setting

1.3.1 The full address for the Facility:

Deeside Power Station
Weighbridge Road
Deeside Industrial Park
Deeside
Flintshire
CH5 2UL

Figure 1.3.1: Facility Location



1.3.2 Deeside Power Station is located within Deeside Industrial Park on the northeast side of the Dee Estuary close to Fingerpost Gutter, a drainage ditch which feeds to River Dee. The site occupies approximately 1.8 hectares of land with an NGR at the centre of the site SJ 29703 71233.

1.3.3 The nearest residential property is approximately 1197m from the Facility boundary.

1.3.4 The nearest surface water feature and main river is the Fingerpost Gutter located 16m west of the Facility.

1.3.5 A review of the Flood Risk Map on the NRW website shows the Facility to have a low risk of flooding from the sea along the Facility's western and southern boundary edges. There are also four small areas across the Facility that are listed as having a low risk of flooding from surface water and small watercourses. Finally, the Flood Risk Map records a very low risk from rivers at the Facility.

1.3.6 A review of Defra's Magic website was undertaken (www.magic.defra.gov.uk) and the proposed facility is not located within a Source Protection Zone.

1.3.7 The proposed Facility lies on a Secondary A aquifer within the bedrock geology and an undifferentiated secondary aquifer within the superficial geology.

1.3.8 The site is not located within a Nitrate Vulnerable Zone.

1.3.9 The Shotton Lagoons and Reedbeds Site of Special Scientific Interest (SSSI) and the Dee Estuary SSSI, Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar Site lie approximately 110m from the southern boundary of the Facility at their nearest point.

1.3.10 The prevailing wind direction is from the west, west southwest, southwest and south southwest based on historic daily observation data sourced from Hawarden Airport weather station between June 2005 and December 2024. The weather station is located approximately 8.8km southeast of the Facility (based on data provided by www.windfinder.com), see Appendix B for details.

1.4 Permitted Activities

1.4.1 The listed activities within this permit application are in accordance with the Environmental Permitting (England and Wales) Regulations 2016 (as amended 2023). Schedule 1 listed activities and Directly Associated Activities (DAA's) are summarised in Table 1.4.1 below.

Table 1.4.1: Proposed Activities

Activity	Description of Activity and WFD Annex I and Annex II operations	Limits of specified activity and waste types
Part A(1) Section 1.1 (a)	Burning of any fuel in an appliance with a net rated thermal input of 50 or more megawatts.	Combustion of natural gas in 11no gas reciprocating engines.
Directly Associated Activities		
DAA 1	Surface Water Treatment	Handling and storage of site drainage until discharge to the site surface water system.
DAA 2	Water Treatment.	From capture of surface water drainage to discharge.
DAA 3	Waste Management	Waste oil generation and handling - from generation of waste to despatch from the installation
DAA 4	Storage and Handling of raw materials and fuel	From receipt of raw materials to handling, storage and use to despatch from the installation
DAA 5	Electricity transformers and 400kV banking compound	From generator to the connection to the National Grid
DAA 6	Standby emergency diesel generator	From generator to gas turbines

1.5 Operating Hours

1.5.1 The Facility will operate for a maximum of 2000 hours per year as a rolling average. It will operate when called on to supply electricity by the National Grid during periods of high demand.

1.5.2 The Facility will therefore be on standby 24 hours a day, 7 days a week and every day of the year with the potential to run at any time. However, the peak times for the National grid are typically between 08:00 and 22:00.

1.6 Raw Materials

1.6.1 Raw materials are used at the Facility as part of the activities. Raw material deliveries (other than natural gas piped from the grid) will take place at the site during the following restricted operational hours:

- Monday to Sunday – 08:00 to 17:00
- No deliveries on bank holidays

1.6.2 The raw materials to be used at the Facility are detailed within Table 1.6.1 below.

Table 1.6.1: Raw Materials

Raw Material	Estimated Annual Throughput	Maximum Storage Quantity
Antifreeze/coolant	1l	500l
Engine oil	22 000l	20 000l
Natural gas	22 968Nm^3	N/a fed directly from the national grid

1.6.3 The antifreeze/coolant is used within each of the engines at the facility with additional anti-freeze/coolant stored within bunded IBCs. Following initial filling of the cooling systems, they will only require small top ups annually to compensate for losses.

1.6.4 Engine oil is used within each engine at a rate of 0.92kg/hr and is stored within two 10,000l bunded steel tanks. One of the 10,000l tanks stores new engine oil and the second 10,000l tank stores the used engine oil, prior to off-site disposal.

1.6.5 Natural gas is used as the fuel within the engines at a rate of 1.044 Nm^3/h. There will be no storage of natural gas at the Facility as the engines will receive the natural gas on demand from the national grid.

1.7 Nearby Sensitive Receptors

1.7.1 The key sensitive receptors that have the potential to be impacted by the Facility are summarised in Table 1.7.1 below. These receptors have been considered, where appropriate within each risk assessment undertaken.

Table 1.7.1: Sensitive Receptors

Receptor	Type	Distance (m)	Direction
Bedrock geology Secondary A aquifer	Hydrogeological	-	Onsite
Superficial geology undifferentiated secondary aquifer	Hydrogeological	-	Onsite
Fingerpost Gutter	Hydrological and Ecological	16	W
Shotton Converter Station	Industrial	97	E
Shotton Lagoons and Reedbeds SSSI	Hydrological and Ecological	110	S, W and N
The Dee Estuary SSSI, SAC, SPA and Ramsar Site	Hydrological and Ecological	110	S, W and N
Dee Estuary / Aber Afon Dyfrdwy	Hydrological and Ecological	200	S, W and N
Shotton Mill	Industrial	395	E
Tata Steel	Industrial	396	SE
Connah's Quay Power Station	Industrial	1142	WSW
Afon Dyfrdwy (River Dee) SSSI	Hydrological and Ecological	1169	S
Parc Adfer EfW facility	Industrial	1195	E
Residential properties off Quay Lane	Residential	1197	SSW
Dock Road Industrial Estate	Industrial	1224	S
Converter Station	Industrial	1226	SE
Residential Properties off Bank Road	Residential	1239	SW
St. Mark's Parish Church	Recreational	1322	SSW

Receptor	Type	Distance (m)	Direction
Logistic Centre off Weighbridge Road	Industrial	1354	ENE
River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	Hydrological and Ecological	1465	SE
Connah's Quay Cricket Club	Recreational	1475	SSW
Golftyn Primary School	Education	1592	SW
Coleg Cambria School	Education	1627	SW
Toyota Deeside	Industrial	1640	ESE
Commercial Complex off Dock Road	Commercial	1705	SSW
Inner Marsh Farm SSSI	Ecological	1777	NNE
Deeside Industrial Park Zone 3	Industrial	1789	ENE
Deeside and Buckley Newt SAC	Ecological	2625	S
Connah's Quay Ponds and Woodland SSSI	Ecological	2661	S

1.8 Emissions from the Facility

Point Source Emissions to Air

1.8.1 There are currently 8no. of point source emissions to air listed in the Permit and 7no. of these are to be removed during this permit variation, with 11no. new point source emissions to be added.

1.8.2 The 7no. point source emissions to be removed relate to the HRSGs, temporary diesel generator, cooling towers and the gas heater vents. The point source emission from the diesel backup generator will remain at the Facility.

1.8.3 The existing point source emissions and whether they are to remain or be removed as part of this permit variation are detailed in Table 1.8.1 below.

Table 1.8.1: Existing Point Source Emissions to Air from the Facility

Emission Point Reference	Source of Emission	Receiving Media	Emission Point to Remain after Permit Variation?
A1	Large Combustion Plant LCP83 (HRSG)	Air	No
A2	Large Combustion Plant LCP84 (HRSG)	Air	No
A3	Emergency diesel generator	Air	Yes
A4	Temporary diesel generator	Air	No
A5	Cooling towers	Air	No
A6	Cooling towers	Air	No
A7	Gas heater vent	Air	No
A8	Gas heater vent	Air	No

1.8.4 The 11no. of new point source emissions to air from the Facility, result from the exhaust stacks serving each of the new gas engines. The main emissions, requiring monitoring, from the new exhaust stacks will be Oxides of Nitrogen (NOx) and Carbon Monoxide (CO).

1.8.5 The new point source emissions are detailed within Table 1.8.2 below and the emissions points are shown on the Site Layout Plan referenced C5682-GA-101, contained within the drawings section of this application.

Table 1.8.2: New Point Source Emissions to Air from the Facility

Emission Point Reference	Source of Emission	Receiving Media	Emissions
A9	Natural gas fueled engine	Air	CO, NOx
A10	Natural gas fueled engine	Air	CO, NOx
A11	Natural gas fueled engine	Air	CO, NOx
A12	Natural gas fueled engine	Air	CO, NOx
A13	Natural gas fueled engine	Air	CO, NOx
A14	Natural gas fueled engine	Air	CO, NOx
A15	Natural gas fueled engine	Air	CO, NOx
A16	Natural gas fueled engine	Air	CO, NOx
A17	Natural gas fueled engine	Air	CO, NOx
A18	Natural gas fueled engine	Air	CO, NOx
A19	Natural gas fueled engine	Air	CO, NOx

Point Source Emissions to Water

1.8.6 There are currently 4no. of point source emissions to water listed in the Permit and 3no. of these are to be removed during this permit variation. The point source emissions to be removed relate to the site drainage and River Dee water intake pumphouse. The point source emission W1 will remain at the Facility although cooling water will no longer be discharged at this location. Instead, the site drainage, currently discharged at emission points W2a and W2b, will be routed into this system for discharge at emission point W1.

1.8.7 The existing point source emissions and whether they are to remain or be removed as part of this permit variation are detailed in Table 1.8.3 below.

Table 1.8.3: Existing Point Source Emissions to Water from the Facility

Emission Point Reference	Source of Emission	Receiving Media	Emission Point to Remain after Permit Variation?
W1	Cooling waters to the River Dee outfall	Water	Yes, although it will discharge site surface water drainage and no longer any cooling water.
W2a	Site drainage	Water	No
W2b	Site drainage	Water	No
W3	River water intake pumphouse	Water	No

Point Source Emissions to Land, Groundwater and Sewer

1.8.8 The office blocks and welfare facilities all discharge to the existing foul drainage network which discharges to the main sewerage network. No additional discharge will be made to the foul drainage network as part of this permit variation.

1.8.9 There will be no point source emissions to land or groundwater as a result of this permit variation.

2.0 Environmental Risk Assessments

2.1 Scope of Assessments Completed

2.1.1 This ERA has been compiled to determine the environmental risks posed by the proposed Facility and to ensure there are no significant impacts on the environment or human health, in accordance with regulatory guidance. In accordance with NRW Guidance 'How to carry out a risk assessment for an Environmental Permit', 17 July 2024, the following potential risks to the environment were considered and either assessed qualitatively or quantitatively in this document, or screened out.

2.1.2 This ERA identified the following potential risks to the environment for consideration and inclusion in the assessment, if they are likely to be present:

- point source releases to air;
- point source discharges to surface waters;
- point source discharges to sewer;
- point source discharges to ground or groundwater;
- fugitive emissions to air;
- fugitive emissions to land, surface waters and groundwater;
- odour impacts;
- noise and vibration impacts;
- pests and vermin;
- mud and litter;
- disposal or recovery of wastes produced on site; and
- impacts from accidents.

2.1.3 Each assessment completed is summarised below with an assessment of the risks from the proposed Facility provided in Appendix A. Full details of control measures compared with techniques described in the sector guidance is presented in the BAT Assessment and Operational Techniques and Monitoring Plan (OTMP) referenced CRM 343 005 PE R 006.

2.1.4 Mitigation measures have been proposed where necessary with consideration of NRW Guidance 'How to comply with your environmental permit guidance', October 2014 and industry best practice.

2.2 Point Source Emissions to Air

2.2.1 There are 12no. of point source emissions to air from the proposed Facility, as detailed in Tables 1.8.1 and 1.8.2 above. Each of the new gas engines to be installed at the Facility will have a net rated thermal input of 9.896MWth, giving a total net rated thermal input of 108.856MWth for all 11 engines combined.

2.2.2 An Air Quality Assessment (AQA) was undertaken in November 2024 using ADMS 6 (v6.0.2.1). Impacts at sensitive receptors were quantified and the results compared with the relevant long and short-term Environmental Assessment Levels (EALs) and Environmental Quality Standards (EQS).

2.2.3 The AQA was carried out using the worst-case conditions to ensure that the modelled predictions represent the upper limit of concentrations produced by the Facility.

2.2.4 The AQA concludes that '*Considering annual mean results, all results at both human and ecological receptors were below the relevant assessment metrics'*. A copy of the assessment is contained within Appendix C of this report.

2.3 Point Source Emissions to Land, Water or Sewer

2.3.1 There will be one point source emission to surface water from the Facility following this permit variation, as detailed within Table 1.8.3 above.

2.3.2 The point source emission will be from the existing River Dee outfall, designated W1 within the existing permit. The outfall will discharge the clean surface water drainage from the Facility only and will no longer discharge any cooling waters.

2.3.3 The discharge point W1 is a holding pit that can only be manually discharged after inspection for quality.

2.3.4 The site offices and welfare facilities will continue to discharge into the existing foul drainage network. The Facility's foul drainage network is then routed to the main sewerage network. No other discharges will be made to sewer.

2.3.5 There are no point source emissions to groundwater or land from the Facility. Point source emissions to groundwater, land and sewer have therefore been screened out from this assessment.

2.4 Fugitive Emissions to Air

2.4.1 The key sensitive receptors at risk of exposure to potential fugitive emission to air from the Facility have been identified as site employees, nearby ecological receptors and local business' including Shotton Converter Station, Shotton Mill and Tata Steel. Environmental sensitive receptors are listed in Table 1.7.1 above.

2.4.2 The potential fugitive emissions to air from the proposed Facility will comprise natural gas in the event of a leak, the release of VOC's in the event of a spill of oil or coolant and from an increase in engine stack emissions resulting from abnormal operations or plant malfunction.

2.4.3 Activities at the Facility are managed in accordance with the Operator's Environmental Management System (EMS), including regular inspections and maintenance of the engines. The Operator has a maintenance contract in place with the Original Equipment Manufacturer (OEM).

2.4.4 The gas engines will be monitored annually using MCERTS methods to ensure compliance with permitted limits. The plant is fitted with a DCS control system and any abnormal operation will trigger alarms within the 24 hour a day manned main control room. The plant also has an automatic gas supply shut off in the event of a fire. Fire alarms will be both local and in the control room and will comply with NFPA 85 regulations.

2.4.5 All vehicle movements will take place on areas of asphalt or concrete hardstanding. A strict site speed limit of 10mph will be maintained across the Facility.

2.4.6 The residual risk from fugitive emissions to air is considered to be low.

2.5 Fugitive Emissions to Land and Water

2.5.1 The main potential pollutants to surrounding land and water would be from oil or coolant from spillages during deliveries, and/or during removal of spent oil and coolant from the Facility. Oil and coolant are contained within a sealed system inside each individual contained engine unit. The units are sealed and internally bunded to a capacity to contain all of the liquid within the cooling system. The units are then located on concrete hardstanding.

2.5.2 Clean oil is stored within a bunded 10,000l tank and waste oil is stored within a separate bunded 10,000l tank. The waste oil tank is emptied when approaching capacity for off-site disposal. Oil collections and deliveries are made by road going tankers which travel along asphalt haul roads at the Facility.

2.5.3 The engine oil tanks are located on bunded concrete hardstanding constructed in accordance with The Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 and meet British Standard BS 799 Part 5:2010.

2.5.4 The transformers to be used at the Facility are pre-existing and pre-date the Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016. The three transformers at the Facility are all contained within bunded compounds but the bunds are not impervious as required by the new regulations.

2.5.5 However, there are several stages of protection to prevent any oil in from being released from site, consisting of the following:

- Diverter Chamber and Oil Retaining Tank;
- Skimovex Oil Water Separator; and
- Wastewater Sump.

2.5.6 All of the transformer bunds are drained initially via the diverter chamber. The diverter chamber contains a float known as the 'density valve' which is lifted by water when there is sufficient volume in the chamber. When the density valve is raised it uncovers the outlet and allows discharge of the water contained within. In the event of an uncontrolled release of oil into the drains, caused by a loss of containment, the chamber fills with oil which is not dense enough to lift the density valve and the outlet remains closed. The chamber would continue to fill until it overflows into the oil retaining tank.

2.5.7 A float operated alarm in the chamber alerts the operational staff that the density valve has operated. This alarm is tested regularly for functionality.

2.5.8 Water from the diverter chamber flows through the Skimovex Oil Water Separator which only allows clean water to pass to the Wastewater Sump. The separator contains a skimming mechanism allowing any oil contamination to be skimmed off the surface and diverted into a separate waste tank.

2.5.9 Water from the Skimovex is collected in the wastewater Sump which can only be emptied manually by a pump from the bottom. The sump consists of three components, the first is a large settlement enclosure which captures the water to a certain level. The pipe in the second holding enclosure is under the surface of the first holding tank, ensuring any oil on the surface of the first holding tank cannot progress any further. The second holding tank has manually operated pumps which move the water into the outfall pit where it discharges to the Dee by gravity.

2.5.10 The wastewater sump is routinely inspected and emptied, if required, so only uncontaminated water is pumped into the outfall pit where it then decants via pipeline to the River Dee.

2.5.11 No other potentially polluting liquids are stored on site.

2.5.12 Surface watercourses in the vicinity of the Facility will act as both a receptor for potential pollution and as a pathway to mobilise pollutants to the River Dee. The nearest watercourse is Fingerpost Gutter adjacent to the Facility's western boundary. Fingerpost Gutter is designated as a main river and feeds directly into the River Dee.

2.5.13 The site is located over a Secondary A aquifer within the bedrock geology and an undifferentiated secondary aquifer within the superficial geology. The Facility is designated as having a low risk of flooding from the sea along its western and southern boundary edges with the rest of the site having a very low risk.

2.5.14 There are also four small areas across the Facility that are listed as having a low risk of flooding from surface water and small watercourses with the rest of the site having a very low risk. Finally, the Flood Risk Map records a very low risk from rivers across the entire Facility.

2.5.15 The majority of the site area is covered by soft landscaping and aggregates with some limited areas of concrete hardstanding, associated with the former Facility use. The haul routes around the site are comprised of asphalt and are served by a drainage system.

2.5.16 The site drainage passes through an oil/water separator before being pumped to the River Dee outfall off site (W1). The oil/water is inspected on a regular basis to check its integrity and the levels of oil contained within.

2.5.17 In the event of flooding and adverse weather, to mitigate the potential for the mobilisation of pollutants off site, all engine containers and the control rooms are suitably sealed to prevent water ingress. Coolant and oil in the transformers and engines are contained within sealed systems, monitored via the DCS control system. The Operator will subscribe to NRW's Flood warning system.

2.5.18 A programme of planned preventative maintenance is undertaken at the Facility with all engines and their containment systems regularly inspected. The Operator also has a maintenance contract in place with the OEM.

2.5.19 In the event of a leak, an OEM field engineer will be notified immediately and dispatched to the site. Spill kits will be available on site, with materials suitable for absorbing and containing minor spills and drain matts and booms to direct pollutants away from surface water channels. Site staff will be trained in their use and in the spill clean-up procedures detailed within the Facility's EMS.

2.5.20 The clean surface water drainage system is a sealed drainage system, so in case of emergencies no contamination can enterthe River Dee.

2.5.21 The residual risk from fugitive emissions to water and land is considered to be low.

2.6 Odour

2.6.1 No potentially odorous activities will be undertaken at the Facility. Therefore, odour has been screened out from further assessment.

2.7 Noise and Vibration

2.7.1 The primary sources of noise emissions at the site will arise from the gas engines. The three main emission sources are the engines themselves, the exhausts serving them and the radiators on top of each of the fully enclosed concrete sided structures containing the engines.

2.7.2 The nearest residential property that may be impacted by noise generation is located approximately 1,197m from the Facility site boundary.

2.7.3 The engines are individually contained within fully enclosed concrete sided structures to reduce the noise emitted from the engines and each of the exhaust stacks are installed with silencers.

2.7.4 The residual risk from noise is considered to be low.

2.7.5 The potential hazard from vibration is low based on the limited sources of vibration and the control measures to be put in place and the distance to any sensitive receptors.

2.7.6 Vibration has therefore been discounted as a potential hazard and no further assessment has been undertaken.

2.8 Pests and Vermin

2.8.1 No activities that will lead to the attraction of pests and vermin will be carried out at the Facility. Therefore, pests and vermin have been screened out from further assessment.

2.9 Mud and Litter

2.9.1 It is unlikely that there will be any litter generated on site. General housekeeping measures detailed within the site's EMS will ensure any other litter generated at the Facility is minimal and does not escape into the environment.

2.9.2 There is limited potential for mud to be generated on site as the access roads across site comprise asphalt hardstanding.

2.9.3 The residual risk from mud or litter impacting the identified receptors is considered to be very low. Therefore, mud and litter have been screened out from further assessment.

2.10 Wastes Generated and Waste Management

2.10.1 The primary purpose of the Facility is for the production of electricity from the combustion of natural gas. As such, there will be very minimal wastes produced as part of activities on site.

2.10.2 Wastes which are produced will comprise waste oil and the occasional wastes from maintenance activities. Oil usage will be minimised by regular servicing and maintenance of the engines and any waste oil will be taken off site for recovery at a suitably permitted facility.

2.10.3 General waste from the offices and welfare facilities will be collected under contract with a local waste disposal contractor.

2.10.4 For all wastes generated on site, the waste hierarchy as defined within the Waste Framework Directive will be applied.

2.11 Accidents

2.11.1 There is potential for exposure from accidents or incidents on site, to anyone living, visiting or working close to the site. The key sensitive receptors include visitors and workers of Shotton Converter Station, Shotton Mill and Tata Steel, surface waters and the local human population.

2.11.2 Full details of control measures to minimise the impact of accidents compared with requirements described in the relevant technical guidance notes are described in the OTMP, referenced CRM 343 005 PE R 005.

2.11.3 Based on the output of the risk assessment in Appendix A, the potential risk from accidents is low.

2.12 Conclusions

2.12.1 The assessments undertaken consider the possible impacts on sensitive receptors from a range of potential emissions from the Facility. The risk assessments have considered both the intended design and operational practices at the Facility and conclude that:

- The air quality assessment carried out to assess the impacts of the Facility's point source emissions to air, concludes that 'Considering annual mean results, all results at both human and ecological receptors were below the relevant assessment metrics'.
- Following implementation of management measures and controls, point source emissions to water, odour and fugitive emissions to air, land and water are considered as not being significant.
- The overall risk to receptors from accidents is considered low due to the low-risk nature of activities at the Facility.
- The overall risks from noise, vibration, odour, mud, litter and pests are considered very low due to the nature of the activities carried out and design of the facility.

2.12.2 Full details of control measures to minimise the impact of accidents compared with requirements detailed in the relevant technical guidance notes is described in the OTMP.

Table 1: Point Source Emissions to Water

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
Contaminated run-off from site surfaces	Loss of containment on site	Surface water drainage system	River Dee	Low	Medium	Medium	All potentially polluting materials are contained within bunded tanks or plant which are located on impermeable concrete hardstanding. Oil tanks are constructed in accordance with The Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 and meet British Standard BS 799 Part 5:2010. Transformers are within bunds which drain via diverter chamber and oil retaining Tank, Skimovex oil water separator and a wastewater Sump. All deliveries and collections at the Facility are supervised with spill kits available. Sealed drainage system which can only be manually discharged after inspection. Spill clean-up procedure in place to minimise the impact from spills and leaks.	Low
Release from storage tanks (clean oil and dirty oil), transformers or engines	Loss of Containment on site	Surface water drainage system	River Dee	Medium	Medium	Medium	All potentially polluting materials are contained within bunded tanks or plant which are located on impermeable concrete hardstanding. Regular inspection of the storage tanks to identify leaks.	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
							Transformers are within bunds which drain via diverter chamber and oil retaining Tank, Skimovex oil water separator and a wastewater Sump. Spill clean-up procedure in place to minimise the impact from spills and leaks. Tanks are constructed in accordance with The Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 and meet British Standard BS 799 Part 5:2010. All deliveries and collections at the Facility are supervised with spill kits available. Sealed drainage system which can only be manually discharged after inspection. Spill clean-up procedure in place to minimise the impact from spills and leaks. Replacement/top up of engine oil done automatically from main oil storage tank.	

Table 2: Fugitive Emissions to Air

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
Loss of containment of natural gas	Leaks of natural gas from	Air transport	Staff and visitors at	Medium	Low	Low	No storage of gas on site. Gas piped to site and distributed to engines from natural gas grid	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
	pipework and gas engines or from a mechanical failure		local businesses, Nearby natural habitats				Leaks of natural gas are prevented through the inspection and maintenance of equipment, leak detection systems within each engine containment structure and the avoidance of over pressurisation. The DCS control system monitors pressure to avoid over pressurisation. A gas detection monitor is in place in each engine containment structure to identify leaks. Shutoff valves are in place on all gas delivery pipework. Routine inspections of components, such as distribution pipework and the engine containment structure, is regularly undertaken and a maintenance programme is carried out by the OEM, under a contract with the Operator.	
Release of VOC's	Spills of coolant and/or oil on site	Air transport	Staff and visitors at local businesses, Nearby natural habitats	Low	Low	Low	The contained engines are sealed and internally bunded to prevent any polluting liquids escaping in the event of a breakdown or malfunction. The engines are also located on impermeable concrete hardstanding. Pipework is subject to regular inspections and all staff are tasked with monitoring for evidence of spillages and leaks All deliveries and oil changes are undertaken by certified contractors and supervised by the Operator. Spill kits are available on site.	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
							All spillages will be cleaned up as soon as practicable, according to the response procedure detailed in the EMS.	
Increased emissions from abnormal operations of engines	Engine exhausts	Air transport	Local residents, Staff and visitors at local businesses, Nearby natural habitats	Low	Medium	Low	A DCS control system is in place which will raise an alert should abnormal performance/operations of the engines occur. The Facility is manned 24 hours a day, 7 days a week for every day of the year. A planned preventative maintenance schedule will be in place to ensure plant and equipment is maintained in accordance with the manufacturer's recommendations, including maintenance contract with the OEM. MCerts testing will be conducted on the engines as required under the Environmental Permit which will verify emission levels and accordance with Emission Limit Values. If necessary, engines will be temporarily shut down whilst investigation and maintenance is undertaken	Low

Table 3: Fugitive Emissions to Land and Water

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
Contaminated run-off from site surfaces	Contamination from spillages and/or leakages	Percolation through soils, direct run-off from site across the ground and entering surface water drains or natural channels/ ditches	Nearby natural habitats, Groundwater, Fingerpost Gutter	Low	Medium	Medium	All potentially polluting materials are contained within bunded tanks or plant which are located on impermeable concrete hardstanding. Tanks are constructed in accordance with The Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 and meet British Standard BS 799 Part 5:2010. The site drainage passes through an oil/water separator prior to discharge. Records will be available and kept up to date of maintenance of all drainage structures and the oil/water separator. Pipework is subject to regular inspections and all staff are tasked with monitoring for evidence of spillages and leaks during their day to day routine. Clean up and spill procedures will be implemented as part of the site's EMS to deal with fuel or other spillages or leaks of potentially polluting liquids. All staff will be trained in the procedures and correct use of equipment and sufficient spill kits will be maintained on site.	Low
Accidental release of potentially polluting	Flooding and loss of	Percolation through soils, direct run-off from site	Nearby natural habitats,	Low	Medium	Medium	All potentially polluting materials are contained within bunded tanks or plant which	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
substances through flooding	containment on site	across the ground and entering surface water drains or natural channels/ ditches	Groundwater, Fingerpost Gutter				are located on impermeable concrete hardstanding. The Operator will subscribe to NRW's Flood warning system.	

Table 4: Noise and Vibration

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
Noise and vibration from engines impacting off site receptors	Engines on site	Noise through the air and vibrations through the ground	Staff and visitors at local businesses	Low	Low	Low	The engines and generators are within closed concrete buildings. The engine containment structures are located on impermeable concrete hardstanding. Silencers are fitted to each stack exiting the engine containment structures. Regular engine maintenance and remote monitoring to ensure optimal operation minimises noise generation and vibration. Operational procedures are in place to deal with complaints about noise, with records maintained.	Low

Table 5: Accidents

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
Oil storage Containment failure	Oil and coolant system failure Oil tank failure Pipework failure Overfilling	Percolation through soils, direct run-off from site across the ground and entering surface water drains or natural channels / ditches	Nearby natural habitats, Groundwater, Fingerpost Gutter, River Dee	Medium	Medium	Medium	The engines are sealed and internally bunded to prevent any polluting liquids escaping in the event of a breakdown or malfunction. The engines are also located on impermeable concrete hardstanding. Oil tanks and the engines are inspected on a regular basis and a maintenance contract is in place with the OEM. The spill response procedure in the Environmental Management System will be followed. Sealed drainage system which can only be manually discharged after inspection. The surface water drainage passes through an oil/water separator prior to discharge.	Low
Arson and / or vandalism and or theft causing the release of polluting materials to air (smoke or fumes), water or land.	Unauthorised access	Air transport of smoke then inhalation Spillages and contaminated firewater by direct run off from site	Site employees, Staff and visitors at local businesses Members of the public and local residents, Nearby natural habitats,	Medium	High	Medium	Activities will be managed and operated in accordance with a management system (which will include site security measures to prevent unauthorised access). An Accident Management Plan has been compiled to manage foreseeable risks from the installation. Site security measures to prevent unauthorised access will include total fencing of the site, security gates and 24-hour presence of site staff.	Low

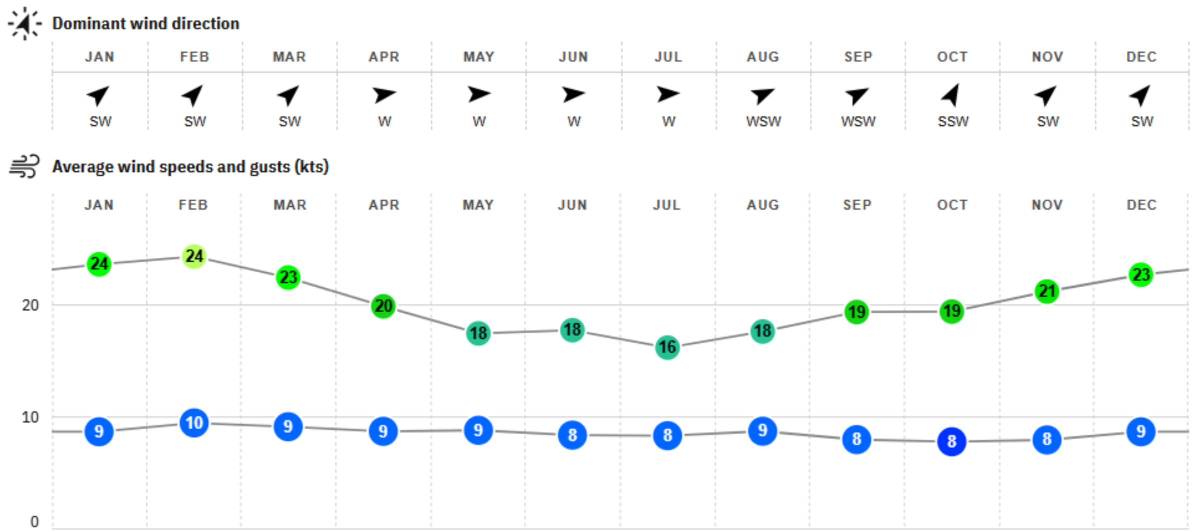
Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
			Unauthorised users of site equipment				Security gates will be kept locked and secured when not in use. CCTV cameras are be installed.	
Accidental fire/explosion causing the release of polluting materials to air (smoke or fumes), water or land.	On-site infrastructure	Air transport of smoke then inhalation. Spillages and contaminated firewater by direct run off from site.	Site employees, Staff and visitors at local businesses Members of the public and local residents, Nearby natural habitats	Medium	High	Medium	Plant and equipment is maintained in accordance with manufacturers recommendations and a maintenance contract is in place with the OEM. Designated gas zones with that comply with DSEAR regulations. Fire extinguishers are in place on the access door to every engine containment structure. The site has a No Smoking Policy which will be strictly enforced by Site Rules and by signage around the site. Fire training and emergency drills are undertaken. Fire detection, gas monitoring and alarm systems are in place within each engine containment structure which will sound an alarm to the manned site office. Activities will be managed and operated in accordance with a management system. Shutoff valves are in place on gas supply points. Good housekeeping measures will be in place including the cleaning of small leaks of oils or other flammable liquids immediately. The site Management System will include procedures and actions required in the event	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
							of fire or spillage to control and minimise their spread. Firefighting equipment will be maintained on site in accordance with fire regulations.	
Flooding causing equipment breakdown or mobilising pollutants off site	On-site infrastructure Contamination on site surfaces	Floodwater run-off from site across the ground and entering surface water drains or natural channels / ditches	Nearby natural habitats, Fingerpost gutter, River Dee	Low	Medium	Low	Filling points for oil storage systems are all suitably raised above ground level. All engine containment structures, control rooms and switchgear are completely sealed to prevent the ingress of floodwater The lube oil and coolant in the engines are sealed systems or within sealed containers with internal bunding. All containers and engines are also contained on impermeable concrete hardstanding. The Operator will subscribe to NRW's Flood warning system.	Low
Vehicle Collision	Delivery vehicles, Maintenance vehicles and on-site infrastructure	Contact with vehicles	Site employees, Staff and visitors at local businesses Members of the public and local residents,	Low	Medium	Low	Vehicle movements on site are minimal and any deliveries and collections are scheduled and supervised. Secure gates and fences are in place around the sites perimeter. Site is manned 24-hour a day. The site spill procedure will be followed, found in the Environmental Management System. A log will be kept of near misses or incidents. Strict site speed limit of 10mph is enforced on site.	Low

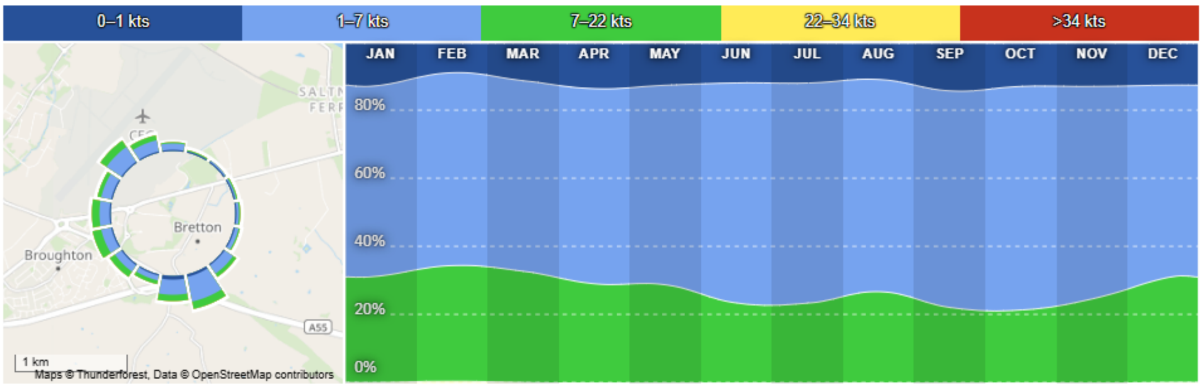
Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual Risk
			Nearby natural habitats					

Statistics based on observations taken between 06/2005 - 12/2024.

Monthly wind speed statistics and directions for Hawarden Airport



Monthly wind direction and strength distribution



Caulmert Limited

Deeside Power Station

Air Dispersion Modelling Report

February 2025

Document Control Sheet

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EXECUTIVE SUMMARY

Purpose of Report

Bureau Veritas has been commissioned by Caulmert for support with Environmental Permitting requirements for the proposed Peaking Power Plant at the former Deeside Power Plant. This document provides supporting technical information for the application of an Environmental Permit in accordance with the Industrial Emissions Directive (IED) to operate the site. The application includes eleven gas-fired generators, with a combined thermal input of 110 MW_{th}. Each generator discharges out of its own independent stack at up to 15 m from the ground.

The assessment has used detailed dispersion modelling to undertake a study of emissions to air during the operation of the 11 generators on site.

The generators are operated using natural gas as the fuel; hence, the following pollutants were included in the assessment: nitrogen oxides (NO_x) and carbon monoxide (CO). Release rates for NO_x and CO were derived using information provided by the generator manufacturers and emission limits legislation.

Summary of Conclusions

The assessment has resulted in the following conclusions:

- Considering annual mean results, all results at both human and ecological receptors were below the relevant assessment metrics.

- The results for nitrogen deposition show exceedances at two ecological receptors. Where the contribution from the plant is less than 1% of the PEC, this can be considered not significant. However, E58 (Shotton_2) and E20 (Dee_3) were observed to contribute 3.1% and 1.2% PC of critical load respectively. Therefore, it was determined that further assessment was required at these monitoring locations. The contour plots in Appendix B show that a small area of Dee Estuary SSSI as well as the eastern part of Shotton Lagoons SSSI, are located within the 1% exceedance zone of the minimum critical load for nitrogen deposition of 10 and 5 kg N ha^{-1} y^{-1}, respectively. An Ecological Impact Assessment was conducted by Rachel Hacking Ecology and found that these exceedances have to be considered in the context of the significant exceedance that is already occurring. The report states that due to current exceedance levels of 32.5% and 40.3% respectively, it is very unlikely to significantly exacerbate the problems caused by a slight addition to nitrogen deposition.

- As the modelled results of the acid deposition PC are less than 1% of the PEC at all considered ecological receptors, these can be described as not significant.

- Considering short-term results, all results at human receptors were below the relevant assessment metrics.

Due to worst-case conditions being employed throughout the assessment, the modelled predictions are expected to represent the upper limit of concentrations.

1 INTRODUCTION

Bureau Veritas has been commissioned by Caulmert for support with Environmental Permitting requirements for the proposed Peaking Power Plant at the former Deeside Power Plant. This document provides supporting technical information for the application of an Environmental Permit in accordance with the Industrial Emissions Directive (IED) to operate the site. The application covers the installation of 11 new natural gas generators.

Each of the generators utilise natural gas, hence, the following pollutants were included in the assessment: nitrogen oxides (NO_x (as NO_2)) and carbon monoxide (CO).

This report presents the methodology and the subsequent results of the dispersion modelling of emissions to air.

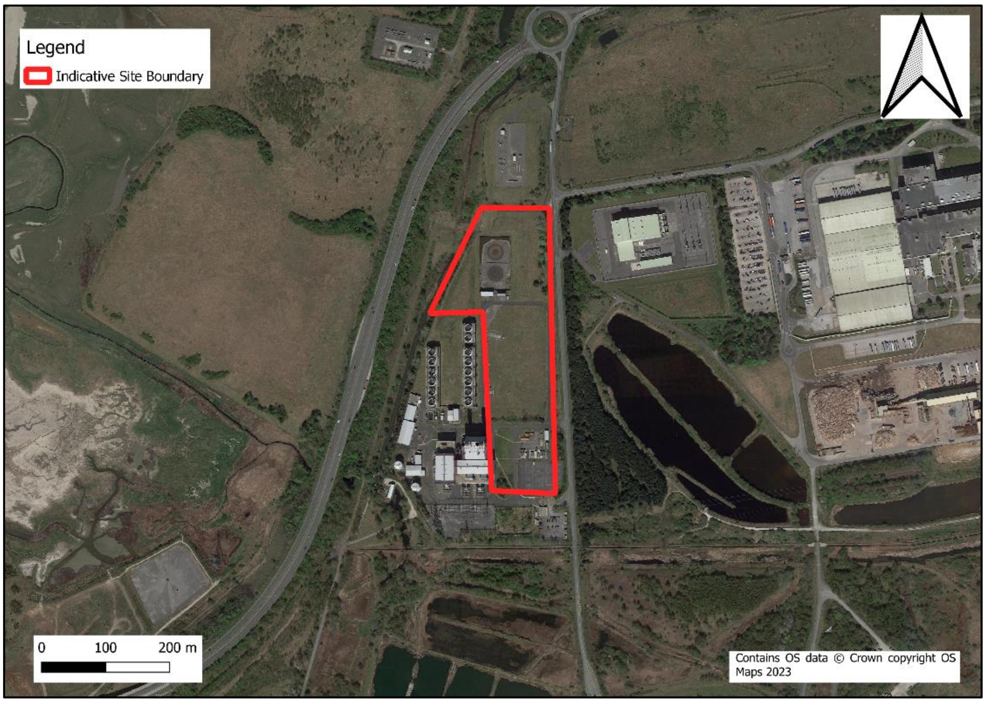
1.1 Site location

The site is located off the A548, about 1.5 km north of Connah's Quay High Street. The area around the site is primarily industrial in nature with areas of ecological designations, as well as residential areas at a greater distance. The site location is shown in Figure 1.1.

The closest human receptors to the site are residential properties at Connah's Quay, located approximately 1.2 km of the site boundary to the south. The closest ecological receptor, designated as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) (Dee Estuary), is located approximately 350 m west of the site.

In terms of existing air quality conditions in the area, there are no Air Quality Management Area (AQMA) declared within the jurisdiction of the North Wales Authorities. The closest AQMA to the site is the Chester City Centre, located 11.2 km west of the Site. This AQMA is declared for exceedances of the annual mean nitrogen dioxide (NO_2) objective. Due to the distance between the site and the AQMA, it is unlikely that the sites activities will affect NO_2 concentration within the AQMA.

Figure 1.1 - Site Location



2 DISPERSION MODELLING METHODOLOGY

ADMS 6 version 6.0.2.1 modelling software was used for this study. ADMS 6 is an advanced atmospheric dispersion model that has been developed and validated by Cambridge Environmental Research Consultants (CERC). The model was used to predict ground level concentrations of combustion products emitted to atmosphere from the combustion plant at the site. The model is used extensively throughout the UK for regulatory compliance purposes. It is accepted as an appropriate air quality modelling tool by the Environment Agency (EA) and local authorities.

ADMS 6 parameterises stability and turbulence in the Atmospheric Boundary Layer (ABL) by the Monin-Obukhov length and the boundary layer depth. This approach allows the vertical structure of the ABL to be more accurately defined than by the stability classification methods of earlier dispersion models such as R91 or ISCST3. In ADMS, the concentration distribution follows a symmetrical Gaussian profile in the vertical and crosswind directions in neutral and stable conditions. However, the vertical profile in convective conditions follows a skewed Gaussian distribution to take account of the inhomogeneous nature of the vertical velocity distribution in the Convective Boundary Layer (CBL).

A range of input parameters is required for the model. This includes, but is not limited to, data describing the local area, meteorological measurements, and emissions data. The data utilised within the modelling assessment is detailed in the following sections of this chapter.

2.1 Process Emissions

Details of the generators at the site have been provided to Bureau Veritas by Caulmert. The assessment has assumed 11 generators across the building (unit) at the site. The model input parameters for each type of combustion plant are detailed in Table 2.1.

Release rates for NO_x and CO were derived using information provided by the generator manufacturers and emission limits legislation. All generators have been modelled as vertical point sources.

Table 2-1 - Exhaust Parameters

Parameter	Gens 1-11
Stack Height (m) [a]	15.0
Stack Diameter (m) [a]	0.8
Rated Electrical Output (kW)	4500
Electrical Efficiency (%)	45.5
Volume Flow (Nm^3/s)	8.30
Volume Flow (Am^3/s)	11.96
Actual Oxygen Content (%)	10.46
Efflux Velocity ($m\ s^{-1}$) [b]	23.79
Efflux Temperature (°C) [a]	351
NO_X (mg/m^3)	95
CO (mg/m^3)	100
NO_X (g/s)	0.79
CO (g/s)	0.83

Reference conditions: 273 K, 101.3 kPa, 15% O_2, dry gas

The data input into the calculations which have been undertaken to derive pollutant emission rates from information provided by Caulmert are detailed in Table 2-1 above.

The following scenarios have been included in this assessment, based on operating information provided by Caulmert.

The coordinates of the 11 identical generators are provided in Table 2-2 below:

Table 2-2 – Generator Locations

Generator	X (m)	Y (m)
1	329789.2	371579.9
2	329789.2	371573.9
3	329789.2	371567.9
4	329789.2	371561.9
5	329789.2	371555.9
6	329789.2	371543.9
7	329789.2	371537.9
8	329789.2	371531.9
9	329789.2	371525.9
10	329789.2	371519.9
11	329789.2	371513.9

Table 2-3 – Modelled Scenarios

Scenario Name	Operations
Final Model	11 generators running placed at the north end of the site

Since the exact time during the year when the gensets will operate is currently unknown, the model was run under reduced hours, for 2,000 hours of the year. This is a conservative estimate, as exact operating hours is unknown. Results have been post-processed to account for short-term averaging periods, according to the follow:

- For annual averaging periods, result have been post-processed using the factor n/8760, where 'n' is the total operating hours within an annual period.
- For averaging periods of 24 hours or 8 hours, results have been post-processed using the factor n/24, or n/8, where 'n' is the total operating hours within the relevant period.
- The annual averaging periods were post-processed for a total of 2000 hours of operation.

The generators are placed in 11 identical blocks with a length of approximately 5.5 meters each. They have been evenly spaced along the length of the generator building running from north to south.

Figure 2.1 - Emission Points Visualisation

2.2 Meteorology

For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of monitoring sites where the required meteorological measurements are made. The year of meteorological data that is used for a modelling assessment can also have a significant effect on ground level concentrations.

This assessment has utilised meteorological data recorded at the Hawarden meteorological station during across a five-year period (2019 to 2023). The Hawarden meteorological station is located approximately 7.9 km to the southeast of the site and offers data in a suitable format for the model. Figure 2.2– Figure 2.6 illustrate the frequency of wind directions and wind speeds for the years considered.

ADMS cannot, as standard, model calm weather conditions, since this results in a discontinuity produced by a ‘divide by zero’ calculation. Most Gaussian plume models simply skip lines of meteorological data where calm conditions occur. Met lines will also be skipped where any of the required meteorological input parameters are missing. The generally accepted best practice requirement is to ensure that no more than 10% of meteorological data is omitted from the model run.

Table 2-4 demonstrates that this requirement was satisfied for all the meteorological ‘met’ data years proposed for the assessment. This is presented in Table 2-4.

Table 2-4 – Meteorological Data Capture

Year	Number of met lines used	Number of lines with calm conditions	Number of lines with inadequate data	Number of non-calm met lines with wind speed less than the minimum value of 0.75 m/s	Percentage of lines used
2019	8302	47	95	316	95%
2020	8283	52	112	337	94.%
2021	8091	100	129	440	92%
2022	8204	203	125	228	94%
2023	8342	216	9	193	95%

Figure 2.2 – 2019 Hawarden Wind Rose

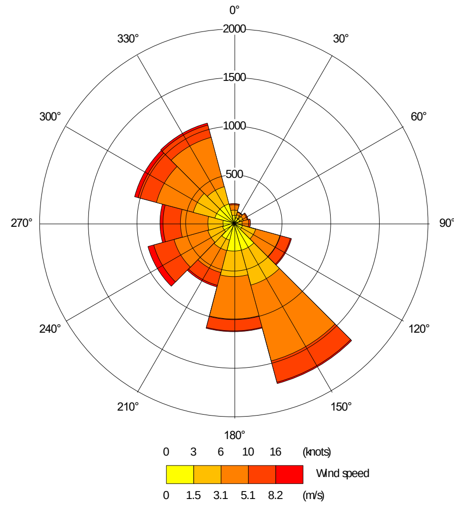


Figure 2.3 - 2020 Hawarden Wind Rose

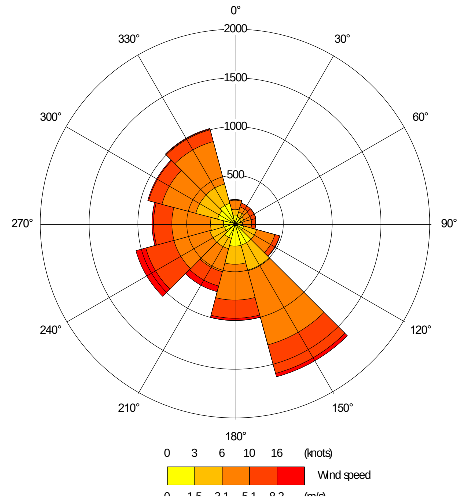


Figure 2.4 – 2021 Hawarden Wind Rose

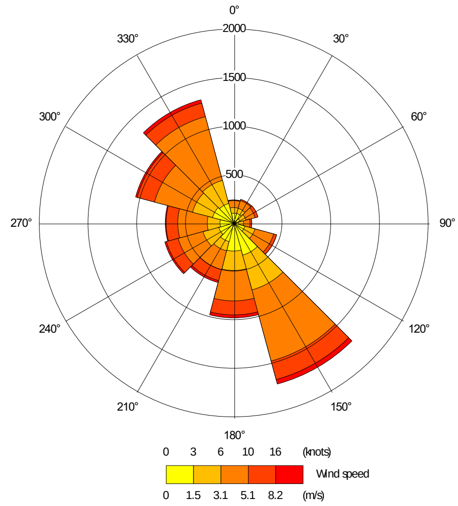


Figure 2.5 – 2022 Hawarden Wind Rose

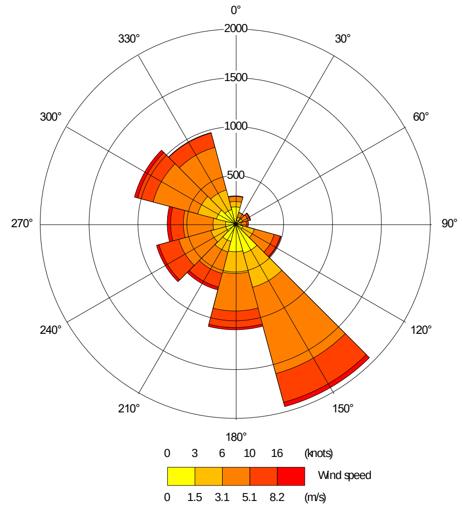
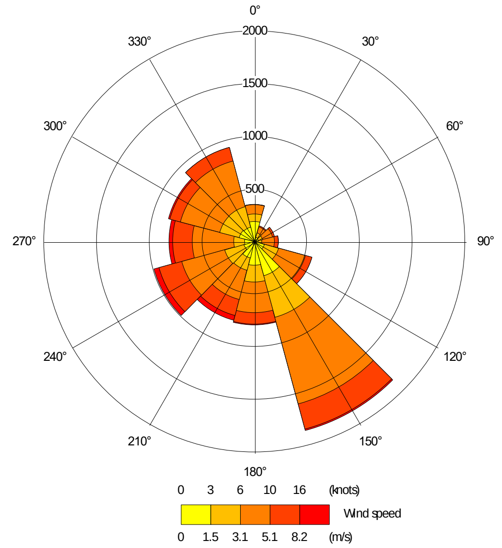


Figure 2.6 – 2023 Hawarden Wind Rose



2.3 Surface Characteristics

The predominant surface characteristics and land use in a model domain have an important influence in determining turbulent fluxes and, hence, the stability of the boundary layer and atmospheric dispersion. Factors pertinent to this determination are detailed below.

2.3.1 Surface Roughness

Roughness length, z_0, represents the aerodynamic effects of surface friction and is physically defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by meteorological pre-processors to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing.

The surface roughness length is related to the height of surface elements; typically, the surface roughness length is approximately 10% of the height of the main surface features. Thus, it follows that surface roughness is higher in urban and congested areas than in rural and open areas. Oke (1987) and CERC (2003) suggest typical roughness lengths for various land use categories (Table 2-5).

Table 2-5 - Typical Surface Roughness Lengths for Various Land Use Categories

Type of Surface	z_0 (m)
Ice	0.00001
Smooth snow	0.00005
Smooth sea	0.0002
Lawn grass	0.01
Pasture	0.2
Isolated settlement (farms, trees, hedges)	0.4
Parkland, woodlands, villages, open suburbia	0.5-1.0
Forests/cities/industrialised areas	1.0-1.5
Heavily industrialised areas	1.5-2.0

Increasing surface roughness increases turbulent mixing in the lower boundary layer. This can often have conflicting impacts in terms of ground level concentrations:

- The increased mixing can bring portions of an elevated plume down towards ground level, resulting in increased ground level concentrations closer to the emission source; however;
- The increased mixing increases entrainment of ambient air into the plume and dilutes plume concentrations, resulting in reduced ground level concentrations further downwind from an emission source.

The overall impact on ground level concentration is, therefore, strongly correlated to the distance and orientation of a receptor from the emission source.

2.3.2 Surface Energy Budget

One of the key factors governing the generation of convective turbulence is the magnitude of the surface sensible heat flux. This, in turn, is a factor of the incoming solar radiation. However, not all solar radiation arriving at the Earth's surface is available to be emitted back to atmosphere in the form of sensible heat. By adopting a surface energy budget approach, it can be identified that, for fixed values of incoming short and long wave solar radiation, the surface sensible heat flux is inversely proportional to the surface albedo and latent heat flux.

The surface albedo is a measure of the fraction of incoming short-wave solar radiation reflected by the Earth's surface. This parameter is dependent upon surface characteristics and varies throughout the year. Oke (1987) recommends average surface albedo values of 0.6 for snow covered ground and 0.23 for non-snow covered ground, respectively.

The latent heat flux is dependent upon the amount of moisture present at the surface. The Priestly-Taylor parameter can be used to represent the amount of moisture available for evaporation:

$$\alpha = \frac{1}{S(B+1)}$$

Where:

α = Priestly-Taylor parameter (dimensionless)

$$S = \frac{s}{s+\gamma}$$

$$s = \frac{de}{dT}$$

e_s = Saturation specific humidity (kg H_2O / kg dry air)

T = Temperature (K)

$$\gamma = \frac{c_{pw}}{\lambda}$$

c_{pw} = Specific heat capacity of water (kJ kg^{-1} K^{-1})

λ = Specific latent heat of vaporisation of water (kJ kg^{-1})

B = Bowen ratio (dimensionless)

Areas where moisture availability is greater will experience a greater proportion of incoming solar radiation released back to atmosphere in the form of latent heat, leaving less available in the form of sensible heat and, thus, decreasing convective turbulence. Holstag and van Ulden (1983) suggest values of 0.45 and 1.0 for dry grassland and moist grassland respectively.

2.3.3 Selection of Appropriate Surface Characteristic Parameters for the Site

A detailed analysis of the effects of surface characteristics on ground level concentrations by Auld et al. (2002) led them to conclude that, with respect to uncertainty in model predictions:

> *"…the energy budget calculations had relatively little impact on the overall uncertainty"*

In this regard, it is not considered necessary to vary the surface energy budget parameters spatially or temporally, and annual averaged values have been adopted throughout the model domain for this assessment.

As snow covered ground is only likely to be present for a small fraction of the year, the surface albedo of 0.23 for non-snow covered ground advocated by Oke (1987) has been used whilst the model default α value of 1.0 has also been retained.

From examination of 1:10,000 Ordnance Survey maps, it can be seen that within the immediate vicinity of the site, land use is predominately industrial to the west with more open land to the east and south. Consequently, a composite surface roughness length of 0.3 m has been deemed appropriate to take account of the respective land use categories in the model domain. For the meteorological site, a surface roughness of 0.3 m has been utilised given the representative land use categories in this area.

2.4 Buildings

Any large, sharp-edged object has an impact on atmospheric flow and air turbulence within the locality of the object. This can result in maximum ground level concentrations that are significantly different (generally higher) from those encountered in the absence of buildings. The building 'zone of influence' is generally regarded as extending a distance of 5L (where L is the lesser of the building height or width) from the foot of the building in the horizontal plane and three times the height of the building in the vertical plane.

The main building specifications, where the generators are situated were provided by Caulmert. The specifications for seven other buildings situated to the west and south of the main generator building were also inputted into the model. Details of the buildings included in the model are provided in Table 2-6.

Table 2-6 - Modelled Buildings

Name	Centre Easting (m)	Centre Northing (m)	Height (m)	Length / Diameter (m)	Width (m)
Main Generator Building	329789	371547	5	76	33
Building 1	329666	371246	19	28	18
Building 2	329665	371212	28	48	28
Building 3	329711	371206	22	64	37
Building 4	329819	371144	5	13	12
Building 5	329612	371298	8	25	15
Building 6	329605	371268	10	37	19
Building 7	329617	371208	8	23	16

2.5 Terrain

The concentrations of an emitted pollutant found in elevated, complex terrain differ from those found in simple level terrain. There have been numerous studies on the effects of topography on atmospheric flows. A summary of the main effects of terrain on atmospheric flow and dispersion of pollutants are summarised below:

- Plume interactions with windward facing terrain features;
    - Plume interactions with terrain features whereby receptors on hills at a similar elevation to the stack experience elevated concentrations.
    - Direct impaction of the plume on hill slopes in stable conditions.
    - Flow over hills in neutral conditions can experience deceleration forces on the upwind slope, reducing the rate of dispersion and increasing concentrations.
- Plume interactions with lee sides of terrain features; and
    - Regions of recirculation behind steep terrain features can rapidly force pollutants towards the ground culminating in elevated concentrations.

  - Releases into the lee of a hill in stable conditions can also be recirculated, resulting in increased ground level concentrations.

- Plume interactions within valleys.
  - Releases within steep valleys experience restricted lateral dispersion due to the valley sidewalls. During stable overnight conditions, inversion layers develop within the valley essentially trapping all emitted pollutants. Following sunrise and the erosion of the inversion, elevated ground level concentrations can result during fumigation events.
  - Convective circulations in complex terrain due to differential heating of the valley side walls can lead to the impingement of plumes due to crossflow onto the valley sidewalls and the subsidence of plume centrelines, both having the impact of increasing ground level concentrations.

These effects are most pronounced when the terrain gradients exceed 1 in 10, i.e., a 100 m change in elevation per 1 km step in the horizontal plane. In the model domain the terrain around the site does not exceed this criterion and terrain has therefore been excluded within the model.

2.6 Modelled Domain and Receptors

2.6.1 Modelled Domain

A 4 km x 4 km Cartesian grid centred on the site was modelled, with an approximate receptor resolution of 10 m, to assess the impact of atmospheric emissions from the site on local air quality. This grid resolution has been selected to ensure that all local receptors are within the gridded area and the resolution is such that the maximum impact will be identified.

2.6.2 Human Receptors

The receptors considered were chosen based on locations where people may be located and judged in terms of the likely duration of their exposure to pollutants and proximity to the site, following the guidance given in Section 4 of this report. Details of the locations of human receptors are given in Table 2-7 and illustrated Figure 2.7 below. Human receptors have been modelled at a height of 1.5 m, representative of the normal ‘breathing zone’ height.

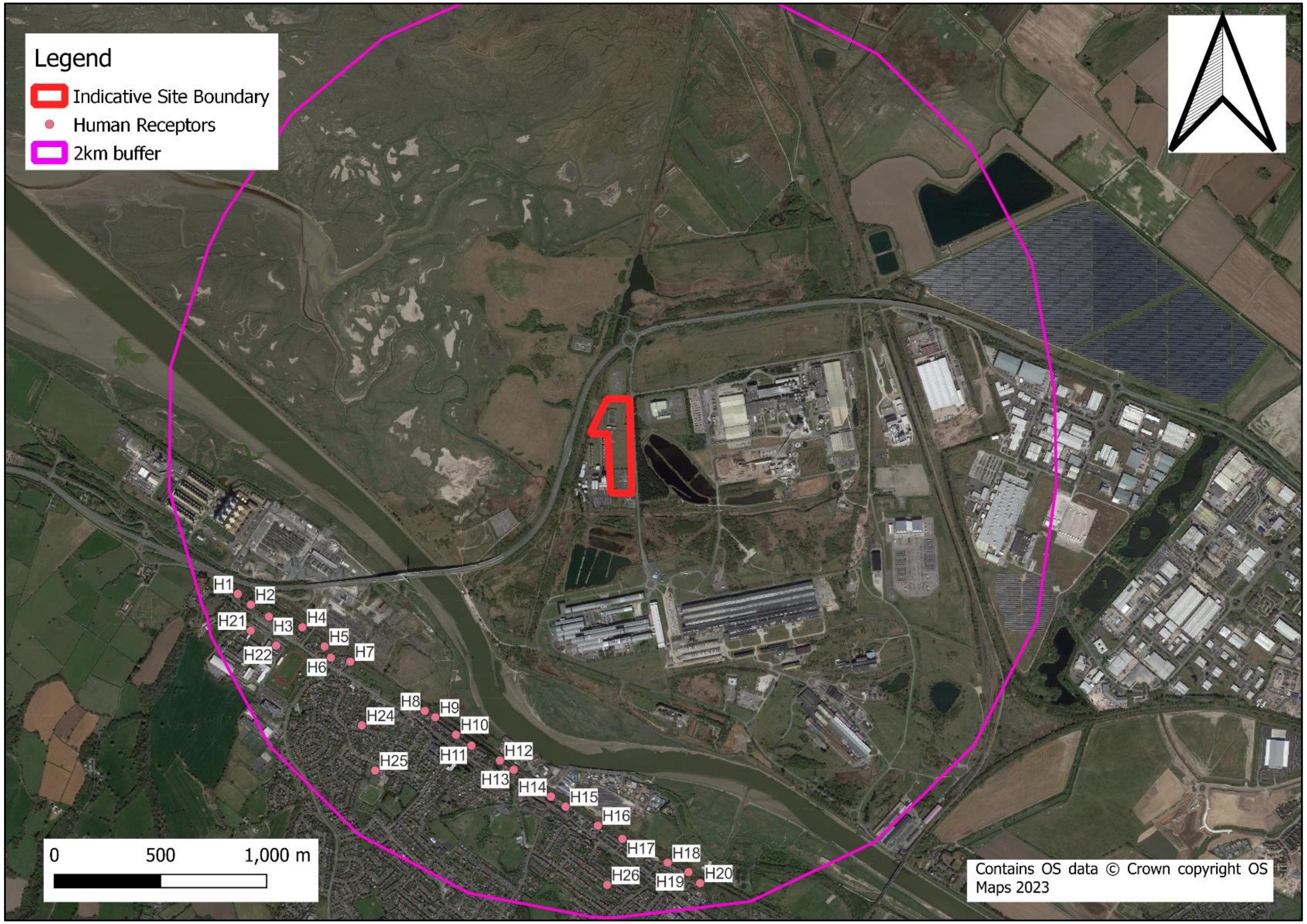
The majority of human receptors are locations where both long-term and short-term pollutant averaging periods will apply (see Table 4-2).

Workplace locations have been excluded in accordance with the guidance from Environmental Protection UK and the Air Quality Standards Regulations 2010. These guidance documents are detailed in Section 4 of this report.

Table 2-7 - Modelled Human Receptors

ID	Receptor Description	Easting (m)	Northing (m)	Height (m)
H1	Residential	327983	370701	1.5
H2	Residential	328045	370650	1.5
H3	Residential	328130	370594	1.5
H4	Residential	328288	370544	1.5
H5	Residential	328392	370453	1.5
H6	Residential	328422	370401	1.5
H7	Residential	328513	370382	1.5
H8	Residential	328864	370150	1.5
H9	Residential	328913	370120	1.5
H10	Residential	329011	370038	1.5
H11	Residential	329084	369986	1.5
H12	Residential	329218	369916	1.5
H13	Residential	329283	369873	1.5
H14	Residential	329459	369746	1.5
H15	Residential	329527	369699	1.5
H16	Residential	329679	369610	1.5
H17	Residential	329795	369547	1.5
H18	Residential	330008	369435	1.5
H19	Residential	330106	369390	1.5
H20	Residential	330161	369338	1.5
H21	Residential	328044	370528	1.5
H22	Residential	328165	370457	1.5
H23	Residential	328568	370081	1.5
H24	Residential	328630	369869	1.5
H25	Residential	329723	369330	1.5
H26	Residential	327983	370701	1.5

Figure 2.7 - Location of Modelled Human Receptors



2.6.3 Ecological Receptors

The Environment Agency's AER Guidance provides the following detail regarding consideration of ecological receptors:

- Check if there are any of the following within 10 km of your site (within 15 km if you operate a large electric power station or refinery):
  - Special Protection Areas (SPAs)
  - Special Areas of Conservation (SACs)
  - Ramsar Sites (protected wetlands)
- Check if there are any of the following within 2 km of your site:
  - Sites of Special Scientific Interest (SSSIs)
  - Local Nature Sites (ancient woods, Local Wildlife Sites (LWS), Sites of Nature Conservation Importance (SNCIs) and national and Local Nature Reserves (LNR)).

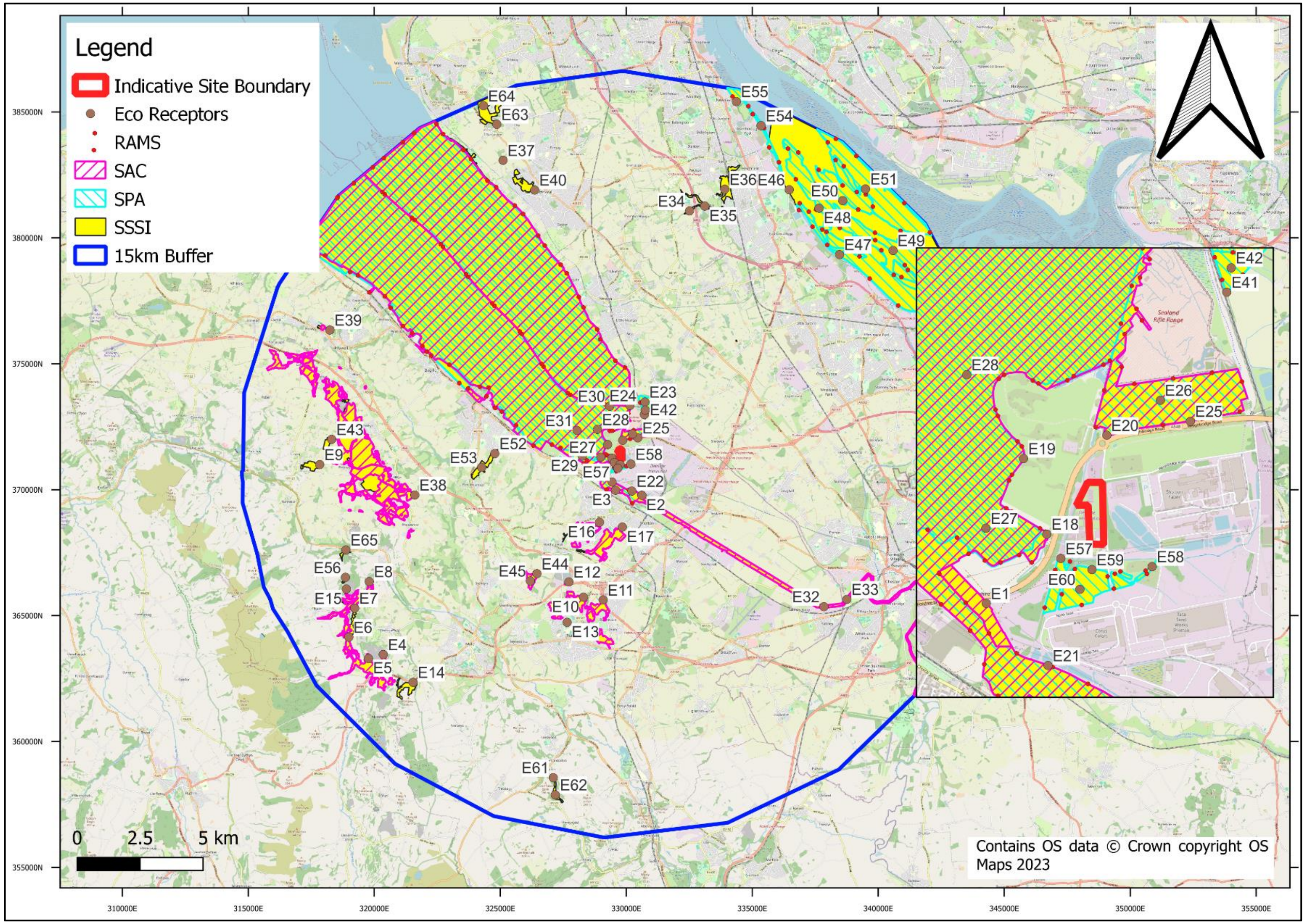
Following the above guidance, Table 2-8 and Figure 2.8 provide details of sixty-five ecological receptor points which have been considered within this assessment.

Table 2-8 - Modelled Ecological Receptors

ID	Receptor Description	Easting (m)	Northing (m)	Height (m)
E1	River Dee SSSI/SAC	328996	370750	0
E2	River Dee SSSI/SAC	330622	369775	0
E3	River Dee SSSI/SAC	329577	369974	0
E4	Alyn Valley SSSI/SAC	320357	363452	0
E5	Alyn Valley SSSI/SAC	319771	363294	0
E6	Alyn Valley SSSI/SAC	318992	364142	0
E7	Alyn Valley SSSI/SAC	319223	365292	0
E8	Alyn Valley SSSI/SAC	319802	366348	0
E9	Parc Bodlondeb SSSI	317835	370994	0
E10	Buckley Claypits SSSI/SAC	328306	365733	0
E11	Buckley Claypits SSSI/SAC	329085	365621	0
E12	Buckley Claypits SSSI/SAC	327724	366335	0
E13	Buckley Claypits SSSI	327655	364728	0
E14	Cambrian Quarry SSSI	321541	362345	0
E15	Cefn Meadow SSSI	318892	366055	0
E16	Connah's Quay SSSI/SAC	328940	368703	0
E17	Connah's Quay SSSI/SAC	329849	368513	0
E18	Dee Estuary SSSI/SPA/SAC/RAMS	329430	371247	0
E19	Dee Estuary SSSI/SPA/SAC	329263	371790	0
E20	Dee Estuary SSSI/SPA/SAC/RAMS	329861	371958	0
E21	Dee Estuary SSSI/SPA/SAC/RAMS	329439	370304	0
E22	Dee Estuary SSSI/SPA/SAC/RAMS	330224	369943	0
E23	Dee Estuary SSSI/SAC/RAMS	330742	373480	0
E24	Dee Estuary SSSI/SPA/SAC/RAMS	330148	373343	0
E25	Dee Estuary SSSI/SPA/SAC/RAMS	330461	372058	0
E26	Dee Estuary SSSI/SPA/SAC/RAMS	330246	372209	0
E27	Dee Estuary SSSI/SPA/SAC/RAMS	328993	371290	0

E28	Dee Estuary SSSI/SPA/SAC/RAMS	328856	372392	0
E29	Dee Estuary SSSI/SPA/SAC/RAMS	328265	371334	0
E30	Dee Estuary SSSI/SPA/SAC/RAMS	329346	373312	0
E31	Dee Estuary SSSI/SPA/SAC/RAMS	328044	372351	0
E32	Dee Estuary SSSI/SPA	337849	365350	0
E33	Dee Estuary SSSI/SPA	338760	365643	0
E34	Dibbinsdale SSSI	332516	381069	0
E35	Dibbinsdale SSSI	333121	381262	0
E36	Dibbinsdale SSSI	333912	381933	0
E37	The Dungeon SSSI	325111	383079	0
E38	Halkyn Mountains SSSI/SAC	321612	369788	0
E39	Halkyn Mountains SSSI/SAC	318242	376338	0
E40	Heswall Dales SSSI	326366	381899	0
E41	Inner Marsh SSSI/SPA/RAMS	330722	372985	0
E42	Inner Marsh SSSI/SPA/RAMS	330754	373160	0
E43	Parc Linden SSSI	318309	371997	0
E44	Maes SSSI/SAC	326455	366663	0
E45	Maes SSSI/SAC	326196	366373	0
E46	Mersey Estuary SSSI	336473	381910	0
E47	Mersey Estuary SSSI/SPA/RAMS	338470	379334	0
E48	Mersey Estuary SSSI/SPA/RAMS	337653	381177	0
E49	Mersey Estuary SSSI/SPA/RAMS	340591	379496	0
E50	Mersey Estuary SSSI/SPA/RAMS	338594	381478	0
E51	Mersey Estuary SSSI/SPA/RAMS	339496	381941	0
E52	Flint Mountain SSSI	324783	371432	0
E53	Flint Mountain SSSI	324262	370884	0
E54	Mersey Estuary SSSI/SPA/RAMS	335350	384456	0
E55	New Ferry SSSI/SPA/RAMS	334374	385412	0
E56	New Ferry SSSI/SPA/RAMS	318855	366516	0
E57	Shotton RAMS/SSSI/SPA	329531	371073	0
E58	Shotton RAMS/SSSI/SPA	330186	371014	0
E59	Shotton RAMS/SSSI/SPA	329755	370993	0
E60	Shotton RAMS/SSSI/SPA	329668	370851	0
E61	Talon Marsh SSSI	327106	358562	0
E62	Talon Marsh SSSI	327184	357881	0
E63	Thurstaston SSSI	324864	384510	0
E64	Thurstaston SSSI	324339	385246	0
E65	Tyddyn SSSI	318874	367606	0

Figure 2.8 - Location of Assessed Ecological Receptors



2.7 Deposition

The predominant route by which emissions to air will affect land in the vicinity of a process is by deposition of atmospheric emissions. Potential ecological receptors can be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

Deposition processes in the form of dry and wet deposition remove material from a plume and alter the plume concentration. Dry deposition occurs when particles are brought to the surface by gravitational settling and turbulence. They are then removed from the atmosphere by deposition on the land surface. Wet deposition occurs due to rainout (within cloud) scavenging and washout (below cloud) scavenging of the material in the plume. These processes lead to a variation with downwind distance of the plume strength and may alter the shape of the vertical concentration profile as dry deposition only occurs at the surface.

Near to sources of pollutants (< 2 km), dry deposition is the predominant removal mechanism (Fangmeier et al. 1994). Dry deposition may be quantified from the near-surface plume concentration and the deposition velocity (Chamberlin and Chadwick, 1953);

$$F_d = v_d C(x, y, 0)$$

where:

F_d = dry deposition flux (µg m^{-2} s^{-1})

v_d = deposition velocity (m s^{-1})

$C(x, y, 0)$ = ground level concentration (µg/m^3)

Assuming irreversible uptake, the total wet deposition rate is found by integrating through a vertical column of air;

$$F_w = \int_0^z \Lambda C \; dz$$

where;

F_w = wet deposition flux (µg m^{-2} s^{-1})

Λ = washout co-efficient (s^{-1})

C = local airborne concentration (µg/m^3)

z = height (m)

The washout co-efficient is an intrinsic function of the rate of rainfall.

Environment Agency guidance AQTAG06 (Environment Agency, 2014) recommends deposition velocities for various pollutants, according to land use classification (Table 2-9).

Table 2-9 - Recommended Deposition Velocities

Pollutant	Deposition Velocity (m s^{-1})	
	Short Vegetation	Long Vegetation/Forest
NO_x	0.0015	0.003
SO_2	0.012	0.024
Source: Environment Agency (2014) 'Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air', AQTAG06 Updated Version (March 2014)'		

In order to assess the impacts of deposition, habitat-specific critical loads and critical levels have been created. These are generally defined as (e.g. Nilsson and Grennfelt, 1988):

> *"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"*

It is important to distinguish between a critical load and a critical level. The critical load relates to the quantity of a material deposited from air to the ground, whilst critical levels refer to the concentration of a material in air. The UK Air Pollution Information System (APIS) provides critical load data for ecological sites in the UK.

The critical loads used to assess the impact of compounds deposited to land which result in eutrophication and acidification are expressed in terms of kilograms of nitrogen deposited per hectare per year (kg N ha^{-1} y^{-1}) and kilo equivalents deposited per hectare per year (keq ha^{-1} y^{-1}). To enable a direct comparison against the critical loads, the modelled total wet and dry deposition flux (µg m^{-2} s^{-1}) must be converted into an equivalent value.

For a continuous release, the annual deposition flux of nitrogen can be expressed as:

$$F_{NTot} = \left(\frac{K_2}{K_3}\right) \cdot t \cdot \sum_{i=1}^{T} F_i \left(\frac{M_N}{M_i}\right)$$

where:

F_{NYot} = Annual deposition flux of nitrogen (kg N ha^{-1} y^{-1})

K_2 = Conversion factor for m^2 to ha (= 1x104 m^2 ha^{-1})

K_3 = Conversion factor for µg to kg (= 1x109 µg kg^{-1})

t = Number of seconds in a year (= 3.1536x107 s y^{-1})

i = 1,2,3…….T

T = Total number of nitrogen containing compounds

F = Modelled deposition flux of nitrogen containing compound (µg m^{-2} s^{-1})

M_N = Molecular mass of nitrogen (kg)

M = Molecular mass of nitrogen containing compound (kg)

The unit eq (1 keq ≡ 1,000 eq) refers to molar equivalent of potential acidity resulting from e.g. sulphur, oxidised and reduced nitrogen, as well as base cations. Conversion units are provided in AQTAG(06):

- 1 keq ha^{-1} y^{-1} = 14 kg N ha^{-1} y^{-1}
- 1 keq ha^{-1} y^{-1} = 32 kg S ha^{-1} y^{-1}

Wet deposition has not been assessed since this is not a significant contributor to total deposition over shorter ranges (Fangmeier et al., 1994; Environment Agency, 2006).

2.8 Other Treatments

Specialised model treatments, for short-term (puff) releases, coastal models, fluctuations or photochemistry were not used in this assessment.

2.9 Conversion of NO to NO_2

Emissions of NO_x from combustion processes are predominantly in the form of nitric oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. NO_x chemistry in the lower troposphere is strongly interlinked in a complex chain of reactions involving Volatile Organic Compounds (VOCs) and Ozone (O_3). Two of the key reactions interlinking NO and NO_2 are detailed below:

$$NO_2 + hv \xrightarrow{O_2} NO + O_3 \qquad (R_1)$$

$$NO + O_3 \longrightarrow NO_2 + O_2 \qquad (R_2)$$

Where *hv* is used to represent a photon of light energy (i.e., sunlight).

Taken together, reactions R_1 and R_2 produce no net change in O_3 concentrations, and NO and NO_2 adjust to establish a near steady state reaction (photo-equilibrium). However, the presence of VOCs and CO in the atmosphere offer an alternative production route of NO_2 for photolysis, allowing O_3 concentrations to increase during the day with a subsequent decrease in the NO_2:NO_x ratio.

However, at night, the photolysis of NO_2 ceases, allowing reaction R_2 to promote the production of NO_2, at the expense of O_3, with a corresponding increase in the NO_2:NO_x ratio. Similarly, near to an emission source of NO, the result is a net increase in the rate of reaction R_2, suppressing O_3 concentrations immediately downwind of the source, and increasing further downwind as the concentrations of NO begin to stabilise to typical background levels (Gillani and Pliem, 1996).

Given the complex nature of NO_x chemistry, the Environment Agency's Air Quality Modelling and Assessment Unit (AQMAU) have adopted a pragmatic, risk-based approach in determining the conversion rate of NO to NO_2 which dispersion model practitioners can use in their detailed assessments[1]. The AQMAU guidance advises that the source term should be modelled as NO_x (as NO_2) and then suggests a tiered approach when considering ambient NO_2:NO_x ratios:

- **Screening Scenario:** 50% and 100% of the modelled NO_x process contributions should be used for short-term and long-term average concentration, respectively. That is, 50% of the predicted NO_x concentrations should be assumed to be NO_2 for short-term assessments and 100% of the predicted NO_x concentrations should be assumed to be NO_2 for long-term assessments;

[1] http://www.environment-agency.gov.uk/static/documents/Conversion_ratios_for__NOx_and_NO2_.pdf

- **Worst Case Scenario:** 35% and 70% of the modelled NO_x process contributions should be used for short-term and long-term average concentration, respectively. That is, 35 % of the predicted NO_x concentrations should be assumed to be NO_2 for short-term assessments and 70% of the predicted NO_x concentrations should be assumed to be NO_2 for long-term assessments; and

- **Case Specific Scenario:** Operators are asked to justify their use of percentages lower than 35% for short-term and 70% for long-term assessments in their application reports.

In line with the AQMAU guidance, this assessment has therefore used a NO_x to NO_2 ratio of 70% for long term average concentrations, 35% for short term concentrations.

3 Existing Ambient Data

3.1 Local Air Quality Management

Flintshire County Council ("the Council") under its Local Air Quality Management (LAQM) obligations, continually reviews and assesses concentrations of key air pollutants in the borough to ascertain the requirement, or otherwise, to declare an AQMA.

Due to the historical trend of pollution levels, the Council has declared no AQMA within its jurisdiction.

The most recent publicly available monitoring data has been collated from the Council's Air Quality 2023 Annual Status Report[2], which contains monitoring data for 2022.

3.1.1 Monitoring Data

The Council did not undertake automatic (continuous) monitoring. Flintshire County Council undertook non-automatic (passive) monitoring at 59 locations in 2023. Two of the passive monitoring locations are within 2 km of the Deeside Power Station site. Table 3-1 contains the annual mean NO_2 concentration results for the diffusion tubes sites within 2 km of the site, for the years 2019 to 2023.

Table 3-1 - NO_2 Diffusion Tube Monitoring Results

Site Name	X	Y	Site Type	Annual Mean Concentration (µg/m^3)				
				2019	2020	2021	2022	2023
ADDC-033	329906	370882	Industrial	16.6	12.9	14.0	10.6	10.1
ADDC-036	330575	371802	Kerbside	18.3	20.1	18.5	11.6	12.5
N.B. Data taken from North Wales Authorities Collaborative Project Annual Progress Report 2024.								

Current monitoring results show that recent and current concentrations of NO_2 in the area local to the Deeside Power Station site are comfortably compliant with the annual mean NO_2 Air Quality Strategy objective.

3.2 Defra Mapped Background Concentrations

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1 km grid square resolution. The datasets include annual average concentration estimates for NO_x, NO_2, PM_{10}, $PM_{2.5}$, CO and SO_2 and benzene. The model used is empirical in nature: it uses the National Atmospheric Emissions Inventory (NAEI) emissions to model the concentrations of pollutants at the centroid of each 1 km grid square but then calibrates these concentrations in relation to actual monitoring data.

3.2.1 Background Concentrations used in the Assessment

Annual mean background concentrations at the assessed human and ecological receptor locations have been derived from the Defra background maps for the 1 km grid square in which they are located.

The annual average process contribution is added to the annual average background concentration to give a total concentration at each receptor location. This total concentration can then be compared against the relevant Air Quality Standard/Objective (AQS/O) and the likelihood of an exceedance determined.

[2] North Wales Authorities Collaborative Project , 2023 Air Quality Annual Progress Report (APR)

It is not technically rigorous to add predicted short-term or percentile concentrations to ambient background concentrations not measured over the same averaging period, since peak contributions from different sources would not necessarily coincide in time or location. Without hourly ambient background monitoring data available it is difficult to make an assessment against the achievement or otherwise of the short-term AQS/O. For the current assessment, conservative short-term ambient levels have been derived by applying a factor of two to the annual mean background data as per the recommendation in Environment Agency guidance. Those background annual mean concentrations used in the assessment are detailed in Table 3-2.

Table 3-2 - Background Annual Mean Concentrations used in the Assessment

Receptor	2023 Annual Mean Pollutant Concentrations (µg/m^3)		
	NO_x [a]	NO_2 [a]	CO [b]
E1	10.6	-	522.0
E2	10.4	-	576.0
E3	11.2	-	552.0
E4	5.4	-	418.0
E5	5.2	-	406.0
E6	5.0	-	406.0
E7	5.4	-	414.0
E8	5.5	-	416.0
E9	5.4	-	398.0
E10	10.2	-	558.0
E11	11.3	-	572.0
E12	11.1	-	540.1
E13	10.5	-	526.0
E14	6.0	-	436.0
E15	5.3	-	412.0
E16	9.5	-	552.0
E17	9.7	-	574.0
E18	13.1	-	518.0
E19	13.1	-	518.0
E20	13.1	-	518.0
E21	14.8	-	540.1
E22	10.4	-	576.0
E23	9.1	-	534.0
E24	9.1	-	534.0
E25	10.2	-	530.1
E26	10.2	-	530.1
E27	8.5	-	530.1
E28	7.7	-	530.1
E29	8.5	-	518.0
E30	8.4	-	518.0
E31	7.7	-	518.0
E32	11.1	-	602.0
E33	10.9	-	654.0
E34	12.6	-	700.1
E35	10.9	-	740.1

E36	10.9	-	740.1
E37	7.9	-	560.1
E38	6.6	-	444.0
E39	7.4	-	456.0
E40	8.9	-	564.0
E41	10.2	-	530.1
E42	9.1	-	534.0
E43	5.7	-	434.0
E44	8.0	-	520.1
E45	8.0	-	520.1
E46	17.7	-	730.1
E47	14.8	-	730.1
E48	14.4	-	730.1
E49	14.4	-	730.1
E50	14.4	-	730.1
E51	14.4	-	730.1
E52	7.7	-	500.1
E53	7.6	-	500.1
E54	15.0	-	730.1
E55	14.1	-	730.1
E56	5.3	-	412.0
E57	13.1	-	518.0
E58	12.5	-	536.0
E59	14.8	-	540.1
E60	14.8	-	540.1
E61	6.0	-	450.1
E62	5.8	-	444.0
E63	7.5	-	524.0
E64	7.4	-	534.0
E65	6.6	-	412.0
H1	8.4	6.6	512.0
H2	10.6	8.2	522.0
H3	10.6	8.2	522.0
H4	10.6	8.2	522.0
H5	10.6	8.2	522.0
H6	10.6	8.2	522.0
H7	10.6	8.2	522.0
H8	10.6	8.2	522.0
H9	10.6	8.2	522.0
H10	14.8	11.1	540.1
H11	11.2	8.7	552.0
H12	11.2	8.7	552.0
H13	11.2	8.7	552.0
H14	11.2	8.7	552.0
H15	11.2	8.7	552.0
H16	11.2	8.7	552.0

H17	11.2	8.7	552.0
H18	10.4	8.0	576.0
H19	10.4	8.0	576.0
H20	10.4	8.0	576.0
H21	10.6	8.2	522.0
H22	10.6	8.2	522.0
H24	10.6	8.2	522.0
H25	9.9	7.7	534.0
H26	11.2	8.7	552.0

[a] 2018 reference year annual mean background concentration of NO and, NO_x, taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares). Due to ecological receptors not being assessed for annual and hourly NO_2 , the background concentration has not been included.

[b] Background concentration of CO taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares) 2001 background maps.

3.3 Background Deposition Rates

Estimated background deposition rates of nutrient nitrogen and total acid deposition for the UK are available via the Air Pollution Information Service (APIS) website (http://www.apis.ac.uk). Table 3-3 provides estimated deposition rates for the ecological receptors considered in this study, as obtained from the APIS website. It should be noted that the level of uncertainty associated with these modelled estimates is relatively high and the results are presented from the model across the UK on a 5 km grid square resolution.

Table 3-3 - Estimated Background Deposition Rates

ID	Background Nitrogen Deposition (kg N ha^{-1} y^{-1})	Background Nitric Acid Deposition (keq ha^{-1} y^{-1})	Background Sulphuric Acid Deposition (keq ha^{-1} y^{-1})
E1	0.33	0.33	0.33
E2	0.33	0.33	0.33
E3	0.33	0.33	0.33
E4	0.17	0.17	0.17
E5	0.17	0.17	0.17
E6	0.17	0.17	0.17
E7	0.17	0.17	0.17
E8	0.17	0.17	0.17
E9	0.16	0.16	0.16
E10	0.19	0.19	0.19
E11	0.19	0.19	0.19
E12	0.19	0.19	0.19
E13	0.19	0.19	0.19
E14	0.21	0.21	0.21
E15	0.17	0.17	0.17
E16	0.2	0.2	0.2
E17	0.2	0.2	0.2
E18	0.33	0.33	0.33
E19	0.33	0.33	0.33
E20	0.33	0.33	0.33
E21	0.33	0.33	0.33
E22	0.33	0.33	0.33
E23	0.33	0.33	0.33
E24	0.33	0.33	0.33
E25	0.33	0.33	0.33
E26	0.33	0.33	0.33
E27	0.33	0.33	0.33
E28	0.33	0.33	0.33
E29	0.33	0.33	0.33
E30	0.33	0.33	0.33
E31	0.33	0.33	0.33
E32	0.19	0.19	0.19
E33	0.19	0.19	0.19
E34	0.23	0.23	0.23
E35	0.23	0.23	0.23
E36	0.23	0.23	0.23
E37	0.17	0.17	0.17
E38	0.16	0.16	0.16
E39	0.16	0.16	0.16
E40	0.17	0.17	0.17
E41	0.24	0.24	0.24
E42	0.24	0.24	0.24
E43	0.17	0.17	0.17
E44	0.19	0.19	0.19
E45	0.19	0.19	0.19
E46	0.24	0.24	0.24
E47	0.24	0.24	0.24
E48	0.24	0.24	0.24
E49	0.24	0.24	0.24
E50	0.24	0.24	0.24
E51	0.24	0.24	0.24
E52	0.22	0.22	0.22
E53	0.22	0.22	0.22
E54	0.25	0.25	0.25
E55	0.25	0.25	0.25
E56	0.17	0.17	0.17
E57	0.2	0.2	0.2
E58	0.2	0.2	0.2
E59	0.2	0.2	0.2

ID	Background Nitrogen Deposition (kg N ha^{-1} y^{-1})	Background Nitric Acid Deposition (keq ha^{-1} y^{-1})	Background Sulphuric Acid Deposition (keq ha^{-1} y^{-1})
E60	0.2	0.2	0.2
E61	0.22	0.22	0.22
E62	0.22	0.22	0.22
E63	0.17	0.17	0.17
E64	0.17	0.17	0.17
E65	0.16	0.16	0.16
Source: Air Pollution Information Service (APIS) website (http://www.apis.ac.uk)			

3.4 Sensitivity Analysis and Uncertainty

Wherever possible, this assessment has used worst-case scenarios, which will exaggerate the impact of the emissions on the surrounding area, including emissions, operational profile, ambient concentrations, meteorology and surface roughness. This assessment has considered the years predicting the highest ground-level concentrations at the nearest sensitive receptor for comparison with the AQS objectives.

Sensitivity analysis has been undertaken for a number of model input parameters to investigate the results of the model with respect to changes in buildings and surface roughness.

3.4.1 Buildings

A sensitivity analysis has been undertaken to investigate the impact of modelling with and without buildings on the modelled results. Results have been normalised by the value obtained from the parameter resulting in the highest ground level process contribution at any modelled receptor location and are presented in Table 3-4.

Table 3-4 - Building Inclusion Sensitivity Analysis

Buildings	Normalised Maximum Ground Level Concentration	
	NO_x Annual Mean	NO_x 99.79 Percentile of 1-Hour Mean
With Buildings	1.00	1.00
Without Buildings	0.99	0.99

From the above predicted ground level concentration ratios, inclusion of buildings result in worst case concentrations for the 1-hour mean NO_x and for the annual mean NO_x averaging periods. Thus, the model has included building in the assessment.

3.4.2 Surface Roughness

A sensitivity analysis has been undertaken to investigate the impact of modelling with different surface roughness lengths. Results have been normalised by the value obtained from the parameter resulting in the highest ground level process contribution at any modelled receptor location and are presented below.

Table 3-5 – Surface Roughness Sensitivity Analysis

Surface Roughness Length	Normalised Maximum Ground Level Concentration	
	NO_x Annual Mean	NO_x 99.79 Percentile of 1-Hour Mean
0.3 m	1.00	1.00
0.5 m	0.97	0.98
1 m	0.91	0.78

1.5 m	0.83	0.61

From the above predicted ground level concentration ratios, it can be seen that a surface roughness length of 0.3 m results in the highest results for both long-term and short-term averaging periods. A surface roughness length of 0.3 m has been used in the assessment to provide a conservative approach.

3.4.3 Meteorological Year Sensitivity Testing

Results in this assessment are presented for the meteorological year resulting in the highest concentrations at any receptor location, as a worst-case assumption. The worst-case meteorological year was determined separately for long and short-term concentrations at the worst-case receptor location for each pollutant, thus the worst-case data has been reported within Section 5.

For information, a table showing the inter-year variability of meteorological conditions at the worst-case human receptor is provided below. The results have been normalised against the maximum value. At the worst-case receptor, it demonstrates that 2021 provides the worst-case conditions for long-term and short-term means. However, this can vary by receptor, hence the consideration of the worst-case meteorological year by individual receptor, as described above.

Table 3-6 - Inter-year Variability in Concentration (Normalised)

Annual Mean NOx					1-hour Mean NOx				
2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
0.50	0.69	1.00	0.48	0.62	0.85	0.85	1.00	0.69	0.74

3.4.4 Model Uncertainty

Dispersion modelling is inherently uncertain but is nonetheless a useful tool in plume footprint visualisation and prediction of ground level concentrations. The use of dispersion models has been widely used in the UK for both regulatory and compliance purposes for a number of years and is an accepted approach for this type of assessment.

In addition to all available input data. this assessment has incorporated a number of worst-case assumptions, as described above, which may result in an overestimation of the predicted ground level concentrations from the process. Therefore, the actual predicted ground level concentrations would be expected to be lower than this and, in some cases, significantly lower.

4 RELEVANT LEGISLATION AND GUIDANCE

4.1 UK Legislation

4.1.1 The Air Quality Standards Regulations 2010

The Air Quality Standards Regulations 2010 (the 'Regulations') came into force on the 11th June 2010 and transpose EU Directive 2008/50/EC into UK legislation. The Directive's limit values are transposed into the Regulations as 'Air Quality Standards' (AQS) with attainment dates in line with the Directive.

These standards are legally binding concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects of sensitive groups or on ecosystems.

Similar to Directive 2008/50/EC, the Regulations define ambient air as;

> *"…outdoor air in the troposphere, excluding workplaces where members of the public do not have regular access."*

With direction provided in Schedule 1, Part 1, Paragraph 2 as to where compliance with the AQS' does not need to be assessed:

> *"Compliance with the limit values directed at the protection of human health does not need to be assessed at the following locations:*
>
> *a) any location situated within areas where members of the public do not have access and there is no fixed habitation;*
>
> *b) on factory premises or at industrial locations to which all relevant provisions concerning health and safety at work apply;*
>
> *c) on the carriageway of roads and on the central reservation of roads except where there is normally pedestrian access to the central reservation."*

4.1.2 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The 2023 Air Quality Strategy for England provides a framework for improving air quality at a national and local level and supersedes the previous strategy published in 2007 for England.

Central to the Air Quality Strategy are health-based criteria for certain air pollutants; these criteria are based on medical and scientific reports on how and at what concentration each pollutant affects human health. The objectives derived from these criteria are policy targets often expressed as a maximum ambient concentration not to be exceeded, without exception or with a permitted number of exceedances, within a specified timescale.

The AQOs, based on a selection of the objectives in the Air Quality Strategy, were incorporated into UK legislation through the Air Quality Regulations 2000, as amended.

Paragraph 4(2) of The Air Quality (England) Regulations 2000 states:

> *"The achievement or likely achievement of an air quality objective prescribed by paragraph (1) shall be determined by reference to the quality of air at locations –*

a) which are situated outside of buildings or other natural or man-made structures above or below ground; and

b) where members of the public are regularly present

Consequently, compliance with the AQOs should focus on areas where members of the general public are present over the entire duration of the concentration averaging period specific to the relevant objective.

4.1.3 Environment Act 2021

The Environment Act 2021 came into force on 9th November 2021, with Part 4 of the Act (and associated Schedules 11 and 12) reserved for matters pertaining to air quality.

The Environment Act 2021 includes amendments to Environment Act 1995 (further detail in Section 4.2) the Clean Air Act 1993 to give Local Authorities more power. It also requires the Secretary of State to set at least one long-term target in relation to air quality and, in addition, a short-term legally binding target to reduce $PM_{2.5}$.

4.2 Local Air Quality Management

Part IV of the Environment Act 1995 requires that Local Authorities periodically review air quality within their individual areas. As previously discussed, this Act has now been amended and supplemented by the Environment Act 2021 Schedule 11. Defra have said: “Responsibility for tackling local air pollution will now be shared with designated relevant public authorities, all tiers of local government and neighbouring authorities.”

This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government’s AQOs.

To carry out an air quality Review and Assessment under the LAQM process, the Government recommends a three-stage approach. This phased review process uses initial simple screening methods and progresses through to more detailed assessment methods of modelling and monitoring in areas identified to be at potential risk of exceeding the objectives in the Regulations.

Review and assessments of local air quality aim to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government’s AQOs by the required dates.

For the purposes of determining the focus of Review and Assessment, Local Authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

Where the assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an AQMA. The declaration of an AQMA requires the Local Authority to implement an Air Quality Action Plan (AQAP), to reduce air pollution concentrations so that the required AQOs are met.

Flintshire County Council proactively considers the impact of air quality on the area through policies and decisions[3]. The Council works alongside the Public services Board, to help encourage a multi-agency approach to addressing air quality, whilst noting the contents of the North Wales Combined Authority Air Quality Report.

[3] Flintshire County Council, Air Quality in Flintshire (2018)

In the Flintshire Local Development Plan (2015-2030), Policy STR1 highlights the need to minimise pollution to land, water and air when proposing new developments and Policy STR7 examines the need to safeguard the natural environment[4].

4.3 Other Guideline Values

In the absence of statutory standards for the other prescribed substances that may be found in the emissions, there are several sources of applicable air quality guidelines.

4.3.1 Air Quality Guidelines for Europe, the World Health Organisation (WHO)

The updated WHO Global Air Quality Guidelines (WHO, 2021) provides a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. These guidelines are intended to provide guidance and information to international, national and local authorities making risk management decisions, particularly in setting air quality standards.

4.3.2 Environmental Assessment Levels (EALs)

The Environment Agency's AER Guidance provides methods for quantifying the environmental impacts of emissions to all media. The AER guidance contains long and short-term Environmental Assessment Levels (EALs) and Environmental Quality Standards (EQS) for releases to air derived from a number of published UK and international sources. For the pollutants considered in this study, these EALs and EQS are equivalent to the AQS and AQOs set in force by the Air Quality Strategy for England, Scotland Wales and Northern Ireland.

4.4 Air Quality Impacts of the Process

The atmospheric emissions of a number of pollutants have been identified as requiring detailed dispersion modelling. The emitted pollutants of primary concern to the local environment are:

- Oxides of nitrogen (NO_x as NO_2); and
- Carbon monoxide (CO).

A brief description of each pollutant is given in Table 4.1.

[4] North Wales Combined Authority, Annual Progress Report (2017)

Table 4-1 - Summary of the Pollutants Assessed

Pollutant	Description and effect on human health and the environment	Principal Sources
Oxides of Nitrogen (NO_X) A, B, C	Nitrogen dioxide (NO_2) and Nitric oxide (NO) are both collectively referred to as oxides of Nitrogen (NO_X). It is NO_2 that is associated with adverse effects on human health. Most atmospheric emissions are in the form of NO which is converted to NO_2 in the atmosphere through reactions with Ozone. The oxidising properties of NO_2 theoretically could damage lung tissue, and exposure to very high concentrations of NO_2 can lead to inflammation of lung tissue, affect the ability to fight infection. The greatest impact of NO_2 is on individuals with asthma or other respiratory conditions, but consistent impacts on these individuals is at levels of greater than 564 µg/m^3, much higher than typical UK ambient concentrations.	All combustion processes produce NO_X emissions, and the principal source of NO_X is road transport, which accounted for 32% of total UK emissions in 2008. Emissions from power stations contributed a further 20%.
Carbon Monoxide (CO) B, C	The toxicity of CO results in it binding avidly to haemoglobin and thus reducing the oxygencarrying capacity of the blood. In very high doses, the restriction of oxygen to the brain and heart can be fatal. At lower concentrations, CO can affect higher cerebral function, heart function and exercise capacity.	The principal source of CO is emissions from petrol vehicles, accounting for 54% of total UK emissions in 2008.

A Defra, 2022, Part IV of the Environment Act 1995 Local Air Quality Management: Technical Guidance LAQM.TG(22).

B Harrison, R.M., *Air Pollution: Sources, Concentrations and Measurements*. In: Harrison, R.M., 2000, *Pollution: Causes, Effects and Controls*, 4th Edition Royal Society of Chemistry.

C Walters, S. and Ayers, J., *The Health Effects of Air Pollution*. In: Harrison, R.M., 2000, *Pollution: Causes, Effects and Controls*, 4th Edition Royal Society of Chemistry.

4.5 Criteria Appropriate to the Assessment

Table 4-2 sets out those AQS, AQOs and EALs that are relevant to the assessment with regard to human receptors.

Table 4-2 - Air Quality Standards, Objectives and Environmental Assessment Levels

Pollutant	AQS/AQO/ EAL	Averaging Period	Value (µg/m^3)
Nitrogen dioxide (NO_2)	AQS	Annual mean	40
	AQS	1-hour mean, not more than 18 Exceedances a year (equivalent of 99.79 Percentile)	200
Carbon monoxide (CO)	AQS	8-hour mean	10,000
	EAL	1-hour mean	30,000

4.6 Critical Levels and Critical Loads Relevant to the Assessment of Ecological Receptors

A summary of the relevant AQS and EAL that apply to the emissions from the plant and their impact on ecological receptors are given in Table 4-3.

Table 4-3 - Relevant Air Quality Standards and Environmental Assessment Levels for Ecological Receptors

Pollutant	AQS/EAL	Averaging Period	Value ($\mu g/m^3$)
Oxides of nitrogen (NO_x)	AQS	Annual mean	30
Oxides of nitrogen (NO_x)	Target	Daily mean	75
	WHO Assessment Level	Daily mean	200*
*Where O_3 and SO_2 are not present above their respective critical levels.			

The Air Pollution Information System (APIS) website[5] provides specific information on the potential effects of nitrogen deposition on various habitats and species. This information, relevant to habitats of some of the ecological receptors considered in this assessment, is presented in Table 4-4.

Table 4-4 - Typical Habitat and Species Information Concerning Nitrogen Deposition from APIS

Habitat and Species Specific Information	Critical Load (kg N ha^{-1} yr^{-1})	Specific Information Concerning Nitrogen Deposition
Saltmarsh	30-40	Many saltmarshes receive large nutrient loadings from river and tidal inputs. It is unknown whether other types of species-rich saltmarsh would be sensitive to nitrogen deposition. Increase in late-successional species, increased productivity but only limited information available for this type of habitat.
Littoral Sediments	20 - 30	Increase late successional species, increase productivity increase in dominance of graminoids.
Coastal Stable Dune Grasslands	10-20	Foredunes receive naturally high nitrogen inputs. Key concerns of the deposition of nitrogen in these habitats relate to changes in species composition.
Alkaline Fens and Reed beds	10-35	Nitrogen deposition provides fertilization. Increase in tall graminoids (grasses or Carex species) resulting in loss of rare species and decrease in diversity of subordinate plant species.
Temperate and boreal forests	10-20	Increased nitrogen deposition in mixed forests increases susceptibility to secondary stresses such as drought and frost, can cause reduced crown growth. Also can reduce the diversity of species due to increased growth rates of more robust plants.
Hay Meadow	20-30	The key concerns are related to changes in species composition following enhanced nitrogen deposition. Indigenous species will have evolved under conditions of low nitrogen availability. Enhanced Nitrogen deposition will favour those species that can increase their growth rates and competitive status e.g. rough grasses such as false brome grass (Brachypodium pinnatum) at the expense of overall species diversity. The overall threat from competition will also depend on the availability of propagules
Acid Grasslands	10-25	Nitrogen deposition provides fertilization to acid grasslands, this increase robust grass growth that may limit other species reducing diversity.
Raised bog and blanket bog	5-10	Nitrogen deposition provides fertilization, this increase robust vegetation growth that may limit other species reducing diversity
Oak Woodland	10-15	Increased nitrogen deposition in Oak forests increases susceptibility to secondary stresses such as drought and frost, can cause reduced crown growth

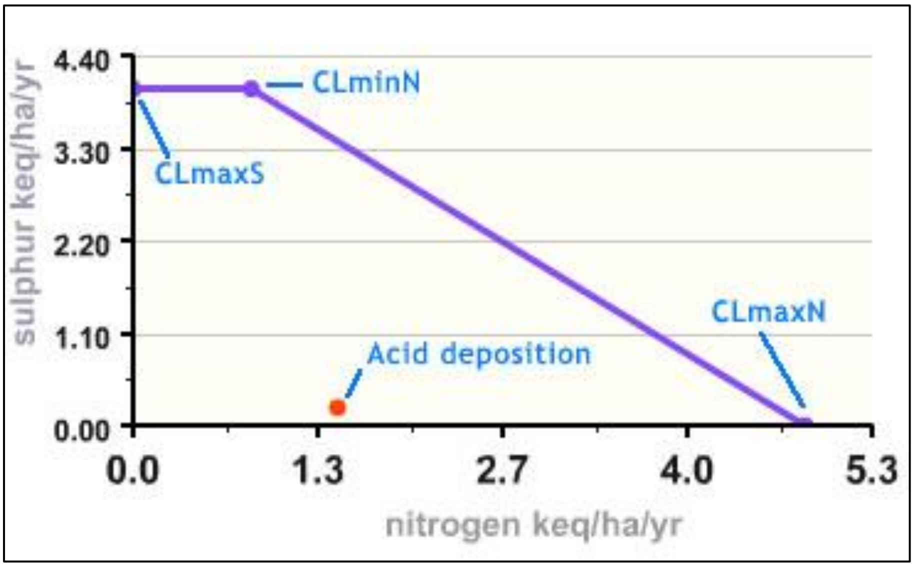
[5] http://www.apis.ac.uk/

Information relating specifically to acid deposition is provided using three critical load parameters:

- $CL_{max}S$: the maximum critical load of sulphur, above which sulphur alone would be considered to cause an exceedance;
- $CL_{min}N$: a measure of the ability of the habitat/ecosystem to 'consume' deposited nitrogen; and
- $CL_{max}N$: the maximum critical load of nitrogen, above which nitrogen alone would be considered to cause an exceedance.

These three parameters define the critical load function, as illustrated in Figure 4.1. The region under the three-node line represents results where critical loads are not exceeded, whereas combinations of deposition above this line would be considered an exceedance.

Figure 4.1 - Critical Load Function (sourced from APIS)



Source: http://www.apis.ac.uk/clf-guidance

5 ASSESSMENT RESULTS

This section sets out the results of the dispersion modelling and compares predicted ground level concentrations to ambient air quality standards. The predicted concentrations resulting from the process are presented with background concentrations and the percentage contribution that the predicted environmental concentrations would make towards the relevant Air Quality Assessment Level (AQAL), i.e., the relevant Air Quality Standard or Objective (AQS/AQO) or Environmental Assessment Level (EAL).

Results are presented for the meteorological year resulting in the highest concentrations at any receptor location, as a worst-case assumption. Results that exceed the relevant AQAL are underlined within the results tables.

5.1 Model Results for Annual Mean Metrics

Results assessed against annual mean metrics for NO_x and NO_2, need to consider total annual running hours, as they can all take place over the corresponding proportion of the year. Results assessed against hourly mean metrics for CO, consider both hourly and 8-hourly running hours.

As such, results for annual mean metrics have been presented separately to short-term metrics, taking account of the cumulative annual operating hours. Summary results are presented in Table 5-1 for the worst-case receptor for each parameter. Full results tables are contained in Appendix B.

5.1.1 Concentrations in Air

The summary results show that annual mean results for NO_2, CO (8-hour rolling) and CO (1-hour) at human receptors and annual mean results for NO_x at ecological receptors are all comfortably below the relevant AQAL.

In terms of human receptors, the maximum long-term results were at receptor H10 (in terms of PEC) for annual mean NO_2. For ecological receptors, the maximum result of annual mean NO_X (in terms of PEC) is predicted to occur at Mersey 1.

Table 5-1 - Maximum Annual Mean Concentrations in Air at Human and Ecological Receptors

Parameter	Annual Mean Results				
	AQAL µg/m³	PC µg/m³	PEC µg/m³	% PC OF AQAL	% PEC OF AQAL
Human Receptors					
Annual mean NO_2 (H10)	40	0.03	11.1	0.1	27.9
Ecological Receptors					
Annual mean NO_x (Mersey 1)	30	0.02	17.75	0.1	59.2
AQAL = Air Quality Assessment Level PC = Process Contribution PEC = Predicted Environmental Concentration (PC + background)					

5.1.2 Deposition

The impact assessment for ecological receptors also includes an assessment of pollutants deposited to land in the form of nitrogen deposition and acid deposition. These are also based on annual mean metrics, as such, these results are presented in full in Table 5-2 for nitrogen deposition and Table 5-3 for acid deposition.

The results for acid deposition are presented in line with the Critical Load Function Tool as contained on the Air Pollution Information System (APIS) website[6]. As described on APIS: "the Critical Load Function is a three-node line on a graph representing the acidity critical load. Combinations of deposition above this line would exceed the critical load, while all areas below or on the line represent an "envelope of protection" where critical loads are not exceeded". Therefore, where 'no exceedance' is stated with regards to acid deposition, it denotes no exceedance of the critical load function.

The results for nitrogen deposition show exceedances at all ecological receptors considered in the assessment. However, this is due to the background deposition rate at all receptors exceeding the minimum critical load (CL). When taking the PC into account, this makes up less than 1% of the overall result at all ecological receptors, except for E58 (Shotton_2) and E20 (Dee_3) where 3.1% and 1.2% PC of minimum critical loads were predicted, respectively. Therefore, it was determined that further assessment was required at these monitoring locations.

Where the PC is less than 1% of the overall result, the contribution from the plant can be considered not significant. In the same manner, all results for acid deposition can be described as not significant.

Table 5-2 - Nitrogen Deposition Rates at Ecological Receptors

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL_{min} (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL_{min}
E1	5	<0.1	0.3	16.8	16.8	336.3
E2	5	<0.1	0.5	17.2	17.2	344.5
E3	5	<0.1	0.2	17.2	17.2	344.2
E4	10	<0.1	<0.1	17.2	17.2	172.0
E5	10	<0.1	<0.1	17.5	17.5	175.0
E6	10	<0.1	<0.1	17.7	17.7	177.0
E7	10	<0.1	<0.1	17.2	17.2	172.0
E8	10	<0.1	<0.1	17.0	17.0	170.0
E9	5	<0.1	<0.1	16.6	16.6	332.0
E10	5	<0.1	<0.1	17.9	17.9	358.0
E11	5	<0.1	<0.1	17.9	17.9	358.0
E12	5	<0.1	<0.1	18.2	18.2	364.0
E13	5	<0.1	<0.1	18.2	18.2	364.0
E14	10	<0.1	<0.1	17.0	17.0	170.0
E15	5	<0.1	<0.1	16.7	16.7	334.0
E16	6	<0.1	<0.1	17.4	17.4	290.0
E17	6	<0.1	0.1	17.6	17.6	293.4
E18	10	<0.1	0.5	16.1	16.1	161.5
E19	10	0.1	0.7	16.4	16.5	164.7
E20	10	0.1	**1.2**	16.6	16.7	167.2
E21	10	<0.1	0.1	16.7	16.7	167.1
E22	10	<0.1	0.2	16.7	16.7	167.2
E23	10	<0.1	0.2	16.2	16.2	162.2%
E24	10	<0.1	0.2	16.2	16.2	162.2

[6] http://www.apis.ac.uk/critical-load-func0tion-tool

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL_{min} (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL_{min}
E25	10	0.1	0.8	16.6	16.7	166.8
E26	10	0.1	0.6	16.6	16.7	166.6
E27	10	<0.1	0.2	16.2	16.2	162.2
E28	10	<0.1	0.4	15.8	15.8	158.4
E29	10	<0.1	0.1	15.8	15.8	158.1
E30	10	0.1	0.5	15.8	15.9	158.5
E31	10	<0.1	0.1	15.9	15.9	159.1
E32	10	<0.1	0.2	21.3	21.3	213.2
E33	10	<0.1	0.2	21.3	21.3	213.2
E34	10	<0.1	<0.1	16.4	16.4	164.0
E35	10	<0.1	<0.1	16.6	16.6	166.0
E36	10	<0.1	<0.1	16.5	16.5	165.0
E37	5	<0.1	0.1	25.9	25.9	518.1
E38	5	<0.1	<0.1	16.6	16.6	332.0
E39	5	<0.1	<0.1	16.6	16.6	332.0
E40	5	<0.1	0.1	26.6	26.6	532.1
E41	5	<0.1	0.5	16.2	16.2	324.5
E42	5	<0.1	0.4	16.2	16.2	324.4
E43	5	<0.1	<0.1	16.6	16.6	332.0
E44	5	<0.1	<0.1	17.5	17.5	350.0
E45	5	<0.1	<0.1	17.5	17.5	350.0
E46	5	<0.1	<0.1	17.1	17.1	342.0
E47	5	<0.1	0.1	17.1	17.1	342.1
E48	5	<0.1	<0.1	17.1	17.1	342.0
E49	5	<0.1	<0.1	17.1	17.1	342.0
E50	5	<0.1	<0.1	17.1	17.1	342.0
E51	5	<0.1	<0.1	17.1	17.1	342.0
E52	5	<0.1	<0.1	16.1	16.1	322.0
E53	5	<0.1	<0.1	16.4	16.4	328.0
E54	10	<0.1	<0.1	16.0	16.0	160.0
E55	10	<0.1	<0.1	15.7	15.7	157.0
E56	10	<0.1	<0.1	16.7	16.7	167.0
E57	5	<0.1	0.6	16.4	16.4	328.6
E58	5	0.2	**3.1**	16.7	16.9	337.1
E59	5	<0.1	0.6	16.8	16.8	336.6
E60	5	<0.1	0.4	16.8	16.8	336.4
E61	5	<0.1	<0.1	17.6	17.6	352.0
E62	5	<0.1	<0.1	17.6	17.6	352.0
E63	5	<0.1	0.1	14.1	14.1	282.1
E64	5	<0.1	0.1	14.10	14.1	282

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL_{min} (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL_{min}
E65	10	<0.1	<0.1	16.40	16.4	164

CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.*

PC = Process contribution

PEDR = Predicted environmental deposition rate (PC + background)

Table 5-3 - Acid Deposition Rates at Ecological Rceptors

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E1	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.7	Not significant
E2	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.7	Not significant
E3	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.7	Not significant
E4	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E5	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E6	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E7	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E8	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E9	<0.1	<0.1	No exceedance	No exceedance	<0.1	35.0	35.0	Not significant
E10	<0.1	<0.1	No exceedance	No exceedance	<0.1	71.1	71.1	Not significant
E11	<0.1	<0.1	No exceedance	No exceedance	<0.1	71.1	71.1	Not significant
E12	<0.1	<0.1	No exceedance	No exceedance	<0.1	71.1	71.1	Not significant
E13	<0.1	<0.1	No exceedance	No exceedance	<0.1	71.1	71.1	Not significant
E14	<0.1	<0.1	0.6	0.6	<0.1	134.0	134.0	Not significant
E15	<0.1	<0.1	No exceedance	No exceedance	<0.1	36.1	36.1	Not significant
E16	<0.1	<0.1	No exceedance	No exceedance	<0.1	90.8	90.8	Not significant
E17	<0.1	<0.1	No exceedance	No exceedance	<0.1	90.8	90.8	Not significant
E18	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E19	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E20	<0.1	<0.1	No exceedance	No exceedance	0.2	32.6	32.8	Not significant
E21	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E22	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E23	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E24	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E25	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E26	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E27	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E28	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.6	Not significant
E29	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E30	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E31	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E32	<0.1	<0.1	No exceedance	No exceedance	<0.1	22.8	22.9	Not significant
E33	<0.1	<0.1	No exceedance	No exceedance	<0.1	22.8	22.9	Not significant
E34	<0.1	<0.1	No exceedance	No exceedance	<0.1	58.0	58.0	Not significant
E35	<0.1	<0.1	No exceedance	No exceedance	<0.1	58.0	58.0	Not significant
E36	<0.1	<0.1	No exceedance	No exceedance	<0.1	58.0	58.0	Not significant
E37	<0.1	<0.1	0.1	0.1	<0.1	106.4	106.5	Not significant
E38	<0.1	<0.1	No exceedance	No exceedance	<0.1	27.8	27.8	Not significant
E39	<0.1	<0.1	No exceedance	No exceedance	<0.1	27.8	27.8	Not significant
E40	<0.1	<0.1	0.1	0.1	<0.1	103.8	103.8	Not significant
E41	<0.1	<0.1	No exceedance	No exceedance	<0.1	30.4	30.4	Not significant
E42	<0.1	<0.1	No exceedance	No exceedance	<0.1	30.4	30.4	Not significant
E43	<0.1	<0.1	No exceedance	No exceedance	<0.1	35.3	35.3	Not significant
E44	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.9	31.9	Not significant
E45	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.9	31.9	Not significant
E46	<0.1	<0.1	No exceedance	No exceedance	<0.1	24.0	24.0	Not significant
E47	<0.1	<0.1	No exceedance	No exceedance	<0.1	24.0	24.1	Not significant
E48	<0.1	<0.1	No exceedance	No exceedance	<0.1	24.0	24.0	Not significant
E49	<0.1	<0.1	No exceedance	No exceedance	<0.1	24.0	24.0	Not significant
E50	<0.1	<0.1	No exceedance	No exceedance	<0.1	24.0	24.0	Not significant
E51	<0.1	<0.1	No exceedance	No exceedance	<0.1	24.0	24.0	Not significant

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E52	<0.1	<0.1	0.3	0.3	<0.1	119.4	119.4	Not significant
E53	<0.1	<0.1	0.3	0.3	<0.1	119.4	119.4	Not significant
E54	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.5	32.5	Not significant
E55	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.5	32.5	Not significant
E56	<0.1	<0.1	No exceedance	No exceedance	<0.1	36.1	36.1	Not significant
E57	<0.1	<0.1	No exceedance	No exceedance	<0.1	5.0	5.0	Not significant
E58	<0.1	<0.1	No exceedance	No exceedance	<0.1	5.0	5.0	Not significant
E59	<0.1	<0.1	No exceedance	No exceedance	<0.1	5.0	5.0	Not significant
E60	<0.1	<0.1	No exceedance	No exceedance	<0.1	5.0	5.0	Not significant
E61	<0.1	<0.1	1.9	1.9	<0.1	397.4	397.4	Not significant
E62	<0.1	<0.1	1.9	1.9	<0.1	397.4	397.4	Not significant
E63	<0.1	<0.1	No exceedance	No exceedance	<0.1	38.6	38.6	Not significant
E64	<0.1	<0.1	No exceedance	No exceedance	<0.1	38.6	38.6	Not significant
E65	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.3	31.3	Not significant

CL = Critical load
PEC = Predicted environmental concentration (PC + background)
No exceedance as per the output of the critical load function tool available on APIS

5.2 Short-term Model Results

Table 5-4 details the results of the short-term impact assessment results. The summary table provides the maximum result at any receptor for each pollutant and averaging period under operating conditions. The maximum CO (8-hour rolling and hourly means) were observed at H19 and H18 respectively. The full results are contained within Appendix B.

Table 5-4 - Short-term Results at Human and Ecological Receptors

Parameter	Short-term Mean				
	AQAL µg/m^3	PC µg/m^3	PEC µg/m^3	% PC of AQAL	% PEC of AQAL
Human Receptors					
99.79 percentile 1-hour mean NO_2 (H10)	200	5.49	27.72	2.7	13.9
CO 8-hour (H19)	10,000	13.4	1165.4	0.1	11.7
CO-hour (H18)	30,000	27.8	1179.8	0.1	3.9
Ecological Receptors					
24-hour mean NO_x (Dee 1)	75	9.77	36.01	13.0	48.0

Table 5-4 indicates that the results of the short-term assessment metrics for both human and ecological receptors are below the relevant AQAL during operation of the plant.

6 CONCLUSIONS

Bureau Veritas has been commissioned by Caulmert for support with Environmental Permitting requirements for the proposed Peaking Power Plant at the former Deeside Power Plant. This document provides supporting technical information for the application of an Environmental Permit in accordance with the Industrial Emissions Directive (IED) to operate the site. The application covers the installation of 11 new natural gas generators.

The generators are operated using natural gas as the fuel; hence, the following pollutants were included in the assessment: nitrogen oxides (NO_x) and carbon monoxide (CO) where applicable. Release rates for NO_x and CO were derived using information provided by the generator manufacturers and emission limits legislation.

The assessment has resulted in the following conclusions:

- Considering annual mean results, all results at both human and ecological receptors were below the relevant assessment metrics.

- The results for nitrogen deposition show exceedances at two ecological receptors. Where the contribution from the plant is less than 1% of the PEC, this can be considered not significant. However, E58 (Shotton_2) and E20 (Dee_3) were observed to contribute 3.1% and 1.2% PC of critical load respectively. Therefore, it was determined that further assessment was required at these monitoring locations. The contour plots in Appendix B show that a small area of Dee Estuary SSSI as well as the eastern part of Shotton Lagoons SSSI, are located within the 1% exceedance zone of the minimum critical load for nitrogen deposition of 10 and 5 kg N ha^{-1} y^{-1}, respectively. An Ecological Impact Assessment was conducted by Rachel Hacking Ecology and found that these exceedances have to be considered in the context of the significant exceedance that is already occurring. The report states that due to current exceedance levels of 32.5% and 40.3% respectively, it is very unlikely to significantly exacerbate the problems caused by a slight addition to nitrogen deposition.

- As the modelled results of the acid deposition PC are less than 1% of the PEC at all considered ecological receptors, these can be described as not significant.

- Considering short-term results, all results at human receptors were below the relevant assessment metrics.

Due to worst-case conditions being employed throughout the assessment, the modelled predictions are expected to represent the upper limit of concentrations.

Appendix A: Pollutant Concentration Isopleths

Figure B1 – Nitrogen Deposition Exceedance Zone Maps (1% of minimum critical load of 10 kg N ha^{-1} y^{-1})

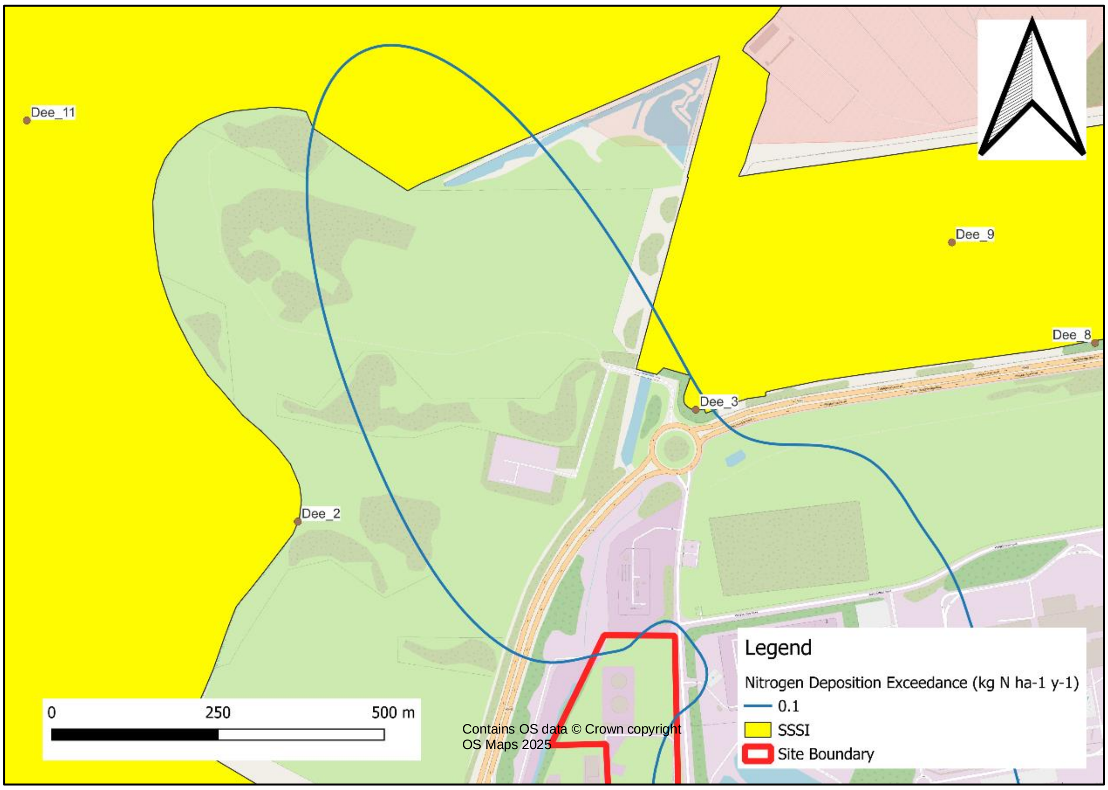
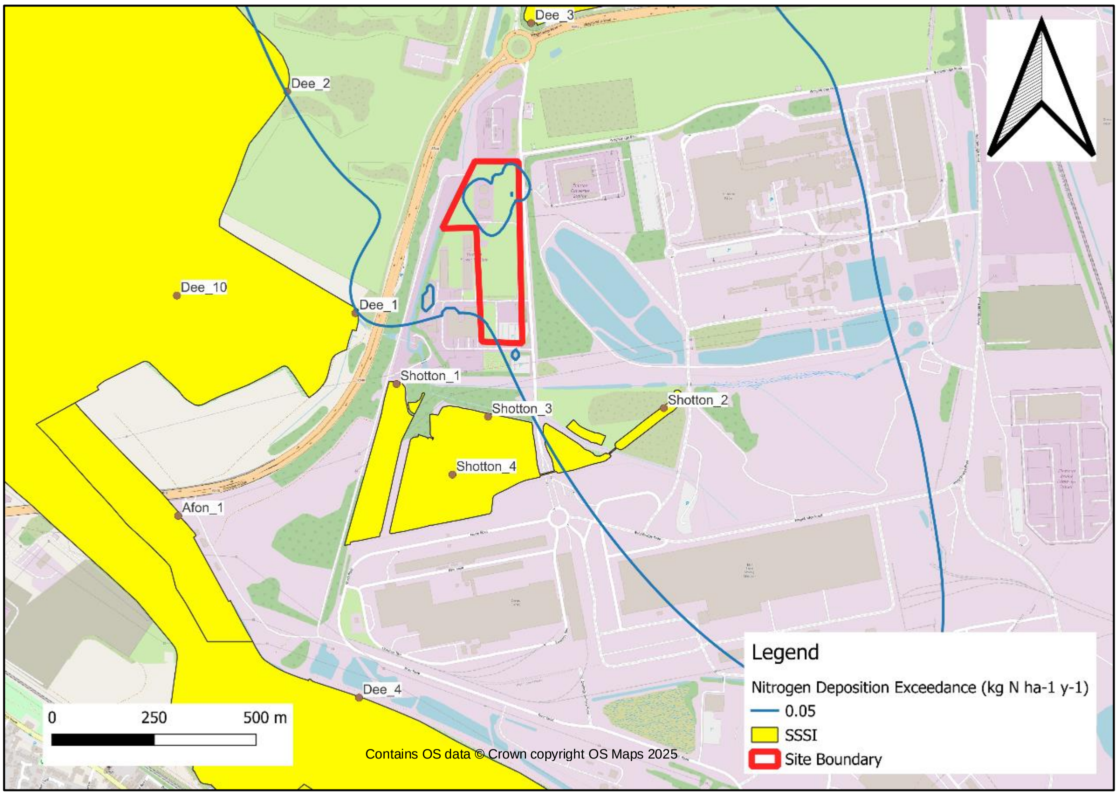


Figure B2 – Nitrogen Deposition Exceedance Zone Maps (1% of minimum critical load of 5 kg N ha^{-1} y^{-1})



Appendix B: Full Results Tables

ATTACHED AS SEPARATE FILE

Appendix C: Model Files

ATTACHED AS SEPARATE FILE

Appendix D: Ecology Impact Assessment

ATTACHED AS SEPARATE FILE

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