HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.3.28 ES Volume C - Road traffic-related effects (project-wide) App C4-2 - Assessment of Road Traffic Emissions - Mainland Wales

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1 Introduction

1.1 Purpose and applicability

1.1.1 The construction of the Power Station would take up to 10 years to complete. During the peak construction period (anticipated to be approximately 2023 based on the implementation of the Wylfa Newydd Project in 2019 (i.e. Year 5 of the construction programme)) there is the potential for up to 9,000 construction workers to be working at the Wylfa Newydd Development Area and other Wylfa Newydd Project development sites. In addition to the daily vehicle movements on the road network associated with these construction workers and other people travelling to and from the Wylfa Newydd Development Area and other development sites, there would also be vehicle movements such as deliveries of materials and components and removal of waste. Additional vehicle movements would also be generated on the road network during operation of the Power Station. However, the predicted road traffic movements on mainland Wales during operation of the Power Station are approximately 50% or lower than those during the peak construction year of 2023. The assessment presented here focuses on the highest potential effects during construction and the predicted effects during operation would be lower than those presented in this report. Should the implementation of the Wylfa Newydd Project commence after 2019 this would not materially affect the conclusions of this assessment.

1.1.2 Emissions of pollutants from these additional vehicle movements would have the potential to adversely affect local air quality at sensitive locations close to the road network on the Isle of Anglesey and on mainland Wales. Therefore, an assessment of road traffic emissions is required to determine the potential for significant effects and, if practicable, identify appropriate mitigation to reduce these effects.

1.1.3 This report provides the assessment of road traffic emissions on mainland Wales as part of the application for a Development Consent Order (DCO) for the Wylfa Newydd Project.

1.2 Terms and definitions

Table 1-1 Terms and definitions

Term	Definition
Air Pollution Information System (APIS)	The APIS site managed by the Centre for Ecology and Hydrology provides a searchable database and information on pollutants and their impacts on habitats and species.
Air Quality Management Area (AQMA)	Areas within a local authority's boundary that are identified as areas where Air Quality Objectives are not likely to be achieved.

Term	Definition
Air Quality Objective (AQO)	Defined levels of air quality and maximum pollution limits as specified in the *Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, 2007.
Annual average daily traffic (AADT)	Total volume of vehicle traffic on a road flowing past a certain point over a year divided by 365 days.
Associated Development	Works included in the DCO which facilitate the delivery of the NSIP, and which include: the Site Campus; Park and Ride; Logistics Centre; and the A5025 Off-line Highway Improvements.
Automatic Traffic Counter (ATC)	Equipment placed on a road that counts traffic.
Baseline	A reference level of existing environmental conditions against which a project is measured and controlled.
Cheshire West and Chester Council (CWCC)	The local authority governing the Cheshire west and Chester area.
Conwy County Borough Council (CCBC)	The local authority governing the Conwy area.
Critical level	An air quality standard or guideline for ambient concentrations of a pollutant which applies at ecological receptors.
Critical load	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. This is used to assess modelled nitrogen and acid deposition at ecological receptors.
Department for Environment, Food and Rural Affairs (Defra)	The UK Government department responsible for the environment, food and rural affairs. When referring to Defra, this also includes reference to the devolved administrations.
Department for Transport	The UK Government department responsible for transport issues predominantly in England.
Denbighshire County Council (DCC)	The local authority governing the Denbighshire area.

Term	Definition
Design Manual for Roads and Bridges (DMRB)	A comprehensive manual, prepared by the Highways Agency (now Highways England) that sets out all current standards, advice notes and other published documents relating to the design, assessment and operation of trunk roads (including motorways). Volume 11 of the DMRB sets out the criteria for the environmental assessment of road schemes.
Development Consent Order (DCO)	The consent for a Nationally Significant Infrastructure Project required under Section 37 of the *Planning Act 2008*.
Dispersion modelling	The mathematical simulation of how air pollutants disperse in the ambient atmosphere. A dispersion model is used to estimate or predict the downwind concentration of air pollutants emitted from sources such as industrial facilities or road traffic.
Effects	The consequences of the changes in airborne concentrations and/or dust deposition for a receptor. These might be manifested as annoyance due to soiling, health effects due to exposure to PM_{10} or $PM_{2.5}$ (defined below) or plant dieback due to reduced photosynthesis. The term 'significant effect' has a specific meaning in Environmental Impact Assessment regulations. The opposite is a 'not significant effect'. In the context of construction impacts, any effect will usually be adverse; however, professional judgement is required to determine whether this adverse effect is significant based on the evidence presented.
Environment Agency	The executive non-departmental public body with responsibility for environmental regulation in England.
Environmental Impact Assessment (EIA)	The process through which the likely significant effects of a development on the environment are identified and assessed.
Environmental Statement	The document(s) setting out the EIA process and the findings of the EIA.
Environmental Protection UK (EPUK)	EPUK is a national charity that provides policy analysis and advice on air quality, land quality, waste and noise and their effects on people and communities in terms of a wide range of issues including public health, planning, transport, energy and climate.

Term	Definition
European Designated Site	The generic term in the application documents for the Wylfa Newydd Project to describe the sites considered by the Habitats Regulations Assessment, namely: • Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); • sites that are in the process of designation as SACs and SPAs; these are known as proposed SACs (pSACs), candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Importance (SCIs), depending on the type of designation and point of progression through the designation process; and • Ramsar Sites.
Flintshire County Council (FCC)	The local authority governing the Flintshire area.
Gwynedd Council (GC)	The local authority governing the Gwynedd area.
Heavy Duty Vehicle (HDV)	Heavy duty vehicles include a vehicle with a gross weight of more than 3.5 tonnes and buses.
Impacts	The changes in airborne concentrations and/or dust deposition. A scheme can have an 'impact' on airborne dust without having any 'effects', for instance if there are no receptors to experience the impact.
Institute of Air Quality Management (IAQM)	The professional body for air quality professionals.
Isle of Anglesey County Council (IACC)	The local authority governing the area within which the Wylfa Newydd Project is intended to be constructed.
Kilo equivalents per hectare per year (keq/ha/year)	The principal unit of measurement of acid deposition.
Kilograms of nitrogen per hectare per year (kgN/ha/year)	The principal unit of measurement of nitrogen deposition.
Light Duty Vehicle (LDV)	Light duty vehicles include a vehicle with a gross weight of less than 3.5 tonnes.
Local Air Quality Management (LAQM)	A process that requires local authorities across the UK to review, assess and manage the air quality within their geographical areas.
Metre (m)	Unit of length

Term	Definition
Micron	One millionth of a metre.
Microgram (µg)	One millionth of a gram.
Micrograms per cubic metre (µg/m^3)	The principal unit of measurement for the concentration of an air pollutant in ambient air.
Nanometre	One billionth of a metre.
National Policy Statement (NPS)	Statements prepared and designated by the Secretary of State under the *Planning Act 2008*, which establish national policy for Nationally Significant Infrastructure Projects, including energy, transport and water, waste water and waste and against which applications for DCOs are assessed.
Natural Resources Wales (NRW)	The public body whose stated purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future. It absorbed the regulatory and advisory duties of the Environment Agency Wales, Countryside Council for Wales and the Forestry Commission in Wales.
Nitrogen deposition rate	The rate at which nitrogen accumulates on a surface as a result of separation from the atmosphere. The principal unit of measurement of nitrogen deposition is kilograms of nitrogen per hectare per year.
Nitrogen dioxide (NO_2)	An air quality pollutant measured in respect of Defra's AQOs for the protection of human health. NO_2 is gas that is released into the atmosphere when fossil fuels are burned (for example, petrol or diesel in a car engine, or natural gas in a domestic central heating boiler or power station).
Oxides of nitrogen (NOx)	Together, nitric oxide and nitrogen dioxide are known as oxides of nitrogen. It is released into the atmosphere when fossil fuels are burned.
Particulate Matter (PM)	Airborne particulate matter is made up of a collection of solid and/or liquid materials of various sizes that range from a few nanometres in diameter (about the size of a virus) to around 100 microns (about the thickness of a human hair).
PM_{10}	Particulate matter with an aerodynamic diameter of 10 microns or less.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5 microns or less.

Term	Definition
Power Station	The proposed new nuclear power station at Wylfa, including two UK Advanced Boiling Water Reactors, the Cooling Water System, supporting facilities, buildings, plant and structures, radioactive waste and spent fuel storage buildings and the Grid Connection.
Receptor	A location that may be affected by air pollution.
Site of Special Scientific Interest (SSSI)	Sites designated as being of special interest for their flora, fauna or geological or physiographical features and protected under the Wildlife and Countryside Act 1981.
Special Area of Conservation (SAC)	An area which has been identified as being important for a range of vulnerable habitats, plant and animal species within the European Union and are designated under the Habitats Directive.
Special Protection Area	A site designated under the Birds Directive due to their international importance for the breeding, feeding, wintering, or the migration of, rare and vulnerable species of birds.
Study area	The spatial area within which environmental effects are assessed (i.e. extending a distance from the development footprint in which significant environmental effects are anticipated to occur). This area varies between different environmental topic areas.
Wylfa Newydd Development Area	The indicative areas of land and sea including the Power Station Site, and the surrounding areas that would be used for the construction and operation of the Power Station.
Wylfa Newydd DCO Project	The elements of the Wylfa Newydd Project for which consent is being sought through the DCO comprising the construction and operation of the Power Station, other on-site development, the Marine Works, the Off-Site Power Station Facilities and the Associated Development.
Wylfa Newydd Project	The Wylfa Newydd DCO Project, the Licensable Marine Activities and the Enabling Works.

1.3 Scope

1.3.1 This report sets out the assessment of emissions to air of pollutants from road traffic (e.g. cars, vans, buses and lorries) associated with the Wylfa Newydd Project. The assessment focuses on the key pollutants emitted from road traffic: oxides of nitrogen (NOx); nitrogen dioxide (NO_2) and fine particulate matter to include PM_{10} and $PM_{2.5}$. The assessment considers the effects of the emissions of these pollutants on human health and the potential effects on sensitive vegetation and ecosystems. This includes the resulting deposition of nutrient nitrogen and acid at ecological sites derived from the emissions of NOx.

1.3.2 The report contains the following information:

- an overview of the approach used to define the study area;
- the methodology and rationale behind the assessment;
- the road traffic data used to assess effects of additional emissions on mainland Wales;
- an overview of the existing air quality within the study area; and
- the results of the assessment and determination of significance of effects.

2 'Affected' roads and study area

2.1 'Affected' roads

2.1.1 This study considers the year that is anticipated to give rise to the maximum increase in road traffic movements associated with the construction or operation of the Power Station (2023).

2.1.2 There are no Air Quality Management Areas (AQMAs) within or in close proximity to the study area. The 'affected' road links have been identified where predicted changes in traffic flows on mainland Wales due to the Wylfa Newydd Project would exceed the relevant thresholds set out in the Environmental Protection UK (EPUK)/ Institute of Air Quality Management (IAQM) guidance document [RD1], as follows:

- the annual average daily traffic (AADT) flow, in vehicles per day, of cars and light goods vehicles (collectively known as light goods vehicles (LDVs)) would change by 500 or more; or
- Heavy Duty Vehicle (HDV) flow, including buses, would change by 100 AADT or more.

2.1.3 The extent of the affected road network on mainland Wales for the peak road traffic scenario in 2023 is the A55 from the Britannia Bridge in the west to the junction with the A494 in the east (junction 34 of the A55 to the west of Chester).

2.1.4 The affected road network is shown in appendix 1-1. It is noted that the full extent of the affected road network is defined predominantly by HDVs. The affected road threshold of 500 AADT for LDVs is exceeded between junction 9 in the west to junction 20 in the east. Further east of junction 20 the change in LDVs is less than 500 AADT. It is assumed that the AADT for HDVs would fall below the threshold of 100 AADT at the junction of the A55 with the A494 (junction 34) as the HDVs disperse on the wider strategic road network based on the origin destination of the deliveries. HDVs travelling from ports or distribution centres in the north-west and further north are most likely to connect to the A55 via the A494 whereas HDVs travelling from the south would connect to the A55 further west of this junction (e.g. A483).

2.1.5 Further details on the traffic flows on the A55 are provided in section 4.1 of this report. No other roads on mainland Wales are forecast to experience changes in road traffic flows which exceeded the EPUK/IAQM thresholds set out in paragraph 2.1.2. Where increases in road traffic are below the EPUK/IAQM thresholds, the air quality effects are considered to be negligible. Key trunk roads connected to the A55 which are forecast to experience the highest increases in traffic associated with the Wylfa Newydd Project include the A487, A4087 and A5. For the A487 heading south towards Caernarfon, the predicted increase in AADT was 332 LDVs and 11 HDVs; heading north on the A487 towards the Menai bridge and the A5 junction, the predicted increase in AADT was 50 LDVs and 4 HDVs. The A4087 was forecast to experience an increase of 164 LDVs and 12 HDVs and the A5 was forecast to experience an increase of 112 LDVs and 16 HDVs as an AADT. These are below the thresholds set out above. Further details of the traffic flows

associated with the Wylfa Newydd Project and the affected road network and study area for the assessment of road traffic emissions are provided in *Extent of Study Area and Receptor Selection for the Assessment of Air Quality* Rev 3.0 [RD2]. The latest version of this report was issued to Natural Resources Wales (NRW) and the relevant mainland Wales local authorities (Gwynedd Council (GC), Conwy County Borough Council (CCBC), Denbighshire County Council (DCC) and Flintshire County Council (FCC)) in June 2017.

2.1.6 A separate assessment of road traffic emissions for the affected roads on the Isle of Anglesey is presented in chapter C4 (air quality effects of traffic) (Application Reference Number: 6.3.4) of the Environmental Statement and is not considered within this report.

2.2 Study area and receptors

2.2.1 The prescribed process when undertaking dispersion modelling of road traffic emissions is to identify all human and ecological receptors within 200m of affected roads in accordance with the DMRB guidance [RD3]. In this case, where the assessment is based on a screening methodology, a number of the closest human receptors to the affected road network were identified to initially determine if there is the potential for significant air quality effects to occur. All relevant sensitive ecological sites within 200m of the affected road network were considered.

2.2.2 Based on the above, the assessment considered 20 of the nearest human receptors to the A55 including one layby location. The assessed receptors are considered to be 'worst case' and likely to experience the highest concentrations of pollutants due to emissions from road traffic on the A55. The receptors are relevant long-term exposure locations (e.g. residential properties), with the exception of the layby location R41, which is relevant for short-term exposure only (i.e. one-hour mean concentrations).

2.2.3 For ecological receptors, the assessment considered European Designated Sites (i.e. Special Protection Areas (SPA) and Special Areas of Conservation (SAC)) and Sites of Special Scientific Interest (SSSIs) within 200m of the affected road network. This resulted in the selection of six sensitive ecological receptors within 200m of the A55 which were considered to be sensitive to air pollution.

Human receptors

2.2.4 The long-term human exposure receptor locations within the study area were selected using internet-based geographical referencing tools and are presented in table 2-1. The nearest façade of the receptor was selected as the assessment location.

2.2.5 The predicted increase in pollutant concentrations at relevant exposure locations, which are further from the A55 and within the same area as these receptor locations, would be expected to be lower than those modelled.

Table 2-1 Assessed human receptors

Ref.	Location Description	Distance to roadside of the A55 (m)
R40	North of the A55 to the north-west of junction 9 near Treborth, west of the A487	62
R41	Layby (A55, east bound) southeast of Britannia Bridge. Short-term exposure location for the assessment of peak one-hour mean NO_2 concentrations.	1
R42	North of the A55 between junction 9 and 10, east of the A487	27
R43	South of the A55 between junction 10 and 11	25
R44	South of the A55 between junction 11 and 12, east of the A5	23
R45	South of the A55 between junction 12 and 13	9
R46	North of the A55 between junction 13 and 14	9
R47	South of the A55 between junction 14 and 15, north of Llanfairfechan	18
R48	South of A55 between junction 15 and 15A, east of Llanfairfechan	14
R49	South of A55 between junction 16 and 16A, north-west of Dwygyfylchi	30
R50	North of A55 between junction 17 and 18, north of Conwy	24
R51	South of A55 between junction 19 and 20, east of Conwy	15
R52	South of A55 between junction 20 and 21, north of Colwyn Bay	13
R53	South of A55 between junction 21 and 22, north of Colwyn Bay	16
R54	South of A55 between junction 22 and 23, north-east of Old Colwyn	11
R55	South of A55 between junction 23 and 23A, east of Llanddulas	9
R56	East of A55 between junction 23A and 24, north-east of Abergele	9

Ref.	Location Description	Distance to roadside of the A55 (m)
R57	South of A55 between junction 26 and 27, west of St Asaph	18
R58	North of A55 between junction 30 and 31, east of St Asaph	24
R59	East of A55 between junction 33 and 33A, east of Northop	15

Assessed ecological receptors

2.2.6 A review of all relevant ecological sites within 200m of the A55 was undertaken. Discussions were held with NRW to identify the sites which were potentially sensitive to air pollution (e.g. sensitive to nitrogen deposition) and the relevant assessment criteria were agreed for each site (see section 3.6). Further details are outlined in chapter B5 (air quality) (Application Reference Number: 6.2.5) and appendix B5-2 (existing nitrogen and acid deposition and critical loads at ecological receptors for the Wylfa Newydd Project) (Application Reference Number: 6.2.19). Table 2-2 presents the assessed ecological sites and the distance of the nearest point of each site to the A55.

Table 2-2 Assessed ecological receptors

Ecological receptor	Location Description	Distance to roadside of the A55 (m)
Coedydd Afon Menai SSSI	East of the A55 Britannia Bridge and extending north-east from the A55.	15[1]
Coedydd Aber SAC/SSSI	South of the A55 east of junction 13 at Abergwyngregyn.	45
Sychnant Pass SSSI	South of the A55 at junction 16A west of Conwy.	119
Llanddulas Limestone and Gwrych Castle Wood SSSI	South of the A55 east of junction 23, east of Llanddulas.	180
Traeth Pensarn SSSI	North of the A55 at junction 23A north of Abergele.	92
Halkyn Mountain/Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI	East and westbound carriageway of the A55 at its closest point east of junction 31.	10

Note 1: the location of the Coedydd Afon Menai SSSI relative to the A55 is relatively complex. At its closest point to the A55, the Coedydd Afon Menai SSSI is approximately 30m wide and is adjacent to the Afon Menai. It extends north-east from the northern side of the A55 at the Britannia Bridge. However, at this location, the A55 is elevated approximately 30–40m above the ground level within the Coedydd Afon Menai SSSI. A conservative approach has been adopted in determining the distance for use in the assessment. It was assumed that a distance of 15m would represent the straight-line distance from the A55 on the Britannia Bridge to the nearest part of the tree canopy within the Coedydd Afon Menai SSSI. The distance is likely to be further than this.

3 Methodology

3.1 Introduction to the methodology

3.1.1 This section of the report provides an overview of the inputs required and rationale behind the approach adopted for the assessment of potential effects on mainland Wales. More detailed information about the assessment approach is presented in appendix 1-1.

3.2 Assessment overview: human receptors

3.2.1 The approach used for the assessment at human receptors is summarised below.

- Identify the distance of the closest human receptors to the A55 within the study area.
- Obtain existing roadside and background pollutant concentrations of NO_2 and PM_{10} within the study area from respective local authority Local Air Quality Management (LAQM) reports and the Department for Environment, Food and Rural Affairs (Defra) website [RD4].
- Calculate the predicted increase in pollutant concentrations at the identified receptor locations (i.e. the increase in pollutant concentrations associated with the Wylfa Newydd Project road traffic emissions only).
- Compare the increase in the NO_2 and PM_{10} concentrations to the impact descriptors set out in the EPUK/IAQM guidance [RD1], taking into account the existing concentrations of pollutants recorded in close proximity to the A55.
- Consideration of the likely total concentrations, which for this assessment approach would be the predicted increase in pollutant concentration plus existing representative measured roadside concentrations for comparison to the AQOs (see section 3.6). The significance of the changes are then determined with reference to the EPUK/IAQM guidance [RD1]. This approach to screening for risk of significant effects is consistent with the air quality assessment approach set out in chapter B5 of the Environmental Statement (Application Reference Number: 6.2.5).

3.3 Assessment overview: ecological receptors

3.3.1 The approach used for the assessment at ecological receptors is summarised below.

- Identify ecological sites (i.e. SAC, SPA and SSSI) within 200m of the A55 within the study area and confirm the sensitivity of these sites to air pollutants and nutrient nitrogen and acid deposition.
- Obtain and review measured roadside and background pollutant concentrations for NO_2 and NOx within the study area from respective local authority LAQM reports. Where appropriate, convert measured NO_2

diffusion tube concentrations to equivalent NOx concentrations using the Defra NOx to NO_2 calculator tool [RD5].

- Obtain nitrogen and acid deposition critical loads and existing deposition rates for each of the identified ecological sites from the APIS website [RD6] and NRW [RD7]. The critical loads were agreed with NRW and are set out in full in appendix B5-2 (Application Reference Number: 6.2.19).
- Calculate the predicted increase in NOx and NO_2 concentrations due to emissions from the increase in road traffic associated with the Wylfa Newydd Project at each of the ecological receptors.
- Convert the NO_2 concentration into an acid and nitrogen deposition rate using the Air Quality Technical Advisory Group (AQTAG) guidance [RD8] (see appendix 1-2).
- Calculate the increase in the predicted NOx concentration as a percentage of the AQO (the 'critical level'). If this is 1% or less of the AQO then it can be screened out from requiring further consideration. This follows Environment Agency guidance adopted by NRW [RD9] and is consistent with the approach adopted for the air quality assessment as described in chapter B5 (Application Reference Number: 6.2.5). If the increase is greater than 1% of the critical level, the potential significance of the effect is determined with reference to the likely total NOx concentration and further consideration by an ecologist.
- Compare the predicted increase in nitrogen and acid deposition rates to the critical loads for each ecological site. If the increase is 1% or less of the relevant critical load then the contribution from the Wylfa Newydd Project can be considered to be insignificant in line with guidance adopted by NRW [RD9] and chapter B5 (Application Reference Number: 6.2.5). If the contribution is greater than 1% of the relevant critical load then the information is provided to a suitably qualified ecologist to determine the significance of the effect, where required. The determination of significance is provided as 'not significant' or 'significant'. Increases of 1% or less are individually categorised as 'insignificant' and this represents a 'not significant' effect overall.

3.4 Calculation of road traffic emissions and dispersion

3.4.1 The method applied for the assessment of road traffic emissions on mainland Wales is presented in outline below and described in more detail within appendix 1-1.

3.4.2 A spreadsheet-based modelling exercise has been undertaken using the DMRB dispersion equation [RD10]. The dispersion formula uses the receptor to road edge distance (m) to calculate the road contribution as a pollutant concentration ($\mu g/m^3$) at the receptor location. This is based on the respective traffic emissions (g/km/s) from the modelled road link, which have been calculated from the Wylfa Newydd Project traffic flows (total flow and

percentage of HDVs), road type (i.e. urban, rural, motorway) and average vehicle speed information.

3.4.3 The road vehicle emissions for each modelled road link are based on Defra's Emission Factor Toolkit (EFT version 7.0) [RD11] (EFT v7.0), with NOx emissions determined by use of the Calculator Using Realistic Emissions for Diesels (CURED version 2A) [RD12] (CURED v2A), which uplifts the EFT v7.0 emissions to account for the disparity with the on-road performance of modern diesel vehicles against the emission standards.

3.4.4 The emissions were calculated for the year of assessment (i.e. 2023, the peak traffic flow during construction of the Power Station), 2016 to enable model verification for NO_2 and 2015 for model verification of PM_{10}.

3.4.5 The predicted road contributions at the receptors have been adjusted in accordance with *LAQM Technical Guidance (TG 16)* [RD13] following the verification and adjustment process. Adjustment factors derived through the process of model verification for both road NOx and PM_{10} have been applied. A cautionary approach has been taken and the maximum adjustment factor of all verification sites considered has been applied to all modelled road NOx contributions. The details of the verification process are provided in appendix 1-1.

3.4.6 Verification was not undertaken for $PM_{2.5}$ as it is not measured by the local authorities within or close to the study area. The adjustment factor for PM_{10} was applied to the $PM_{2.5}$ road contributions.

3.4.7 To facilitate the calculation of predicted road NO_2 contributions from the adjusted road NOx contribution, the LAQM NOx to NO_2 calculator has been used [RD5]. In the absence of representative background monitoring sites within the study area, Defra's mapped background pollutant concentrations [RD4] have been used within the NOx to NO_2 tool. Mapped background concentrations are available in 1km x 1km grid squares for years 2013 to 2030. The 2013 values have been applied to this assessment as a conservative approach as this assumes no decrease in existing concentrations between 2013 and the assessment year 2023. The 2016 and 2015 values have been applied for the verification process of NO_2 and PM_{10}, respectively.

3.5 Traffic data

3.5.1 The traffic data used for the assessment have been derived from the Strategic Traffic Model for the Wylfa Newydd Project (see chapter C2 (traffic and transport) (Application Reference Number: 6.3.2)). HDVs within the Strategic Traffic Model for 2023 are predominantly associated with the construction activities at the Wylfa Newydd Development Area on the Isle of Anglesey. The specific detail of where materials associated with the main site construction would be sourced and delivered from is unknown at this stage. It is broadly assumed this would involve more specialised materials travelling from further afield and therefore, in the absence of other information, HDVs are assumed to route the full length of the A55 corridor across mainland Wales to the junction of the A55 with the A494 (junction 34). Average traffic speeds on the mainland are not expected to change as a result of the Wylfa Newydd Project.

3.5.2 Table 3-1 presents the modelled changes in flows associated with the Wylfa Newydd Project on the affected road links for the assessment year of 2023. The change in LDVs drops below the screening threshold level at junction 20 of the A55 whilst HDVs remain constant between junction 11 and junction 34 of the A55.

3.5.3 The extent of the traffic model and the affected road links are shown on appendix 1-1. All other roads are below the EPUK/IAQM thresholds and have not been considered further. Changes in pollutant concentrations or nitrogen and acid deposition at receptors adjacent to roads which are not affected are concluded to be negligible and air quality effects would be not significant.

Table 3-1 Mainland Wales Wylfa Newydd Project traffic data – affected road links (2023)

Receptor[1]	Road link	Increase in AADT (veh/day)	Increase in LDV (veh/day)	Increase in HDV (veh/day)	Speed (km/h)
R40, R41 & Coedydd Afon Menai SSSI	A55 J8A to J9	1,675	1,486	189	80
R42	A55 J9 to J10	1,293	1,119	174	112
n/a	A55 J9 through junction	1,293	1,119	174	112
R43	A55 J10 to J11	1,145	984	161	112
n/a	A55 J10 through junction	1,129	968	161	112
R44	A55 J11 to J12	1,017	872	145	112
R45	A55 J12 to J13	1,017	872	145	112
R46 & Coedydd Aber SAC/SSSI	A55 J13 to J14	1,017	872	145	112
R47	A55 J14 to J15	1,017	872	145	112
R48	A55 J15 to J15A	970	825	145	112
n/a	A55 J15A to J16	932	787	145	112
R49	A55 J16 to J16A	919	774	145	112

Receptor[1]	Road link	Increase in AADT (veh/day)	Increase in LDV (veh/day)	Increase in HDV (veh/day)	Speed (km/h)
Sychnant Pass SSSI	A55 J16A to J17	919	774	145	112
R50	A55 J17 to J18	882	736	145	112
n/a	A55 J18 to J19	770	625	145	112
R51	A55 J19 to J20	666	520	145	112
R52	A55 J20 to J21	601	456	145	80
R53	A55 J21 to J22	601	456	145	80
	A55 J21 off slip	54	54	0	50
R54	A55 J22 to J23	547	402	145	112
R55, Llanddulas Limestone and Gwrych Castle Wood SSSI & Traeth Pensarn SSSI	A55 J23 to J23A	534	389	145	112
R56	A55 J23A to J24	490	344	145	112
n/a	A55 J24 to J24A	358	213	145	112
n/a	A55 J24A to J25	358	213	145	112
n/a	A55 J25 to J26	351	206	145	112
R57	A55 J26 to J27	351	206	145	112
n/a	A55 J27 to J27A	311	166	145	112
n/a	A55 J27A to J28	311	166	145	112
n/a	A55 J28 to J29	304	159	145	112

Receptor[1]	Road link	Increase in AADT (veh/day)	Increase in LDV (veh/day)	Increase in HDV (veh/day)	Speed (km/h)
n/a	A55 J29 to J30	304	159	145	112
R58	A55 J30 to J31	304	159	145	112
Halkyn Mountain /Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI	A55 J31 to J32	281	135	145	112
n/a	A55 J32 to J32A	250	105	145	112
n/a	A55 J32A to J32B	250	105	145	112
n/a	A55 J32B to J33	250	105	145	112
R59	A55 J33 to J33A	199	54	145	112
n/a	A55 J33A to J33B	186	41	145	112
n/a	A55 J33B to J34	186	41	145	112

Note 1: n/a = a receptor has not been modelled at this link as there are no receptors within 200m or the receptors are considerably further from the A55 than the assessed receptors.

3.6 Assessment Criteria

Human receptors

3.6.1 The assessment criteria applied in this assessment are presented in table 3-2. These are based on the UK statutory AQOs set out in *The Air Quality (Wales) Regulations 2000* and *Air Quality (Amendment) (Wales) Regulations 2002* or limit values in *The Air Quality Standards (Wales) Regulations 2010*. AQOs are health-based standards which are set at a level to provide protection to the whole population.

Table 3-2 Relevant AQOs for the protection of human health

Pollutant	Concentration ($\mu g/m^3$)	Measured as
NO_2	40	Annual mean
	200	One-hour mean not to be exceeded more than 18 times per year (equivalent to the 99.8th percentile)
PM_{10}	40	Annual mean
	50	24-hour mean not to be exceeded more than 35 times per year (equivalent to the 90.4th percentile)
$PM_{2.5}$	25	Annual mean

3.6.2 Models of road traffic emissions do not predict short-term (i.e. one-hour or 24-hour mean) concentrations as well as they do annual mean concentrations. The following approach is widely accepted by environmental regulators and local authorities and follows LAQM (TG16) guidance [RD13] for the determination of the potential for exceedances of the short-term AQOs to occur.

One-hour mean NO_2 AQO

3.6.3 Research undertaken on behalf of Defra and the Devolved Administrations [RD13] identified that exceedances of the NO_2 one-hour mean AQO are unlikely to occur where the annual mean is below $60\mu g/m^3$.

24-hour mean PM_{10} AQO

3.6.4 The number of exceedances of the 24-hour mean air quality objective for PM_{10} of $50\mu g/m^3$ may be estimated using the relationship set out in LAQM (TG16) [RD13].

3.6.5 Number of 24-hour mean exceedances of $50\mu g/m^3$ = -18.5 + 0.00145* (Predicted Annual-mean $PM_{10})^3$ + 206 / (Predicted Annual-mean PM_{10} Concentration).

3.6.6 This relationship suggests that the 24-hour mean AQO for PM_{10} is likely to be met if the predicted annual-mean PM_{10} concentration is $31.8\mu g/m^3$ or less.

Ecological receptors

3.6.7 The assessment criteria applied in this assessment for ecological receptors with regard to ambient concentrations of pollutants are presented in table 3-3. Although a 24-hour mean critical level for NOx is specified in Environment Agency guidance [RD14] adopted by NRW, this is generally applicable to industrial sources and not applied to assessment of road traffic emissions.

Table 3-3 Relevant critical level for the protection of vegetation and ecosystems

Pollutant	Concentration ($\mu g/m^3$)	Measured as
NOx	30	Annual mean

3.6.8 Table 3-4 presents the critical loads for nutrient nitrogen and acid deposition at the assessed ecological receptors. The nitrogen deposition critical loads were provided by NRW [RD7]. Acid deposition critical loads were obtained from the APIS website using the 'Site Relevant Critical Loads' tool as agreed with NRW (see appendix B5-2, Application Reference Number: 6.2.19). The tool provides a list of the broad habitat features that are present at each designated ecological receptor. It then lists the specific priority habitats within that broad habitat category, regardless of whether they are present at the designated site. Where relevant, the qualifying features from the respective ecological sites' citations were selected. In the absence of this information, advice was sought from the project ecologist, to ascertain the most appropriate and the most stringent (lowest) critical load for the priority habitats present at each ecological site (see appendix B5-2 (Application Reference Number: 6.2.19) for all critical load information related to the project wide effects.

3.6.9 Deposition rates of nitrogen and acid vary based on whether they are depositing on short or tall vegetation. Where an ecological receptor contained habitat types representing both tall and short vegetation, deposition rates and critical load values were obtained for each of these separately.

3.6.10 The nitrogen deposition critical loads were provided as a range. It is accepted best practice to apply the lower end of the range when initially determining the potential significance of the predicted increase in deposition. For acid deposition, it is more complex as the critical load is made up of a number of values that represent a critical load function based on the nitrogen and sulphur derived acid deposition. There are rules on how this critical load function should be applied, as specified on the APIS website [RD6], and which were followed for this assessment.

Table 3-4 Critical loads at the assessed ecological receptors

Ecological receptor	Vegetation Type (for deposition velocity)	Critical Load			
		Acid Deposition (keq/ha/year)			Nitrogen Deposition (kgN/ha/year)
		CLmaxS	CLminN	CLmaxN	
Coedydd Afon Menai SSSI	Tall	2.47	0.36	2.82	10
Coedydd Aber SAC/SSSI	Tall	1.84	0.29	2.13	10
Sychnant Pass SSSI	Short	0.46	0.18	0.64	10
Llanddulas Limestone and Gwrych Castle Wood SSSI	Tall	2.56	0.36	2.91	15
Traeth Pensarn SSSI	Short	1.60	0.44	2.04	Not sensitive
Halkyn Mountain/Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI	Short	0.83	0.18	1.01	10

4 Existing air quality

4.1.1 A review of baseline air quality in the vicinity of the A55 and assessed receptors was carried out to understand the existing air quality situation at locations close to the road and to inform the assessment of the potential significance of the predicted increases in pollutant concentrations or deposition. Further details of relevant monitoring are provided in appendix B5-1 (baseline data synopsis report - air quality, Application Reference Number: 6.2.18).

4.2 NO_2

4.2.1 Measured annual mean NO_2 concentrations recorded at monitoring sites within or close to the study area on mainland Wales are presented in table 4-1. 2016 data have been used as the most recent and complete year of data. The monitoring locations are presented on appendix 1-1.

4.2.2 The highest measured concentrations were recorded at monitoring location GCC_038 and co-located tube GCC_039. However, these are located on a bridge above the A55. The concentrations were likely to be influenced by other factors and are not representative of typical non-elevated roadside locations along the A55 where receptors are located. The measurements are included for reference only.

4.2.3 Site CBC_018 recorded the highest annual mean concentration in 2016 (20.9µg/m^3) of all other monitoring sites, which are more representative of receptors adjacent to the A55 relevant to this assessment. It is located approximately 9m from the edge of the A55, downwind of the prevailing wind direction from the A55. Concentrations recorded at this location would generally be indicative of the existing concentrations at properties of similar distance from the A55 roadside and where there are similar traffic flows and characteristics. Concentrations have fluctuated at this site between 2011 and 2016. A measurement of 22.6µg/m^3 was recorded in 2015 and is higher than the measurement for 2016. The consideration of the likely predicted environmental concentrations (PEC) and appropriate background to use is discussed in section 5 (assessment of effects).

4.2.4 Flintshire site 46 (FCC_46) is an urban background location and recorded the lowest concentration out of the tubes considered. This is not representative of existing concentrations at properties closest to the A55 but is included for reference.

4.2.5 The Defra background map NO_2 concentrations for 2013 range between 6.4µg/m^3 and 18.9µg/m^3 across the study area. The 2013 concentration for the grid square associated with monitoring site FCC_46 was 13.2µg/m^3.

4.2.6 It should be noted that none of the local authorities on mainland Wales through which the A55 runs have deemed it necessary to declare an AQMA. This indicates that the existing concentrations of NO_2 (and the other key pollutants of concern including PM_{10} and $PM_{2.5}$) are within the relevant AQOs at the relevant exposure locations closest to the A55.

Table 4-1 Measured annual mean NO_2 concentrations in the vicinity of the mainland Wales A55 study area

Ref	Distance to edge of A55 (m)	2016 annual mean NO_2 concentration ($\mu g/m^3$)	Data capture (%)	Local authority, location	2015 AADT (HDV%)
GCC_038	n/a	28.6	75	GC, A55 Bangor	n/a
GCC_039	n/a	28.4	75	GC, A55 Bangor	n/a
CBC_017	24	19.0	100	CCBC, A55 Colwyn Bay	41,765 (5.1%)
CBC_018	9	20.9	100	CCBC, A55 Pensarn	38,285 (5.8%)
CBC_021	25	17.7	100	CCBC, A55 Llanfairfechan	23,985 (7.2%)
CBC_022	38	20.7	100	CCBC, A55 Mochdre	41,765 (5.1%)
CBC_033	18	13.8	100	CCBC, A55 Old Colwyn	48,897 (5.5%)
DCC_DBR5	38	15.5	100	DCC, A55 St Asaph	38,190 (6.7%)
DCC_DBR8	132	15.5	100	DCC, A55 St Asaph	38,190 (6.7%)
DCC_DBR9	56	21.1	100	DCC, A55 St Asaph	38,190 (6.7%)
DCC_DBR10	64	16.1	100	DCC, A55 St Asaph	38,190 (6.7%)
FCC_46	53	12.7	92	FCC, A55 Northop	51,387 (7.8%)
FCC_49	15	16.9	83	FCC, A55 Broughton	26,782 (7.4%)

4.3 PM_{10} and $PM_{2.5}$

4.3.1 CCBC operated a single PM_{10} analyser close to the A55 within the study area. This was located in a cul-de-sac and situated approximately 20m from the A55. It is sheltered from the A55 by a treeline between the A55 and the continuous monitor. The site was decommissioned in September 2015, therefore the annualised concentration for 2015 ($16.6\mu g/m^3$) has been used in this assessment and is considered to be indicative of concentrations at properties of similar distance from the A55.

4.3.2 GC monitored PM_{10} at a site set back from the A5 between 2013 and 2014 which is unrepresentative of the study area. Similarly, Cheshire West and Chester Council operates four continuous PM_{10} analysers. These are not located adjacent to the A55 and are outside the study area and have also been discounted from this assessment.

4.3.3 The Defra background map PM_{10} concentrations for 2013 range between 10.5µg/m^3 and 15.1µg/m^3 across the study area.

4.3.4 Monitoring of $PM_{2.5}$ is not undertaken within the study area. Mapped background concentrations for 2013 ranged between 7.3µg/m^3 and 10.5µg/m^3 and are considered to be indicative of concentrations within the study area.

4.4 Nitrogen and acid deposition

4.4.1 The existing nitrogen and acid deposition for each of the assessed ecological receptors is presented in table 4-2. This shows that the existing nitrogen deposition is above the critical loads set out in table 3-4 at all ecological receptors. The existing acid deposition is very close to or above the critical load (using the guidance from the APIS website) at three of the six ecological receptors.

Table 4-2 Existing deposition at the assessed ecological receptors

Designated Site	Vegetation Type (for deposition velocity)	Existing Deposition Rate		
		Acid Deposition (keq/ha/year)		Nitrogen Deposition (kgN/ha/year)
		Nitrogen	Sulphur	
Coedydd Afon Menai SSSI	Tall	2.27	0.21	31.80
Coedydd Aber SAC/SSSI	Tall	1.70	0.38	23.80
Sychnant Pass SSSI	Short	0.95	0.26	13.30
Llanddulas Limestone and Gwrych Castle Wood SSSI	Tall	1.57	0.26	21.98
Traeth Pensarn SSSI	Short	1.03	0.23	Not sensitive
Halkyn Mountain/Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI	Short	1.25	0.21	17.50

5 Assessment of effects

5.1.1 The predicted increases in pollutant concentrations (NOx, NO_2, PM_{10} and $PM_{2.5}$) and nitrogen and acid deposition at the assessed receptors as a result of the additional road traffic associated with the Wylfa Newydd Project are presented below. The results are presented for the peak year which represents the largest potential increases in road traffic flows on mainland Wales. During all other years of the construction of the Power Station and subsequent operation of the Power Station, the predicted increases in pollutant concentrations and nitrogen and acid deposition would be lower than those presented below.

5.2 Human receptors

5.2.1 The predicted maximum increase in NO_2 concentrations at human receptors due to emissions from the Wylfa Newydd Project road traffic is presented in table 5-1.

Table 5-1 Predicted increase in annual mean NO_2 concentrations at human receptors

Ref	Increase in NO_2 concentration ($\mu g/m^3$)	Change Relative to AQO (%)[1]
R40	0.20	+1%
R41[2]	1.73	+4%
R42	0.40	+1%
R43	0.39	+1%
R44	0.36	+1%
R45	0.72	+2%
R46	0.71	+2%
R47	0.43	+1%
R48	0.50	+1%
R49	0.27	+1%
R50	0.30	+1%
R51	0.35	+1%
R52	0.28	+1%
R53	0.26	+1%
R54	0.28	+1%
R55	0.41	+1%
R56	0.38	+1%
R57	0.18	0%
R58	0.13	0%

Ref	Increase in NO_2 concentration ($\mu g/m^3$)	Change Relative to AQO (%)[1]
R59	0.14	0%

Note 1: In line with the EPUK/ IAQM guidance [RD1], the percentages have been rounded to whole numbers.

Note 2: R41 is representative of a layby location used occasionally by truckers overnight or resting. The predicted concentrations were considered against the threshold for identifying potential exceedances of the one-hour mean AQO.

5.2.2 The maximum predicted increase in annual mean NO_2 concentration was 0.72µg/m^3 at receptor R45 which is closest to the A55 and is indicative of the likely maximum contributions experienced at properties 9m or more from the A55. The increase is equivalent to 2% of the annual mean AQO. In accordance with the impact descriptors set out in table 6.3 of the IAQM/EPUK guidance [RD1], a 2% change in annual mean NO_2 concentration would be described as a negligible impact unless the total concentration is 30µg/m^3 or higher. The maximum (and representative) monitored NO_2 concentration measured within the study area was 20.9µg/m^3 at CBC_018 in 2016. CBC_018 is a similar distance to the edge of the A55 as R45 (approximately 9m). On that basis, and because ambient concentrations of NO_2 are expected to decrease between 2016 and 2023, the total concentrations are likely to be lower than 30µg/m^3 and the effect at receptor R45 would be described as negligible. Given that the predicted increases in annual mean NO_2 concentrations at all other receptors are lower than predicted at R45, and are further from the A55, the effects would be negligible at all other human receptors locations. Should the higher measured 2015 NO_2 concentration be applied (22.6µg/m^3), the effects would still be negligible.

5.2.3 The annual mean NO_2 concentrations would also be well below 60 µg/m^3. Therefore, it is unlikely that an exceedance of the one-hour mean NO_2 AQO would occur at the long-term exposure locations.

5.2.4 The predicted increase in annual mean NO_2 concentration at the short-term exposure layby location (R41) was 1.73µg/m^3. It is understood that measurements undertaken at the layby location close to the kerbside of the A55 indicate that annual mean concentrations could exceed 60µg/m^3 [RD15]. On this basis, there is the possibility that the one-hour mean AQO value of 200µg/m^3 could be exceeded more than the permitted 18 times in the year. A further consultation meeting with GC is planned to review the full monitoring dataset once 12 months of data have been recorded. Further monitoring and assessment work is anticipated following this meeting in order to identify the significance of air quality effects and to explore mitigation options.

5.2.5 The significance of the predicted changes in NO_2 concentrations at long-term exposure across the study area is therefore considered to be not significant. Further consideration of the effects of increases in NO_2 concentrations at short-term exposure locations are anticipated to determine the significance of effects.

5.2.6 The predicted increase in PM_{10} and $PM_{2.5}$ concentrations are presented in table 5-2.

Table 5-2 Predicted increase in PM_{10} and $PM_{2.5}$ concentrations at human receptors

Ref	Increase in PM_{10} concentration ($\mu g/m^3$)	Change Relative to PM_{10} AQO ($40\mu g/m^3$) (%)[1]	Increase in $PM_{2.5}$ concentration ($\mu g/m^3$)	Change relative to $PM_{2.5}$ AQO ($25\mu g/m^3$) (%)[1]
R40	0.08	0%	0.05	0%
R42	0.13	0%	0.08	0%
R43	0.12	0%	0.08	0%
R44	0.11	0%	0.07	0%
R45	0.23	+1%	0.14	+1%
R46	0.23	+1%	0.14	+1%
R47	0.14	0%	0.08	0%
R48	0.16	0%	0.10	0%
R49	0.09	0%	0.05	0%
R50	0.10	0%	0.06	0%
R51	0.12	0%	0.07	0%
R52	0.13	0%	0.08	0%
R53	0.12	0%	0.07	0%
R54	0.13	0%	0.08	0%
R55	0.15	0%	0.09	0%
R56	0.15	0%	0.09	0%
R57	0.08	0%	0.05	0%
R58	0.06	0%	0.04	0%
R59	0.07	0%	0.04	0%

Note 1: In line with the EPUK/ IAQM guidance, the percentages have been rounded to whole numbers.

5.2.7 The maximum predicted increase in annual mean PM_{10} concentrations is $0.23\mu g/m^3$ at receptors R45 and R46. These are the closest long-term exposure human receptors to the A55 and are indicative of the likely maximum contributions experienced at properties close to the A55. As with NO_2, a 1% change in annual mean PM_{10} concentrations would be described as a negligible impact unless the total concentration at the receptor is $38\mu g/m^3$ or higher (in accordance with the impact descriptors set out in table 6-3 of the IAQM/EPUK guidance [RD1]). The CCBC PM_{10} monitoring site is located further from the A55 (20m) than the highest predicted concentrations at R45 and R46 (9m from the A55). The measured concentration of $16.6\mu g/m^3$ indicates that it is very unlikely that total PM_{10} concentrations would be $38\mu g/m^3$ or higher on the basis that there are no published roadside PM_{10}

measurements close to or above 38µg/m^3 within Wales, on the national air quality website for 2015 and 2016 [RD16].

5.2.8 On this basis, the effects at receptors R45 and R46 would be described as negligible. The change at all other receptors was 0%, which represents a negligible impact.

5.2.9 Similarly, for $PM_{2.5}$, the predicted increases in annual mean concentrations were negligible (i.e. 0%) for all receptors except R45 and R46. The predicted increase in annual mean $PM_{2.5}$ concentration is 0.14µg/m^3, which equates to 1% of the AQO of 25µg/m^3. On the same basis as above for PM_{10}, a predicted increase of this magnitude would represent a negligible impact.

5.2.10 The significance of the predicted changes in PM_{10} and $PM_{2.5}$ concentrations at long-term exposure receptors assessed across the study area is therefore considered to be not significant.

5.3 Ecological receptors

5.3.1 The predicted increase in NOx concentrations are presented in table 5-3.

Table 5-3 Predicted increase in NOx concentrations at ecological receptors

Receptor	Increase in NOx concentration (µg/m^3)	Change relative to critical level (%)	Further consideration required
Coedydd Afon Menai SSSI	1.06	+4	Yes
Coedydd Aber SAC/SSSI	0.40	+1	No
Sychnant Pass SSSI	0.16	+1	No
Llanddulas Limestone and Gwrych Castle Wood SSSI	0.07	0	No
Traeth Pensarn SSSI	0.13	0	No
Halkyn Mountain/Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI	0.44	+1	No

5.3.2 The maximum predicted increase in annual mean NOx concentrations was 1.1µg/m^3 at Coedydd Afon Menai SSSI, which equates to 4% of the critical level of 30 µg/m^3. NOx is not measured by GC or any of the other local authorities and due to the complexity of the site's location to the road source (i.e. below the Britannia Bridge), it is difficult to determine the existing NOx concentrations. Due to its location 30–40m below the Britannia Bridge and relatively rural location adjacent to the Afon Menai, it is likely that ambient concentrations would be well below the critical level of 30µg/m^3 at ground level within the Coedydd Afon Menai SSSI. The 2013 Defra background map concentration for the 1km x 1km grid square representative of the site location is 11.7µg/m^3. Although it is unlikely to directly represent the NOx

concentrations at the closest part of the Coedydd Afon Menai SSSI to the A55, it indicates that, generally, the concentrations across the site are likely to be considerably lower than the critical level of 30µg/m^3. The conservative approach to the assessment should also be taken into account when considering the potential for a significant effect to occur. The assessment used the highest adjustment factor from any of the verification points rather than the average ratio and a distance of 15m was used for the dispersion calculation to potentially represent the very closest part of the tree canopy.

5.3.3 Further modelling was undertaken to estimate the predicted environmental concentration (PEC). The Wylfa Newydd Project traffic flows including the baseline traffic flows were obtained from the Strategic Traffic Model (see chapter C2, Application Reference Number: 6.3.2) and the predicted contributions based were added to the 2013 sector removed Defra background map concentrations. A PEC of 35.6µg/m^3 was predicted, which, in line with the Environment Agency criteria, was indicative of the potential for significant effects and the requirement for an ecologist to examine the site in more detail. However, the modelling was based on the highest verification adjustment factor (1.4) and nearest potential canopy distance of 15m, both of which are considered to be conservative. Applying an average verification adjustment factor of the five sites considered during verification (a factor of 0.66, see appendix 1-1), which follows the approach set out in the LAQM TG16 [RD13] guidance. The predicted PEC for annual mean NOx was considerably lower (21.3µg/m^3) at a distance of 15m from the edge of the A55. At 20m from the A55, the predicted annual mean NOx PEC was 18.9µg/m^3.

5.3.4 On the above basis it is considered that the predicted increase in annual mean NOx concentrations due to road traffic emissions associated with the Wylfa Newydd Project during the peak construction period would not lead to a significant effect on air quality at the Coedydd Afon Menai SSSI.

5.3.5 The predicted increase in annual mean NOx concentrations is 1% of the critical level at Coedydd Aber SAC/SSSI, Synchant Pass (SSSI) and Halkyn Mountain/Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI, and less than 1% for all other site locations. The IAQM position statement on using a criterion for identifying insignificant effects on ecological sites [RD17] notes that the criterion of using 1% as a trigger to consider the issue in greater detail is appropriate. The application of this criterion was originally intended where the change was clearly above 1%, rather than 1% or slightly greater. The IAQM position also states the criterion of 1% should be used as an indication that there may be the potential for a significant effect rather than as a threshold above which, damage is implied. As such, it is unlikely that the Wylfa Newydd Project traffic would lead to a significant effect at any of these sites.

5.3.6 The predicted increase in nitrogen deposition rates at the ecological sites is presented in table 5-4.

Table 5-4 Predicted increase in nitrogen deposition rate at ecological receptors

Name	Vegetation type	Nitrogen deposition rate (kg N/ha-year)		Contribution as a percentage of critical load (%)	Further consideration required
		Contribution due to Wylfa Newydd Project	Critical load		
Coedydd Afon Menai SSSI	Tall	0.17	10	+2	Yes
Coedydd Aber SAC/SSSI	Tall	0.06	10	+1	No
Sychnant Pass SSSI	Short	0.01	10	0	No
Llanddulas Limestone and Gwrych Castle Wood SSSI	Tall	0.01	15	0	No
Traeth Pensarn SSSI	Short	0.01	Not sensitive		
Halkyn Mountain/Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI	Short	0.03	10	0	No

5.3.7 The results in table 5-4 show the predicted contributions to nutrient nitrogen deposition are equal to or less than 1% of the relevant critical loads at all sites except Coedydd Afon Menai SSSI and further consideration is not required.

5.3.8 The predicted nitrogen deposition at Coedydd Afon Menai SSSI is above 1%, therefore further consideration of this site was undertaken. The existing deposition rate is 31.8kgN/ha/yr, which exceeds the critical load of 10kgN/ha/yr. The predicted increase in nitrogen deposition equates to 0.5% of the existing nitrogen deposition rate. As discussed in section 5.3.3, the conservative approach to the assessment means that the predicted nitrogen deposition is likely to be an overestimate. Using the average bias adjustment factor in accordance with the LAQM TG16 guidance [RD13] results in a predicted increase of 0.8% of the critical load value.

5.3.9 The additional nitrogen deposition is considered to be unlikely to cause a significant effect on the current condition status of the SSSI, nor would it be detrimental to the maintenance of the site's conservation status.

5.3.10 The predicted increase in acid deposition rates at the ecological sites is presented in table 5-5. The results show the predicted contributions to acid deposition are 1% or less of the relevant critical loads.

Table 5-5 Predicted increase in acid deposition rate at ecological receptors

Designated Site	Vegetation Type	Acid Deposition Rate (keq /ha-year)		Contribution as a Percentage of Critical Load (%)	Further consideration required
		Contribution due to Wylfa Newydd Project	Critical Load		
Coedydd Afon Menai SSSI	Tall	0.012	2.82	0	No
Coedydd Aber SAC/SSSI	Tall	0.005	2.13	0	No
Sychnant Pass SSSI	Short	0.001	0.64	0	No
Llanddulas Limestone and Gwrych Castle Wood SSSI	Tall	0.001	2.91	0	No
Traeth Pensarn SSSI	Short	0.001	2.04	0	No
Halkyn Mountain/Mynydd Helygain SAC & Halkyn Common and Holywell Grasslands SSSI	Short	0.002	1.01	0	No

6 Conclusions

6.1.1 The results from the screening assessment of road traffic emissions associated with the Wylfa Newydd Project have indicated the following.

- The maximum predicted increase in annual mean NO_2 concentrations at human receptors close to the A55 was 2% of the annual mean AQO. Measurements of NO_2 at similar distances from the A55 to the nearest receptors showed that the impact would be described as negligible and the effect would be not significant.
- The one-hour mean NO_2 AQO is also unlikely to be exceeded at long-term exposure locations based on the estimated total NO_2 concentrations being below 60µg/m^3. The Wylfa Newydd Project road traffic is estimated to increase annual mean concentrations by 1.7µg/m^3 at a short-term exposure layby location adjacent to the A55 to the southeast of the Britannia Bridge. It is likely that the threshold of 60µg/m^3 would be exceeded at this location, indicating the potential for the one-hour mean AQO to be exceeded. Further assessment is planned following further consultation with GC and review of new monitoring data.
- The maximum predicted increases in annual mean PM_{10} and $PM_{2.5}$ concentrations were generally negligible (i.e. 0% of the AQOs) except for two of the closest receptors to the A55 where the increases equated to 1% of the annual mean AQOs. Consideration of available monitoring data indicated that these increases would also represent a negligible effect.
- The predicted increases in annual mean NOx concentrations were 1% or less of the critical level at all ecological receptors, except Coedydd Afon Menai SSSI. The effects at these locations due to emissions from the Wylfa Newydd Project traffic would be not significant. Coedydd Afon Menai SSSI is predicted to experience an increase in NOx concentrations of 4%, based on the conservative approach to the assessment. Consideration of a more realistic conservative approach indicated that the predicted increase in annual mean NOx concentrations would lead to a not significant effect on the Coedydd Afon Menai SSSI.
- The increase in nutrient nitrogen deposition rates were 1% or less of the relevant critical loads at all ecological receptors with the exception of Coedydd Afon Menai SSSI. Therefore, the effects of the increase in traffic emissions associated with the Wylfa Newydd Project would be not significant at these sites. The increase in the nutrient nitrogen deposition rate at Coedydd Afon Menai SSSI was 2% of the relevant critical load (representing an increase of only 0.5% to the existing deposition rates). As for NOx concentrations, consideration of a more realistic approach indicated that the increase would be less than 1% of the critical load and therefore not significant.

- The increases in acid deposition rates at all ecological receptor locations were below 1% of the relevant critical loads. The effects of the increase in road traffic emissions associated with the Wylfa Newydd Project would therefore be not significant.
- Only the impacts at national and internationally designated sites have been considered given that more stringent criteria are applicable to these sites compared to sites of lower importance or local designated sites such as ancient woodlands or local wildlife sites. The predicted increases in NOx concentrations and nitrogen and acid deposition presented for the assessed ecological receptors demonstrate that there would not be the potential for significant effects to occur at such sites.

6.1.2 There are no AQMAs within the study area and existing air quality is within relevant AQOs of the key pollutants of concern at all relevant exposure locations.

6.1.3 In summary, the predicted increase in road traffic emissions as a result of the Wylfa Newydd Project is unlikely to cause significant air quality effects at the worst-case (i.e. closest) human or ecological receptors within 200m of the A55. All other roads were screened out from the need for assessment as the change in traffic flows were below the relevant criteria.

6.1.4 Overall, it is concluded that the effects due to the additional road traffic on the road network on mainland Wales associated with the Wylfa Newydd Project (either during construction or operation of the Power Station) would not lead to a significant air quality effect.

7 References

Table 7-1 Schedule of references

ID	Reference
RD1	Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) (EPUK/IAQM). January 2017. *Land-Use Planning & Development Control: Planning for Air Quality*.
RD2	Horizon Nuclear Power Ltd. 2017. Wylfa Newydd DCO Project, *Extent of Study Area and Receptor Selection for the Assessment of Air Quality*. DCRM: WN034-JAC-PAC-MEM-00024, December 2016. Revision 3.0
RD3	Highways Agency 2007. *Design Manual for Roads and Bridges, Volume 11: Environmental Assessment, Section 3: Environmental Assessment Techniques*, *Part 1: Air quality (HA207/07)*.
RD4	Department for Environment, Food and Rural Affairs (Defra). 2016. *LAQM support website*. [Online]. [Accessed: August 2016]. Available from: https://uk-air.defra.gov.uk/data/laqm-background-home.
RD5	Department for Environment, Food and Rural Affairs. 2016. *NOx to NO_2 Calculator (v5.1) LAQM Support*. [Online]. [Accessed: August 2016]. Available from: http://laqm.defra.gov.uk/review-and-assessment/tools.
RD6	Centre for Ecology and Hydrology. 2016. *UK Air Pollution Information System*. [Accessed 09 September 2016]. Available from http://www.apis.ac.uk.
RD7	Natural Resources Wales. 2017. Critical loads provided in email from NRW dated 17th February, 2017.
RD8	Environment Agency. 2014. *AQTAG 06, Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air*. Updated version, March 2014.
RD9	Environment Agency. 2016. *Air Emissions Risk Assessment for your Environmental Permit*. [Online]. [Accessed: August 2016] Available from: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
RD10	Highways England. 2016. *DRAFT DMRB Spreadsheet Tool version 4.2, 2016*. [DMRB Screening Method Spreadsheet, draft version 4.2. Available on request from LAQMhelpdesk@bureauveritas.com].
RD11	Department for Environment, Food and Rural Affairs. 2016. *EFT v7.0 LAQM Support*. [Online]. [Accessed: August 2016].

	Available from http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html.
RD12	Air Quality Consultants Ltd (AQC). 2016. *CURED_V2A (the Calculator Using Realistic Emissions for Diesels)* [online]. [Accessed August 2016]. Available from http://www.aqconsultants.co.uk/Resources/AQC-Tools.aspx.
RD13	Department for Environment, Food and Rural Affairs. 2016. *Local Air Quality Management, Technical Guidance (TG16)*. April 2016, Department for Environment, Food and Rural Affairs, London.
RD14	Environment Agency. 2016. *Air Emissions Risk Assessment for your Environmental Permit*. [Online]. [Accessed: July 2017] Available from: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
RD15	As discussed in a meeting with Horizon, IACC, GC and National Grid, 11th January 2018.
RD16	Air Quality in Wales; http://www.welshairquality.co.uk/data_and_statistics_home. Data sourced December 2017
RD17	Institute of Air Quality Management, *Position Statement – Effects of Air Quality Impacts on Sensitive Habitats*, January 2016 [Online] [accessed: June 2017] Available from: http://iaqm.co.uk/guidance/
RD18	Air Quality Consultants Ltd (AQC). 2016. *Overview of Changes Introduced by EFT v7.0 and by Cured v2A, August 2016*. [online], available from http://www.aqconsultants.co.uk/getattachment/Resources/Download-Reports/Note-on-EFT7-and-CURED2A-Comparison-August-2016.pdf.aspx.
RD19	Department for Transport website, https://www.dft.gov.uk/traffic-counts/ accessed January 2018.

8 Figures

Figure 1 Mainland Wales road traffic emissions study area, monitoring and receptors locations

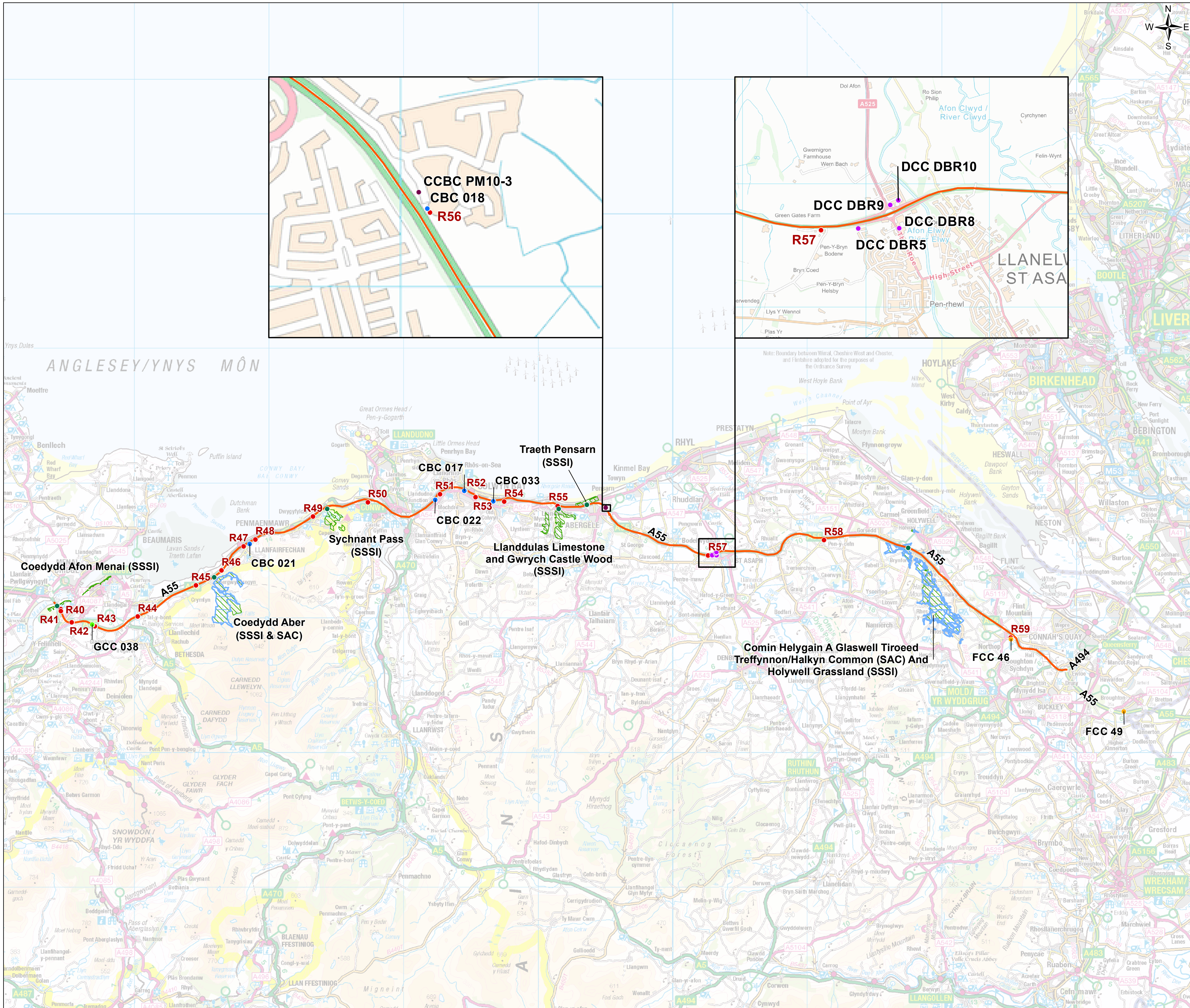

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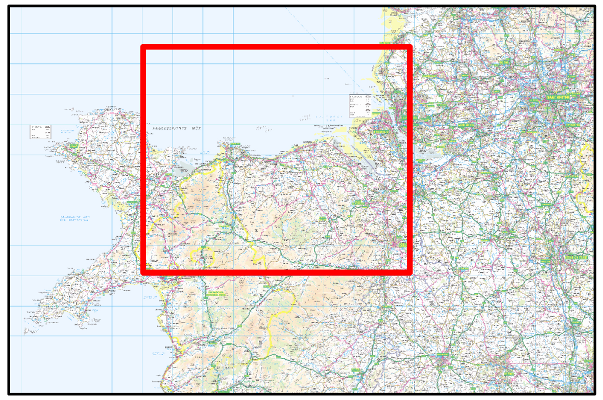
FIGURE 1

Legend

- Affected road network – mainland Wales
- Special Area of Conservation within 200m of affected roads (SAC)
- Site of Special Scientific Interest within 200m of affected roads (SSSI)
- Modelled human receptor location
- Modelled ecological receptor location
- CCBC NO_2 measurement location
- DCC NO_2 measurement location
- FCC NO_2 measurement location
- GC NO_2 measurement location
- CCBC PM_{10} monitoring location

Note:
CCBC = Conwy County Borough Council
DCC = Denbighshire County Council
FCC = Flintshire County Council
GC = Gwynedd Council



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1.0	MAR 18	DCO submission	HNPWL	HNPWL	HNPWL	HNPWL

Client

HORIZON NUCLEAR POWER

Project

WYLFA NEWYDD PROJECT
ENVIRONMENTAL STATEMENT

Drawing Title

MAINLAND WALES ROAD TRAFFIC EMISSIONS
STUDY AREA, MONITORING AND RECEPTOR LOCATIONS

Scale @ A3	1:275,000	DO NOT SCALE
Jacobs No.	60PO8077	
Client No.		
Drawing No.	60PO8077_DCO_VOL_C_APP_04_02_01	

Appendix 1-1 Approach to calculate the dispersion of road traffic emissions

1-1.1.1 An overview of the method and tools used to calculate the road traffic emissions and the predicted pollutant concentrations and nitrogen and acid deposition at receptors for the mainland Wales study area is in this appendix, and includes the rationale behind the approach used.

1-1.1.2 An overview of the approach is summarised below.

- Information on the increase in LDV and HDV flows and average vehicle speed for the assessment year was compiled from the information developed as part of the assessment of traffic (further details on road traffic associated with the Wylfa Newydd Project are provided in chapter C2 (Application Reference Number: 6.3.2)).
- The emissions from the increase in road vehicles were calculated using EFT v7.0 and the CURED v2A approach.
- The closest human receptors within 200m of the affected roads were identified and distances to the affected roads recorded.
- All ecological receptors (SPAs, SACs and SSSIs) within 200m of the affected roads were identified and the distances to the affected roads recorded.
- Using the dispersion calculation from the DMRB screening method tool [RD10], the increases in NOx, NO_2 and PM_{10} concentrations were calculated at the identified receptor locations.
- The nitrogen and acid deposition was calculated based on the modelled NO_2 concentrations at the identified ecological receptors.
- Local roadside measurements of NO_2 and PM_{10} recorded by GC, CCBC, DCC and FCC, and existing nitrogen and acid deposition rates from the APIS website [RD6], were obtained.
- The increase in concentrations and existing deposition rates were compared to the relevant AQOs and critical loads and the potential significance of effects determined based on relevant guidance [RD2].

1-1.1.3 The following sections provide information on the vehicle emissions, the method used to calculate the predicted concentrations and deposition at receptors and information on verification of the assessment approach.

1-1.2 Vehicle emissions and dispersion

1-1.2.1 The road vehicle emissions modelling has been undertaken based on the latest available vehicle emissions data, EFT v7.0 [RD11], which draws on emissions generated by the European Environment Agency COPERT 4 (v11.0) emission calculation tool, and includes updated NOx, PM_{10} and $PM_{2.5}$ emission factor assumptions for Euro 5 and Euro 6 vehicles.

1-1.2.2 The EFT v7.0 emissions are vehicle-weighted averaged emissions for the national vehicle fleet. Emission factors are set for each year to represent

the predicted vehicle fleet, and the range of vehicle types and Euro emissions standards present across the fleet.

1-1.2.3 Historically, air quality modelling carried out using these emission factors has predicted year-on-year reductions in NOx emissions and concentrations in future years. However, in recent years it has been realised that these reductions have not been reflected in ambient measurements close to roads [RD18]. This disparity relates to the on-road performance of modern vehicles, particularly diesel, versus that recorded under standardised laboratory conditions. It is recognised that modern vehicles are not performing as well as expected despite tighter approval standards being applied to these new vehicles. The EFT v7.0 [RD11] takes account of updated emission functions and updated information on fleet compositions, but does not directly address this disparity.

1-1.2.4 The CURED v2A approach, released by Air Quality Consultants Limited [RD18] is a spreadsheet tool aimed at addressing the disparity highlighted with the on-road performance of modern diesel vehicles. The tool uses the same fleet information and speed emission curves as the EFT v7.0, but uplifts them to give higher emissions of NOx. There is no change to the emissions of other pollutants, and it is recognised that the on-road performance of petrol vehicles appears to reflect the reductions in future years imposed by the Euro standards. The CURED v2A approach has been used for this assessment, and is applied to NOx emissions only.

1-1.2.5 The parameters required to calculate the vehicle emissions and undertake the prediction of concentrations of pollutants at the receptors include:

- traffic data for the road link at the receptor location (i.e. AADT flows and speeds in kilometres per hour (km/h) of the road traffic associated with the Wylfa Newydd Project;
- road link type (i.e. classification corresponding with EFT descriptors);
- road link width; and
- distance of the receptors (human and ecological) to the road link.

1-1.2.6 Traffic information was derived from the strategic traffic model. Road type was allocated based on the Department for Transport's definition of rural/urban classification, which is based on population density.

1-1.2.7 Distances have been measured using detailed internet based geo-referencing tools. Where national speed restrictions were identified within the study area, these were used in place of the modelled data. Any assumptions applied are intended to be conservative, where appropriate.

1-1.2.8 The CURED v2A spreadsheet tool was populated using some of the above information to produce the NOx emission rate (g/km/s) for each modelled road link. The same procedure was undertaken using the EFT v7.0 to produce the PM_{10} and $PM_{2.5}$ emission rate in g/km/s for each modelled road link.

1-1.2.9 These emissions were then used in the dispersion calculation formula embedded within the DMRB Screening Method Spreadsheet tool [RD10], together with the information on the distance of the receptor to the modelled

road link, to calculate the predicted annual mean NOx, PM_{10} and $PM_{2.5}$ concentration (µg/m^3) at each receptor.

1-1.3 Model verification and Adjustment

1-1.3.1 Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. NO_2 monitoring sites within or close to the assessment study area have been reviewed and their suitability considered. The study area has only one PM_{10} monitoring site available for consideration, which is typical of many air quality assessments. The monitoring sites used within the verification process and the discussion behind the selections are presented in table A1-2.

Model Precision

1-1.3.2 Residual uncertainty may remain after systematic error or 'model accuracy' has been accounted for in the final predictions. Residual uncertainty may be considered synonymous with the 'precision' of the model predictions (i.e. how wide the scatter or residual variability of the predicted values compare with the monitored true value, once systematic error has been allowed for). The quantification of model precision provides an estimate of how the final predictions may deviate from true (monitored) values at the same location over the same period.

Model performance

1-1.3.3 An evaluation of model performance has been undertaken to establish confidence in the modelled outputs. LAQM (TG16) [RD13] identifies a number of statistical measures that are appropriate to evaluate model performance and assess the uncertainty. The statistical parameters used in this assessment and their purpose are presented in table A1-1. These parameters estimate how the model results agree or diverge from the observations.

Table A1-1 Model performance statistics applied

Statistical parameter	Comment	Ideal value
Root mean square error (RMSE)	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual average NO_2 objective of 40µg/m^3, if an RMSE of 10µg/m^3 or above is determined for a model it is advised to revisit the model parameters and model verification.	0.01

Statistical parameter	Comment	Ideal value
	Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual average NO_2 objective.	
Fractional bias (FB)	FB is used to identify if the model shows a systematic tendency to over- or under-predict. FB values vary between +2 and -2 and have an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	0.00
Correlation coefficient (CC)	CC is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.	1.00

Assessment verification

1-1.3.4 The predicted road NOx and road PM_{10} contributions have been adjusted following a method set out in LAQM (TG16) [RD13] and referred to as model verification and adjustment. The steps followed for this assessment are outlined below.

1-1.3.5 Automatic Traffic Count (ATC) information from the Department for Transport [RD19] was downloaded for the ATC sites identified on road links adjacent to or most representative of traffic passing the local authority monitoring location for the year 2016 (the same year of the monitored pollutant concentrations). The ATC sites provide AADT, LDV and HDV flows. National speed limits were applied, as speed is not measured at the ATC sites. This data was input into the model to calculate the respective road NOx contribution, which was then converted to total NO_2 following the method provided in the main chapter.

1-1.3.6 The monitored data for 2016 from roadside locations within the study area were compared to the modelled concentrations at the same locations and are presented in table A1-3. Sites considered unsuitable for verification purposes were excluded prior to this and are presented in table A1-2.

Table A1-2 NO_2 Monitoring sites excluded from model verification

Monitor ID	Local Authority	Exclusion comment
GCC_038	GC	Site location was moved in 2013 to a lamp post on the bridge above the A55, so not representative of the A55.
GCC_039		Co-located with GCC_038.
CBC_021	CCBC	Located adjacent to a roundabout. Unrepresentative of the 'free-flow' character of the A55.

Monitor ID	Local Authority	Exclusion comment
CBC_033		Located behind a bunded verge, so measured concentrations are likely to be influenced by the barrier.
DCC_DBR8	DCC	Located > 50m from the A55. Concentrations are unlikely to be representative of conditions close to the A55.
DCC_DBR9		Contributions will be included from the A5252 and therefore the site is not representative of the A55.
DCC_DBR10		Located > 50m from the A55. Concentrations are unlikely to be representative of conditions close to the A55.
FCC_46	FCC	Urban background site and therefore unrepresentative of conditions close to the A55.

1-1.3.7 Table A1-3 presents the monitored and modelled NO2 concentrations for comparison.

Table A1-3 Non-adjusted modelled versus monitored annual mean NO_2 concentrations, 2016

Monitor ID	Local Authority	Road	X (m)	Y (m)	Monitored annual mean NO_2 ($\mu g/m^3$)	Non-adjusted modelled annual mean NO_2 ($\mu g/m^3$)
CBC_017	CCBC	A55	284526	379417	19.0	22.2
CBC_018			295049	378144	20.9	30.8
CBC_022			282362	378757	20.7	17.2
DCC_DBR5	DCC		302938	374638	15.5	15.8
FCC_ 49	FCC		333531	363028	18.8	24.6

1-1.3.8 The results indicated that the model tended to over-predict concentrations and the average RMSE was greater than 25% at a number of locations. Where the model performed poorly against the monitoring data, checks were undertaken to ensure that all input data was reasonable and had been accurately represented. To determine if the performance of the model could be improved, an average of the ratios (monitored road NOx vs modelled road NOx) for all sites considered was calculated and used to adjust the modelled road NOx component for each site. The adjusted road NOx was then converted to equivalent total and road NO_2. Mapped background concentrations for 2016 published by Defra [RD4] were added to the modelled road NO_2 concentrations. The total adjusted modelled NO_2 concentration was then compared against the monitored NO_2 concentrations.

1-1.3.9 The model performance statistics with adjustments applied as described above are presented in table A1-4.

1-1.3.10 The ratios between site locations for road NOx ranged between 0.5 and 1.4 (0.7, 0.5, 1.4, 1.0 and 0.5). The average of these ratios (and which is applied to the statistics in table A1-4) is 0.66 for road NOx.

Table A1-4 Model performance statistics for NO_2

Summary Table	A55	
	No adjustment	With adjustment
Within +- 10%	1	2
Within +- 10 to 25%	1	2
Greater than +-25%	3	1
Uncertainties assessment		
Correlation	0.55	0.52
RMSE (µg/m³)	7.9	4.3
Fractional bias	-0.3	-0.1

1-1.3.11 There was a tendency to over-predict at sites along the A55, which has been corrected for. The average error or uncertainty with the model is improved with two sites within 10%, two sites between 10 and 25% and one site greater than 25%.

1-1.3.12 Although the verification process identified that a factor of 0.66 should be applied to the predicted road NOx, and this would improve the model performance as shown in table A1-4, the highest individual road NOx adjustment factor of 1.4 calculated at CBC_022 was used in this assessment. This was the highest individual adjustment factor calculated for all monitoring sites considered in the verification process. Therefore, this maintains a conservative approach for this assessment as it will more accurately represent the concentrations at one verification point, but over-predict concentrations at locations represented by the other verification points on the A55. Using this approach would provide worse performance statistics than presented in table A1-4 based on the average adjustment factor. However, the use of the highest adjustment factor is considered to outweigh this in favour of presenting a worst case approach. It should be noted that this is not in accordance with the verification process set out in the LAQM (TG16) guidance [RD13] and presents an unrealistic worst-case approach. It has only been adopted here due to the screening assessment approach to initially identify the potential for significant effects to occur. Where the assessment using this worst-case approach has indicated the potential for significant effects, the average bias adjustment factor (as recommended by the LAQM (TG16) guidance [RD13]) has also been taken into consideration. Any further studies, or more detailed assessments, would be undertaken more fully in accordance with the verification process set out in the LAQM (TG16) guidance [RD13].

1-1.3.13 Model verification for PM_{10} was undertaken using the only site available for comparison CCBC_PM_{10}-3. The data is presented in table A1-5.

Table A1-5 Model performance statistics for PM_{10}

Monitor ID	Local Authority	Road	X (m)	Y (m)	Monitored annual mean PM_{10} ($\mu g/m^3$)	Non-adjusted modelled annual mean PM_{10} ($\mu g/m^3$)
CCBC_PM_{10}-3	CCBC	A55	295033	378174	16.6	12.5

1-1.3.14 The model tends to under-predict concentrations, which could be due to the location of the continuous monitor (approximately 20m from the roadside) and within a sheltered cul-de-sac with a vegetation barrier between the monitoring location and the A55. In the absence of alternative monitoring sites for inclusion, the adjustment factor of 3.72 was applied to all predicted PM_{10} and $PM_{2.5}$ concentrations.

Appendix 1-2 Calculating acid and nitrogen deposition

1-2.1.1 Nitrogen and acid deposition have been predicted using the methodologies presented in the Air Quality Technical Advisory (AQTAG) guidance *Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air* [RD8]

1-2.1.2 When assessing the deposition of nitrogen, it is important to consider the different deposition properties of nitric oxide (NO) and NO_2. It is generally accepted that there is no wet or dry deposition arising from NO in the atmosphere, and that there is no wet deposition due to NO_2. Thus it is normally necessary to distinguish between NO and NO_2 in a deposition assessment. In this case, predicted NO_2 concentration for use in the deposition calculations was calculated from the predicted NOx concentrations using the LAQM NOx to NO_2 calculator [RD5].

1-2.1.3 Where required, information on the existing nitrogen and acid deposition was obtained from the APIS database [RD6]. Information on the deposition critical loads for each habitat site was provided by NRW [RD7] or obtained from the APIS database [RD6] (these are provided in appendix B5-2 (Application Reference Number: 6.2.19)). The selection of the acid deposition critical load for all ecological receptors was based on identifying the vegetation or habitat types present at each site using the 'site relevant critical loads' function on the APIS website [RD6].

1-2.1.4 If the annual average ground level concentration of a pollutant is C ($\mu g/m^3$) and the dry deposition velocity for that pollutant is Vd (m/s) then the annual dry deposition rate D in kilograms per hectare per year (kg/ha/yr) is calculated from the following formula:

$$D = Vd \times C \times R \times 315.36$$

1-2.1.5 Where:

- R is 14/46 for NO_2 and converts from nitrogen dioxide to nitrogen; and
- '315.36' converts to kg/ha/yr[1].

1-2.1.6 Dry deposition velocities vary depending on the type of land mass and weather conditions such as humidity. The following values have been used for Vd, as presented within the AQTAG technical guidance note.

- NO_2 – 0.0015 m/s for short vegetation (e.g. grassland); and
- NO_2 – 0.0030 m/s for tall vegetation (e.g. trees).

[1] 315.36 = 10,000 (m^2 in hectare) x 8,760 (hours in year) x 3,600 (seconds in hour) divided by 1,000,000,000 (micrograms in kilogram)

1-2.1.7 In order to calculate acid deposition in terms of $kEqH^+$/ha/year (kilo-equivalents hydrogen ion per hectare per year) from deposition data (calculated using the equation above), the following conversion factors are used:

- Nitrogen derived acid deposition: 1 kg N/ha/yr is equal to 1/14 keq N/ha/yr.