ABERDEEN HARBOUR
EXPANSION PROJECT
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# CHAPTER 19: AIR QUALITY

# 19. AIR QUALITY

## 19.1 Introduction

This chapter, prepared by Waterman Infrastructure & Environment (WIE), presents an assessment of the significance of effects of the Aberdeen Harbour Expansion Project (AHEP) on air quality. In particular, consideration is given to the effects of potential emissions from the construction works, as well as the effects of emissions from road traffic and harbour emissions associated with the operational harbour.

This chapter provides a summary of relevant legislation, planning policy and guidance, together with a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the site and surrounding area, and an assessment of the effects of the AHEP during construction works and once the AHEP is completed and operational. Mitigation measures are identified (where appropriate) to avoid, reduce or offset any significant adverse effects identified, together with the nature and significance of likely residual effects.

This chapter is supported by ES Appendix 19-A: Air Quality Modelling Study.

## 19.2 Legislation and Planning Policy

This section outlines the policy, legislation and guidance that are relevant to air quality. Policy, legislation and guidance applicable to the wider project can be found in ES Chapter 4: Planning and Legislation.

### 19.2.1 Legislation

19.2.1.1 International Regulations for Shipping Emissions

Globally, air pollution from ships is regulated by the International Maritime Organization (IMO) through its “International Convention on the Prevention of Pollution from Ships”, known as MARPOL 73/78 (http://www.imo.org/en/About/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx). However, limits on air pollutant emissions were not set in the Convention before its amendment in 1997, and the introduction of Annex VI - Air Pollution (MARPOL Annex VI - Regulations for the Prevention of Air Pollution from Ships), which came into force in 2005.

Annex VI regulations include limits in marine fuel sulphur content and set out sulphur oxides ($SO_x$ - the main air pollutant of concern from marine vessels) Emission Control Areas (SECA, or $SO_x$ ECA) for which special fuel requirements with tighter sulphur content are applicable. The Baltic Sea, North Sea and English Channel have all been designated as SECAs in 2007, for which a more stringent limit of 1.5% m/m fuel sulphur content applied (The unit m/m means "by mass" and does not stand for any particular units).

Annex VI was amended in 2008, introducing a tighter limit of 1% sulphur content for SECAs, which came into force in July 2010 (http://www.dnv.com/binaries/marpol%20brochure_tcm4-383718.pdf). The revised Annex VI also allowed for an ECA to be designated for additional air pollutants -

particulate matter (PM), nitrogen oxides ($NO_x$), or all three pollutants ($SO_x$, PM and $NO_x$). Annex VI sets limits on $NO_x$ emissions from diesel engines, through the adoption of the $NO_x$ Technical Code 2008. The limits applicable in ECAs for $SO_x$ and PM were further reduced to 0.1%, from 1 January 2015.

19.2.1.2 European Legislation

Air pollutants at high concentrations can give rise to adverse effects to the health of humans and ecosystems. European Union (EU) legislation on air quality forms the basis for national UK legislation and policy on air quality.

The European Union Framework Directive 2008/50/EC (Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe) on ambient air quality assessment and management came into force in May 2008 and was implemented by Member States, including the UK, by June 2010. The Directive aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants.

19.2.1.3 National Legislation

**Air Quality Standards**

The Air Quality Standards (Scotland) Regulations 2010 implement Limit Values prescribed by the Directive 2008/50/EC. The Limit Values are legally binding and the Scottish Ministers, on behalf of the UK Government, is responsible for their implementation.

**The UK Air Quality Strategy (AQS)**

In a parallel process, the Environment Act 1995 (ODPM, 1995) required the preparation of a national air quality strategy setting health-based air quality objectives for specified pollutants and outlining measures to be taken by local authorities in relation to meeting these (the Local Air Quality Management (LAQM) system).

The current UK AQS was published in 2007 (DEFRA, 2007) and sets out the objectives (referred to hereafter as the ‘AQS objectives’) for local authorities in undertaking their local air quality management duties.

Objectives in the current UK AQS are in some cases more onerous than the Limit Values set out within the relevant EU Directives and the Air Quality Standards (Scotland) Regulations 2010. In addition, the AQS objectives were established for a wider range of pollutants.

The Limit Values and AQS objectives of air pollutants relevant to this assessment are summarised in Table 19.1.

**Table 19.1: Summary of relevant air quality limit values and UK (Scotland) AQS objectives**

| Pollutant | Averaging Period | Standard | | Target Date |
|---|---|---|---|---|
| | | Objective/Limit Value | Not to be Exceeded More Than | |
| Nitrogen dioxide ($NO_2$) | 1 hour | 200 µg/m$^3$ | 18 times per calendar year | 31/12/2005 (a) |
| | | 200 µg/m$^3$ | | 01/01/2010 (b) |
| | Annual | 40 µg/m$^3$ | - | 31/12/2005 (a) |
| | | 40 µg/m$^3$ | | 01/01/2010 (b) |
| Particle Matter ($PM_{10}$) (c) | 24 hour | 50 µg/m$^3$ | 7 times per year | 31/12/2004 (a) |
| | | 50 µg/m$^3$ | | 31/12/2010 (b) |
| | Annual | 40 µg/m$^3$ | - | 31/12/2004 (a) |
| | | 18 µg/m$^3$ | | 31/12/2010 (b) |
| Particulate Matter ($PM_{2.5}$)(d) | Annual | Target of 15% reduction in concentrations at urban background locations | - | Between 2010 and 2020 |
| | | Variable target of up to 20% reduction in concentrations at urban background locations (e) | - | Between 2010 and 2020 |
| | Annual | 12 µg/m$^3$ | - | 01/01/2010 (b) |
| | | 25 µg/m$^3$ | - | 01/01/2020 (a) |

**Notes:**
a) Target date set in UK Air Quality Strategy 2007
b) Target date set in Air Quality Standards (Scotland) Regulations 2010
c) Particulate matter with a mean aerodynamic diameter less than 10 microns (µm)
d) Particulate matter with a mean aerodynamic diameter less than 2.5 microns (µm)
e) Aim to not exceed 18µg/m$^3$ by 2020

There are currently no statutory UK standards in relation to deposited dust and its propensity to cause nuisance. A deposition rate of 200mg/m$^2$/day (averaged over a month) is sometimes used as a threshold value for potentially significant dust nuisance effects (Bate and Coppin, 1991).

**Local Authority Responsibility**

Part IV of the Environment Act 1995 provides a system of Local Air Quality Management (LAQM) under which local authorities are required to review and assess the quality of the air in their area by way of a staged process. In the event that this process suggests that any of the AQS Objectives will not be met by the target dates, the local authority must consider the declaration of an Air Quality Management Area (AQMA) and the subsequent preparation of an Air Quality Action Plan (AQAP) to improve the air quality in that area in pursuit of the objectives. A summary of the Aberdeen City Council (ACC) Review and Assessment of air quality is provided in the Baseline Conditions section of this Chapter.

### 19.2.2 National Planning Policy

19.2.2.1 <u>Scottish Planning Policy, 2014</u>

The Scottish Planning Policy (SPP) 2014 document outlines the Scottish Government's policy on land use planning. It outlines the core principles of the Scottish planning framework, stating that new developments need to contribute to: "supporting sustainable economic growth and regeneration, and the creation of well-designed, sustainable places" and "reducing our carbon emissions and adapting to climate change".

In relation to Transport, SPP 2014 identifies that local authorities should "promote opportunities for travel by more sustainable modes in the following order of priority: walking, cycling, public transport, cars. The aim is to promote development which maximises the extent to which its travel demands are met first through walking, then cycling, then public transport and finally through use of private cars". In terms of new development, it states that:

- "Buildings and facilities should be accessible by foot and bicycle and have appropriate operational and servicing access for large vehicles. Cycle routes, cycle parking and storage should be safeguarded and enhanced wherever possible".

19.2.2.2 <u>The Scottish Government, Planning Advice Note 51: Planning, Environmental Protection and Regulation, 2006</u>

Planning Advice Note (PAN) 51: Planning, Environmental Protection and Regulation (The Scottish Executive, 2006) recognises that air quality is likely to be a "material consideration for large scale proposals or if they are to be occupied by sensitive groups such as the elderly or young children or are likely to have cumulative effects" where proposals exist within an AQMA or adjacent to them.

For proposals which are likely to yield a significant effect on local air quality, a study of air quality will be warranted. PAN 51 also states that "it may be necessary to consider the cumulative effect of developments on air quality leading to a gradual deterioration".

19.2.2.3 <u>Planning Advice Note 75: Planning for Transport, 2005</u>

PAN 75: Planning for Transport (The Scottish Executive, 2005) recognises the need to consider potential local air quality effects associated with new developments, which arise from transport, with particular regard to the National Air Quality Strategy and AQMAs.

### 19.2.3 Regional Planning Policy

19.2.3.1 <u>The Aberdeen City and Shire Strategic Development Planning Authority, Development Plan Scheme 2013/2014</u>

The Development Plan Scheme (Aberdeen City Council, 2013) sets out the process and anticipated timescales for preparing and reviewing the strategic development plan and what is likely to be involved at each stage. There are no policies within the Development Plan Scheme that relate to air quality.

19.2.3.2 <u>Aberdeen City Council, Proposed Local Development Plan 2015</u>

ACC published in March 2015 its Proposed Local Development Plan (LDP) (Aberdeen City Council, 2015) for representations. The consultation period closed on Monday 1 June 2015. The plan is not yet adopted. Proposed Policy T4 Air Quality states:

"Development proposals which may have a detrimental impact on air quality will not be permitted unless measures to mitigate the impact of air pollutants are proposed and agreed with the Planning Authority. Planning applications for such proposals should be accompanied by an assessment of the likely impact of development on air quality and any mitigation measures proposed.

The relevant Supplementary Guidance Air Quality, detailed below sets out the likely circumstances in which applicants must submit an assessment of the potential impact of particular types of development on existing and future air quality, particularly in and around Air Quality Management Areas. It also provides guidance on the process of air quality assessment and how mitigation measures will be assessed and implemented."

19.2.3.3 Aberdeen City Council, Aberdeen Local Development Plan, 2012

The Aberdeen Local Development Plan (ALDP) (Aberdeen City Council, 2012) was adopted on 29 February 2012. Policy NE10 - Air Quality states:

"Planning applications for development which has the potential to have a detrimental impact on air quality will not be permitted unless measures to mitigate the impact of air pollutants are proposed and can be agreed with the Planning Authority. Such planning applications should be accompanied by an assessment of the likely impact of development on air quality and any mitigation measures proposed (see Air Quality Supplementary Guidance)."

### 19.2.4 Guidance

19.2.4.1 Environmental Protection UK: Planning for Air Quality, 2010

The Environmental Protection UK's (EPUK) Development Control: Planning for Air Quality (Update 2010) guidance advises that:

- "… in arriving at a decision about a specific proposed development the [Local Planning Authority] is required to achieve a balance between economic, social and environmental considerations… For this reason, appropriate consideration of issues such as air quality … is necessary… particular attention should be paid to the potential for the development to give rise to breaches of the national air quality objectives and of EU limit values to whether the development will materially affect any air quality action plan or strategy, and to the overall degradation in local air quality. It is also important to consider whether the new development will introduce new public exposure into an area of poor air quality…" and
- Based on the EPUK guidance, consideration should be given to the wider air quality benefits from the opening of the development.

19.2.4.2 Aberdeen Local Development Plan: Supplementary Guidance, 2015

The supplementary guidance (Aberdeen City Council, 2015a) expands upon existing policies and proposals and is used to support the content of the Local Development Plan (LDP). It is a material consideration in the determination of planning applications, and carries the same weight as the policies in the LDP itself. The supplementary guidance was open to consultation until Monday 1 June 2015. Topic Area 7: Transport, Air Quality and Noise provides more detail on Policy T4 – Air Quality. The guidance also provides details on the methodology that should be undertaken to support the planning application and the mitigation measures that should be considered as part of the development proposals.

19.2.4.3 Low Emissions Strategies - Good Practice Guide, 2010

In January 2010, Defra published good practice guidance (DEFRA, 2010) for advising local authorities on ways in which the planning system may be used to reduce transport emissions and thus improve air quality. The guidance provides local authorities with typical measures and examples of good practice including:

- On-site parking: residential/customer parking spaces set aside for car clubs or low emission vehicles;
- Low emission infrastructure: provision of providing electric charging bays or low emissions fuelling points, cycle rental schemes, development and promotion of car clubs;
- Innovative and creative ideas;
- Commitments via procurement and supply chains; and
- Contributions to local plans: standardised for all developments over a certain threshold but related to the actual effect.

19.2.4.4 BRE Pollution Control Guide: 'Controlling Particles, Vapour and Noise from Construction Sites', 2003

The Building Research Establishment (BRE) produced a guide (Building Research Establishment, 2003) to assist with the control of air pollution and noise emissions from construction sites and sets out guidance on controlling pollution emissions through effective pre-project planning and management issues that are an essential part of any construction project. Other Guides in the series give methods for controlling air and noise pollution from various construction and demolition activities.

19.2.4.5 Institute of Air Quality Management: Guidance on the Assessment of Dust from Demolition and Construction, 2014

The Institute of Air Quality Management (IAQM) Construction Dust Guidance (Institute of Air Quality Management, 2014) provides guidance to consultants and Environmental Health Officers (EHOs) on how to assess air quality effects from construction related activities. The guidance provides a risk based approach based on the potential dust emission magnitude of the site (small, medium or large) and the sensitivity of the area to dust effects. The importance of professional judgement is noted throughout the guidance. The guidance recommends that once the risk class of the site is identified, the appropriate level of mitigation measures are implemented to ensure that the construction activities have no significant effects.

## 19.3 Assessment Methodology and Significance Criteria

### 19.3.1 Assessment Methodology

This air quality assessment has been undertaken using information from a variety of sources using the following methodology:

- A review of ACC air quality review and assessment documents in order to identify baseline air quality conditions in the area and inform the verification of the air quality modelling results;
- A review of the AHEP and the site's local area to identify potentially sensitive receptor locations, both existing and proposed, that could be affected by changes in air quality that would result from the AHEP;

- Consultation with ACC in order to agree the scope of the assessment and the precise methodology to be employed to inform the assessment;
- The review and analysis of traffic flow data (see ES Appendix 18-A: Transport Assessment), used as part of the air quality modelling;
- A review of the likely operational harbour and shipping activity associated with the AHEP;
- The use of the atmospheric dispersion model ADMS-Roads (Cambridge Environmental Research Consultants LTD, 2011) to predict the likely pollutant concentrations at the Site and determine the effect of the completed and operational AHEP on local air quality due to road traffic emissions, as agreed with the EHO at ACC;
- The use of the latest $NO_2$ from NOx Calculator (AEA, 2012) available from the LAQM Support website (http://laqm.defra.gov.uk/) to derive the road-related $NO_2$ concentrations from the modelled NOx concentrations;
- The comparison of predicted air pollutant concentrations with ACC monitored air pollutant concentrations, and adjustment of modelled results where necessary (model verification);
- The comparison of predicted air pollutant concentrations with the UK and Scottish AQS objectives;
- Determination of the effects of the operational phase of the AHEP on air quality, based on the application of the EPUK significance criteria to modelled results;
- Determination of the effects of proposed construction activities; and
- Identification of mitigation measures to minimise the effects of both construction and operational phases, where appropriate.

The UK AQS identifies the pollutants associated with road traffic emissions and local air quality as:

- Nitrogen oxides ($NO_X$),
- Particulate matter (as $PM_{10}$ (particles with a diameter up to 10 µm) and $PM_{2.5}$ (particles with a diameter up to 2.5 µm)),
- Carbon monoxide (CO), and
- 1,3-butadiene ($C_4H_6$) and benzene ($C_6H_6$).

Emissions of total $NO_X$ from motor vehicle exhausts comprise nitric oxide (NO) and $NO_2$. NO oxidises in the atmosphere to form $NO_2$.

ACC has declared three AQMAs within its administrative area for both $NO_2$ and $PM_{10}$, due to exceedences of the AQS objectives attributable to road traffic emissions. The most significant pollutants associated with road traffic emissions, in relation to human health, are $NO_2$ and particulate matter. The assessment therefore focuses on the pollutants $NO_2$ and fine particulate matter.

19.3.1.1 EIA Scoping Responses

The EIA Scoping Report (ES Appendix 1-C and 1-D), which included submissions on air quality from ACC, the Scottish Environment Protection Agency (SEPA) and Transport Scotland, provided the following advice:

- Assessment of the likely impact of fugitive emissions arising from the movement of materials on site during construction in terms of local residences and potentially local habitats will be required;
- The main impacts from air quality will originate from the construction phase of the proposal;
- Specific site surveys would identify levels of $NO_2$ and $PM_{10}$ in close proximity to representative worst case sensitive receptors, including Natura and locally designated ecological sites.
- The EHO must be consulted regarding methodology;
- The EIA should consider impact of construction activity and traffic on key routes to and from the harbour, particularly Wellington Road, where roadside pollution has increased year on year; and
- Where a significant change in road characteristics has been identified as a result of the proposed development, changes in air quality at a worst case scenario sensitive receptor adjacent to the trunk road will require further assessment.

Each of these issues has been fully addressed within this chapter.

19.3.1.2 Construction Assessment Methodology

**Dust Emissions**

The assessment of the effects of the construction activities in relation to dust has been based on the guidance published by the IAQM (2014) and the following:

- A consideration of planned construction activities and their phasing;
- A review of the sensitive uses in the area immediately surrounding the site in relation to their distance from the site.
- Following the IAQM guidance, construction activities can be divided into the following four distinct activities:
- **Earthworks:** the excavation, haulage, tipping and stockpiling of material, which may also involve levelling the site and landscaping;
- **Construction:** any activity involved with the provision of a new structure; and
- **Trackout:** the movement of vehicles from unpaved ground on a site, where they can accumulate mud and dirt, onto the public road network where dust might be deposited.

The IAQM guidance considers three separate dust effects, with the proximity of sensitive receptors being taken into consideration for:

- Annoyance due to dust soiling;
- Potential effects on human health due to significant increase in exposure to $PM_{10}$; and
- Harm to ecological receptors.

A summary of the four step process which has been undertaken for the dust assessment of construction activities as set out in the IAQM guidance is presented in Table 19.2.

**Table 19.2: Examples of dust sensitive receptors**

| Step | | Description |
|---|---|---|
| 1 | Screen the Need for a Detailed Assessment | Simple distance-based criteria are used to determine the requirement for a detailed dust assessment. An assessment will normally be required where there are 'human receptors' within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on public highway, up to 500 m from the site entrance or 'ecological receptors' within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on public highway, up to 500 m from the site entrance. |
| 2 | Assess the Risk of Dust Effects | The risk of dust arising in sufficient quantities to cause annoyance and/or health or ecological effects should be determined using three risk categories: low, medium and high based on the following factors:<br>• The scale and nature of the works, which determines the risk of dust arising (i.e. the magnitude of potential dust emissions) classed as small, medium or large;<br>• The sensitivity of the area to dust effects, considered separately for ecological and human receptors (i.e. the potential for effects), defined as low, medium or high. |
| 3 | Site Specific Mitigation | Determine the site specific measures to be adopted at the site based on the risk categories determined in Step 2 for the four activities. For the cases where the risk is 'insignificant' no mitigation measures beyond those required by legislation are required. Where a local authority has issued guidance on measures to be adopted these should be taken into account. |
| 4 | Determine Significant Effects | Following Steps 2 and 3, the significance of the potential dust effects should be determined, using professional judgement, taking into account the factors that define the sensitivity of the surrounding area and the overall pattern of potential risks. |

**Vehicle Exhaust Emissions**

The IAQM guidance on assessing construction impacts states that:

"Experience of assessing the exhaust emissions from on-site plant and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed".

Given the size of the AHEP and the duration of the construction phase, in accordance with the IAQM guidance, it is considered that a quantitative assessment of the exhaust emissions from construction plant and traffic is not required, and a qualitative assessment is appropriate.

19.3.1.3 <u>Completed Development Assessment Methodology</u>

**Road-Traffic Emissions**

The effect on local air quality in relation to traffic generated by the completed AHEP was assessed using the advanced atmospheric dispersion model, ADMS-Roads, as agreed with the EHO at ACC. Further details of the ADMS-Roads modelling are presented in ES Appendix 19-A.

Traffic data for the local road network were provided by Fairhurst (see ES Appendix 19-A for further details). The baseline year of 2014 was assessed and the 'without development' and 'with development' scenarios for the year 2020, the anticipated year of completion of the AHEP. Road traffic emissions were used as input to the ADMS-Roads model to predict pollutant concentrations for these scenarios, and determine the significance of effects from additional traffic movements generated by the AHEP on future local air quality at off-site receptor locations.

The ADMS-Roads dispersion model predicts how emissions from roads combine with local background pollution levels, taking account of meteorological conditions, to affect local air quality. The ADMS-Roads model has been run for the completion year 2019, and therefore used 2020 background pollutant concentrations and vehicle emission rates as inputs. For the verification assessment (see ES Appendix 19-A), 2014 background pollutant concentrations and vehicle emission rates have been used (see below). The model allows pollution concentrations to be quantified at selected specific receptors, representative of sensitive locations relevant for public exposure.

**$NO_2$ Sensitivity Analysis**

Analyses of historical monitoring data by Defra (http://laqm.defra.gov.uk/faqs/faqs.html) have identified a disparity between measured $NO_x$ and $NO_2$ concentrations and the projected decline associated with emission forecasts which form the basis of air quality modelling as described above. The precise reason for the disparity is not fully understood but is thought to be related to the on-road performance of certain vehicles compared to calculations based on Euro emission standards which inform emission forecasts.

A note on Projecting $NO_2$ Concentrations (DEFRA, 2012) published by Defra provides a number of alternative approaches that can be followed in air quality assessments in relation to concerns about future $NO_2$ concentrations. These include the use of revised background pollution maps, alternative projection factors and revised vehicle emission factors. However, the Defra note does not form part of statutory guidance and no prescriptive method is recommended for use in an air quality assessment.

This air quality assessment has been based on current guidance, i.e. using existing forecast emission rates and background concentrations to the completion year of 2019, which assume a progressive reduction compared to the baseline year 2014. However, in addition, a sensitivity analysis has been undertaken on the basis of no $NO_2$ reductions by 2019 (i.e. considering the potential effect of the AHEP against the current baseline 2014 conditions, assuming no reduction in background concentrations or road-traffic emissions between 2014 and 2019). The sensitivity approach presented in this air quality assessment is now typically agreed with and accepted by local authorities as being robust, and provides a clear method to account for the uncertainty in future $NO_x$ and $NO_2$ concentrations in air quality assessments. The sensitivity analysis is presented in ES Appendix 19-A.

**Harbour Emissions**

The effects on air quality from emissions, other than road traffic, generated by the harbour operations associated with the AHEP (i.e. emissions from ships and cargo handling equipment (CHE)) have been determined based on a qualitative assessment. The assessment was based on the source-pathway-receptor approach, considering the following:

- Determination of the sources of emissions (nature and location);
- Identification of sensitive receptors nearby; and
- Analysis of local weather conditions.

### Background Pollutant Concentrations

The ADMS-Roads model requires the use of background pollutant concentration data to which the model adds pollutant contributions from local road traffic. Full details in relation to the background data used within the air quality assessment are included in ES Appendix 19-A.

### Model Verification

Model verification is the process of comparing monitored and modelled pollutant concentrations, and adjusting modelled results if necessary, in order to give confidence in the accuracy of the modelling results.

In relation to $NO_2$, the model was verified by comparing the modelled annual mean $NO_2$ concentration for 2014 (the latest year for which ACC air quality monitoring data is available) with the monitored annual mean $NO_2$ concentrations at the ACC automatic monitors located at Market Street and Wellington Road and at four diffusion tube locations (the nearest ACC monitors to the Site within the road traffic network supplied by Fairhurst).

In relation to $PM_{10}$, the modelled annual mean $PM_{10}$ concentration for 2014 was compared with the monitored annual mean $PM_{10}$ concentrations at the Market Street and Wellington Road automatic monitors.

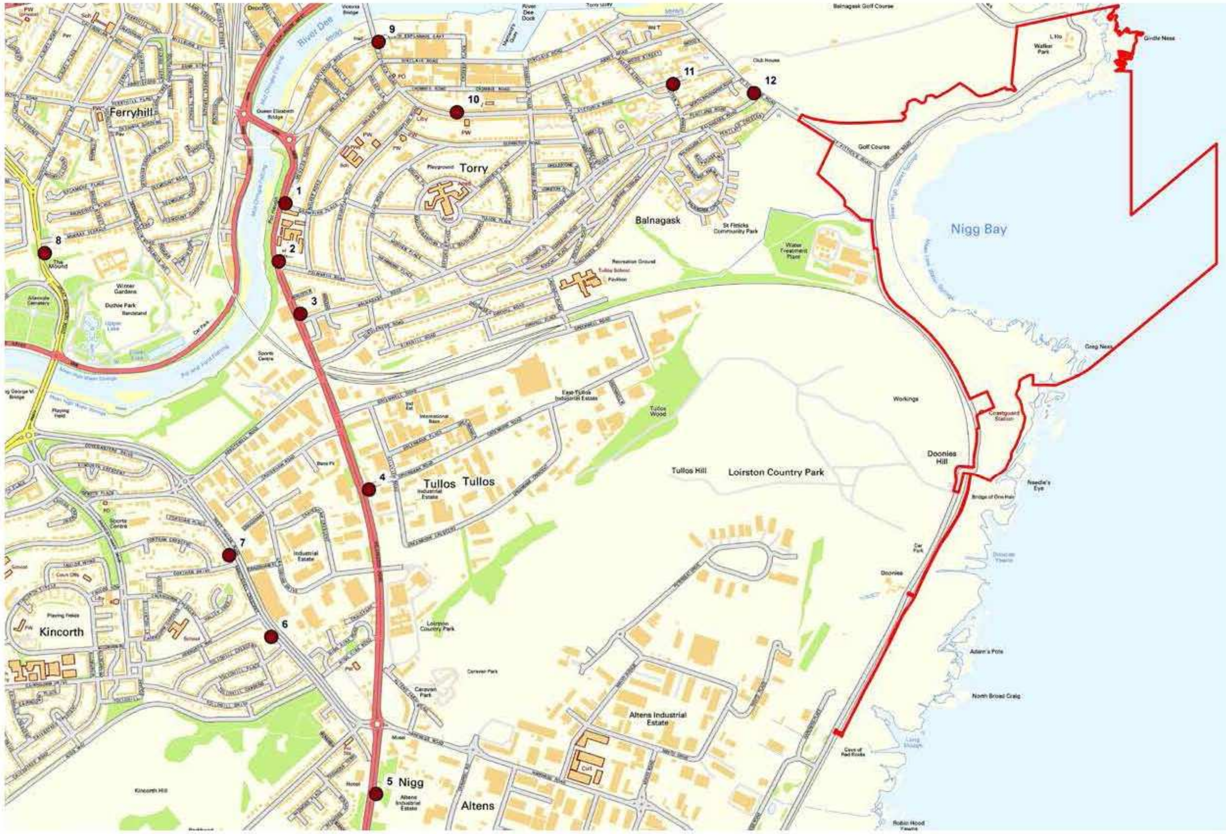
The $NO_2$ and $PM_{10}$ verification process is described in detail in ES Appendix 19-A. This shows that overall the model is performing well and is considered to be suitable for use within the impact assessment.

### Identification of Potentially Sensitive Receptors

The approach adopted by the Air Quality Strategy is to focus on areas at locations at, or close to, ground level where members of the public (in a non–workplace area) are likely to be exposed to pollutants over the averaging time of the AQS objective in question (i.e. over 1 hour, 24 hour or annual periods). Objective exceedences principally relate to annual mean $NO_2$ and $PM_{10}$, and 24 hour mean $PM_{10}$, so that potentially sensitive locations relate mainly to residential properties and other sensitive locations (such as schools) where the public may be exposed for prolonged periods.

### Sensitive Receptors along the Affected Road Network

Table 19.3 presents existing potentially sensitive receptors (residential properties) that have been selected due to their proximity to the road network that would be affected by the AHEP (Receptor 1 to Receptor 12). Receptor locations are presented in Figure 19.1.




Development Boundary

| Receptor Number | Address of Receptor |
|---|---|
| 1 | 119 Menzies Road* |
| 2 | 1 Polwarth Road* |
| 3 | 57 Wellington Road* |
| 4 | 133 Wellington Road |
| 5 | Smiddy Cottage, Wellington Road |
| 6 | 138 Abbotswell Crescents |
| 7 | 100 Abbotswell Crescents |
| 8 | 119 Great Southern Road |
| 9 | 2 Flat South* |
| 10 | 153 Victoria Road |
| 11 | 346 Victoria Road |
| 12 | 94 St Fitticks Road |

| | |
|---|---|
| Project Details | WIB14221-100: Aberdeen Harbour |
| Figure Title | Figure 19.1: Site Plan and Road Emission Sensitive Receptor Locations |
| Figure Ref | WIB14221-100_GR_ES_19.1A |
| Date | August 2015 |
| File Location | \\s-lncs\wie\projects\wib14221\100\graphics\es\issued figures |

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**Figure 19.1: Site plan and road emission sensitive receptor locations**

**Table 19.3: Selected receptor locations**

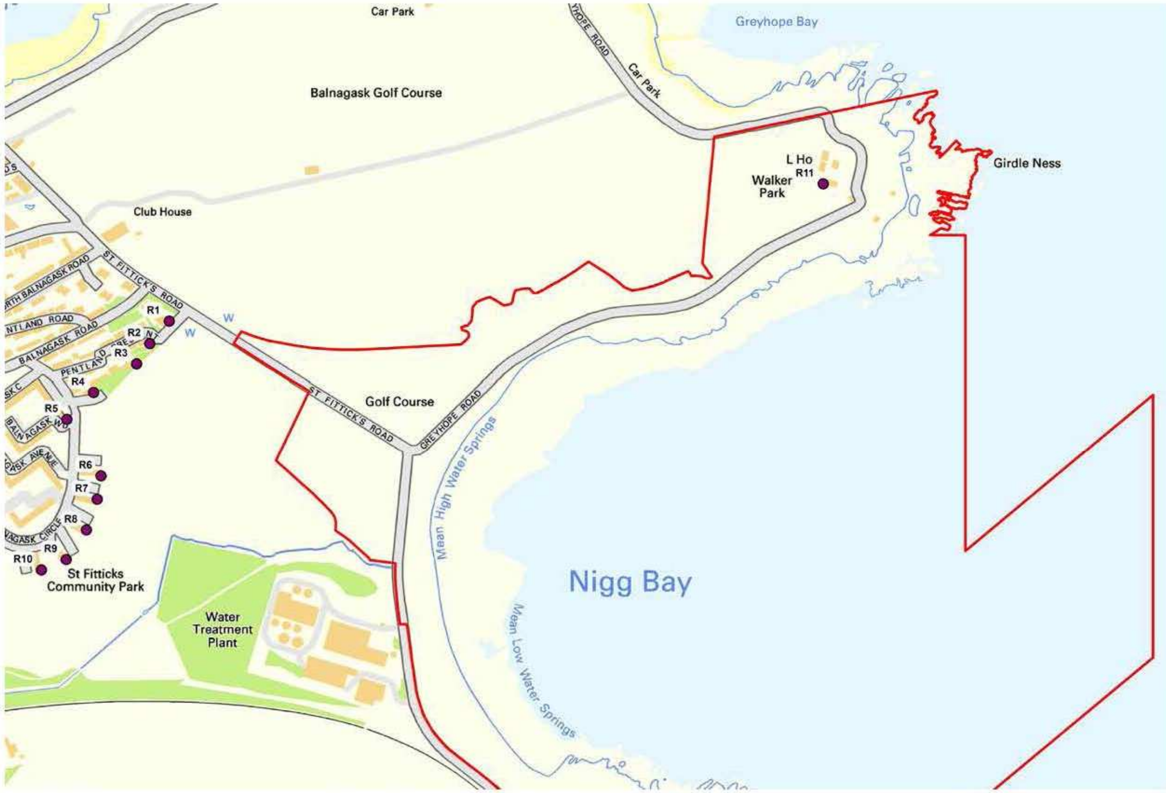
| Receptor Number | Address of Receptor | Grid Reference | Height Above Ground [m] |
|---|---|---|---|
| 1 | 119 Menzies Road* | 394397, 804770 | 0 |
| 2 | 1 Polwarth Road* | 394373, 804567 | 0 |
| 3 | 57 Wellington Road* | 394450, 804383 | 0 |
| 4 | 133 Wellington Road | 394690, 803765 | 0 |
| 5 | Smiddy Cottage, Wellington Road | 394715, 802697 | 0 |
| 6 | 138 Abbotswell Crescents | 394347, 803248 | 0 |
| 7 | 100 Abbotswell Crescents | 394199, 803535 | 0 |
| 8 | 119 Great Southern Road | 393551, 804596 | 0 |
| 9 | 2 Flat South* | 394724, 805336 | 0 |
| 10 | 153 Victoria Road | 394999, 805090 | 0 |
| 11 | 346 Victoria Road | 395760, 805189 | 0 |
| 12 | 94 St Fitticks Road | 396044, 805157 | 0 |
| **Note:**<br>* Receptor locations located within an AQMA | | | |

**Sensitive Receptors near Future Harbour Operations**

The closest sensitive receptors to the site are the residential properties in the Torry area, facing Nigg Bay along:

- Greyhope Road at the Girdleness Lighthouse;
- Pentland Crescent/Pentland Place; and
- Balnagask Circle.

The location of these sensitive receptors is illustrated in Figure 19.2. Table 19.4 shows the key receptors along these roads, with their approximate distance and direction to the proposed West Quay of AHEP, which is likely to be the nearest source of emissions from the new harbour.




Development Boundary

| ID | Location |
|---|---|
| R1 | Pentland Crescent |
| R2 | Pentland Crescent |
| R3 | Pentland Crescent |
| R4 | Pentland Crescent |
| R5 | Balnagask Circle |
| R6 | Balnagask Circle |
| R7 | Balnagask Circle |
| R8 | Balnagask Circle |
| R9 | Balnagask Circle |
| R10 | Balnagask Circle |
| R11 | Girdleness Lighthouse |

| | |
|---|---|
| Project Details | WIB14221-100: Aberdeen Harbour |
| Figure Title | Figure 19.2: Harbour Emission Sensitive Receptor Locations |
| Figure Ref | WIB14221-100_GR_ES_19.2A |
| Date | August 2015 |
| File Location | \\s-lncs\wlef\projects\wib14221\100\graphics\es\issued figures |
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**Figure 19.2: Harbour emission sensitive receptor locations**

**Table 19.4: Key sensitive receptors closest to emission sources from the harbour**

| ID | OS Coordinates | | Location | Distance from West Quay [m] | Direction from West Quay |
|---|---|---|---|---|---|
| | X | Y | | | |
| R1 | 396097 | 805097 | Pentland Crescent | 450 | WNW |
| R2 | 396066 | 805061 | Pentland Crescent | 470 | WNW |
| R3 | 396045 | 805029 | Pentland Crescent | 490 | WNW |
| R4 | 395976 | 804983 | Pentland Crescent | 550 | WNW |
| R5 | 395934 | 804940 | Balnagask Circle | 590 | W |
| R6 | 395988 | 804849 | Balnagask Circle | 530 | W |
| R7 | 395982 | 804812 | Balnagask Circle | 540 | W |
| R8 | 395965 | 804763 | Balnagask Circle | 560 | W |
| R9 | 395932 | 804716 | Balnagask Circle | 590 | W |
| R10 | 395893 | 804699 | Balnagask Circle | 630 | W |
| R11 | 397142 | 805316 | Girdleness Lighthouse | 300* | N* |

### 19.3.2 Significance Criteria

19.3.2.1 Construction

The significance of effects of demolition and construction activities on air quality have been assessed based on professional judgement and with reference to the criteria set out in the IAQM guidance. Appropriate site specific mitigation measures that would need to be implemented to minimise any adverse effect have also been considered. Details of the assessors' experience and competence to undertake the dust assessment is provided in ES Appendix 19-A: Air Quality Modelling Study.

The assessment of the risk of dust effects arising from each of the construction activities, as identified by the IAQM guidance, is based on the magnitude of potential dust emission and the sensitivity of the area. The risk category matrix for each of the construction activity types, taken from the IAQM guidance, is presented in Table 19.5 to Table 19.8. Examples of the magnitude of potential dust emissions for each construction activity and factors defining the sensitivity of an area are provided in Table A.12 to Table A.16 in ES Appendix 19-A: Air Quality Modelling Study.

**Table 19.5: Construction significance criteria**

| Sensitivity of Area | Dust Emission Magnitude | | |
|---|---|---|---|
| | Large | Medium | Small |
| High | High risk | Medium risk | Medium risk |
| Medium | High risk | Medium risk | Low risk |
| Low | Medium risk | Low risk | Negligible |

**Table 19.6: Risk category from earthworks activities**

| Sensitivity of Area | Dust Emission Magnitude | | |
|---|---|---|---|
| | Large | Medium | Small |
| High | high risk | Medium risk | Low risk |
| Medium | Medium risk | Medium risk | Low risk |
| Low | Low risk | Low risk | Negligible |

**Table 19.7: Risk category from construction activities**

| Sensitivity of Area | Dust Emission Magnitude | | |
|---|---|---|---|
| | **Large** | **Medium** | **Small** |
| High | High risk | Medium risk | Low risk |
| Medium | Medium risk | Medium risk | Low risk |
| Low | Low risk | Low risk | Negligible |

**Table 19.8: Risk category from trackout activities**

| Sensitivity of Area | Dust Emission Magnitude | | |
|---|---|---|---|
| | **Large** | **Medium** | **Small** |
| High | High risk | Medium risk | Low risk |
| Medium | Medium risk | Low risk | Negligible |
| Low | Low risk | Low risk | Negligible |

The risk category determined for each of the construction activity types is used to define the appropriate, site-specific, mitigation measures that should be applied. The IAQM guidance recommends that significance is only assigned to the effect after considering mitigation and assumes that all actions to avoid or reduce the environmental effects are an inherent part of the proposed development, and that in the case of demolition/construction mitigation (secured through planning conditions, legal requirements or required by regulations), would ensure that potential significant adverse residual effects will not occur.

IAQM outlines that experience of implementing mitigation measures for construction activities demonstrates that total mitigation is normally possible. Accordingly, the IAQM guidance recommends that the significance of construction activity effects should only be considered post-mitigation where the residual effects (in accordance with the above evidence based theory) would not be 'significant'. Therefore it follows that, within this assessment, no post-mitigation significance criteria are provided for the likely residual effects of the demolition, refurbishment and construction work.

### 19.3.3 Completed Development

The significance of effects of the completed AHEP on air quality has been established through professional judgement and the consideration of:

- The geographical extent (local, district or regional) of these effects;
- Their duration (temporary or long-term);
- Their reversibility (reversible or permanent);
- The magnitude of changes in pollutant concentrations;
- The exceedence of standards (e.g. AQS objectives); and
- Changes in pollutant exposure.

The EPUK Guidance Development Control: Planning for Air Quality (2010) Update provides an approach to defining the magnitude of changes and describing the air quality effects at specific receptors recommended by the IAQM.

Table 19.9 presents the magnitude of change descriptors, based on the change in concentration predicted to be brought about by a scheme as a percentage of the assessment level (i.e. the AQS objective). Tables 19.10 and 19.11 present the effect significance descriptors that take account of the magnitude of changes (both positive and negative) given in Table 19.9, and the concentration in relation to the AQS objective.

As stated within the EPUK Guidance, for $PM_{10}$ the annual mean AQS objective for Scotland is the most stringent criteria (compared to the 24 hour mean objective), therefore changes in annual mean $PM_{10}$ concentrations are most important. Therefore, the EPUK Guidance does not include significance criteria for the 24 hour mean $PM_{10}$ AQS objective in Scotland because "this would involve part days and would not be very meaningful". Furthermore, the EPUK Guidance does not provide any significance criteria for changes in annual mean $PM_{2.5}$ concentrations in Scotland.

**Table 19.9: Magnitude of change descriptor in relation to changes in concentrations of $NO_2$ and $PM_{10}$**

| Magnitude of Change | Changes in Pollutant Concentration Relative to the AQS Objective | Annual Mean $NO_2$ | Annual Mean $PM_{10}$ |
|---|---|---|---|
| Large | Increase/decrease > 10% | >4 µg/m$^3$ | >1.8 µg/m$^3$ |
| Medium | Increase/decrease 5-10% | 2-4 µg/m$^3$ | 0.9-1.8 µg/m$^3$ |
| Small | Increase/decrease 1-5% | 0.4-2 µg/m$^3$ | 0.2-0.9 µg/m$^3$ |
| Imperceptible | Increase/decrease < 1% | <0.4 µg/m$^3$ | < 0.2 µg/m$^3$ |
| **Note:** Percentage calculated as a change of the level of assessment | | | |

**Table 19.10: Effect significance criteria for annual mean $NO_2$**

| Concentration in Relation to Standard | Small | Medium | Large |
|---|---|---|---|
| **Decrease with Development** | | | |
| Above objective without development (>40 µg/m$^3$) | Minor beneficial | Moderate beneficial | Major beneficial |
| Just below without development (36 µg/m$^3$ - 40 µg/m$^3$) | Minor beneficial | Moderate beneficial | Moderate beneficial |
| Below objective without development (30 µg/m$^3$ - 36 µg/m$^3$) | Negligible | Minor beneficial | Minor beneficial |
| Well below objective without scheme (<30 µg/m$^3$) | Negligible | Negligible | Minor beneficial |
| **Increase with Development** | | | |
| Above objective with development (>40 µg/m$^3$) | Minor adverse | Moderate adverse | Major adverse |
| Just below with development (36 µg/m$^3$ - 40 µg/m$^3$) | Minor adverse | Moderate adverse | Moderate adverse |
| Below objective with development (30 µg/m$^3$ - 36 µg/m$^3$) | Negligible | Minor adverse | Minor adverse |
| Well below objective with scheme (<30 µg/m$^3$) | Negligible | Negligible | Minor adverse |
| **Note:** An imperceptible change would be described as 'negligible' | | | |

**Table 19.11: Impact significance criteria for annual mean $PM_{10}$**

| Concentration in Relation to Standard | Small | Medium | Large |
|---|---|---|---|
| **Decrease with Development** | | | |
| Above objective without development (>18 µg/m$^3$) | Minor beneficial | Moderate beneficial | Major beneficial |
| Just below without development (16 µg/m$^3$ - 18 µg/m$^3$) | Minor beneficial | Moderate beneficial | Moderate beneficial |
| Below objective without development (14 µg/m$^3$ - 16 µg/m$^3$) | Negligible | Minor beneficial | Minor beneficial |
| Well below objective without scheme (<14 µg/m$^3$) | Negligible | Negligible | Minor beneficial |
| **Increase with Development** | | | |
| Above objective with development (>18 µg/m$^3$) | Minor adverse | Moderate adverse | Major adverse |
| Just below with development (16 µg/m$^3$ - 18 µg/m$^3$) | Minor adverse | Moderate adverse | Moderate adverse |
| Below objective with development (14 µg/m$^3$ - 16 µg/m$^3$) | Negligible | Minor adverse | Minor adverse |
| Well below objective with scheme (<14 µg/m$^3$) | Negligible | Negligible | Minor adverse |
| **Notes:**<br>An imperceptible change would be described as 'negligible'<br>Significance criteria specific to Scotland | | | |

## 19.4 Baseline Conditions

### 19.4.1 Aberdeen City Council Review and Assessment of Air Quality

The first round of the review and assessment process predicted exceedences of the annual mean objective for $NO_2$ in parts of the city centre. An Air Quality Management Area (AQMA) was declared for the city centre in June 2001. Following subsequent detailed assessments in 2001 and 2002 the AQMA was slightly amended in March 2003.

As part of the second round of the review and assessment, ACC undertook an Updating and Screening Assessment (USA) in 2003 which identified that a detailed assessment was required for $NO_2$ and $PM_{10}$ in the city centre and Aberdeen Harbour. The subsequent 2004 Detailed Assessment detailed the extension of the city centre AQMA for $NO_2$ and inclusion of predicted exceedences of the 1-hour objective on Market Street. The City Centre AQMA was also declared for $PM_{10}$ due to predicted exceedences of the 2010 annual mean objective. It was concluded that emissions from the existing Aberdeen Harbour did not cause exceedences of objectives, but did contribute to elevated levels of $NO_2$ and $PM_{10}$.

Further Updating and Screening Assessment and Progress Reports were completed in 2006, 2007 and 2008 respectively in the third round of review and assessment. The 2007 Progress Report recommended a Detailed Assessment, which was undertaken in 2008. The Detailed Assessment declared two AQMA's on Anderson Drive/Haudagain roundabout and Wellington Road, due to predicted exceedences of the annual mean $NO_2$ and 2010 $PM_{10}$ objectives.

In the fourth round review and assessment, the 2009 USA recommended additional $NO_2$ diffusion tubes at potential areas of exceedences, and modelling of City Centre $PM_{10}$ and $NO_2$ levels to support the proposed AQAP. The City Centre Modelling Study in 2010 predicted widespread exceedences of the annual mean $PM_{10}$ objective and minor potential areas of exceedences of the $NO_2$ annual mean objective outside the City Centre AQMA.

The AQAP covering all three AQMAs was adopted in March 2011.

In the fifth round review and assessment, the 2012 USA (Aberdeen City Council, 2012) confirmed continued exceedences of the annual mean $PM_{10}$ and $NO_2$ objectives across the three AQMAs, with levels broadly similar to previous years.

The subsequent Review and Assessment documents produced by ACC between 2012 and 2014, including the latest 2014 progress report (Aberdeen City Council, 2014) continue to identify exceedences in $NO_2$ and $PM_{10}$ in all three AQMAs.

### 19.4.2 Local Monitoring

ACC currently undertakes monitoring of $NO_2$, $PM_{10}$ and $PM_{2.5}$, $O_3$, NO and $NO_x$ at six locations using automatic monitors. $NO_2$ is also measured at 46 locations using diffusion tubes.

The automatic monitors are located on:

- **Wellington Road:** approximately 2.1 km south-west of the site (monitoring $PM_{10}$, $NO_2$ (NO, $NO_x$));
- **Market Street:** approximately 2.2 km south-west of the site (monitoring $PM_{10}$, $NO_2$ (NO, $NO_x$));
- **Union Street:** approximately 3.2 km south-west of the site (monitoring $PM_{10}$, $NO_2$ (NO, $NO_x$));
- **Errol Place:** approximately 3.4 km south-west of the site (monitoring $PM_{10}$, $PM_{2.5}$, $O_3$, $NO_2$ (NO, $NO_x$));
- **Anderson Drive:** approximately 4.1 km south-west of the site (monitoring $PM_{10}$, $NO_2$ (NO, $NO_x$)); and
- **King Street:** approximately 4.6 km south-west of the site (monitoring $PM_{10}$, $NO_2$ (NO, $NO_x$)).

The results for the Wellington Road monitoring location, which is the closest monitor to the Site and classified as a roadside location, are presented in Table 19.12, from 2011 to 2013.

**Table 19.12: Annual mean monitored concentrations at the Wellington Road automatic monitor**

| Pollutant | Averaging Period | AQS Objective | Year | | |
|---|---|---|---|---|---|
| | | | 2011 | 2012 | 2013 |
| $NO_2$ | Annual mean (µg/m$^3$) | 40µg/m$^3$ | **51** | **59** | **52** |
| | Hourly (number of hours) | 200µg/m$^3$ not to be exceeded more than 18 times a year | 4 | 10 | 6 |
| $PM_{10}$ | Annual mean (µg/m$^3$) | 18µg/m$^3$ | **24** | **23** | **22** |
| | Number of days | 50µg/m$^3$ not to be exceeded more than 7 times per year | **8** | **10** | 7 |
| **Note:** Exceedences of the AQS Objectives shown in bold text | | | | | |

**Source:** 2014 Air Quality Progress Report

The monitoring results in Table 19.12 indicate that the monitored annual mean $NO_2$ and $PM_{10}$ objectives were exceeded at the Wellington Road roadside monitor in all years. The roadside monitor also exceeds the daily mean $PM_{10}$ objective of 50 µg/m$^3$ more than seven times a year in both 2011 and 2012.

The most recent annual mean $NO_2$ concentrations measured at the five nearest diffusion tubes to the Site are presented in Table 19.13.

**Table 19.13: ACC diffusion tube annual mean $NO_2$ concentrations (µg/m$^3$)**

| Site ID | Location | Classification | Approximate Distance to Centre of Site [km] | Year | | | |
|---|---|---|---|---|---|---|---|
| | | | | 2011 | 2012 | 2013 | 2014 |
| DT6 | 86 Victoria Road, Torry | Roadside | 1.8 | 33 | **41** | 34.4 | 35 |
| DT37 | 137 Wellington Road | Roadside | 2.1 | 31 | 36 | 30.9 | 26.9 |
| DT36 | 115 Menzies Road/ Wellington Road | Roadside | 2.2 | 31 | **48** | **43.4** | **41.0** |
| DT7 | Wellington Road/ Kerloch Place | Roadside | 2.2 | **45** | **42** | **46.3** | **45.6** |
| DT10 | 184/192 Market Street | Roadside | 2.3 | **64** | **71** | **70.4** | **53.9** |

**Source:** www.aberdeencity.gov.uk 2014 Air Quality Progress Report

The monitoring results in Table 19.13 indicate that the annual mean $NO_2$ objective of 40 µg/m$^3$ was exceeded at four out of five monitoring locations between 2011 and 2014.

## 19.5 Assessment of Effects

### 19.5.1 Construction

#### 19.5.1.1 Nuisance Dust

Construction activities in relation to the AHEP have the potential to affect local air quality via earthworks, construction and trackout activities.

The site is located in an area predominantly occupied by commercial and leisure uses, including the Nigg Bay Golf Course located immediately to the north of the site boundary and Nigg Bay Waste Water Treatment Works (WWTW) adjacent to the western site boundary. However, there are some residential land uses in proximity to the site. The closest existing residential properties to the site are located within the site boundary at Girdle Ness Lighthouse, approximately 85 m north of Nigg Bay on Greyhope Road, and 120 m to the east of the site boundary on Pentland Crescent. Doonies Rare Breed Farm is located approximately 20 m from the southerly extent of the EIA Boundary (see Figure 19.1).

As sensitive receptors have been identified within 350 m of the boundary of the site, and within 50 m of the routes that would be used by construction vehicles on the public highway, it is considered that a detailed qualitative assessment is required to determine the likely dust effects, as recommended by the IAQM guidance on construction dust. Results of this assessment are provided for each main activity (earthworks, construction and trackout).

The sensitivity of the area to each main activity has been assessed based on the number and distance of the nearest sensitive receptors to the activity, and the sensitivity of these receptors to dust soiling, human health and ecological effects. Based on the criteria set out in Table A1.17 to Table A1.21 in ES Appendix 19A: Air Quality Modelling Study. Table 19.14 presents the sensitivity of the area.

**Table 19.14: Summary of the sensitivity of the area**

| Receptor Sensitivity | Sensitivity of the Surrounding Area | | |
|---|---|---|---|
| | Earthworks | Construction | Trackout |
| Dust soiling | Low | Low | Low |
| Human health | Low | Low | Low |
| Ecological | Medium | Medium | Medium |

### Earthwork

The total volume of material to be dredged is 2,300,000m$^3$. The dredged material would have a high moisture content. Based on this, and considering the criteria in Table A.12 in ES Appendix 19-A: Air Quality Modelling Study, the potential dust emissions during earthworks activities would be of **large** magnitude.

### Construction

The estimate for the total volume of breakwaters and quays to be constructed is greater than 100,000m$^3$. Based on this, and considering the criteria in Table 19A.12 in ES Appendix 19-A, the potential dust emissions during construction activities would be of **large** magnitude.

### Trackout

The scheme transport engineers, Fairhurst, forecast a maximum number of 218 HGVs per day during breakwater construction which would reduce to 150 HGVs per day if articulated lorries with a 29 ton capacity are used. Based on this, and considering the criteria in Table 19A.12 in ES Appendix 19.1, the potential for dust emissions due to trackout activities would be of **large** magnitude.

The summary of the risk of dust effects based on the emissions magnitude and sensitivity of the area is presented in Table 19.15.

**Table 19.15: Summary of the risk of dust effects**

| Potential Effect | Risk | | |
|---|---|---|---|
| | **Earthworks** | **Construction** | **Trackout** |
| Dust soiling | Low risk | Low risk | Low risk |
| Human health | Low risk | Low risk | Low risk |
| Ecological | Medium risk | Medium risk | Medium |

As outlined in Table 19.15, the site is considered to be a **medium risk** site. Therefore, site specific mitigation measures would be required to ensure that there are no adverse effects from construction.

19.5.1.2 Construction Vehicle and Plant Emissions

Plant operating on the site and construction vehicles entering and leaving the site would have the potential to temporarily increase local pollutant concentrations, particularly $NO_2$ and $PM_{10}$.

The scheme transport engineers, Fairhurst, forecast a maximum number of 218 HGVs per day during breakwater construction which would reduce to 150 HGVs per day if articulated lorries with a 29 ton capacity are used. It is anticipated that the effect on local air quality of construction vehicles entering and leaving the site would therefore be, at worst, temporary, local and of **minor adverse** significance during peak construction periods and **negligible** at all other times in the context of local background pollutant concentrations and existing traffic movements (negligible is considered not significant in EIA terms).

Any emissions from plant operating on the site would be small in comparison to the emissions from traffic movements on the roads adjacent to the site and therefore would be of **negligible** significance, which is not significant in EIA terms. In addition, the proposed mitigation measures (described further below) would further reduce any potential effect.

### 19.5.2 Completed Development

19.5.2.1 Road-Traffic Effects

Effects on local air quality associated with the completed and operational AHEP would likely result from changes to traffic flows along the local road network.

The results of the dispersion modelling of emissions from operational traffic (based on current guidance, i.e. with reduced emission rates and background concentration to the completion year of 2019) are presented in Table 19.16. Full details are provided within ES Appendix 19-A.

**Table 19.16: Dispersion modelling results at sensitive receptors**

| | $NO_2$ Annual Mean [µg/m³] | $PM_{10}$ Annual Mean [µg/m³] | $PM_{10}$ – Number of Days >50µg/m³ | $PM_{2.5}$ Annual Mean [µg/m³] |
|---|---|---|---|---|
| **Receptor 1: 119 Menzies Road** | | | | |
| 2013 Existing | **44.2** | **23.6** | **9** | **15.4** |
| 2019 Without development | 30.2 | **22.3** | 7 | **14.4** |
| 2019 With development | 30.4 | **22.4** | 7 | **14.4** |
| **2019 Change** | 0.2 | 0.1 | 0 | 0.1 |
| **Receptor 2: 1 Polwarth Road** | | | | |
| 2013 Existing | **46.0** | **24.4** | **11** | **15.9** |
| 2019 Without development | 31.1 | **23.0** | **8** | **14.8** |
| 2019 With development | 31.3 | **23.2** | **8** | **14.9** |
| **2019 Change** | 0.2 | 0.1 | 0 | 0.1 |
| **Receptor 3: 57 Wellington Road** | | | | |
| 2013 Existing | **42.0** | **22.7** | 7 | **14.8** |
| 2019 Without development | 29.0 | **21.4** | 5 | **13.8** |
| 2019 With development | 29.2 | **21.5** | 6 | **13.9** |
| **2019 Change** | 0.2 | 0.0 | 1 | 0.1 |
| **Receptor 4: 133 Wellington Road** | | | | |
| 2013 Existing | 32.7 | **18.9** | 2 | **12.4** |
| 2019 Without development | 24.3 | 17.9 | 1 | 11.6 |
| 2019 With development | 24.5 | **18.0** | 1 | 11.7 |
| **2019 Change** | 0.21 | 0.1 | 0 | 0.1 |
| **Receptor 5: Smiddy Cottage, Wellington Road** | | | | |
| 2013 Existing | 38.1 | **21.4** | 5 | **14.0** |
| 2019 Without development | 27.8 | **20.5** | 4 | **13.2** |
| 2019 With development | 28.1 | **20.8** | 4 | **13.4** |
| **2019 Change** | 0.3 | 0.2 | 0 | 0.2 |
| **Receptor 6: 138 Abbotswell Crescent** | | | | |
| 2013 Existing | 26.9 | 16.9 | 1 | 11.2 |
| 2019 Without development | 22.0 | 16.3 | 0 | 10.6 |
| 2019 With development | 22.0 | 16.3 | 0 | 10.6 |
| **2019 Change** | 0.1 | 0.0 | 0 | 0.0 |
| **Receptor 7: 100 Abbotswell Crescent** | | | | |
| 2013 Existing | 27.8 | 17.3 | 1 | 11.4 |
| 2019 Without development | 22.5 | 16.6 | 1 | 10.8 |
| 2019 With development | 22.6 | 16.7 | 1 | 10.9 |
| **2019 Change** | 0.1 | 0.0 | 0 | 0.0 |

**Notes:**
For accuracy, the changes arising from the Development have been calculated using the exact output from the dispersion model (i.e. numbers to at least 10 decimal places) rather than the rounded numbers in Table 19.11
Exceedences of the AQS objectives highlighted in Bold.

**Table 19.16: Dispersion modelling results at sensitive receptors continued**

| | $NO_2$ Annual Mean [µg/m$^3$] | $PM_{10}$ Annual Mean [µg/m$^3$] | $PM_{10}$ – Number of Days >50µg/m$^3$ | $PM_{2.5}$ Annual Mean [µg/m$^3$] |
|---|---|---|---|---|
| **Receptor 8: 119 Great Southern Road** | | | | |
| 2013 Existing | 34.3 | **20.1** | 4 | **13.1** |
| 2019 Without development | 26.2 | **19.4** | 3 | **12.5** |
| 2019 With development | 26.2 | **19.4** | 3 | **12.5** |
| **2019 Change** | 0.0 | 0.0 | 0 | 0.0 |
| **Receptor 9: 2 Flat South** | | | | |
| 2013 Existing | 27.6 | 17.0 | 1 | 11.2 |
| 2019 Without development | 22.3 | 16.5 | 0 | 10.7 |
| 2019 With development | 22.5 | 16.6 | 1 | 10.8 |
| **2019 Change** | 0.1 | 0.1 | 1 | 0.1 |
| **Receptor 10: 153 Victoria Road** | | | | |
| 2013 Existing | 27.7 | 17.0 | 1 | 11.3 |
| 2019 Without development | 22.4 | 16.5 | 1 | 10.8 |
| 2019 With development | 22.6 | 16.6 | 1 | 10.8 |
| **2019 Change** | 0.2 | 0.1 | 0 | 0.1 |
| **Receptor 11: 346 Victoria Road** | | | | |
| 2013 Existing | 25.5 | 16.3 | 0 | 10.8 |
| 2019 Without development | 21.3 | 15.7 | 0 | 10.3 |
| 2019 With development | 21.4 | 15.8 | 0 | 10.3 |
| **2019 Change** | 0.1 | 0.1 | 0 | 0.1 |
| **Receptor 12: 94 St. Fitticks Road** | | | | |
| 2013 Existing | 23.3 | 15.5 | 0 | 10.3 |
| 2019 Without development | 20.2 | 15.0 | 0 | 9.8 |
| 2019 With development | 20.2 | 15.0 | 0 | 9.8 |
| **2019 Change** | 0.0 | 0.0 | 0 | 0.0 |

**Notes:**
For accuracy, the changes arising from the Development have been calculated using the exact output from the dispersion model (i.e. numbers to at least 10 decimal places) rather than the rounded numbers in Table 19.11
Exceedences of the AQS objectives highlighted in Bold.

### Nitrogen Dioxide ($NO_2$)

The results indicate that for the 2014 baseline, the $NO_2$ annual mean AQS objective (40 µg/m$^3$) is exceeded at three receptor locations (Receptors 1, 2, and 3). This is consistent with these receptors being located within the Wellington Road AQMA. The $NO_2$ annual mean AQS objective is met at all other existing receptor locations in 2014.

As discussed in ES Appendix 19-A, the 1 hour mean objective for $NO_2$ is unlikely to be exceeded at a roadside location where the annual mean $NO_2$ concentration is less than 60 µg/m$^3$. As shown in Table 19.16, predicted annual mean $NO_2$ concentrations in 2014 are below 60 µg/m$^3$ at all receptor locations. Accordingly, the 1 hour mean objective is likely to be met at these locations.

In 2019, both 'without' and 'with' the AHEP, all existing receptors are predicted to be below the $NO_2$ annual mean objective. Therefore, the 1 hour mean objective is also predicted to be met at all existing receptor locations. The maximum concentration is predicted at Receptor 2 (31.3 µg/m$^3$ with the AHEP).

Using the magnitude of change descriptors outlined in Table 19.9, the AHEP is predicted to result in an 'imperceptible' change (i.e. changes of less than 0.4 µg/m$^3$ in annual mean $NO_2$) at all existing receptors. Based on the significance criteria outlined in Table 19.10, the effect on the annual mean $NO_2$ is predicted to be **negligible** at all existing receptors, which is not significant in EIA terms. Accordingly, it is considered that the AHEP would also have a **negligible** effect on hourly $NO_2$ concentrations, which is not significant in EIA terms.

**Particulate Matter ($PM_{10}$ and $PM_{2.5}$)**

The results indicate that for the 2014 baseline, the $PM_{10}$ annual mean AQS objective (18 µg/m$^3$) is exceeded at six receptor locations (Receptors 1, 2, 3, 4, 5 and 8). The $PM_{10}$ annual mean AQS objective is met at all other existing receptor locations in 2014. The 24 hour mean objective is exceeded at two receptor locations (Receptors 1 and 2) and met at all other receptor locations in 2014.

In 2019, both 'without' and 'with' the AHEP, the $PM_{10}$ annual mean AQS objective (18µg/m$^3$) is exceeded at five receptor locations (Receptors 1, 2, 3, 5 and 8). 'With' the AHEP, the annual mean $PM_{10}$ AQS objective is exceeded at Receptor 4 (a contribution of 0.1µg/m$^3$). The annual mean AQS objective is met at the remaining existing receptor locations.

As shown in Table 19.16, the 24 hour mean objective is met at all but one receptor location (Receptor 2). It should be noted that the AHEP itself does not cause any exceedences of the objectives, i.e. the predicted exceedences occur without the AHEP in operation. The maximum predicted concentration is 23.2 µg/m$^3$ at Receptor 2.

Using the magnitude of change descriptors outlined in Table 19.9, the AHEP is predicted to result in an 'imperceptible' change (a change of less than 0.2 µg/m$^3$ in annual mean $PM_{10}$) at 10 existing receptor locations and a 'small' change (a change of 0.2 µg/m$^3$ to 0.9 µg/m$^3$ in annual mean $PM_{10}$) at the remaining two receptor locations (Receptors 2 and 5). On the basis of the significance of effect criteria outlined in Table 19.11, the likely effect is considered to be **minor adverse** at two receptor locations (Receptors 2 and 5) and **negligible,** which is not significant in EIA terms, at all other receptor locations.

There are no significance criteria in relation to 24 hour mean $PM_{10}$ concentrations. However, given the predicted concentrations are well below the 24 hour mean $PM_{10}$ AQS objective, and no change is predicted at all receptor locations, it is considered that the AHEP would result in a **negligible** effect, which is not significant in EIA terms, on 24 hour mean $PM_{10}$ concentrations.

The results in Table 19.16 indicate that the annual mean $PM_{2.5}$ objective of 12 µg/m$^3$ is predicted to be exceeded at six receptor locations (Receptors 1, 2, 3, 4, 5 and 8) and met at the remaining six receptor locations in 2014. In 2019, both 'with' and 'without' the AHEP in place, the annual mean $PM_{2.5}$

objective is predicted to be exceeded at five receptor locations (Receptors 1, 2, 3, 5 and 8). There are no significance criteria in relation to annual mean $PM_{2.5}$ concentrations. However, it is considered that the effects of the AHEP on annual mean $PM_{2.5}$ would be similar to those on annual mean $PM_{10}$, i.e. these would be **minor adverse** to **negligible,** which is not significant in EIA terms.

**$NO_2$ Sensitivity Analysis Results**

The results of the sensitivity analysis (i.e. considering the likely air quality effects of the AHEP against the current baseline, 2014 conditions, assuming no reduction in background concentrations or road traffic emission factors between 2014 and 2019) are presented in Table 19A.11 in ES Appendix 19-A. The overall predicted concentrations are higher than those presented above for 2019 due to higher background concentrations and vehicles emissions rates in 2014 than 2019.

These results show that, in 2019, both 'without' and 'with' the AHEP, assuming no improvements in future $NO_x$ and $NO_2$, concentrations would meet the $NO_2$ annual mean objective at all but three receptor locations (Receptors 1, 2 and 3). The maximum predicted concentration at Receptor 2 is 44.2 µg/m$^3$ in 2019 'with' the AHEP. This is consistent with these receptors being located within the Wellington Road AQMA.

As predicted annual mean $NO_2$ concentrations would still be well below 60 µg/m$^3$, the 1 hour mean objective is still likely to be met at all receptor locations.

In accordance with the magnitude of change descriptors outlined in Table 19.9 and the significance of effects criteria outlined in Table 19.10, assuming no improvements to $NO_x$ and $NO_2$, the AHEP is predicted to result in a **minor adverse** effect, which is not significant in EIA terms, at two receptor locations (Receptors 2 and 5) and a **negligible** effect, which is not significant in EIA terms, on annual mean $NO_2$ concentrations at the remaining ten receptor locations. Given this, it is considered that the AHEP would have a **negligible** effect, which is not significant in EIA terms, on 1 hour mean $NO_2$ concentrations.

19.5.2.2 <u>Impact of Harbour Emissions</u>

Apart from emissions from additional road traffic, the AHEP will also include the following sources of air pollution, associated with the proposed harbour operations:

- Emissions from ships;
- Emissions from CHE.

**Description of Shipping Emissions**

Shipping emissions include air pollutant emissions from marine vessels using the harbour facilities to load/unload cargo, as well as harbour craft, essentially tugs and tow-boats assisting ocean going vessels entering and leaving the harbour.

Emissions from marine vessels are generally split in the following separate operating modes:

- Cruising (or "At Sea");
- Manoeuvring;

- At berth (or in port), which can further be divided into two distinct modes:
  - Loading/unloading; and
  - Hotelling.

These modes are characterised by different energy consumption and engine load, and therefore lead to distinct emission patterns. They are also associated to a specific geographical area.

Cruising (or also referred to as At Sea) is the mode during which the ship operates at service speed (or also referred to as sea speed or normal cruising speed).

Manoeuvring mode is associated with arrival and departure from a port, i.e. the time within the port area during which a ship approaches or leaves the pier/wharf/dock (PWD) and generally operates at slower speed. Propulsion engines are generally still in operation even with tug assist.

At Berth mode covers the time during which the ship is stationary at PWD and either hotelling or loading/unloading. Hotelling is the time at berth when the vessel is operating auxiliary engines only or is 'cold ironing' (i.e. using shore power to provide electricity to the ship instead of using the auxiliary engines). During this time, the ship is neither loading nor unloading cargo, and therefore consumes minimal power.

Based on the above, the main emissions from marine vessel within the development would be those associated with the Manoeuvring (At Berth) mode. Emissions from tugs and towboats can generally be included in the Manoeuvring mode.

The main pollutants of concern from marine vessels are generally $NO_x$, $SO_x$ and particulate matter. However, low sulphur diesel would be used for all vessels, and therefore $SO_2$ emissions are likely to be negligible.

There may also be fugitive emissions of VOCs (Volatile Organic Compounds) during bunkering (i.e. refuelling) of marine vessels at berth. However bunkering would typically be completed by trained, competent personnel using a nozzle that fits the manifold tightly, and VOC emissions are therefore likely to be negligible.

It has been assumed that the harbour will be totally flexible and that any type of vessel will be able to berth anywhere. Emissions associated with the "at berth" mode would occur along the 3 mains quays proposed as part of the AHEP, namely:

- The West Quay (300 m);
- The North Quay (554 m); and
- The East Quay (410 m).

**Description of Cargo Handling Equipment (CHE) Emissions**

CHE covers a wide range of equipment used to load/unload and move cargo (containers, dry, bulk and general cargo) to and from marine vessels and HGVs. CHE would typically include (but not limited to) the following equipment:

- Mobile cranes;
- Dockside Mobile Loaders (Hoppers);
- Grain Elevator;
- Flatbed lorries;
- HGVs;
- Light Vans;
- Tankers; and
- Forklifts.

CHE is likely to be encountered on all areas of the harbour quayside. As none of the CHE will be owned or operated by Aberdeen Harbour Board (AHB) and will be dependent on harbour users, there is no detailed information available on the number and type of equipment likely to be in operation. Therefore, it is not possible to calculate detailed air pollutant emissions from CHE associated with the AHEP; however, general predictions can be made based on experience.

Most CHE would be conventionally powered, emitting combustion gases from petrol/diesel use. As part of risk control measures to reduce air pollution, as detailed in the Environmental Risk Assessment (November 2014), all marine vessels and CHE would be subject to routine preventative maintenance to preserve operating efficiency and reduce pollution. This work would be carried out by trained, competent personal and records would be kept. CHE operators would be trained to stop engines when equipment is not in use to avoid idling emissions. As CHE is replaced, high-efficiency replacements would be selected.

Of all CHE, mobile cranes are likely to be the main sources of pollution, assuming the worst-case scenario that all cranes would be diesel fuelled, rather than powered by electricity. The main pollutants of concern for diesel fuelled cranes would be $NO_x$, $SO_x$ and particulate matter.

Fugitive dust emissions may also occur during loading/unloading/handling of dry bulk cargo, which could be blown by the wind. AHB would ensure operators are trained to use the grab in a way that minimises fugitive emissions (e.g. by lowering in to hopper before opening). The grain elevator would be operated by third parties, but would be fitted with shrouds to reduce cargo loss. Cargo handling companies would be required to engage a street-sweeper to remove cargo residue after dusty operations.

**Analysis of Local Meteorological Conditions and Determination of Effects**

Figure 19A.3 in ES Appendix 19-A shows the wind rose extracted from hourly weather data measured at the nearest weather station (Aberdeen/Dyce International Airport) for the year 2013. The station is located approximately 11 km north-west of the site, and is deemed representative of the local weather conditions within and around the site. The data show that prevailing winds come from the south, with the majority of wind speeds within 3.1 m/s to 5.1m/s (6 knots to 10 knots, described as "gentle breeze" by the Met Office).

Table 19.17, which presents the associated wind frequency analysis, shows that in 2013:

- Southerly winds occurred about 16% of the time;
- The percentage of occurrence of winds was very similar (within 5% to 8%) for all other directions, apart from north-easterly winds (north north-east, north-east, east north-east), which only occurred 2% to 3% of the time.

**Table 19.17: Key sensitive receptors closest to emission sources from the harbour**

| Wind Direction | Equivalent Mean Direction (Deg) | % Occurrence (Wind Frequency) |
|---|---|---|
| North | 0.0 | 6.8% |
| North-north-east | 22.5 | 2.8% |
| North-east | 45.0 | 1.8% |
| East-north-east | 67.5 | 2.0% |
| East | 90.0 | 4.5% |
| East south-east | 112.5 | 6.0% |
| South-east | 135.0 | 5.2% |
| South-south-east | 157.5 | 7.2% |
| South | 180.0 | 15.8% |
| South-south-west | 202.5 | 7.9% |
| South-west | 225.0 | 7.3% |
| West-south-west | 247.5 | 5.2% |
| West | 270.0 | 7.5% |
| West-north-west | 292.5 | 6.3% |
| North-west | 315.0 | 6.1% |
| North-north-west | 337.5 | 7.7% |
| | **Total** | **100.0%** |

Based on information in Table 19.17, and considering information on nearby sensitive receptors, as shown in Table 19.4, receptors R1 to R4 along Pentland Crescent, located west north-west from the new harbour's main sources of pollution (West Quay) may only be impacted by emissions relatively infrequently, as winds blow towards these properties only 6% of the time during the year. Similarly, receptors R6 to R10 along Balnagask Circle, located west of the proposed West Quay, could be impacted only 4.5% of the time by harbour emissions. R11 on Greyhope Road, located north of the North Quay could be impacted only 15.8% of the time by harbour emissions.

Based on this, and given the distance of these receptors from the proposed Quays, it is considered that they are located at too great a distance (the closest being receptor R11, approximately 300 m from the North Quay and R1, approximately 450 m from the West Quay) to be affected by shipping or CHE emissions from the AHEP. Therefore, the effect of the AHEP emissions on local air quality is considered to be **negligible** for all pollutants, which is not significant in EIA terms.

## 19.6 Mitigation Measures

### 19.6.1 Construction

#### 19.6.1.1 Nuisance Dust

As the site is considered to be a medium-risk site in relation to nuisance dust (refer to earlier in this chapter), a range of environmental management controls would be developed with reference to the IAQM guidance for medium-risk sites. These would be detailed within a Construction Environmental Management Plan (CEMP) with the objective to prevent the release of dust entering the atmosphere and/or being deposited on nearby receptors. Such measures would include:

- Damping down dry/dusty surfaces during dry weather;
- Erecting appropriate hoarding and/or fencing, as appropriate, to reduce dust dispersion;
- Sheeting chutes, skips and vehicles removing materials that could generate dust;
- Appropriate handling and storage of materials, especially stockpiled materials;
- Restricting drop heights onto lorries and other equipment;
- Using a wheel wash for vehicles (if required to reduce dust), appropriate management of vehicle speeds, avoidance of unnecessary idling of engines;
- Ensuring that all plant and vehicles are well maintained so that exhaust emissions do not breach statutory emission limits;
- Prohibiting fires on the construction site, other than as required for construction purposes; and
- Ensuring that a road sweeper is available to clean mud and other debris from hardstanding roads and footpaths.

Measures to control fugitive dust emissions are routinely and successfully applied to construction projects throughout the UK, and are proven to reduce significantly the potential for adverse nuisance dust effects associated with the various stages of construction work.

#### 19.6.1.2 Vehicle Emissions

Detailed mitigation measures to control construction traffic would be discussed with ACC to establish the most suitable access and haul routes for site traffic, and set out in a Traffic Management Plan. The most effective mitigation would be achieved by ensuring that construction traffic does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc.) where possible. Managing the timing of large-scale vehicle movements to avoid peak hours on the local road network would also be beneficial. Further information on traffic management is provided in ES Chapter 18: Traffic and Transport.

### 19.6.2 Completed Development

#### 19.6.2.1 Road-Traffic Effects

When assuming no improvements to $NO_x$ and $NO_2$, the AHEP is predicted to have a minor adverse to **negligible** effect, which is not significant in EIA terms, on local air quality and therefore mitigation measures would be required. A Travel Plan would be prepared to encourage car sharing and reduce the number of single occupancy car trips associated with the AHEP, and encourage sustainable travel, which would also reduce emissions to air. Further details are provided in ES Chapter 18: Traffic and Transport.

19.6.2.2 Shipping and CHE Emissions

Emissions from shipping and CHE that would be operating within the AHEP are considered to have inherent mitigation measures and would result in a **negligible** effect, which is not significant in EIA terms, on local air quality. Therefore, additional mitigation measures would not be required.

## 19.7 Residual Effects

### 19.7.1 Construction

19.7.1.1 Nuisance Dust

Based on the IAQM Guidance on the Assessment of Dust from Demolition and Construction, following the employment of appropriate environmental management controls, **negligible** residual effects, which is not significant in EIA terms, would likely arise from construction-related dust emissions at all receptors.

19.7.1.2 Vehicle Emissions

The likely residual effects of construction vehicles entering and leaving the site would remain as per the predicted effects pre-mitigation, which is at worst, **minor adverse** significance, which is not significant in EIA terms, during the peak construction period and **negligible,** which is not significant in EIA terms, at all other times, in the context of the relatively high local background concentrations or existing adjacent road traffic emissions.

The likely residual effects of plant operating on the site would be **negligible,** which is not significant in EIA terms.

### 19.7.2 Completed Development

19.7.2.1 Road-Traffic Effects

The likely residual effects, when assuming no improvements to $NO_x$ and $NO_2$, would be **minor adverse** to **negligible,** which is not significant in EIA terms, for all pollutants considered.

19.7.2.2 Shipping and CHE Emissions

The likely residual effects of shipping and CHE emissions from activities within the AHEP would be **negligible,** which is not significant in EIA terms, for all pollutants considered.

## 19.8 Conclusion

The main likely effects on local air quality during construction would be related to dust emissions. A range of mitigation measures to minimise or prevent dust emissions would be implemented through the demolition and construction works. This would ensure that the effects of dust emissions are **negligible,** which is not significant in EIA terms, at all receptor locations.

Any emissions from equipment and machinery operating on the site during construction would be small compared to emissions from the large volume of vehicles travelling on roads in the surrounding area of the site. Therefore, it is considered that these emissions would not significantly affect air quality. It is anticipated that the effect of construction vehicles entering and egressing the site during the period of greatest vehicle movements would have an effect of **temporary, short-term, local and of minor adverse significance,** which is not significant in EIA terms, in the context of local background pollutant concentrations and existing local road traffic emissions. During all other periods, the effect would be **negligible,** which is not significant in EIA terms.

Dispersion modelling of air pollutant emissions has been carried out to predict the likely effect of road traffic associated with the completed and operational AHEP. The change in local air quality has been predicted at a number of existing sensitive locations surrounding the site.

The results of the dispersion modelling demonstrate that with the AHEP in place, adverse air quality effects resulting from its operation would be limited to **negligible** to **minor adverse** significance, which is not significant in EIA terms. Its operation would not give rise to any air quality effect that would adversely affect existing sensitive locations surrounding the site.

Residual effects of shipping and CHE emissions from activities within the AHEP would be **negligible,** which is not significant in EIA terms.

**Table 19.18: Summary of potential effects, mitigation measures and likely residual effects**

| Issue | Potential Effect | Mitigation Measures | Likely Residual Effect |
|---|---|---|---|
| **Construction** | | | |
| Dust emissions from construction activities | Adverse significant effects | Routine environmental management control measures to prevent and control dust | Negligible |
| Emissions from construction vehicles | Adverse effect of minor significance to negligible | Routine environmental management measures to control construction traffic | Adverse effect of minor significance to negligible |
| Emissions from construction plant | Negligible | None required | Negligible |
| **Completed Development** | | | |
| Emissions from traffic associated with the completed development | Adverse effect of minor significance to negligible | Production of a travel plan to reduce single occupancy car trips and promote sustainable travel | Adverse effect of minor significance to negligible |
| Shipping and CHE emissions | Negligible | None required | Negligible |

## 19.9 References

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