Low Level Waste Repository:
Site Optimisation and Closure Works
Environmental Statement

Appendix G: Air Quality
June 2011

Prepared for

LLW Repository Ltd

Revision Schedule

Appendix G: Air Quality Assessment
June 2011

Rev	Date	Details	Prepared by	Reviewed by	Approved by
0	June 2011	Final	**David Deakin** Principal Air Quality Consultant	**Richard Lowe** Associate Director	**Ian Campbell** Principal Environmental Scientist

URS Scott Wilson
12 Regan Way
Chetwynd Business Park
Chilwell
Nottingham
NG9 6RZ

Tel +44 (0)115 907 7000
Fax +44 (0)115 9077001

www.urs-scottwilson.com

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1 Introduction

1.1.1 This Appendix assesses the likely significant effects on air quality of the proposed optimisation and closure works at the LLWR site (the Scheme) as detailed in Volume I of the ES. The associated figure is included in the rear of this volume of the ES.

1.1.2 In particular, the assessment identifies the likely significant effects associated with the Scheme including:

- dust generation during the construction of Vaults 9A to 14 and capping works to Trenches 1 to 7 and Vaults 8 to 14;
- emissions generated by plant equipment during construction of Vaults 9A to 14 and capping works to Trenches 1 to 7 and Vaults 8 to 14;
- increases in emissions above baseline from road traffic associated with the construction of Vaults 9A to 14 and capping works to Trenches 1 to 7 and Vaults 8 to 14; and
- increases in emissions above baseline from rail freight associated with the construction of Vaults 9A to 14 and capping works to Trenches 1 to 7 and Vaults 8 to 14.

1.1.3 The different phases of construction and capping are described further in Section 3 of Volume 1 of the Environmental Statement. The anticipated construction and capping programme is also discussed in Section 3 of Volume 1 of the Environmental Statement. The programme indicates that that some phases of work will be undertaken up to the year 2079. Elements of air quality assessment will become uncertain over these extended timescales. For example government approved factors for describing vehicle emissions are available up to 2025 and factors for characterising changes in air quality over time are also only available up to 2025. Consequentially, the assessment has predominantly focused on the earlier years of activities. This approach is considered appropriate, as national ambient air quality is anticipated to improve over time and similar activities associated with this development are planned during the early and later stages of the programme. Therefore, the assessment of air quality impacts on sensitive receptors around the site for the earliest years of activity should represent the worst case for the same sensitive receptors in later years. This is unless works are undertaken at closer distances to receptors in later years. It is also understood that further environmental assessments will be prepared as later phases of work are progressed.

1.1.4 The specific years of construction and capping that have been assessed are listed in Section 4. The rationale for selecting these years is also provided in Section 4.

1.1.5 The implications for air quality will also be discussed in respect to other operational aspects of the Scheme, including:

- disposal of waste in Vaults 9 to 14; and
- high stacking of containers in Vaults 8, 9 and all future vaults.

1.1.6 A high-level assessment has been undertaken for the two aspects of the operational proposed development listed above. This is because significant effects are not anticipated with respect to air quality from these two aspects of the Scheme.

1.1.7 The below list of bullet points outlines the key sections of this Air Quality Assessment Appendix:

- Legislation
- Planning Policy Context
- Assessment Methodology
- Baseline Conditions
- Likely Significant Effects
- Mitigation Measures
- Residual Effects
- Cumulative Impacts
- Summary

2 Legislation

2.1.1 The principal air quality legislation within the United Kingdom is the Air Quality Standards Regulations 2010 [i], which came into force in June 2010 and brings together the Government's requirements to transpose the separate EU Daughter Directives into national legislation through a single consolidated statutory instrument.

2.1.2 In addition, the Environment Act 1995 [ii] requires the Government to produce a national Air Quality Strategy (AQS) containing standards, objectives and measures for improving ambient air quality and to keep the policies identified below under review. It also requires that Local Authorities undertake a tiered appraisal of air quality within their borough to establish compliance or non-compliance with the targets established in the AQS. Where the objectives are likely to be exceeded, the Authority must designate an Air Quality Management Area (AQMA) and establish an Action Plan, which outlines measures to achieve the objectives.

2.1.3 The AQS for England, Scotland, Wales and Northern Ireland [iii] provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the Government to protect human health. These objectives apply to outdoor locations where people are regularly present and do not apply to occupational, indoor, or in-vehicle exposure.

2.1.4 The air quality objectives applicable to Local Air Quality Management are set out in the Air Quality Standards Regulations 2010 [i]. Current assessment criteria applicable to the protection of human health and Local Air Quality Management based on the recent AQS and the 2010 Regulations are presented in Table 2.1. Concentrations are expressed in mass pollutant (micrograms) per cubic metre of air (µg/m^3), unless otherwise stated.

Table 2.1 Air Quality Strategy Objectives µg/m^3

Pollutant	Objective	Averaging period	Percentile	To be met by and maintained after
Nitrogen dioxide (NO_2)	200	1 hour	99.8th (18 exceedances/year)	31 Dec 2005
	40	Annual	Mean	31 Dec 2005
Particulate matter (PM_{10})	40	Annual	Mean	31 Dec 2004
	50	24 hour	90.4th (35 exceedances/year)	31 Dec 2004
Particulate matter ($PM_{2.5}$)	25	Annual	Mean	1 Jan 2015
Carbon monoxide (CO)	10,000	8-hour	100th	31 Dec 2003
Benzene	5	Annual	Mean	31 Dec 2010
1,3 butadiene	2.25	Annual	Mean	31 Dec 2003
Lead	0.25	Annual	Mean	31 Dec 2008

Pollutant	Objective	Averaging period	Percentile	To be met by and maintained after
Poly aromatic hydrocarbons (PAH) (ngm^{-3})	0.25	Annual	Mean	31 Dec 2010
Sulphur dioxide (SO_2)	266	15 minute	99.9th (35 exceedances/year)	31 Dec 2005
	350	1 hour	99.7th (24 exceedances/year)	31 Dec 2004
	125	24 hour	99.2nd (3 exceedances/year)	31 Dec 2004

2.1.5 In addition, a number of objectives have been developed for the protection of vegetation and ecosystems; these are shown in Table 2.2 below.

Table 2.2 Air Quality Strategy Objectives – Protection of Vegetation and Ecosystems

Pollutant	Objective	Averaging period	Percentile	To be met by
Oxides of Nitrogen (NO_x)	30 µg/m^3	Annual	Mean	31 Dec 00
Sulphur dioxide (SO_2)	20 µg/m^3	Annual	Mean	31 Dec 00
Ozone	18 mg/m^3	5 year average of summer 1 hour values		1 Jan 2010

2.1.6 The above legislation relates to concentrations of pollutants in ambient air with respect to the protection of human health or vegetation. There are no legislative standards or agreed guidelines for dust nuisance in the UK, for example due to dust deposition. Most issues of dust nuisance are covered through Statutory Nuisance legislation defined in the Environmental Protection Act, Part III, 1990, Section 79, Parts (d) and (e) which covers dust [iv]:

> *'d) Any dust, smell or effluvia arising on industrial, trade, or business premises and being prejudicial to health or a nuisance;*
>
> *e) Any accumulation or deposit which is prejudicial to health or a nuisance.*'

2.1.7 In the absence of legislative standards for deposited dust there are however a number of non-statutory guidelines that are available when measuring the effect of dust deposition. For example the Environment Agency (EA) has set a custom and practice limit of 200 mg/m^2/day [v], which is the threshold above which the EA considers there is the potential for justifiable nuisance complaints.

3 Planning Policy Context

3.1 National Planning Policy

3.1.1 Air quality is considered in a range of national policy guidance notes and statements including general pollution control statements, local air quality policy guidance, transport guidance notes and also minerals planning notes. This sub-section identifies the key national policy guidance from these different policy areas.

3.1.2 Planning Policy Statement 23 'Planning and Pollution Control' [vi] outlines a number of material planning considerations with respect to pollution control and identifies that air quality can be a material planning consideration.

3.1.3 Policy Guidance Note LAQM.PG(09) [vii] considers all aspects of local air quality management policy, including air quality reviews and assessments, air quality action planning, transport planning, and land use planning. It provides specific guidance on developing local air quality strategies; however the structure and format of a local air quality strategy is entirely up to the local authority.

3.1.4 Planning Policy Guidance Note 13 'Transport' (PPG13) [viii] states that local air quality is a key consideration in the integration of planning and transport issues, and is of particular relevance for areas where the AQS standards are not likely to be met and air quality action plans will be required, and advises that well designed traffic measures contribute to reductions in local air pollution.

3.1.5 Planning Policy Statement 10 (PPS10): Planning for Sustainable Waste Management [ix] provides the overarching policies and principles that apply to sustainable waste management in England. With regard to environmental impacts the statement indicates that: *'In considering planning applications for waste management facilities waste planning authorities should consider the likely impact on the local environment and on amenity'* (see Annex E). In Annex E, air emissions are discussed:

> *'g. air emissions, including dust Considerations will include the proximity of sensitive receptors and the extent to which adverse emissions can be controlled through the use of appropriate and well-maintained and managed equipment and vehicles.*

3.2 Regional Planning Policy

3.2.1 The North West of England Plan Regional Spatial Strategy to 2021 [x] provides guidance for the region's development over the next 11 years to 2021. The strategy considers many themes including the economy, housing, transport, the built and natural environment.

3.2.2 Policy DP 7 - Promote Environmental Quality is of particular relevance to the development stating that: *'Environmental quality (including air, coastal and inland waters), should be protected and enhanced'*. Three items within Policy DP7 relate to air quality:

> *'promoting good quality design in new development and ensuring that development respects its setting taking into account relevant design requirements, the NW Design Guide and other best practice;'*
>
> *'assessing the potential impacts of managing traffic growth and mitigating the impacts of road traffic on air quality, noise and health;'*

'ensuring that plans, strategies and proposals which alone or in combination could have a significant effect on the integrity and conservation objectives of sites of international importance for nature conservation are subject to assessment, this includes assessment and amelioration of the potential impacts of development (and associated traffic) on air quality, water quality and water levels.'

3.2.3 Cumbria County Council also continues to implement a series of twenty three policies from the Cumbria and Lake District Joint Structure Plan 2001 to 2016 [xi]. No specific air quality policies have been retained. However, one policy relating to residual waste and landfill (R51) may be of relevance to the Scheme and in particular item 2 of the policy:

'Proposals for the disposal of waste to landfill will not be permitted in the Lake District National Park and AONBs. Outside these areas, proposals for the disposal of Residual Waste will only be permitted when all the following requirements are met:

2.there are no significant adverse effects on landscape character, conservation interests, environmental infrastructure, transport and local communities,'

3.3 Local Planning Policy

3.3.1 The Copeland Local Plan 2001-2016 [xii] includes Policy ENV19 which states that: *'In dealing with new development the Council will seek to minimise harmful or offensive aerial discharges. The Council will consult statutory bodies to minimise discharges from existing uses'*. Policy ENV19 is included in the Schedule of '*saved*' policies [xiii] from the local plan and therefore the policy remains part of the Development Plan.

3.3.2 The portfolio of Copeland Borough Council Local Development Framework (LDF) documents, which will eventually replace the above Local Plan, have been reviewed to identify specific air quality policies.

3.3.3 The most recently published LDF document is the LDF Issues and Options Responses to Consultation Summary Report [xiv]. This document does not include any specific air quality policies.

3.3.4 No supplementary air quality planning guidance has been identified for Copeland Borough Council.

4 Assessment Methodology

4.1.1 This Section identifies the study pollutants associated with the different potential emission sources associated with proposed development. The Section also identifies the sensitive receptors that could potentially be affected by the emission sources, and describes the significance criteria used to determine the significance of effects on these receptors. The Section also describes the assessment methodology utilised for each potential emission source. Key study guidance is also outlined at the commencement of the assessment methodology section.

4.2 Study Guidance

4.2.1 The following guidance has been utilised in the assessment of air quality issues for the Scheme.

- Department for Environment, Food and Rural Affairs (Defra) (2009) Local Air Quality Management Technical Guidance Note LAQM.TG(09) [xv].
- The Control of Dust and Emissions from Construction and Demolition Best Practice Guidance [xvi].
- Environmental Protection UK (EPUK). (2010). Development Control: Planning for Air Quality, 2010 Update [xvii].
- Highways Agency. (2007). Design Manual for Roads and Bridges (DMRB), Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1, HA207/07, Air Quality [xviii].
- Building Research Establishment (BRE). (2000). Effects of a Construction Site on Local PM_{10} levels [xix].

4.3 Study Scenarios

4.3.1 The construction and capping works at the site are anticipated to commence in 2013 and to continue intermittently up to 2079.

4.3.2 In 2013 various works including the installation of perimeter drainage and the removal of existing vegetation north of Trenches 1 to 7 will be undertaken. Following vegetation removal the area north of Trenches 1 to 7 will be in filled and re-profiled. The Drigg stream will also be diverted in the first phase of works and stockpile areas will also be created at this stage. A cut off wall around Vault 8 will also be constructed in 2013.

4.3.3 In 2014 the first works to re-profile Trenches 1 to 7 will be commenced. The first areas of capping will commence in 2015, for the shoulders of Trenches 1 to 7, with the first year of capping on top of the Trenches undertaken in 2021.

4.3.4 The first construction works of a new vault (Vault 9A) are due to commence in 2019 with the last vault (Vault 14) constructed in 2050 to 2051.

4.3.5 A scheme of works to covering the final decommissioning, removal and demolition of the plutonium containing materials (PCM) retrieval facilities and magazines is also due to be undertaken between 2019 and 2020. These works do not form part of the works which this

Environmental Statement supports. However, these works are considered as part of the cumulative assessment for this proposed development.

4.3.6 The core scenarios considered as part of this assessment of likely significant effects are outlined in Table 4.1. The rationale used to select these core scenarios is also presented in Table 4.1. Other scenarios and activities are also discussed in the assessment of likely significant effects, although the core scenarios are the main focus of the assessment, as these core scenarios are considered to be the worst case scenarios for air quality.

Table 4.1 Core Study Scenarios

Scenario Year	Key Activities	Reason for Selection
2009	N/A	2009 is the most recent complete ratified year of monitoring data available at the time of preparation of this assessment, and is therefore considered to represent the current baseline.
2013	Vegetation removal in the area north and east of Trenches 1 to 7. Earthworks to fill and re-profile the area of vegetation removal. Perimeter drainage installation. Drigg stream diversion. Installation of cut off wall around Vault 8. Preparation and use of stockpile areas and establishment of contractor area.	2013 is the earliest year of works at the site and hence the year which will likely have the highest baseline pollutant concentrations. This is because national ambient air quality is anticipated to improve over time as country-wide vehicle emissions and other sources of pollutant emissions decrease due to improved control technology. The works in 2013 are also the most substantial works to be undertaken the shortest distance from sensitive residential receptors north and east of Trenches 1 to 7. The Drigg stream diversion will also be undertaken in 2013 and these works are to take place the shortest distance from any designated ecological receptor, to the south of the site. These diversion works will also extend around to the northern perimeter and so could be undertaken at the same time as some other works in the north of the site. Therefore, as a worst case it has been assumed that these works could be undertaken at the same time as some of the other works described above (e.g. vegetation removal). An assessment of 2013 is also important as this is the first year that stockpile areas are prepared and used; stockpiles can be a source of dust emissions from construction sites.
2014	First earthworks to re-profile Trenches 1 to 7 ready for capping. Continuation of Drigg Stream diversion.	2014 is the earliest year of re-profiling earthworks for Trenches 1 to 7 and so should be the year with the highest baseline pollutant concentrations at the site during trench re-profiling. In 2014 there will also be combined construction effects from the continued works on the Drigg Stream diversion. This year is therefore expected to give rise to the worst case pollutant emissions during re-profiling works.

Scenario Year	Key Activities	Reason for Selection
2015	First year of capping for the shoulders of Trenches 1 to 7 and the Drigg stream diversion continuation.	2015 is the earliest year of cap placement for the shoulders of Trenches 1 to 7 and so should be the year with the highest baseline pollutant concentrations at the site during any cap replacement activities on-site. The shoulders of the cap are also the closest section of the trench cap to the sensitive receptors north of the site (e.g. The Stubble (R2) – See Table 4.3). In 2015 there will also be combined construction effects from the continued works on the Drigg Stream diversion. Considering the likelihood that 2015 baseline concentrations will be the highest on-site during any capping works, that these capping works will be undertaken the closest distance from receptors north of the site and considering the additional emissions from the Drigg Stream diversion, this 2015 scenario should provide a worst case assessment for any capping works undertaken on-site, including capping works undertaken further from receptors on top of Trenches 1 to 7.
2019	First year of construction works on a new vault (Vault 9A). First year of decommissioning for the separate PCM Retrieval facilities and magazines.	This year is included in the Core Scenarios as the earliest year of construction at the site. As described above, the earliest years of a particular activity are likely to provide a worst case assessment, as higher baseline pollutant concentrations are expected in earlier years. This approach assumes that construction activities are not being undertaken in later years at locations in closer proximity to sensitive receptors. A review of the vault construction sequencing and plans confirms that this is an appropriate assumption for key sensitive receptors north of the site, as construction works will progress across the site in a south east direction. However, for one receptor, Sandy Acre (R4 See Table 4.3) this is not an appropriate assumption and the year 2050 would be the year in which the closest vault construction works are undertaken for this receptor (relating to the construction of Vault 14). However, as described in Section 1 there are various difficulties in predicting air quality beyond 2025. Therefore our assessment of 2019 also includes a discussion of the implications of construction occurring at Vault 14. An assessment of 2019 will also provide a worst case cumulative impact assessment with the separate decommissioning works for the PCM Retrieval facilities and magazines which is due to be commenced in 2019.

4.3.7 Later years of construction, with larger areas of re-profiled trenches and vaults and also potentially larger stockpiles, have not been included as Core Scenarios. This is because areas of re-profiled trenches and vaults will be progressively vegetated and similarly any large long term stockpiles will be vegetated or stabilised. Therefore, it has not been considered necessary to assess, in detail, larger potential source areas of dust, particularly when these sources have been considered in earlier years with higher likely baseline pollutant concentrations.

4.3.8 The air quality implications of some later years of works are briefly discussed. For example the capping works anticipated to be undertaken in 2021 and 2025 are qualitatively discussed. The

focus of the discussion is to identify likely differences in pollutant concentrations between these years and the Core Scenario for trench shoulder capping works in 2015.

4.4 Study Pollutants

4.4.1 The following paragraphs identify the relevant study species from the identified potential sources of pollutants including vehicle emissions from road vehicles and off-road plant, construction dust emissions, rail emissions and operational activities at the Scheme. The main study pollutants identified for the main emission sources in the construction and operational phases are also identified in Table 4.2. There are no point source emissions associated with the development.

Table 4.2 Study Pollutant Matrix

Activity	PM_{10}	$PM_{2.5}$	NO_2	SO_2	Dust
Construction					
Traffic	X	X	X		
Plant Equipment	X	X	X		
Rail Freight	X	X	X	X	
Works (e.g. earthmoving)	X				X
Operation					
Traffic	X	X	X		
Plant Equipment	X	X	X		
Rail Freight	X	X	X	X	

4.4.2 Traffic and plant vehicle exhaust emissions (e.g. from petrol and diesel combustion) comprise a complex mixture of organic and inorganic substances. Of these emissions, assessment criteria for the protection of human health exist for the following pollutants:

- Fine particulate matter (PM_{10} and $PM_{2.5}$);
- Nitrogen dioxide (NO_2);
- Sulphur dioxide (SO_2);
- Carbon monoxide (CO);
- Benzene;
- 1,3-butadiene;
- Lead; and
- Poly Aromatic Hydrocarbons (PAHs)

4.4.3 These pollutants are currently regulated because of their known or suspected deleterious effects upon human health, and because historically, relatively high concentrations have been recorded within and downwind of urban centres.

4.4.4 Within this assessment of vehicular emissions, only fine particulate matter and NO_2 emissions have been considered. Lead is not included as it is no longer added to petrol fuels and emissions from vehicles are, therefore, not considered significant nationally. SO_2 emissions from vehicles are also considered to be insignificant since the introduction of low sulphur diesel and the negligible sulphur content of petrol fuels. The only AQMAs to have been designated within the UK as a result of exceedances of CO, benzene, PAH or 1,3-butadiene objectives was for benzene which was designated by Plymouth City Council at an urban location, predominantly due to emissions from a petrol station, therefore, no quantitative assessment of these pollutants is considered necessary.

4.4.5 The key pollutants of concern with respect to construction activities are suspended dust (e.g. PM_{10} and in particular the coarser size fractions above $PM_{2.5}$) and accumulated dust (soiling/deposition). This is due to the movement of on-site plant equipment, movement of materials on-site and stockpiling of materials on-site.

4.4.6 In accordance with Defra LAQM.TG(09) [xv] SO_2 and NO_2 are considered to be the key pollutants of concern with respect to railway emissions. The potential for emissions from rail movements to and from the site will therefore be considered with respect to SO_2 and NO_2.

4.5 Health Effects

4.5.1 The study pollutants described in the preceding paragraphs have been selected based on the potential of the species to adversely affect human health or adversely affect vegetation and sensitive ecosystems. The known health effects of some of the key identified study species are briefly discussed below:

- Particulate matter – Health based assessment criteria focus on the fine 'PM_{10}' and '$PM_{2.5}$', size fractions. PM_{10} and $PM_{2.5}$ are defined as particulate matter with an aerodynamic diameter of less than 10 microns and 2.5 microns respectively. Emissions of particulates from construction activities and combustion processes are likely to contain a range of particulate sizes, including many larger than 10 microns in diameter. However for the purposes of a worst-case assessment and to enable comparison with national air quality objectives, all airborne particulate emissions have been assumed to constitute PM_{10}. Although the health effects of fine particulate matter are currently the subject of much research, the possible association between exposure to increased levels and respiratory and cardiovascular illness, and mortality has previously been acknowledged. Recent reviews by the World Health Organisation (WHO) and the Committee on the Medical Effects of Air Pollutants (COMEAP) have suggested exposure to $PM_{2.5}$ gives a stronger association with adverse health than the larger particulate fractions.
- Nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x) – Formed as a by-product of high temperature combustion by the oxidation of nitrogen in the air and the fuel. NO_x on emission primarily consists of nitric oxide (NO), which is oxidised in the atmosphere to produce NO_2, as well as small quantities of NO_2 produced directly during combustion. For combustion sources, NO_x emissions are typically in the $NO:NO_2$ ratio of 9:1. NO_2 is the component of NO_x that is principally associated with health impacts, including effects on lung function and airway responsiveness, and potential increase in reactivity to natural allergens (Ref. 9.3).

- Sulphur dioxide (SO_2): Formed during the combustion process due to the oxidation of sulphur present in the fuel. The sulphur content of natural gas is typically 0.001%, compared to the sulphur content of coal of typically 1% or higher. SO_2 can cause constriction of the airways of the lung, particularly in people suffering from asthma and chronic lung disease.

4.6 Sensitive Receptors

4.6.1 A number of sensitive receptors have been identified within the vicinity of the Scheme and these are detailed in Table 4.3 and shown on Figure 12.1.

Table 4.3 Identified Sensitive Receptors

Receptor Number	Receptor Name	Reason for Selection	Emission Type	Grid Reference		Distance to site (m)	Distance to work areas (m)*
				X	Y		
R1	Summer View	Residential receptor close to the north of the site and the trenches	Plant emissions and dust generation.	305065	499940	50	50
R2	The Stubble	Residential receptor close to the north of the site and the trenches	Plant emissions and dust generation.	305611	499481	30	30
R3	Drigg Moorside	Residential receptor close to the north of the site and the trenches	Plant emissions and dust generation.	305615	499844	310	310
R4	Sandy Acre	Closest residential receptor to the south of the site	Plant emissions and dust generation.	305524	498742	10	120
R5	Coal Yard	Commercial Receptor to the west of the site	Plant emissions and dust generation.	304828	499839	15	15
R6	Meadowbridge	Closest residential receptor to contractor compound	Plant emissions	306286	499061	130	280
R7	Drigg Coast	Designated SSSI and SAC to the south and west of the site	Plant emissions and dust generation.	304881	499499	0	0

Notes: * - includes distances from on-site haul routes and areas of work e.g. construction and earthworks. For residential receptors distances to closest façade.

4.6.2 A database search using the government's 'MAGIC' website [xx] has been undertaken for a distance of 1km around the site boundary to identify if there are any designated ecological sites

that may require assessment. The review identified the Drigg Coast Site of Special Scientific Interest (SSSI) and Special Areas of Conservation (SACs). No RAMSAR sites or Special Protection Areas (SPAs) were identified within 1 km of the site. The Drigg Holme SSSI, Hallsenna Moor SSSI and National Nature Reserve (NNR) were also identified but these sites are over 1km from the LLWR and so these sites have not been considered further, since the predicted air quality impacts associated with the construction/ operational activities associated with the Scheme are expected to be negligible more than 1 km from the site boundary, due to the nature of the emission sources.

4.7 Significance Criteria

4.7.1 The assessment of potential effects and their significance has been based on the criteria outlined in the Environmental Protection UK (EPUK) "Development Control: Planning for Air Quality (2010 Update)" publication [xvii].

4.7.2 There are three aspects of effect that must be taken into account when assessing the significance of the effect at individual receptors, these are:

- The magnitude of the change caused by the Scheme;
- The absolute predicted environmental concentration in relation to the air quality objectives; and
- The number of people likely to be affected by the associated impacts.

4.7.3 Particular significance should be given to a change that takes the predicted environmental concentration from below to above the national AQS objective or vice versa because of the importance ascribed to the objectives/EU Limit Values in assessing local air quality. The descriptors also allow for a very small change in concentration to be more significant when the absolute concentration is above the objective/EU Limit Value than for an absolute concentration below the objective/EU Limit Value.

4.7.4 Table 4.4 presents the EPUK criteria for the determination of the "magnitude of change", based on the percentage increase in pollutant concentrations due to the Scheme. Table 4.5 presents the significance of the effects, taking into account the magnitude of change and the absolute concentration in relation to air quality objectives/EU Limit Values.

Table 4.4 Determination of Magnitude of Change (Annual Mean NO_2 and PM_{10} and 24-hour PM_{10})

Magnitude of change	Annual Mean Concentration (NO_2 and PM_{10} µg/m³)	Days PM_{10} >50µg/m3
Large	Increase/decrease >10% (>4)	Increase/decrease >4 days
Medium	Increase/decrease 5-10% (2-4)	Increase/decrease 2-4 days
Small	Increase/decrease 1-5% (0.4-2)	Increase/decrease 1-2 days
Imperceptible	Increase/decrease <1% (<0.4)	Increase/decrease <1day

Table 4.5 Significance of Effects (Annual Mean NO_2 and PM_{10} and 24-hour PM_{10})

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration			
	Imperceptible	Small	Medium	Large
Increase with Scheme				
Above Objective/Limit Value With Scheme (>40 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36-40 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30-36 µg/m³)	Negligible	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m³)	Negligible	Negligible	Negligible	Slight Adverse
Decrease with Scheme				
Above Objective/Limit Value Without Scheme (>40 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (36-40 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (30-36 µg/m³)	Negligible	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<30 µg/m³)	Negligible	Negligible	Negligible	Slight Beneficial

4.7.5 In the absence of short term NO_2 significance criteria within the EPUK approach, changes in short term NO_2 concentrations from plant emissions have also been compared to criteria based on the Tables 4.4 and 4.5, but using the 1-hour AQS Objective of 200 µg/m³. The resultant criteria developed using the same EPUK approach based on the 1-hour AQS Objective of 200 µg/m³ are shown in Tables 4.6 and 4.7.

Table 4.6 Determination of Magnitude of Change (Short Term NO_2)

Magnitude of change	Short Term NO_2 Concentration (µg/m³)
Large	Increase/decrease >10% (>20)
Medium	Increase/decrease 5-10% (10-20)
Small	Increase/decrease 1-5% (2-10)
Imperceptible	Increase/decrease <1% (<2)

Table 4.7 Significance of Effects (Short Term NO_2)

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration			
	Imperceptible	Small	Medium	Large
Increase with Scheme				
Above Objective/Limit Value With Scheme (>200 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (180-200 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (150-180 µg/m³)	Negligible	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<150 µg/m³)	Negligible	Negligible	Negligible	Slight Adverse
Decrease with Scheme				
Above Objective/Limit Value Without Scheme (>200 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (180-200 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (150-180 µg/m³)	Negligible	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<150 µg/m³)	Negligible	Negligible	Negligible	Slight Beneficial

4.7.6 In the absence of significance criteria within the EPUK approach for annual average $PM_{2.5}$, changes in annual average $PM_{2.5}$ concentrations have been compared to criteria based on the Tables 4.4 and 4.5, but using the $PM_{2.5}$ Annual Average AQS Objective of 25 µg/m³. The resultant criteria developed using the same EPUK approach based on the annual AQS Objective of 25 µg/m³ are shown in Tables 4.8 and 4.9.

Table 4.8 Determination of Magnitude of Change (Annual Average $PM_{2.5}$)

Magnitude of change	Short Term NO_2 Concentration (µg/m³)
Large	Increase/decrease >10% (>2.5)
Medium	Increase/decrease 5-10% (1.25-2.5)
Small	Increase/decrease 1-5% (0.25-1.25)
Imperceptible	Increase/decrease <1% (<0.25)

Table 4.9 Significance of Effects (Annual Average $PM_{2.5}$)

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration			
	Imperceptible	Small	Medium	Large
Increase with Scheme				
Above Objective/Limit Value With Scheme (>25 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (22.5-25 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (18.75-22.5 µg/m³)	Negligible	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<18.75 µg/m³)	Negligible	Negligible	Negligible	Slight Adverse
Decrease with Scheme				
Above Objective/Limit Value Without Scheme (>25 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (22.5-25 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (18.75-22.5 µg/m³)	Negligible	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<18.75 µg/m³)	Negligible	Negligible	Negligible	Slight Beneficial

4.7.7 In the absence of significance criteria within the EPUK approach for annual average NO_x Air Strategy Objectives for the Protection of Vegetation and Ecosystems changes in annual average NOx concentrations have been compared to criteria based on the Tables 4.4 and 4.5, but using the NO_x Annual Average AQS Objective of 30 µg/m³. The resultant criteria developed using the same EPUK approach based on the annual AQS Objective of 30 µg/m³ are shown in Tables 4.10 and 4.11.

Table 4.10 Determination of Magnitude of Change (Annual Average NO_x Ecosystems)

Magnitude of change	Short Term NO_2 Concentration (µg/m³)
Large	Increase/decrease >10% (>3)
Medium	Increase/decrease 5-10% (1.5-3)
Small	Increase/decrease 1-5% (0.3-1.5)
Imperceptible	Increase/decrease <1% (<0.3)

Table 4.11 Significance of Effects (Annual Average NO_x Ecosystems)

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration			
	Imperceptible	Small	Medium	Large
Increase with Scheme				
Above Objective/Limit Value With Scheme (>30 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (27-30 µg/m³)	Negligible	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (22.5-27 µg/m³)	Negligible	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<22.5 µg/m³)	Negligible	Negligible	Negligible	Slight Adverse
Decrease with Scheme				
Above Objective/Limit Value Without Scheme (>30 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (27-30 µg/m³)	Negligible	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (22.5-27 µg/m³)	Negligible	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<22.5 µg/m³)	Negligible	Negligible	Negligible	Slight Beneficial

4.7.8 Tables 4.4 to 4.11 provide a mechanism for categorising magnitude of change and significance of impact at individual receptors. The descriptions of impact and significance from individual receptors should be utilised together with the following considerations to derive an overall judgement of significance of impact:

- Number of properties affected by slight, moderate or major air quality impacts and a judgement on the overall balance.
- Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant.
- Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before, or the size of an exceedance area is substantially increased.
- Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced in size.
- Uncertainty, including the extent to which worst-case assumptions have been made in the assessment.
- The extent to which an objective or limit value is exceeded, e.g. an annual mean NO_2 of 40 µg/m^3 should attract less significance than an annual mean of 50 µg/m^3.

4.7.9 The EPUK guidance [xvii] also indicates that it would be useful to outline the experience of the author undertaking an air quality assessment to provide confidence in the assessment of significance due to the role of professional judgement in this task. In this instance the air

quality assessment has been undertaken by Dr David Deakin a Principal Air Quality Consultant and member of the Institute of Air Quality Management (IAQM).

4.8 Assessment of Dust Emissions Generated During Construction Works

4.8.1 In 2000 the Building Research Establishment (BRE) [xix] undertook six months of continuous PM_{10} sampling at three locations within 200m of a demolition and construction site of 0.65 hectares. The site was a former chemical works and required demolition of existing buildings, piling along some of the site boundary, excavation of soil to a depth of 1m across the site (greater than 1m in some areas), and the subsequent erection of new structures. During working hours, in the 6-month monitoring period, 24-hour average PM_{10} concentrations within 1m of the study site boundary increased by up to 11µg/m^3 during demolition, 3µg/m^3 during site preparation and 5µg/m^3 during piling and earth working (including a period of piling at the site boundary). PM_{10} concentrations beyond around 150m from the construction site were indistinguishable from background levels. The site under study utilised 'best practice' dust mitigation measures and the site did not receive any complaints concerning dust effects, despite the presence of residential properties within 10m of the site perimeter.

4.8.2 The findings of this BRE study have been directly applied to the Scheme, taking into consideration the ambient background levels of particulate matter for the area. Therefore it has been assumed that the same changes in PM_{10} 24-hour concentrations will occur at the boundary our works. The findings of the BRE study have been specifically applied to the Core Scenario years 2013, 2014, 2015 and 2019.

4.9 Assessment of Site Plant

4.9.1 Emissions to air during construction activities will be associated with on-site construction vehicles and plant.

4.9.2 In order to provide an indication of the likely effects of emissions from the plant equipment associated with the Core Scenarios a series of scenarios have been modelled using the atmospheric dispersion model ADMS. These scenarios can only provide an indication of likely pollutant concentrations. This is because compared to other more well defined emission sources such as Environment Agency (EA) regulated point and area sources, with set emission limits, the movement of plant on-site is inherently uncertain.

4.9.3 In these scenarios a 50m by 50m area of construction has been modelled as an area source in ADMS for a variety of plant configurations. A 50m by 50m area has been selected as it is considered to be a conservative area, as in reality it is likely that the plant equipment will be spread over a wider area and hence have a lower emission rate per square metre than that modelled. The configurations of plant modelled in the different scenarios are shown in Table 4.12. The emission rates have been obtained from the European Environment Agency's Air Pollutant Emissions Inventory Guidebook 2009 [xxi].

Table 4.12 Plant Equipment Emissions Area Sources

Core Scenario Year	Plant Equipment Included	NO_x emission rate (g/s)	PM_{10} emission rate (g/s)	Reason for Plant Selection
2013	Four Excavators Four Dumpers in an area at the north of the site	2.17	0.35	Worst case for receptors north of the site with equipment from Drigg Stream diversion and perimeter drain works potentially occurring at the same time. This approach assumes both sets of works are undertaken in the same area.
2013	Four Excavators Four Dumpers in an area at the south of the site	2.17	0.35	Worst case for the Drigg Coast SAC south of the site with equipment from Drigg Stream diversion and cut off wall installation works potentially occurring at the same time. This approach assumes works undertaken in the same area.
2013	Two Excavators Two Dumpers in an area in the north of the site	1.08	0.17	This year has been modelled to provide a worst Case Year for Stockpile activities i.e. the year with the highest baseline pollutant concentrations.
2014	Four Excavators Four Dumpers One Roller Two Bulldozers in an area in the north west of the site	3.03	0.45	This year has been modelled as this is the first year of earthworks on the trenches. This scenario also includes plant emissions from activities to divert Drigg Stream. This approach assumes that both sets of works are undertaken in the same area, in reality there is only likely to be limited overlap in activities.
2015	Four Excavators Four Dumpers One Roller Two Bulldozers in an area in the north of the site, immediately south of the site boundary and south of The Stubble (R2).	3.03	0.45	First year of cap placement on the shoulders of the trenches. This scenario also includes plant emissions from activities to divert Drigg Stream. This approach assumes that both sets of works are undertaken in the same area, in reality there is only likely to be limited overlap in activities.

Note: No 2019 Core Scenario has been modelled for plant emissions as the closest human health receptors to the areas of construction are more than 200m from the works, which is too far to be significantly affected. Potential effects in 2019 for the Drigg Coast SAC are discussed in comparison to the worst case works undertaken adjacent to the SAC in 2013.

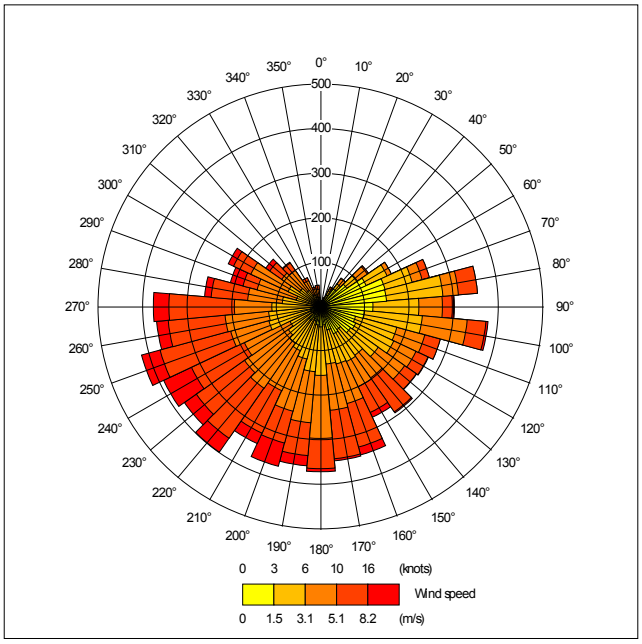
4.9.4 The three area sources described in Table 4.6 for 2013 have all been modelled as occurring simultaneously in the one 2013 scenario. This provides a cumulative assessment of the main emission sources in 2013 for the sensitive receptors.

4.9.5 The stockpile plant emissions described in Table 4.6 have also been included in the models run for 2014 and 2015 to provide a cumulative assessment with the earthworks and capping activities during these years.

4.9.6 NO2 and PM10 results for short term and long term averages have been obtained for each of the seven receptors identified in Table 4.3. In order to provide an assessment of PM2.5, against the PM2.5 annual average AQS objective it has been assumed that all of the PM10 is PM2.5.

4.9.7 The modelling has been undertaken using a site specific meteorological dataset that combines wind speed, direction and temperature taken from the meteorological station located on-site with missing data such as cloud cover that has been obtained from the monitoring station at Blackpool Airport. Data from 2009, the most recent full year of data, has been used and the windrose is shown in Figure 4.1.

Figure 4.1: Wind Rose (2009)



4.9.8 The area sources have been used with a time varying emission factor which allows emissions to be released only during working hours.

4.9.9 A surface roughness of 0.2 to represent open grassland has been used in the model to reflect the open agricultural character of the area.

4.9.10 No terrain files have been included in the modelling as there are no significant changes in topography which would be likely to affect model predictions (i.e. no slopes of 1 in 10).

4.9.11 A sensitivity analysis of would typically be undertaken for a dispersion modelling exercise for point sources and area sources. This testing would be undertaken to establish the sensitivity of model results to those inputs which could vary and affect model results (e.g. meteorological conditions etc). In this instance a sensitivity test could be undertaken to characterise the potential variation in model outputs, typically around 20%, but sensitivity testing could not resolve the uncertainty inherent in the movement of plant equipment around the site. Therefore, as outlined above this modelling work is considered to be indicative only and should only really be used to highlight the potential risk of non-compliance with AQS objectives. However, to assist the reader, with a coherent language to describe results, the magnitude of

change and significance of change criteria outlined in Section 4.6 have been utilised to describe results.

4.10 Assessment of Road Traffic

4.10.1 The level of assessment for road traffic emissions has been established by comparison of anticipated construction and operational traffic flows against a series of traffic criteria which identify significant changes in traffic that have the potential to affect air quality with respect to PM_{10} and NO_2. Where potentially significant traffic changes are identified these are then modelled using either the DMRB air quality screening model or an advanced air quality dispersion model, as appropriate.

4.10.2 The DMRB guidance [xviii] states that assessment of affected roads is only considered necessary where proposals would result in:

- *'An increase in daily traffic flows by 1,000 or more;*
- *Daily Heavy Goods Vehicles (HGVs) flows will change by 200 or more;*
- *Daily average speed will change by 10 km/hr or more; or*
- *Peak hour speed will change by 20 km/hr or more.'*

4.10.3 The Environmental Protection UK (EPUK) document [xvii] states that an air quality assessment will normally be required when:

- *'Proposals that will generate or increase traffic congestion, where 'congestion' manifests itself as an increase in periods with start stop driving;*
- *Proposals that will give rise to a significant change in either traffic volumes, typically a change in annual average daily traffic (AADT) or peak traffic flows of greater than ±5% or ±10%, depending on local circumstances (a change of ±5% will be appropriate for traffic flows within an AQMA), or in vehicle speed (typically of more than ±10 kph), or both, usually on a road with more than 10,000 AADT (5,000 if 'narrow and congested');*
- *Proposals that would significantly alter the traffic composition on local roads, for instance, increase the number of HGVs by say 200 movements or more per day, due to the development of a bus station or an HGV park (professional judgement will be required, taking account of the total vehicle flow as well as the change);*
- *Proposals that include significant new car parking, which may be taken to be more than 100 spaces outside an AQMA, or 50 spaces inside an AQMA. Account should also be taken of car parking turnover, i.e. the difference between short-term and long-term parking, which will affect the traffic flows in and out of the car park. This should also include proposals for new coach or lorry parks. These criteria are designed to trigger the requirement for the assessment of traffic on the local roads. It may also be appropriate to assess the emissions from within the car park itself;*
- *Large, long-term construction sites that would generate large HGV flows (>200 movements per day) over a period of a year or more.'*

4.10.4 The results of the screening exercise to identify if there are any roads requiring further assessment are presented in Section 6.

4.11 Assessment of Rail Freight Emissions

4.11.1 The Defra LAQM.TG(09) guidance document [xv] provides guidance on the assessment of rail emission sources. Including guidance relating to stationary or moving locomotives, identifying distances from sensitive receptors and timescales for idling etc which may cause concern. The assessment of rail freight emissions is presented in Section 6.

5 Baseline Conditions

5.1.1 Copeland Borough Council has been contacted to identify the most up to date air quality baseline information for the assessment. The Council provided the two most recent Local Air Quality Management reports for use in the assessment:

- 2009 Updating and Screening Assessment for Copeland Borough Council. Dated July 2009 [xxii].
- 2010 Air Quality Progress Report for Copeland Borough Council. First Issue. Dated April 2010 [xxiii].

5.1.2 The above reports confirm that Copeland Borough Council has not identified any areas of poor air quality requiring declaration as Air Quality Management Areas (AQMAs).

5.1.3 The reports also indicate the there are no continuous air quality monitoring stations in the local authority area.

5.1.4 In the absence of continuous monitoring data the National Air Quality Archive Background Maps [xxiv] have been utilised to provide background PM10 and PM2.5 concentrations. The closest National Grid Reference to the centre of the site for which data is available has been utilised (National Grid Reference: 305500, 499500). The 2009 PM10 annual average concentration listed for this National Grid Reference is 8.7 µg/m3, which is approximately a quarter of the annual average air quality objective. The PM2.5 concentration listed for this National Grid Reference is 5.4 µg/m3, which is approximately a fifth of the annual average air quality objective.

5.1.5 The council do operate a network of twenty four NO2 passive diffusion tubes, although none at locations near Drigg. In the absence of tubes at the site, the other tubes in similar rural background locations operated by the council have been reviewed to identify an appropriate background concentration of NO_2 for the assessment. The review identified four rural background sites as listed in Table 5.1. The highest concentration from the four locations is 8 µg/m^3 at Bootle Station and Calder Farm, and to provide a conservative estimate of background NO_2 this concentration has been utilised in our assessment. Compared to the annual average air quality objective this concentration is approximately a quarter of the objective.

Table 5.1 Rural Background Monitoring Locations in Copeland BC (2009)

Site ID	Site Name	Grid Reference	Data Capture for 2009	Bias Corrected NO_2 Concentrations µg/m^3
9	Playground, Ennerdale School	307004, 515863	100	6
16	Greendale Guesthouse, Wasdale	314419, 505569	100	4
19	Bootle Station, Bootle	309360, 489313	100	8
21	Calder Farm, Seascale	303800, 502681	100	8

5.1.6 Forecast background concentrations for NO_2 and PM_{10} have been obtained for the Core Scenario Years listed in Section 4.2. PM_{10} forecast concentrations were obtained directly from the relevant National Air Quality Archive maps [xxiv]. NO2 concentrations were calculated using a scaling factor calculated from the ratio of the NO2 concentration from the National Air Quality Archive maps between 2009 and 2012 (0.88), 2012 and 2013 (0.97), 2013 and 2014 (0.97) and 2014 and 2019 (0.84). The calculated factors were then applied to calculate an annual average for 2013, 2014, 2015 and 2019. This approach is consistent with the approach recommended in LAQM.TG(09) [xv] for scaling between assessment years.

5.1.7 Table 5.2 presents all the relevant background ambient air quality data for the required averaging periods. In accordance with the Environment Agency's H1 guidance (Annex f) [xxv], in the absence of actual measured short term background concentrations, these have been assumed to be twice the annual average concentration.

Table 5.2 Mean Background Pollutant Concentrations ($\mu g/m^3$)

Pollutant	Current Estimated Background (2009)	Estimated Background (2013)	Estimated Background (2014)	Estimated Background (2015)	Estimated Background (2019)	Objective	Averaging Period
NO_2	8	7.1	6.9	6.7	5.6	40	Annual mean
	16	14.2	13.7	13.4	11.2	200	1 hour, 99.8th percentile
PM_{10}	8.7	8.4	8.4	8.3	8.1	40	Annual mean
	17.4	16.8	16.8	16.6	16.2	50	Daily mean, 90.4th percentile
$PM_{2.5}$	5.4	5.2	5.1	5.1	4.9	25	Annual mean

5.1.8 No other background monitoring data was identified to characterise rates of dust deposition or soiling.

6 Likely Significant Effects

6.1.1 This section outlines the findings of the assessment undertaken following the approaches outlined in Section 4.

6.2 Assessment of Dust Generation During the Works

6.2.1 The assessment of dust generation (PM_{10}) from the works has been discussed for each of the Core Scenario years in the following sub-sections.

2013 - Dust Generating Activities

6.2.2 The boundary of the coal yard is the closest identified receptor to the areas of potential dust generation in 2013. However, this receptor is not considered to be as sensitive as a residential receptor. Additionally, this receptor would not be assessed against the air quality objectives as places of works are covered by separate occupational health regulations. The closest residential receptor to the works north of the trenches is The Stubble (R2), at a distance of approximately 30m from the site perimeter. Extrapolating the BRE figure for earthworks of an increase of 5µg/m³ in 24-hour PM_{10} concentrations at the boundary results in a 24-hour PM_{10} concentration of 21.8 µg/m³ at the boundary (i.e. the background of 16.8 µg/m³ plus 5 µg/m³). However, in 2013 there could also be combined construction effects from the works on the Drigg Stream diversion. For the purposes of this assessment, it is assumed as a worst case that works on the shoulders of the trenches (e.g. vegetation removal or earthworks) and the Drigg Stream diversion works are both undertaken simultaneously near The Stubble (R2). Extrapolating two sets of earthworks increases of 5µg/m³ from the BRE study would result in a 24-hour PM_{10} concentration of 26.8 µg/m³ at the site boundary. The PM_{10} concentration at the facades of these receptors would also be expected to be lower, due to reductions in concentration from additional dispersion with additional distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration does not result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2013 - Stockpiles

6.2.3 There are a total of four stockpiles planned for the site: labelled A, B, C and D (Figure 4 of Volume 1 of the Environmental Statement). The closest receptor to stockpile A is The Stubble (R2) at a distance in excess of 200m. The closest receptors to stockpile B are The Stubble (R2) and Sandy Acre (R4) at distances over 400m. The closest receptor to stockpile C is Sandy Acre (R4) at a distance of approximately 150m. The closest receptor to stockpile D is The Stubble (R2) at a distance of approximately 80m. Considering R2 as a worst case receptor for any stockpile dust emissions and applying the BRE study earthworks increase of 5µg/m^3 for 24-hour PM_{10} concentrations increases concentrations around stockpile D to 21.8 µg/m³. The concentration at the facade of The Stubble (R2) would also be expected to be lower than this value, due to reductions in concentration from increased dispersion with increased distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration does not result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2013 – Contractor's Compound

6.2.4 Meadowbridge (R6), the closest receptor to the Contractor's compound, is located over 250m away. Utilising the findings of the BRE study, which identified no significant change in concentration at distances greater than 150m from earthworks, no significant changes in concentration would be expected at Meadowbridge (R6). This does not result in an exceedance of the 50 µg/m³ 24-hour PM_{10} AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2013 - Combined Effects

6.2.5 In order to ensure that the effects of increases in 24-hour PM_{10} concentrations from the various activities listed above (i.e. vegetation clearance, earthworks and stream diversion works), plus the potential emissions from the stockpiles and contractor area have been considered cumulatively, a review has been undertaken to identify which receptor in 2013 is likely to be subject the highest potential cumulative increase in PM_{10} concentrations. It is considered likely that this receptor is The Stubble (R2), as it is located in the closest proximity to the areas of activity north of the trenches and it is also the receptor closest to a stockpile (stockpile D). Assuming that this receptor was impacted by simultaneous increases in concentration from both the area of earthworks north of the trenches, the stream diversion and also from Stockpile D this could result in an increase in 24-hour concentration of 15 µg/m³ (i.e. three increases of 5µg/m³), which would result in a predicted 24-hour PM_{10} concentration of 31.8 µg/m³ at the site boundary. It is likely that the concentration at the facade of this receptor would be lower than this, since the receptor is 30 m from the site boundary and there will be reductions in PM_{10} impacts through additional dispersion over the increased distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration is not predicted to result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2014 - Dust Generating Activities

6.2.6 2014 is the earliest year of re-profiling earthworks for Trenches 1 to 7 and so should be the year with the highest baseline pollutant concentrations at the site during trench re-profiling. The receptors closest to the area of re-profiling earthworks are Summer View (R1) and the Coal Yard (R5), with Summer View (R1) the closest at around 50m. In 2014 there will also be combined construction effects from the continued works on the Drigg Stream diversion. This is likely to result in worst case pollutant concentrations for this year of re-profiling works. For the purposes of this assessment, it is assumed as a worst case that re-profiling works and Drigg Stream diversion works are both undertaken simultaneously closest to Summer View. Extrapolating two sets of earthworks increases of 5 µg/m³ from the BRE study would result in a 24-hour PM_{10} concentration of 26.8 µg/m³ at the site boundary. The concentration at the façade of this receptor would be expected to be lower than this, since the receptor is approximately 50 m from the site boundary and there will be reductions in PM_{10} impacts through additional dispersion over the increased distance, Even when ignoring this additional distance from the site boundary, this anticipated change in concentration is not predicted to result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2014 - Stockpiles

6.2.7 No additional emissions from stockpiles have been added to the above worst case assessment for Summer View (R1), as the closest stockpile is anticipated to be over 200m from the receptor and therefore this source would not be expected to add to the overall concentration significantly. This is based on the findings of the BRE study which did not identify significant differences in 24-hour PM_{10} concentrations from background concentrations beyond 150m. However, stockpile emissions have been considered for other receptors. Considering R2 as a worst case receptor for stockpile dust emissions and applying the BRE study earthworks increase of 5µg/m^3 for 24-hour PM_{10} concentrations increases the predicted 24-hour PM_{10} concentration around stockpile D to 21.8 µg/m³. The concentration at R2 would be expected to be lower at the facades of this property, due to reductions in PM_{10} concentration from increased dispersion with increased distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration is not predicted to result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2014 – Contractor's Compound

6.2.8 In 2014 the contractor's compound remains in the same location as assessed in 2013. Therefore, the same conclusion applies from 2013 - that no significant changes in 24-hour PM_{10} concentration would be expected at the closest receptor, Meadowbridge (R6).

2014 - Combined Effects

6.2.9 In order to ensure that the effects of any increases in PM_{10} concentration from the stream diversion works plus the potential emissions from the stockpiles and contractor area have been considered cumulatively, a review has been undertaken to identify which receptor in 2014 is likely to be subject the highest potential increases in PM_{10} concentrations. It is considered likely that this receptor is The Stubble (R2), as it is located in the closest proximity to the stream diversion and it is also is the receptor closest to a stockpile (stockpile D). Assuming that this receptor was impacted by simultaneous increases in concentration from both the stream diversion and also from Stockpile D, this could result in an increase in 24-hour concentrations of 10 µg/m³, which would result in a 24-hour PM_{10} concentration of 26.8 µg/m³ at the site boundary. It is likely that the concentration at the façade of this receptor would be lower than this, since the receptor is 30 m from the site boundary and there will be reductions in PM_{10} impacts through additional dispersion over the increased distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration is not predicted to result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2015 – Dust Generating Activities

6.2.10 2015 is the earliest year of capping works for the shoulders of Trenches 1 to 7 and so should be the year with the highest baseline pollutant concentrations at the site during capping works. The receptors closest to the area of trench shoulder capping are Summer View (R1) and the Coal Yard (R5), with The Stubble (R2) the closest at around 30m. In 2015 there will also be combined construction effects from the continued works on the Drigg Stream diversion. This is likely to result in worst case pollutant concentrations for this year of capping works. For the

purposes of this assessment, it is assumed as a worst case that shoulder capping works and Drigg Stream diversion works are both undertaken simultaneously close to The Stubble (R2). Extrapolating two sets of earthworks increases of 5 µg/m³ from the BRE study would result in a 24-hour PM_{10} concentration of 26.6 µg/m³ at the site boundary. It is likely that the concentration at the façade of this receptor would be lower than this, since the receptor is 30 m from the site boundary and there will be reductions in PM_{10} impacts through additional dispersion over the increased distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration is not predicted to result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2015 - Stockpiles

6.2.11 No additional emissions from stockpiles have been added to the above worst case assessment for Summer View (R1), as the closest stockpile is anticipated to be over 200m from the receptor and therefore this source would not be expected to add to the overall concentration significantly. This is based on the findings of the BRE study which did not identify significant differences in PM_{10} 24-hour concentrations from background concentrations beyond 150m. However, stockpile emissions have been considered for other receptors. Considering The Stubble (R2) as a worst case receptor for stockpile dust emissions and applying the BRE study earthworks increase of 5µg/m^3 for 24-hour PM_{10} concentrations increases the predicted concentration around stockpile D to 21.6 µg/m³ at the site boundary. It is likely that the concentration at the façade of this receptor would be lower than this, since the receptor is 30 m from the site boundary and there will be reductions in PM_{10} impacts through additional dispersion over the increased distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration does not result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

2015 – Contractor's Compound

6.2.12 In 2015 the contractor's compound remains in the same location as assessed in 2014. Therefore, the same conclusion applies from 2014 that no significant changes in 24-hour PM_{10} concentration would be expected at the closest receptor, Meadowbridge (R6).

2015 – Combined Effects

6.2.13 In order to ensure that the effects of any increases in PM_{10} concentration from the stream diversion works, trench shoulder capping, plus the potential emissions from the stockpiles and also the contractor area have been considered cumulatively. A review has been undertaken to identify which receptor in 2015 is likely to be subject the highest potential increases in PM_{10} concentrations. It is considered likely that this receptor is The Stubble (R2), as it is located in the closest proximity to the stream diversion works, shoulder capping and it is also is the receptor closest to a stockpile (stockpile D). Assuming that this receptor was impacted by simultaneous increases in concentration from the stream diversion, shoulder capping and also from Stockpile D this could result in an increase in 24-hour concentrations of 15 µg/m³, which would result in a concentration of 31.6 µg/m³ at the site boundary. It is likely that the concentration at the façade of this receptor would be lower than this, since the receptor is 30 m from the site boundary and there will be reductions in PM_{10} impacts through additional

dispersion over the increased distance. Even when ignoring this additional distance from the site boundary, this anticipated change in concentration is not predicted to result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

6.2.14 Other years of capping works on the Trenches (e.g. 2021 and 2025) are likely to have lesser impacts than those described for 2015. This is because the works in 2015 on the trench shoulders are closer to receptors than the works which will be undertaken on the top of the trenches. Additionally, the assessment above has considered the potential effects of capping in combination with other works. Finally, the assessment of 2015 will provide a worst case assessment as it is assumed that air quality will improve year to year. Therefore, 2015 should be the year of the highest baseline pollutant concentrations in which any capping activities are undertaken.

2019 – Vault Construction

6.2.15 This year is included in the Core Scenario as the earliest year of construction at the site and in particular the first year of construction works on a new vault (Vault 9A). A review of the receptors identified around the site has established that all receptors will be over 200m from the area of construction of Vault 9A and additionally over 200m from the area of construction for any vault, including Vault 14 (the Vault closest to Sandy Acre (R4)). Utilising the findings of the BRE study, which identified no significant change in PM_{10} concentration at distances greater than 150m from a construction site, no significant changes in concentration would be expected at any identified receptor. This does not result in an exceedance of the 50 µg/m³ 24-hour AQS objective, and no additional days of exceedance are predicted. In comparison to the EPUK criteria this is considered to be an imperceptible magnitude of change of negligible significance.

6.2.16 Other activities expected to continue in 2019 include works to install a cut-off wall and stockpiles and the use of the contractor's compound. However, the locations of the stockpiles and contractor's compound remain the same as in earlier years of assessment. Similarly, the other activities on-site are not considered likely to generate more dust than those activities assessed in earlier years and nor are they to be undertaken at distances closer to the sensitive receptors previously assessed. Therefore, the previous years of assessment are considered to reflect worst case conditions. Consistent with previous years of assessment Imperceptible changes in PM_{10} 24-hour average concentrations are anticipated for 2019, with a corresponding negligible significance.

Summary

6.2.17 In summary each year of works assessed has been predicted to not give rise to significant changes in PM_{10} concentrations due to dust generating activities at any sensitive receptor identified. In comparison to the EPUK criteria the changes in concentration have been considered to be of an imperceptible magnitude with a negligible significance.

6.3 Assessment of Emissions Generated by Plant Equipment During the Works

6.3.1 Indicative modelling of demolition/construction vehicle emissions has been undertaken (using ADMS (version 4.1)) as an area source emission, to represent the area under development, as described in Section 4. The modelling outcomes provide an indicative guide to the potential

impacts from demolition/construction site plant, based on a set of assumptions and identified parameters.

6.3.2 The assessment of plant emissions from the works has been discussed for each of the Core Scenario years in the following sub-sections. Changes in concentration and total concentrations are discussed for NO_2 and PM_{10} for short and long term averaging periods for completeness. Annual average $PM_{2.5}$ concentrations are also discussed, as this pollutant may be associated with plant exhaust emissions. However, as plant equipment emissions will only be released in working hours, the short term results are most applicable.

2013 – Combined Activities with Stockpile Emissions

6.3.3 The results from the modelling of the three area sources in 2013, representing works at the boundary of the site in close proximity to The Stubble, works at the cut off wall and Drigg Stream by Vault 8, and emissions from plant at Stockpile D are shown in Tables 6.1, 6.2, 6.3 and 6.4. Tables 6.1 and 6.2 show the predicted results for short and long term NO_2. Tables 6.3 and 6.4 show the predicted results for short and long term PM_{10}. The magnitude of change and significance of change is also presented for each pollutant and receptor.

Table 6.1 2013 Plant Predictions for NO_2 long term concentrations

Receptor Reference	Receptor Name	Change in Annual Average NO_2 (µg/m³)	Total Annual Average NO_2 (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	<0.1	7.1	Imperceptible	Negligible
R2	**The Stubble**	0.3	7.4	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	7.1	Imperceptible	Negligible
R4	Sandy Acre	<0.1	7.1	Imperceptible	Negligible
R5	Coal Yard	<0.1	7.1	Imperceptible	Negligible
R6	Meadowbridge	<0.1	7.1	Imperceptible	Negligible
R7	**Drigg Coast SAC**	0.4	7.5	Small	Negligible

Note: R7 Assigned a small magnitude of change as the change in concentration relative to the 30 µg/m³ Air Quality Strategy Objective for the Protection of Vegetation and Ecosystems, rather than the small/imperceptible magnitude it would have been assigned relative to the 40 µg/m³ Air Quality Strategy Objective. Bold indicates – worst case receptors. < - indicates less than.

6.3.4 The 2013 predictions indicate that either imperceptible or small changes are anticipated for each receptor for both short and long term changes in NO_2 concentration. A corresponding assessment of negligible significance has therefore been assigned to each human health receptor in 2013 with respect to NO_2 (R4 to R6). A negligible significance has also been assigned to the Drigg Coast Line (R7), the only ecological receptor, as the total predicted concentration is well below (less than 70%) of the annual average Air Quality Strategy Objective for the Protection of Vegetation and Ecosystems.

Table 6.2 2013 Plant Predictions for NO_2 short term concentrations

Receptor Reference	Receptor Name	Change in short term NO_2 (µg/m³)	Total short term NO_2 Concentration (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	0.2	14.4	Imperceptible	Negligible
R2	**The Stubble**	3.3	17.5	Small	Negligible
R3	Drigg Moorside	0.2	14.4	Imperceptible	Negligible
R4	Sandy Acre	<0.1	14.2	Imperceptible	Negligible
R5	Coal Yard	0.2	14.4	Imperceptible	Negligible
R6	Meadowbridge	0.2	14.4	Imperceptible	Negligible
R7	**Drigg Coast SAC**	9.2	23.4	Small	Negligible

Note: Bold indicates – worst case receptors. . < - indicates less than. For R7 Drigg Coast SAC there is no applicable short term AQS objective for the protection of ecosystems. Therefore, the Drigg Coast SAC short term results have been assessed against the 1-hour AQS objective for human health.

Table 6.3 2013 Plant Predictions for PM_{10} long term concentrations

Receptor Reference	Receptor Name	Change in Annual Average PM_{10} (µg/m³)	Total Annual Average PM_{10} (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	<0.1	8.4	Imperceptible	Negligible
R2	**The Stubble**	<0.1	8.4	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	8.4	Imperceptible	Negligible
R4	Sandy Acre	<0.1	8.4	Imperceptible	Negligible
R5	Coal Yard	<0.1	8.4	Imperceptible	Negligible
R6	Meadowbridge	<0.1	8.4	Imperceptible	Negligible
R7	**Drigg Coast SAC**	0.1	8.5	Imperceptible	Negligible

Note: Bold indicates – worst case receptors. . < - indicates less than. For R7 Drigg Coast SAC there is no applicable annual AQS objective for the protection of ecosystems. Therefore the Drigg Coast SAC short term results have been assessed against the annual AQS objective for human health.

6.3.5 The 2013 predictions indicate that imperceptible changes are anticipated for each receptor for both short and long term changes in PM_{10} concentration. A corresponding assessment of negligible significance has therefore been assigned to each receptor in 2013 with respect to PM_{10}. Assuming all of the predicted PM_{10} is $PM_{2.5}$ and utilising the criteria developed in Section 4.6 the changes in annual average particulates in 2013 can also be similarly described as imperceptible and negligible.

Table 6.4 2013 Plant Predictions for PM_{10} short term concentrations

Receptor Reference	Receptor Name	Change in short term PM_{10} (µg/m³)	Total short term PM_{10} Concentration (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	<0.1	16.8	Imperceptible	Negligible
R2	**The Stubble**	0.1	16.9	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	16.8	Imperceptible	Negligible
R4	Sandy Acre	<0.1	16.8	Imperceptible	Negligible
R5	Coal Yard	<0.1	16.8	Imperceptible	Negligible
R6	Meadowbridge	<0.1	16.8	Imperceptible	Negligible
R7	**Drigg Coast SAC**	0.2	17.0	Imperceptible	Negligible

Note: Bold indicates – worst case receptors. . < - indicates less than. For R7 Drigg Coast SAC there is no applicable short term AQS objective for the protection of ecosystems. Therefore the Drigg Coast SAC short term results have been assessed against the 24-hour AQS objective for human health.

2014 – Combined Activities with Stockpile Emissions

6.3.6 The modelling results from the two area sources in 2014, the first representing works re-profiling the section of cap and the Drigg Stream diversion near to Summer View (R1) and the second representing the emissions from plant at Stockpile D are shown in Tables 6.5, 6.6, 6.7 and 6.8. Tables 6.5 and 6.6 show the predicted results for short and long term NO_2. Tables 6.7 and 6.8 show the predicted results for short and long term PM_{10}. The magnitude of change and significance of change is also presented for each pollutant and receptor.

Table 6.5 2014 Plant Predictions for NO_2 long term concentrations

Receptor Reference	Receptor Name	Change in Annual Average NO_2 (µg/m³)	Total Annual Average NO_2 (µg/m³)	Magnitude of Change	Significance of Change
R1	**Summer View**	0.2	7.1	Imperceptible	Negligible
R2	**The Stubble**	0.1	7.0	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	6.9	Imperceptible	Negligible
R4	Sandy Acre	<0.1	6.9	Imperceptible	Negligible
R5	Coal Yard	<0.1	6.9	Imperceptible	Negligible
R6	Meadowbridge	<0.1	6.9	Imperceptible	Negligible
R7	Drigg Coast SAC	<0.1	6.9	Imperceptible	Negligible

Note: R7 assigned an imperceptible magnitude of change as the change in concentration relative to the 30 µg/m³ Air Quality Strategy Objective for the Protection of Vegetation and Ecosystems. Bold indicates – worst case receptors. < - indicates less than.

Table 6.6 2014 Plant Predictions for NO_2 short term concentrations

Receptor Reference	Receptor Name	Change in short term NO_2 (µg/m³)	Total short term NO_2 Concentration (µg/m³)	Magnitude of Change	Significance of Change
R1	**Summer View**	4.6	18.3	Small	Negligible
R2	**The Stubble**	1.6	15.3	Imperceptible	Negligible
R3	Drigg Moorside	0.2	13.9	Imperceptible	Negligible
R4	Sandy Acre	<0.1	13.7	Imperceptible	Negligible
R5	Coal Yard	0.5	14.2	Imperceptible	Negligible
R6	Meadowbridge	0.1	13.8	Imperceptible	Negligible
R7	Drigg Coast SAC	<0.1	13.7	Imperceptible	Negligible

Note: Bold indicates – worst case receptors. . < - indicates less than. For R7 Drigg Coast SAC there is no applicable short term AQS objective for the protection of ecosystems. Therefore the Drigg Coast SAC short term results have been assessed against the 1-hour AQS objective for human health.

6.3.7 The 2014 predictions indicate that either imperceptible or small changes are anticipated for each receptor for both short and long term changes in NO_2 concentration. A corresponding assessment of negligible significance has therefore been assigned to each receptor in 2014 with respect to NO_2.

Table 6.7 2014 Plant Predictions for PM_{10} long term concentrations

Receptor Reference	Receptor Name	Change in Annual Average PM_{10} (µg/m³)	Total Annual Average PM_{10} (µg/m³)	Magnitude of Change	Significance of Change
R1	**Summer View**	<0.1	8.4	Imperceptible	Negligible
R2	**The Stubble**	<0.1	8.4	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	8.4	Imperceptible	Negligible
R4	Sandy Acre	<0.1	8.4	Imperceptible	Negligible
R5	Coal Yard	<0.1	8.4	Imperceptible	Negligible
R6	Meadowbridge	<0.1	8.4	Imperceptible	Negligible
R7	Drigg Coast SAC	<0.1	8.4	Imperceptible	Negligible

Note: Bold indicates – worst case receptors. . < - indicates less than. For R7 Drigg Coast SAC there is no applicable annual AQS objective for the protection of ecosystems. Therefore the Drigg Coast SAC short term results have been assessed against the annual AQS objective for human health.

6.3.8 The 2014 predictions indicate that imperceptible changes are anticipated for each receptor for both short and long term changes in PM_{10} concentration. A corresponding assessment of negligible significance has therefore been assigned to each receptor in 2014 with respect to PM_{10}. Assuming all of the predicted PM_{10} is $PM_{2.5}$ and utilising the criteria developed in Section 4.6 the changes in annual average particulates in 2014 can also be similarly described as imperceptible and negligible.

Table 6.8 2014 Plant Predictions for PM_{10} short term concentrations

Receptor Reference	Receptor Name	Change in short term PM_{10} (µg/m³)	Total short term PM_{10} Concentration (µg/m³)	Magnitude of Change	Significance of Change
R1	**Summer View**	0.1	16.9	Imperceptible	Negligible
R2	**The Stubble**	<0.1	16.8	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	16.8	Imperceptible	Negligible
R4	Sandy Acre	<0.1	16.8	Imperceptible	Negligible
R5	Coal Yard	<0.1	16.8	Imperceptible	Negligible
R6	Meadowbridge	<0.1	16.8	Imperceptible	Negligible
R7	Drigg Coast SAC	<0.1	16.8	Imperceptible	Negligible

Note: For R7 Drigg Coast SAC there is no applicable short term AQS objective for the protection of ecosystems. Therefore the Drigg Coast SAC short term results have been assessed against the 24-hour AQS objective for human health.

2015 – Combined Activities with Stockpile Emissions

6.3.9 The modelling results from the two area sources in 2015, the first representing cap placement works on the trench shoulders and the Drigg Stream diversion near to The Stubble (R2), and the second representing the emissions from plant at Stockpile D, are shown in Tables 6.9, 6.10, 6.11 and 6.12. Tables 6.9 and 6.10 show the predicted results for short and long term NO_2. Tables 6.11 and 6.12 show the predicted results for short and long term PM_{10}. The magnitude of change and significance of change is also presented for each pollutant and receptor.

Table 6.9 2015 Plant Predictions for NO_2 long term concentrations

Receptor Reference	Receptor Name	Change in Annual Average NO_2 (µg/m³)	Total Annual Average NO_2 (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	<0.1	6.7	Imperceptible	Negligible
R2	**The Stubble**	0.3	7.0	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	6.7	Imperceptible	Negligible
R4	Sandy Acre	<0.1	6.7	Imperceptible	Negligible
R5	Coal Yard	<0.1	6.7	Imperceptible	Negligible
R6	Meadowbridge	<0.1	6.7	Imperceptible	Negligible
R7	Drigg Coast SAC	<0.1	6.7	Imperceptible	Negligible

Note: R7 assigned an imperceptible magnitude of change as the change in concentration relative to the 30 µg/m³ Air Quality Strategy Objective for the Protection of Vegetation and Ecosystems. Bold indicates – worst case receptors. < - indicates less than.

Table 6.10 2015 Plant Predictions for NO_2 short term concentrations

Receptor Reference	Receptor Name	Change in short term NO_2 (µg/m³)	Total short term NO_2 Concentration (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	0.2	13.6	Imperceptible	Negligible
R2	**The Stubble**	9.0	22.4	Small	Negligible
R3	Drigg Moorside	0.7	14.1	Imperceptible	Negligible
R4	Sandy Acre	<0.1	13.4	Imperceptible	Negligible
R5	Coal Yard	0.1	13.5	Imperceptible	Negligible
R6	Meadowbridge	0.3	13.7	Imperceptible	Negligible
R7	Drigg Coast	0.1	13.5	Imperceptible	Negligible

Note: Bold indicates – worst case receptors. . < - indicates less than. For R7 Drigg Coast SAC there is no applicable short term AQS objective for the protection of ecosystems. Therefore the Drigg Coast SAC short term results have been assessed against the 1-hour AQS objective for human health.

6.3.10 The 2015 predictions indicate that either imperceptible or small changes are anticipated for each receptor for both short and long term changes in NO_2 concentration. A corresponding assessment of negligible significance has therefore been assigned to each receptor in 2015 with respect to NO_2.

Table 6.11 2015 Plant Predictions for PM_{10} long term concentrations

Receptor Reference	Receptor Name	Change in Annual Average PM_{10} (µg/m³)	Total Annual Average PM_{10} (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	<0.1	8.3	Imperceptible	Negligible
R2	**The Stubble**	0.1	8.4	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	8.3	Imperceptible	Negligible
R4	Sandy Acre	<0.1	8.3	Imperceptible	Negligible
R5	Coal Yard	<0.1	8.3	Imperceptible	Negligible
R6	Meadowbridge	<0.1	8.3	Imperceptible	Negligible
R7	Drigg Coast SAC	<0.1	8.3	Imperceptible	Negligible

Note: Bold indicates – worst case receptors. . < - indicates less than. For R7 Drigg Coast SAC there is no applicable annual AQS objective for the protection of ecosystems. Therefore the Drigg Coast SAC short results have been assessed against the annual AQS objective for human health.

6.3.11 The 2015 predictions indicate that imperceptible changes are anticipated for each receptor for both short and long term changes in PM_{10} concentration. A corresponding assessment of negligible significance has therefore been assigned to each receptor in 2015 with respect to PM_{10}. Assuming all of the predicted PM_{10} is $PM_{2.5}$ and utilising the criteria developed in Section 4.6 the changes in annual average particulates in 2015 can also be similarly described as imperceptible and negligible.

Table 6.12 2015 Plant Predictions for PM_{10} short term concentrations

Receptor Reference	Receptor Name	Change in short term PM_{10} (µg/m³)	Total short term PM_{10} Concentration (µg/m³)	Magnitude of Change	Significance of Change
R1	Summer View	<0.1	16.6	Imperceptible	Negligible
R2	**The Stubble**	0.2	16.8	Imperceptible	Negligible
R3	Drigg Moorside	<0.1	16.6	Imperceptible	Negligible
R4	Sandy Acre	<0.1	16.6	Imperceptible	Negligible
R5	Coal Yard	<0.1	16.6	Imperceptible	Negligible
R6	Meadowbridge	<0.1	16.6	Imperceptible	Negligible
R7	Drigg Coast SAC	<0.1	16.6	Imperceptible	Negligible

Note: For R7 Drigg Coast SAC there is no applicable short term AQS objective for the protection of ecosystems. Therefore the Drigg Coast Short results have been assessed against the 24-hour AQS objective for human health.

6.3.12 Other years of capping works on the Trenches (e.g. 2021 and 2025) are likely to have lesser impacts than those described for 2015. This is because the works in 2015 on the trench shoulders are closer to receptors than the works which will be undertaken on the top of the trenches. Additionally, the assessment above has considered the potential effects of capping in combination with other works and so additional plant emissions have been considered. Finally, the assessment of 2015 will provide a worst case assessment as it is assumed that air quality will improve year to year. Therefore, 2015 should be the year of the highest baseline pollutant concentrations in which any capping activities are undertaken.

2019 – Construction Vault 9A

6.3.13 Consistent with the previous assessment of construction dust associated with the construction of the new Vaults no human health receptors are within 200m. Therefore, no significant changes in concentration are anticipated to be associated with plant emissions from these works with respect to human health. This is because vehicle emissions are typically not distinguishable from background pollutant concentrations after 200m [xviii]. In comparison to the significance criteria (Section 4.6) this is considered to be an imperceptible magnitude of change of negligible significance.

6.3.14 The Drigg Coast SAC is within 200m of the construction area, at a distance of approximately 40m. However, the assessment of plant emissions immediately adjacent to the Drigg Coast SAC in 2013 was identified to have a negligible significance, relative to the Air Quality Strategy Objective for the Protection of Vegetation and Ecosystems. In this instance, construction works are to be undertaken a further 40m from the SAC relative to the works previously assessed. Additionally, the construction works are to be undertaken seven years later, with an expected lower background of NO_2 concentrations. Therefore, a negligible significance is anticipated for any changes in NO_2 with the construction works for the Drigg Coast SAC (R7).

Summary

6.3.15 In summary each year of works assessed has been predicted to not have significant changes in PM_{10}, $PM_{2.5}$ or NO_2 concentrations due to plant equipment emissions at any sensitive receptor identified. In comparison to the significance criteria (Section 4.6), the changes in concentration

have been considered to be of a small or imperceptible magnitude, with a negligible significance.

6.3.16 Furthermore, considering a worst case where an increase in the concentration of 24-hour PM_{10} arising from plant emissions is added to the change in PM_{10} 24-hour concentration arising from dust generating activities (Section 6.1), there is no change in the significance of effects previously identified. This is because the magnitude of change from the plant emissions is negligible for each receptor, with a maximum increase of 0.2 µg/m³.

6.4 Emissions from Road Traffic Associated with the Works

6.4.1 Table 6.13 presents the number of vehicles anticipated per day for each phase of works. The traffic changes presented are based on various worst case assumptions. For example it has been assumed that all workers use a vehicle to reach site and therefore there will be no car sharing. It has also been assumed that deliveries for the different elements of each phase, for example cut off wall deliveries and capping deliveries are required concurrently. This is not anticipated to be the case. The traffic increases are below the level of change requiring further assessment against both DMRB and EPUK criteria listed in Section 4. It is therefore considered that the changes in traffic associated with the works will result in imperceptible changes in NO_2 and PM_{10} and hence have a negligible significance in all years.

Table 6.13 Traffic Changes

Phases	HGV Movements per Day	LGVs Movements per Day	Increase in AADT
Phase 1 (2013 - 2015)	**-**	**-**	**-**
Import Bentonite and Cement Powders for Cut-Off Wall	4	-	-
Import Cap Material for north and east skirts	-	-	-
Staff Vehicles	-	60	-
Totals	4	60	64
Phase 2 (2018 - 2022)			**-**
Import Cap Material for Vault 8 and adjacent trenches	-	-	-
Import Bentonite and Cement Powders for Cut-Off Wall	4	-	-
Import Cement Powder for Secant Pile Wall	2	-	-
Import Profiling Fill		-	-
Import Bentonite and Cement Powders for Vault 9a and 10 Construction	8	-	-
Import Bentonite Powder for Capping of Vault 8 and adjacent trenches	4	-	-
Staff Vehicles	-	60	-
Totals	18	60	78
Phase 3 (2023 - 2026)			
Import Cap Material for Vault 9 and adjacent trenches	-	-	-
Import Bentonite and Cement Powders for Cut-Off Wall	4	-	-
Import Cement Powder for Secant Pile Wall	2	-	-
Import Profiling Fill		-	-

Phases	HGV Movements per Day	LGVs Movements per Day	Increase in AADT
Import Bentonite and Cement Powders for Vault 11 Construction	8	-	-
Import Bentonite Powder for Capping of Vault 9 and adjacent trenches	4	-	-
Staff Vehicles	-	60	-
Totals	18	60	78
Phase 4 (2027 - 2029)			
Import Cap Material for Vault 10 and adjacent trenches	-	-	-
Import Bentonite and Cement Powders for Cut-Off Wall	4	-	-
Import Cement Powder for Secant Pile Wall	2	-	-
Import Profiling Fill	-	-	-
Import Bentonite and Cement Powders for Vault 12 Construction	8	-	-
Import Bentonite Powder for Capping of Vault 10 and adjacent trenches	4	-	-
Staff Vehicles	-	60	
Totals	18	60	78
Phase 5 (2031 - 2033)			
Import Cap Material for Vault 11 and adjacent trenches	-	-	-
Import Bentonite and Cement Powders for Cut-Off Wall	4	-	-
Import Cement Powder for Secant Pile Wall	2	-	-
Import Profiling Fill		-	-
Import Bentonite and Cement Powders for Vault 13 Construction	8	-	-
Import Bentonite Powder for Capping of Vault 11 and adjacent trenches	4	-	-
Staff Vehicles	-	60	-
Totals	18	60	78
Phase 6 (2035 - 2036)			
Import Bentonite and Cement Powders for Cut-Off Wall	4	-	-
Import Cap Material for Vault 12 and adjacent trenches	-	-	-
Import Profiling Fill	-	-	-
Import Bentonite Powder for Capping of Vault 12 and adjacent trenches	4	-	-
Staff Vehicles	-	60	-

Phases	HGV Movements per Day	LGVs Movements per Day	Increase in AADT
Totals	8	60	68
Phase 7a (2051 - 2052)			
Import Bentonite and Cement Powders for Cut-Off Wall	4	-	-
Import Cement Powder for Secant Pile Wall	2	-	-
Import Bentonite and Cement Powders for Vault 14 Construction	8	-	-
Staff Vehicles	-	60	-
Totals	14	60	74
Phase 7b (2053 - 2054)			
Import Cap Material for Vault 13 and adjacent trenches	-	-	-
Import Profiling Fill	-	-	-
Staff Vehicles	-	60	-
Totals	0	60	60
Phase 7c (2054 - 2055)			
Import Bentonite Powder for Capping of Vault 13 and adjacent trenches	4	-	-
Import Cap Material for remaining trenches	-	-	-
Import Bentonite Powder for Capping of remaining trenches	4	-	-
Staff Vehicles	-	60	-
Totals	8	60	68
Phase 8 (2078 - 2079)			
Import Cap Material for Vault 14	-	-	-
Import Profiling Fill	-	-	-
Import Bentonite Powder for Capping of Vault 14	4	-	-
Staff Vehicles	-	60	-
Totals	4	60	64

6.5 Assessment of Emissions from Rail Freight Associated with the Works

6.5.1 No phase of the works on-site will require any additional rail trips to and from the site. Currently one delivery is made to the site per day and this will not change during any phase of works, as the necessary materials etc. can be accommodated on existing trains. Therefore, there are no additional emissions of NO_2, SO_2 or particulates which require further assessment. Utilising the

Environmental Protection Guidance [xvii] this equates to an imperceptible change and a negligible significance in all years.

6.6 Supplementary Assessments

6.6.1 The air quality implications of Disposal of waste in Vaults 9 to 14 and commencing higher stacking (up to 9 high) in Vaults 8, 9 and all future vaults are discussed in the two following sub-sections.

Disposal of waste in Vaults 9 to 14

6.6.2 The disposal of waste in Vaults 9 to 14 will involve the same types and numbers of plant equipment as currently utilised for the existing operations at the site. Therefore, no significant changes in emissions of NO_2 or PM_{10} are anticipated. . Additionally, no significant changes exceeding the DMRB and EPUK criteria for operational traffic are anticipated. Consequentially, an imperceptible change in concentrations is expected for NO_2 and PM_{10} with a negligible significance.

Higher stacking (up to 9 high) in Vaults 8, 9 and all future vaults

6.6.3 The disposal of waste in Vaults 9 to 14 with higher stacking will involve the same types and numbers of plant equipment as currently utilised for the existing operations at the site. Additionally, no significant changes exceeding the DMRB and EPUK criteria for operational traffic are anticipated. Therefore, no significant changes in emissions of NO_2 or PM_{10} are anticipated. Consequentially, an imperceptible change in concentrations is expected for NO_2 and PM_{10} with a negligible significance.

7 Mitigation Measures

7.1.1 This section presents the mitigation measures appropriate to minimise the effect on air quality from either construction or operational activities.

7.2 Construction and Capping

7.2.1 Despite the negligible predicted effect from construction and capping activities, construction vehicle emissions would be mitigated through:

- The use (where appropriate) of catalytic converters; and
- The regular maintenance of vehicle engines.

7.2.2 In accordance with best practice, construction dust will be controlled through the application of a series of measures, including (where appropriate):

- Regular inspection and, where necessary, wet suppression of material/soil stockpiles (including wind shielding, storage away from site boundaries);
- Appropriate orientation of material stockpiles and minimising their height, to minimise wind dispersion;
- Stabilisation or vegetation of long term stockpiles;
- Provision of wheel washing and wet suppression during loading of wagons/vehicles;
- Covering vehicles carrying dry spoil and other wastes;
- Shielding of dust-generating construction activities with temporary barriers.
- Provision of suitable site hoarding;
- Restricting vehicle speeds on access roads and other unsurfaced areas of the site to 10 mph.
- Inspection of unsurfaced haulage routes, and wet suppression as necessary, during prolonged dry periods; and
- No waste materials will be burnt on-site.
- Soil stripping is not to be undertaken during periods of high wind speeds of 8 m/s or more, which a 5 on the Beaufort Scale.

7.2.3 A Principal Contractor will be appointed by the Applicant to develop and implement a Construction Environmental Management Plan (CEMP), which will present a comprehensive list of mitigation measures, for agreement with the Council.

7.3 Operation

7.3.1 No operational mitigation measures are recommended as no significant effects are anticipated with respect to air quality from the Operation of the site.

Residual Effects

7.3.2 This Section discusses the anticipated level of effect following implementation of the aforementioned mitigation measures.

7.3.3 The residual effect associated with construction site plant is expected to be negligible at the nearest residential and ecological receptors.

7.3.4 Any effects associated with construction dust are predicted to be negligible as best practice dust mitigation measures will be utilised.

7.3.5 The combined residual effects of PM10 increases from dust generating activities and site plant are also expected to be negligible at the nearest residential receptors.

7.3.6 Traffic emissions associated the Scheme are negligible, as there are small numbers of vehicles associated with the works.

7.3.7 There are no changes in the numbers of rail journeys to and from the site and so there is no change in rail emissions.

7.3.8 There are negligible changes in emissions due to the variations proposed in operational conditions e.g. higher stacking.

7.3.9 The residual effects associated with each aspect that has been assessed is described in Table 8.1.

Table 8.1 Summary of Effects Following Mitigation

Phase	Nature of Effect	Temporal and Spatial Extent	Significance
Site Works (e.g. construction, capping, vegetation removal, earthworks)	Plant emissions	Temporary, Local	Negligible
	Increase in fugitive dust emissions	Temporary, Local	Negligible
	Additional traffic emissions	Temporary, Local	Negligible
	Rail freight emissions	Temporary, Local	Negligible
Operation	Disposal of waste in Vaults 9 to 14	Permanent, Local	Negligible
	High stacking (up to 9 high) in Vaults 8, 9 and all future vaults	Permanent, Local	Negligible

8 Cumulative Impacts

8.1.1 Demolition works are to be undertaken at the PCM retrieval facilities and magazines, commencing in 2019. These demolition works are not part of the planning permission which this assessment supports. Therefore the effects of these demolition works are considered in this cumulative effects section.

8.1.2 In 2019, the vault construction work (Vaults 9A and 10) assessed individually in Section 6 will be on-going, when the above demolition works are undertaken. It is the combination of these construction works and demolition works that are considered in this section.

8.1.3 This section considers the potential cumulative impacts from both sets of works in relation to dust generation (PM_{10}) and also plant equipment emissions (NO_2 and PM_{10}).

Dust Generation

8.1.4 Demolition works in the BRE study were identified to result in an increase in the PM_{10} 24-hour concentration of 11 µg/m³ at a site boundary, with concentrations decreasing to background concentrations at distances over 150m. In this instance the demolition works are to be undertaken at distances over 200m from all the sensitive human health receptors identified around the site. Therefore, these works alone are anticipated to have an imperceptible change and a negligible significance.

8.1.5 Similarly, the assessment of construction works in 2019 for the new Vault (9A) are also to be undertaken at distances over 200m from all the human health sensitive receptors identified around the site. Therefore, these works alone are anticipated to have an imperceptible change and a negligible significance.

8.1.6 Therefore, as both demolition and construction works are to be undertaken at distances greater than 200m from sensitive receptors, the cumulative impact on PM_{10} 24-hour concentrations is considered to be the same as the individual assessments, with an imperceptible change and a negligible significance.

Plant Equipment Emissions

8.1.7 As no human health receptors are within 200m there will be no significant change in concentrations of either NO_2 or PM_{10} at these receptors from the combined demolition and construction plant emissions. This is because vehicle emissions are typically not distinguishable from background pollutant concentrations after 200m [xviii]. In comparison to the EPUK criteria this is considered to be an Imperceptible magnitude of change of negligible significance.

8.1.8 However, the Drigg Coast SAC is within 200m of the construction and demolition areas at a distance of approximately 40m for the construction works and approximately 100m from demolition works. The assessment of plant emissions immediately adjacent to the Drigg Coast SAC in 2013 were identified to have a negligible significance, relative to the Air Quality Strategy Objective for the Protection of Vegetation and Ecosystems. In this instance, the demolition and construction works are to be undertaken a further 100m and 40m respectively from the SAC. Additionally, the demolition and construction works are to be undertaken seven years later, with an expected lower background of NO_2 concentrations. Therefore, a negligible significance is anticipated for any changes in NO_2 with the demolition and construction works for the Drigg Coast SAC (R7).

9 Summary

9.1.1 Consistent with the current EPUK guidance [xvii] consideration has been given to the key results of the air quality assessment in determining the overall air quality significance of the Scheme. These key factors are listed below:

- No properties are predicted to be affected by slight, moderate or major air quality impacts.
- No new exposure is being introduced with the Scheme.
- No exceedances of an air quality objective or limit value are predicted.
- Uncertainty in the predictions undertaken has been minimised through the application of worst case assumptions.
- Cumulative impacts have also been considered and no slight, moderate or major air quality impacts have been identified.

9.1.2 In summary as the air quality significance of effects is considered to be negligible. The proposed development is considered to comply with the relevant air quality policies and plans described in the planning policy context Section of this Appendix. All construction and operational air quality effects following mitigation are considered to be negligible and therefore it is anticipated that air quality will not be a material planning consideration with respect to the above proposals.

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