

## 15 AIR QUALITY

### 15.1 EXISTING ENVIRONMENT

#### *Introduction*

15.1.1 With respect to air quality, the environmental scoping report (Posford Haskoning, 2004) identified the potential sources of air pollutant releases from the construction and operational phases of the proposed scheme but indicated that these would be of relatively minor significance given the nature of the works. It was, therefore, determined that detailed air dispersion modeling would not be required. The operational phase of the scheme is not associated with any significant increase in air pollutant emissions that would be likely to impact upon land-based receptors (i.e. residential properties or designated sites). However, vessel engine emissions associated with the dredging, beach nourishment and disposal works during the construction phase could potentially give rise to impacts on ambient air quality close to the activities. Hence, a screening assessment of these emissions has been undertaken.

15.1.2 The present Government policy for addressing pollutant emission sources is the Air Quality Strategy which introduced the framework for Local Air Quality Management. The 1990 White Paper *This Common Inheritance* laid the foundations for a policy which eventually led to the publication of the *National Air Quality Strategy* in March 1997. The new Government later that year endorsed the Strategy, but committed to review it at the earliest opportunity. The second edition *The Air Quality Strategy for England, Scotland Wales and Northern Ireland* was published in January 2000, and an Addendum to the Strategy was issued in January 2003.

15.1.3 The original strategy identified eight air pollutants associated with effects on human health and laid down future objectives for health protection. The revised Strategy introduced further objectives for the protection of vegetation and ecosystems, and the 2003 Addendum varied the targets across the UK and established Objectives for some pollutants beyond the initial target year. The pollutants now covered are as follows (of this list of pollutants covered by the Strategy, the objectives for ozone and PAH have not been prescribed in regulation and are omitted from the requirement for Local Authority review):

- Benzene;
- 1,3-butadiene;
- Carbon monoxide;
- Lead;
- Nitrogen dioxide (NO<sub>2</sub>);
- Ozone;
- Particles (as 'PM<sub>10</sub>');
- Polycyclic aromatic hydrocarbons (PAH); and,
- Sulphur dioxide (SO<sub>2</sub>).

15.1.4 The Strategy laid down Air Quality Standards and Objectives to be achieved for seven air pollutants by 2005, but the revisions introduced a range of target years for different pollutants between 2003 and 2008. Local Authorities have had to undertake a formal review and assessment of air quality within their areas of jurisdiction to determine the likelihood of compliance with the objectives by the end of the relevant target year. If any

pollutant concentrations are predicted to exceed the relevant Objective, this would lead to the designation of an Air Quality Management Area (AQMA), within and around which an Action Plan to address the elevated pollutant levels must be prepared. As of April 2004, 124 AQMAs had been designated in the UK, mostly in large urbanised areas or where there is a significant local pollutant source. In the majority of cases the AQMAs have been declared on the basis of predicted exceedences of the NO<sub>2</sub> and/or PM<sub>10</sub> Objectives as a result of emissions from road traffic.

- 15.1.5 This so-called 'first round' of review and assessment led to a 'second round' which commenced in 2003, and DEFRA has set out a programme of ongoing updating and reporting air quality assessments up to 2010. Initially, an Updating and Screening Assessment (USA) was required to be produced by all Local Authorities by May 2003. The aim of the USA was to identify those matters that had changed since the first round of review and assessment and which may have required further assessment. Where the USA identified a risk that an air quality objective will be exceeded, the authority was then required to undertake a Detailed Assessment, to identify with reasonable certainty whether or not a likely exceedance will occur. Where a Detailed Assessment indicated that any of the air quality objectives were likely to be exceeded, an AQMA had to be designated.
- 15.1.6 For Local Authorities that identified the need for a more detailed assessment, this had to be completed by April 2004. A rolling programme of Updating and Screening Assessment and Detailed Assessment based on a three-year cycle, with annual progress reporting, has been laid down by DEFRA in its revised policy guidance LAQM.PG(03).
- 15.1.7 In respect of the proposed scheme, the principal pollutants considered are nitrogen dioxide, sulphur dioxide and PM<sub>10</sub> particulate matter. These are the main pollutants associated with the construction phase dredging activities that are most likely to cause breaches of the respective air quality objectives. Carbon monoxide sources are primarily road traffic and some combustion processes, but the air quality objective is not often exceeded even in large urban conurbations in the UK. Lead, PAH, benzene and 1,3-butadiene are emitted from certain industrial processes and, only in the vicinity of such installations, are concentrations of these pollutants likely to be significant. Ozone is a 'secondary' pollutant, formed in the atmosphere by complex reactions, and is not released directly from traffic or other industrial or transport sources.
- 15.1.8 The current air quality objectives are laid down in the Air Quality (England) Regulations 2000 as amended by the Air Quality (England) (Amendment) Regulations 2002. Table 15.1 presents the objectives for those pollutants of relevance to this assessment (nitrogen dioxide, PM<sub>10</sub> particulate matter and sulphur dioxide).

**Table 15.1 Air quality objectives for the protection of human health**

| Pollutant  | Objective   |                                       | Date to be achieved by |
|--|---|---------------------------------------|------------------------|
|  | Concentration   | Measured as                           |                        |
| <b>Objectives for the protection of human health</b>   |   |                                       |                        |
| Nitrogen dioxide <sup>a</sup>  | 40µg/m <sup>3</sup>   | Annual mean                           | 31 December 2005       |
|  | 200µg/m <sup>3</sup>  | Hourly mean, 18 exceedences per year  | 31 December 2005       |
| Particles, PM <sub>10</sub> <sup>b</sup>   | 40µg/m <sup>3</sup>   | Annual mean                           | 31 December 2004       |
|  | 50µg/m <sup>3</sup>   | 24-hour mean, 35 exceedences per year | 31 December 2004       |
| Sulphur dioxide  | 350µg/m <sup>3</sup> not to be exceeded more than 24 times a year | Hourly mean                           | 31 December 2004       |
|  | 125µg/m <sup>3</sup> not to be exceeded more than 3 times a year  | 24 hour mean                          | 31 December 2004       |
|  | 266µg/m <sup>3</sup> not to be exceeded more than 35 times a year | 15 minute mean                        | 31 December 2005       |
| <p>a) The Objectives for nitrogen dioxide are provisional.</p> <p>b) A provisional Objective for PM<sub>10</sub> in England &amp; Wales (outside London) has been set at 50µg/m<sup>3</sup> as a 24 hour mean with the exceedences allowed reduced to 7 days, to be achieved by 2010, and an annual mean in the same areas of 20µg/m<sup>3</sup> to be achieved by the end of 2005. Within London, the number of daily exceedences of the 24 hour mean has provisionally been reduced to 10, and the annual mean to 23µg/m<sup>3</sup> by the end of 2005, and 20µg/m<sup>3</sup> by 2015.</p> |   |                                       |                        |
| <b>Objectives for the protection of vegetation and ecosystems</b>  |   |                                       |                        |
| Nitrogen oxides  | 30µg/m <sup>3</sup>   | Annual mean                           | 31 December 2000       |
| Sulphur dioxide  | 20µg/m <sup>3</sup>   | Annual mean                           | 31 December 2000       |
|  | 20µg/m <sup>3</sup>   | winter mean (Oct – Mar)               |                        |

#### *Summary of local air quality*

15.1.9

The relevant Local Authorities with respect to the proposed scheme are the Borough Councils of Poole and Bournemouth, and Purbeck District Council, none of which declared a statutory AQMA during the first round of review and assessment under the Local Air Quality Management regime. This indicates that no locally elevated pollution levels were predicted and compliance with the Objectives was likely. It should be noted, however, that all Local Authorities are currently carrying out a second round review involving and updating and screening stage and a subsequent detailed assessment for

submission to DEFRA. Nevertheless, existing air quality around Poole Harbour can be described as good. This would be expected for a south coast town and is consistent with the national context.

- 15.1.10 Calculations of background pollutant concentrations in 2004/05 were carried out by the application of factors in accordance with TG(03) (see 15.2.6) and for the 1km grid squares centred on Poole Harbour in the Borough of Poole, on Poole Bay in Bournemouth Borough and on Wareham in Purbeck District. The background concentrations are given in Table 15.2.

**Table 15.2 Background pollutant concentrations derived from national air quality archive maps**

|                        | 2004/05 background pollutant concentrations, $\mu\text{g}/\text{m}^3$ |               |                 |
|------------------------|---|---------------|-----------------|
|                        | Poole Harbour (BoP)   | Wareham (PDC) | Poole Bay (BBC) |
| <b>NO<sub>2</sub></b>  | 18.0  | 16.8          | 22.0            |
| <b>PM<sub>10</sub></b> | 18.6  | 18.0          | 20.0            |
| <b>SO<sub>2</sub></b>  | 3.66  | 1.83          | 2.46            |

- 15.1.11 It is noted that values decrease in future years for all locations in the UK and TG(03), paragraph 1.29, states:

*“background concentrations of all the regulated pollutants are expected to decline in future years, as a result of Government and EU policies and legislation to reduce pollutant emissions.”*

*Methodology*

- 15.1.12 The USEPA Screen-3 dispersion model was run in the point source mode to determine the likely ground level impact of emissions from the dredger funnel stacks in the vicinity of the capital dredging. The model predicts gaseous pollutant gaussian dispersion, using default dispersion conditions (all stabilities and wind classes) to calculate the maximum ground level concentration and the distance from the source.
- 15.1.13 Input parameters were derived from the UK Emission Factor Database in the National Atmospheric Emissions inventory, where factors for pollutant emission rates based on fuel use were derived for the UK International Shipping sector. Fuel use data were provided by dredger operating companies (Westminster Dredging Company and Van Oord UK) for typical dredging activities.
- 15.1.14 The input parameters in Table 15.3 were used.

**Table 15.3 USEPA Screen-3 model input parameters**

| Input parameter                   | Value                                   |
|-----------------------------------|---|
| source release height, m          | 12                                      |
| flagpole receptor height, m       | 2                                       |
| location classification           | rural                                   |
| Assumed efflux velocity, m/s      | 15                                      |
| Assumed release temperature, K    | 523                                     |
| assumed activity rate             | 24hrs x 7 days x 30 weeks               |
| NO <sub>2</sub> release rate g/s  | 4.06E+00                                |
| PM <sub>10</sub> release rate g/s | 2.30E-01                                |
| SO <sub>2</sub> release rate g/s  | 1.18E+00                                |
| meteorology                       | full (all stabilities and wind classes) |

- 15.1.15 A number of conservative assumptions were made in the emission calculations such that the impact assessment can be regarded as a worst-case prediction. For example, the funnel height at which the exhaust gases are released was assumed to be 12m above sea level, a value for a small vessel which is loaded (an unloaded height would be around 15m). Vessels were assumed to use gas oil at a rate of 600 litres per hour, the upper rate in the range typical of trailing suction hopper dredgers. Furthermore the operational activity was assumed to be constant whereas, in reality, vessels would be active for approximately 120-140 hours per week (with a down time balance of around 15%).
- 15.1.16 For the assessment of the impact of dredger emissions on ground level air quality at the nearest land-based receptor locations, the pollutant concentrations predicted by the model arising from the dredger emission sources needed to be added to the 'background' concentrations. This component arises from emission sources which were not included as specific inputs to the model but which contribute to ambient background air quality in any geographical area, such as minor roads, domestic heating and distant pollutant sources.
- 15.1.17 Background values were derived in accordance with DEFRA Technical Guidance LAQM.TG(03), which was published in January 2003, and provides detailed methodologies for local authorities on the air quality review and assessment process. As such, it currently represents the definitive approach for predictive air quality assessment of pollutants in the Air Quality Strategy for comparison with the Government's statutory Objectives. The TG(03) guidance recommends the use of empirically-derived national background maps based on 2001 available in 1x1km square grids (<http://www.airquality.co.uk/archive/laqm/laqm.php>).

## 15.2 POTENTIAL IMPACTS ASSOCIATED WITH THE APPROACH CHANNEL DEEPENING

### Construction phase

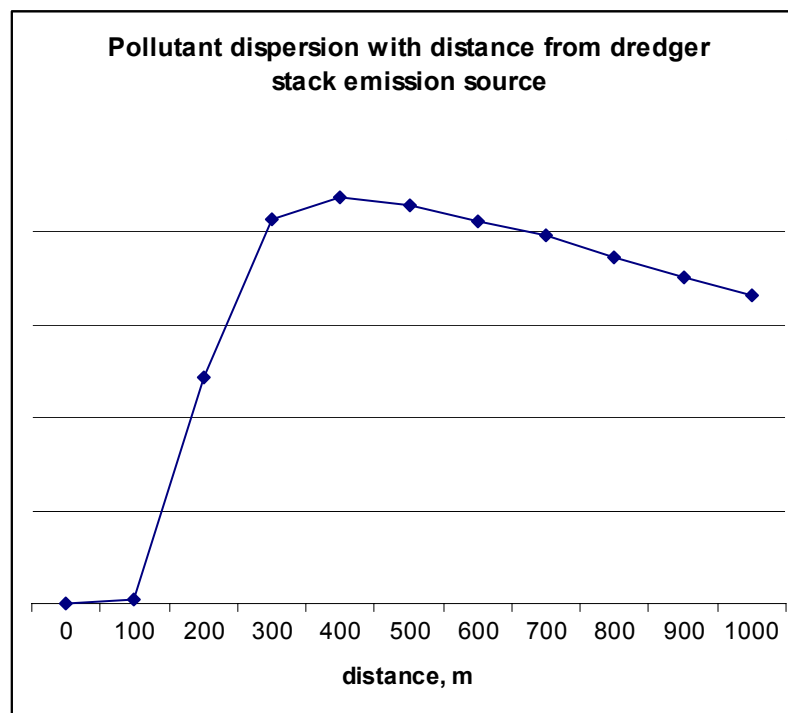
*Potential effect on local air quality due to emissions from the dredger*

- 15.2.1 The screening model outputs indicate maximum ground level pollutant concentrations and distances from the source, as summarised in Table 15.4. Within the Little Channel, most of the dredging would take place within 150m of Poole Quay; the Haven Hotel, Sandbanks would be approximately 225m from dredging in the Middle Ship Channel. Table 15.4 gives the combined impact of the vessel emissions and existing background concentrations in Poole at these two receptor distances, together with the relevant short-term Objective value for comparison.

**Table 15.4 Screening dispersion model outputs**

| Pollutant   | NO <sub>2</sub> | PM <sub>10(grav)</sub>                      | SO <sub>2</sub> |
|---|-----------------|---|-----------------|
| Short term Objective, µg/m <sup>3</sup> (see table 15.2)        | 200             | 50  | 350             |
| Short term Objective reference period                           | 1 hour          | 24 hours<br>(90.4 <sup>th</sup> percentile) | 1 hour          |
| Poole Background Concentration, µg/m <sup>3</sup>               | 18.0            | 21.5  | 18.6            |
| Maximum ground level pollutant concentration, µg/m <sup>3</sup> | 75.5            | 4.3   | 22.0            |
| Distance from source, m   | 427             | 427   | 427             |
| Ground level pollutant concentration at 150m, µg/m <sup>3</sup> | 16.4            | 0.9   | 4.8             |
| Ground level pollutant concentration at 225m, µg/m <sup>3</sup> | 51.3            | 2.9   | 14.9            |

- 15.2.2 For all pollutants the maximum ground level concentration under any dispersion conditions is predicted to occur at 427m from the dredger exhaust emission stack. The height and temperature of the release causes maximum grounding at this distance, with concentrations increasing up to and tailing off beyond this distance (Figure 15.1).



**Figure 15.1 Pollutant dispersion with distance from dredger stack emission source**

- 15.2.3 Thus the impact at 150m is less than at 225m, and as shown the maximum concentration is predicted to occur at 427m.
- 15.2.4 For nitrogen oxides (as NO<sub>2</sub>), the maximum value predicted due to emissions from the dredger for any location under all default meteorology is around 76µg/m<sup>3</sup>. At Poole Bay, 150m from the nearest dredging operation, the dredger emissions combined with the existing background concentration would be around 17% of the *one-hour* Objective value. At the Haven Hotel, the emissions combined with the existing background concentration would be around 35% of the *one-hour* Objective value. These predicted values represent conservative input assumptions and worst-case dispersion conditions, with the vessel operating at the closest point to land receptors. For much of the dredging activity the vessel would be at a greater distance from the shoreline and dispersion conditions would be more favourable.
- 15.2.5 For PM<sub>10</sub> particulate matter, the predicted maximum *one-hour* value at Poole Bay and at the Haven Hotel combined with existing background would be less than half of the *daily* Objective value. This Objective would not be exceeded if the dredging activity were to continue at 150m or 225m from the shoreline receptors for a 24-hour period under continued worst-case dispersion conditions. The impact of PM<sub>10</sub> emissions over a short-term (one hour) period can, therefore, be assumed to be insignificant.
- 15.2.6 For sulphur dioxide, the predicted maximum *one-hour* value at Poole Bay and at the Haven Hotel, when combined with existing background would be less than 5% of the *hourly* Objective value, again under worst-case dispersion conditions.
- 15.2.7 As the dredging activity is expected to be completed within a 7-month period, then there would be no long-term impact on air quality and annual mean Objective values are not relevant to the construction phase of this scheme. There are Government air quality

Objectives associated with the protection of vegetation and ecosystems (expressed as deposition of nitrogen and sulphur oxides), however, these are long-term (annual mean) Objectives and again there would be no long-term impact on protected sites in the vicinity of the proposed scheme.

- 15.2.8 The overall impact on air quality at the nearest receptor location to the dredging activity would be expected to be of **negligible significance** for all three pollutants considered.

*Mitigation and residual impact*

Dredging in the areas closest to residential properties should be kept to minimum practicable timescales. The assessment has been based on fuel consumption values for 3,000m<sup>3</sup> dredgers; it is likely that smaller capacity (1,500m<sup>3</sup>) vessels which are more fuel efficient would be employed for dredging in the Middle Ship and Little Channels, and the above assessment of air pollutant impacts is therefore conservative.

The residual impact on air quality associated with the capital dredging operations is expected to be of **negligible significance** overall.

**Operational phase**

*Potential air quality implications associated with maintenance dredging*

- 15.2.9 Maintenance dredging is a very short term and activity taking place every 2 years, although it would be necessary to undertake agitation dredging within the Turning Basin annually. As a result, the air quality implications associated with maintenance dredging would be of **negligible significance**.

*Mitigation and residual impact*

No mitigation measures are required and the residual impact would be of **negligible significance**.

**15.3 POTENTIAL IMPACTS ASSOCIATED WITH THE OFFSHORE DISPOSAL OF DREDGED MATERIAL**

**Construction phase**

- 15.3.1 *Potential effect on local air quality due to emissions from the dredger*  
 Dredged material would be transported to the offshore disposal ground, away from land based residential properties and designated sites. The impacts of emissions generated by dredging activities close to the shoreline have been assessed and are presented above. Subsequent offshore disposal activities would have **no impact** upon air quality at relevant receptor locations on land.

*Mitigation and residual impact*

No mitigation measures are required. There would be **no residual impact**.

**Operational phase**

*Potential effect on local air quality due to emissions from the dredger*

- 15.3.2 The same issues apply here as those described above for the construction phase. However, disposal of maintenance dredgings is a far less frequent activity than the disposal associated with the construction phase. There would not be an increase in the frequency of maintenance dredging activity (and, therefore, in the disposal of maintenance dredgings) compared with the existing situation as a result of the proposed scheme. Given this, it is expected that there would be **no impact** upon air quality at relevant receptor locations on land.

*Mitigation and residual impact*

No mitigation measures are required. There would be **no residual impact**.

**15.4 POTENTIAL IMPACTS ASSOCIATED WITH BEACH NOURISHMENT**

**Construction phase**

*Potential air quality impact due to emissions from plant*

- 15.4.1 The potential for an impact on air quality during the beach nourishment works is largely associated with exhaust emissions from the mechanical plant (bulldozers and excavators) on the beach redistributing the nourishment material following pumping ashore.
- 15.4.2 The release and dispersion of emissions from construction plant are typically localised and on site. Overall, particularly given the limited number of mechanical plant required to undertake the work, exhaust emissions from the proposed beach nourishment activities are considered to represent an impact of **negligible significance**.
- 15.4.3 With respect to dust, for the assessment of fugitive and uncontrolled PM<sub>10</sub> sources during the works, DEFRA Technical Guidance (TG(03)) on construction activities states:

*'Emissions from these sources are not well quantified, and it is therefore difficult to predict PM<sub>10</sub> concentrations with any accuracy.... It should be noted that these fugitive sources will only impact upon the objectives if they are in operation in or after 2004 or 2010.'*

- 15.4.4 The guidance further states that "concentrations fall off rapidly on moving away from the source", and the determination of public exposure should consider the distance to the actual source and not to the site boundary. Potential exposures beyond 200m of the

source can be ignored (for the purposes of assessment against the 2004 objective) if the background concentration is less than  $26\mu\text{g}/\text{m}^3$ . In the case of BoP, BBC and PDC, the background concentration of  $\text{PM}_{10}$  in 2004 is estimated to be 18.6, 20 and  $18\mu\text{g}/\text{m}^3$ , and so only those properties within 200m of the beach nourishment activities have the potential to be significantly exposed. Furthermore the nature of the work means that the materials would be wetted, and the release of significant quantities of dry sand and/or dust into the air such that there would be an off-site effect is very unlikely and, therefore, **no impact** is predicted.

*Mitigation and residual impact*

No mitigation measures are required. There would be **no residual impact**.

**Operational phase**

*Potential air quality impact due to emissions from plant*

- 15.4.5 During the operational phase, it is recognised that there is the potential for using appropriate material that arises from the maintenance dredging of the approach channel in a beneficial manner for beach renourishment within Poole Bay. The potential environmental impacts of such renourishment would be dependant on the location where it is considered that nourishment is required, the volume of material that is to be placed on the beach and the nature of the material.
- 15.4.6 Given that there is no scheme for renourishment at present, this is outside the scope of this EIA which focuses on the potential impacts of the initial nourishment scheme. The potential environmental impacts associated with any renourishment scheme that may be required would need to be taken into account during the application for the Food and Environment Protection Act and Coast Protection Act consents that would be required.