**Galway Harbour Company**

# Galway Harbour Extension

## Environmental Impact Statement

## Chapter 9

## Air Quality

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# 9 AIR QUALITY

## 9.1 INTRODUCTION

This chapter addresses the impact of the proposed development on air quality including airborne pollutants and dust emissions. Baseline data for this section is based on historical dust and odour monitoring carried out for the Galway Harbour Company at the existing harbour enterprise park.

| Air Quality Standards | | | | | | |
|---|---|---|---|---|---|---|
| **Pollutant** | **Limit Value Objective** | **Averaging Period** | **Limit Value ug/m3** | **Limit Value ppb** | **Basis of Application of the Limit Value** | **Limit Value Attainment Date** |
| SO2 | Protection of human health | 1 hour | 350 | 132 | Not to be exceeded more than 24 times in a calendar year | 1 Jan 2005 |
| SO2 | Protection of human health | 24 hours | 125 | 47 | Not to be exceeded more than 3 times in a calendar year | 1 Jan 2005 |
| SO2 | Protection of vegetation | calendar year | 20 | 7.5 | Annual mean | 19 July 2001 |
| SO2 | Protection of vegetation | 1 Oct to 31 Mar | 20 | 7.5 | Winter mean | 19 July 2001 |
| NO2 | Protection of human health | 1 hour | 200 | 105 | Not to be exceeded more than 18 times in a calendar year | 1 Jan 2010 |
| NO2 | Protection of human health | calendar year | 40 | 21 | Annual mean | 1 Jan 2010 |
| NO + NO2 | Protection of ecosystems | calendar year | 30 | 16 | Annual mean | 19 July 2001 |
| PM10 | Protection of human health | 24 hours | 50 | | Not to be exceeded more than 35 times in a calendar year | 1 Jan 2005 |
| PM10 | Protection of human health | calendar year | 40 | | Annual mean | 1 Jan 2005 |
| PM2.5 - Stage 1 | Protection of human health | calendar year | 25 | | Annual mean | 1 Jan 2015 |
| PM2.5 - Stage 2 | Protection of human health | calendar year | 20 | | Annual mean | 1 Jan 2020 |
| Lead | Protection of human health | calendar year | 0.5 | | Annual mean | 1 Jan 2005 |
| Carbon Monoxide | Protection of human health | 8 hours | 1000 | 8620 | Not to be exceeded | 1 Jan 2005 |
| Benzene | Protection of human health | calendar year | 5 | 1.5 | Annual mean | 1 Jan 2010 |

**Table 9.1.1 - Air Quality Standards**

### *9.1.1 Air Quality Standards*

The standards for Air Quality in Ireland are determined by European Directives as transposed into Irish Legislation. Originally we had the 1996 Air Quality Directive. This has now been replaced by the CAFÉ Directive (2008/50/EC) which has been transposed into Irish Law by the Air Quality Standards Regulations (SI 180/2011) which sets out air quality limit values as indicated in Table 9.1.1.

### *9.1.2 Air Quality Impacts*

In this chapter we consider the potential impacts of emissions to atmosphere arising as a result of the construction and operation activities at the proposed industrial park and new deep water dock. The air quality impacts on the surrounding area could be caused by the following three types of emissions:

- Dust emissions
- Odour Emissions
- Gaseous/Solvent emissions

Emissions may arise during:

- The construction of the industrial park and deep water dock
- Operation of the industrial park
- Operation of the new port (deep water dock) area

With respect to the potential for air quality impacts, the key objective for the proposed industrial and port area is to manage the activities associated with the scheme in order to ensure that the generation of air emissions is prevented where possible and the effects of any such emissions are minimised.

## 9.2 AMBIENT DUST LEVELS

Dust in the air has always been a natural occurrence. The action of wind over dry ground will carry small particles into the air. Large emissions of dust occur naturally; such as wind-blown dust from the shoreline. Manmade natural dust events are caused by the agricultural working of land; road use, aggregate and mineral extraction as well as industrial sources all contributes to ambient dust levels.

The extent to which dust particles can become a nuisance or a hazard will depend on the amount of the particles which become airborne and the extent to which they spread over a large area. Normally the particles will be of a wide size range. The larger particles will not remain airborne for long but the smaller the particle the greater the distance over which it might travel.

There are currently no Irish statutory standards or EPA guidelines relating specifically to dust deposition thresholds for inert mineral/aggregate dust. There are a number of methods to measure dust deposition but only the German TA Luft Air Quality Standard relates a specific method of measuring dust deposition with dust nuisance. The EPA have adopted this standard for all licensable activities and the DoEHLG (now the Department of Environment, Community and Local Government DoECLG) have proposed its adoption by local authorities for planning applications relating to quarries and aggregate extraction. The standard method of measurement of dust deposition is outlined in VDI 2119 – *Measurement of Particulate Precipitations. Determination of Dust Precipitation with collecting pots made of glass (Bergerhoff Method) or Plastic.* This standard measures total dust deposition i.e. all particle sizes, including soluble, insoluble and respirable ($PM_{10}$) dusts.

Galway City has historically had good air quality due to the low level of industrial activity close to the city and the prevailing westerly winds. The only historical data relating to air pollution on record are measurements of smoke concentrations in urban centres which are remarkably low for the size of the city. Throughout the 1990s for example the 98-percentile concentration in Galway was half the corresponding value measured in Wexford, Limerick, Dundalk and Drogheda.

## 9.3 AMBIENT PARTICULATE LEVELS

Particulate is effectively the finer dust particles, the largest of which are known as PM10, whose diameter does not exceed 10 microns, or 0.01 mm. A smaller category of particulate PM2.5 comprises particles whose diameter does not exceed 2.5 microns or 0.0025 mm. It is important to note that PM10 and PM2.5 can comprise aerosols or tiny liquid droplets.

The reason for concern regarding particulate is that fine particles such as PM 2.5 can penetrate directly into the lungs and prolonged exposure to even inert fine particulate has been shown to have adverse health effects. The Environmental Protection Agency has a national particulate monitoring programme in place and EU Directives indicate clearly defined air quality standards that must be maintained in Member States.

Ireland has historically had low levels of industrial related PM10 and PM2.5. Road transport and combustion are significant sources of particulate and monitoring efforts are focused on these sources in urban areas. As aerosols are picked up by some measurement instruments as particulate, measurement of PM10 values near the coast needs to be carefully handled. PM10 can also stay in the atmosphere for extended periods so particulate generated in one country could be transported to another country.

There are also natural sources of fine particulate such as dust from the Sahara or from an Icelandic volcano that can travel significant distances in the atmosphere before falling to land in Ireland.

A study undertaken in the period February 1999 to April 2001 in the Westside area of Galway (in adverse monitoring conditions) by the Air Quality Technology Centre at the National University of Ireland, Galway reported an annual mean $PM_{10}$ level of 23 $mg/m^3$. This level of particulate can be compared with the requirement under Council Directive 1999/30/EC (regarding the limit values of SO2, NO2, NOx, PM and Pb in ambient air) of an annual mean limit of 40 $mg/m^3$.

The monitoring results may have been influenced by the sampling location which was near a motor repair workshop and could have been contaminated by higher than normal particulate levels. The coastal location of Galway could also have had an influence as will be seen later in this chapter. The air quality around Galway is generally categorised as being ‘Good’.

The Environmental Protection Agency and the Public Analyst Laboratory in Galway operated an air quality monitoring site at the Galway City Centre (county Buildings) and at the Headford Road roundabout (Higgins Motorpark) between 2001 and 2006. The sampling indicates that the PM10 levels require continuous measurement, whereas the levels of NO2, CO, SO2, Benzene and Lead are all below the lower assessment threshold.

In April 2006 the monitoring location was moved to the Bodkin Roundabout (Galway Shopping Centre). Results for 2012 indicated 4 exceedances in 1012. The available data (as of Nov 1st 2013 indicates there have been 11 exceedances in 2013, which may be due to enabling roadworks being carried out in the area, although $PM_{10}$ can be transported considerable distances from the source.

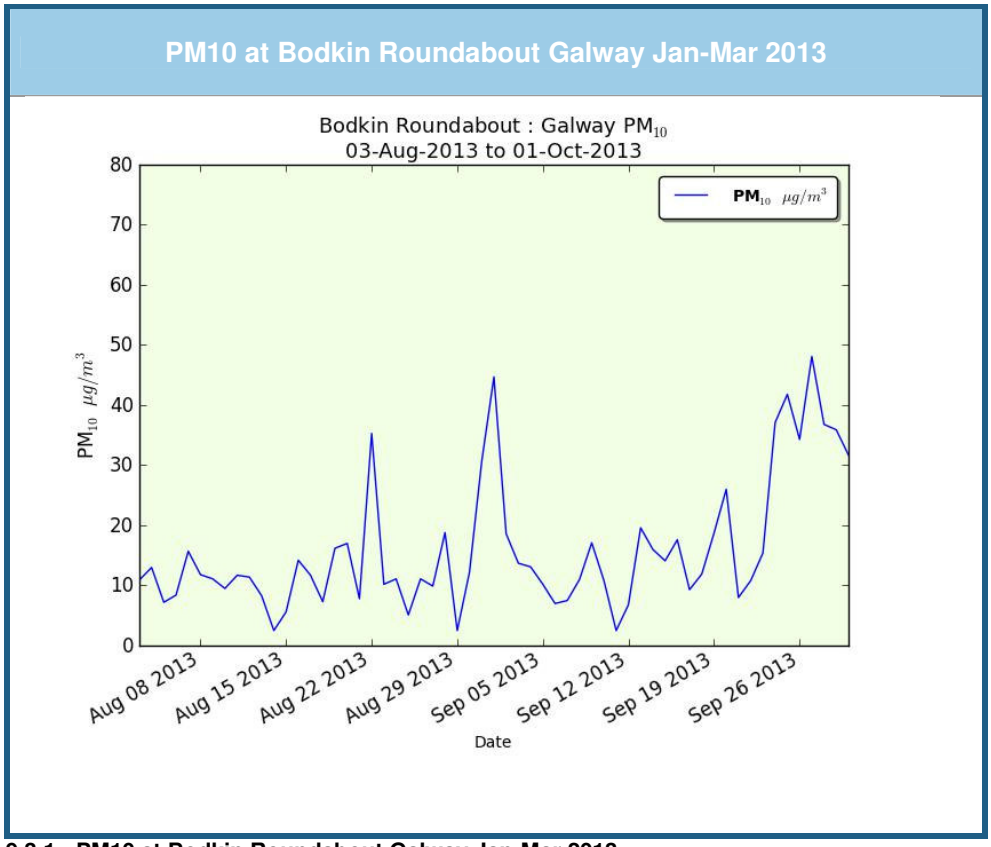


**Figure 9.3.1 - PM10 at Bodkin Roundabout Galway Jan-Mar 2013**

The PM10 limit of 50 ug m-3 is deemed breached if more than 35 exceedances occur in one year.

The trend in 2013 is not compatible with previous year's results and indicates a sudden change in influencing factors has taken place. The historical monitoring carried out on behalf of the Environmental Protection Agency indicates that air quality in Galway is in compliance with the requirements of the Air Quality Framework Directive.

## 9.4 RECEIVING ENVIRONMENT

The existing Galway Harbour Enterprise Park comprises some 25 hectares of industrial land that is bounded to the south by the sea, to the north by the main Galway-Dublin railway line, to the west by the existing sea and harbour and to the east by Ballyloughane beach. The nearest residential area is occupied by the army barracks and residential accommodation in Renmore.

The nearest residential area is the army housing scheme at Mellows Park to the east of the site and the Harbour Apartments (situated above the Harbour Hotel, to the northeast of the site). The greater Renmore area is located northeast of the site but is effectively screened from the site by the main Galway-Dublin railway line which runs north of the site on an elevated embankment. The nearest residences to the west are located in the existing harbour area and along Grattan Road at South Park in the Claddagh.

Nearby amenity areas include the Renmore saltmarsh and beach, the Army pitch & putt course and sports facilities, Ballyloughane Beach, the Lough Atalia area, South Park playing fields at the Claddagh and the inner section of Galway Bay, which is a Special Area of Conservation.

Industrial development, within and adjacent to the existing Enterprise Park includes significant port related activity including oil storage and distribution facilities, coal storage and distribution, bitumen storage and distribution, marine servicing, heavy industrial manufacturing activity, fish handling & processing, steel importation & storage, bus park and servicing and additional port, manufacturing, service & storage activities as the area develops.

The distance to the nearest sensitive locations are set out in the following table:

| Distances to nearby sensitive and amenity areas | | | | |
|---|---|---|---|---|
| **Location** | **Mellows Park housing** | **Harbour Apartments** | **Army Sports facilities** | **South Park pitches** |
| **Centre of existing Industrial Park** | 480 | 600 | 540 | 840 |
| **Centre of proposed Industrial Park** | 960 | 840 | 720 | 840 |
| **Proposed Dock** | 1440 | 1200 | 1100 | 1100 |

**Table 9.4.1 - Distances to nearby sensitive and amenity areas**

The principal existing sources of air pollution in the receiving environment are related to the extensive industrial activity in the harbour area, existing harbour activity, traffic through the inner city route through the existing docks and natural dust arising from proximity to the coast.

The existing harbour area has been filled using Construction and Demolition waste in the city area for the past 15 years with the consequential traffic volumes, dust and noise generation associated with such activity. This activity has been carried on simultaneously with the existing harbour activities and industrial activity on the enterprise park.

## 9.5 AMBIENT AIR QUALITY

On a more site specific basis Dust Deposition measurements and odour surveys have been carried out on a regular basis and the results are on file in the Galway City Planning Office. The survey locations are the Galway Harbour Enterprise Park and Mellows Park. Dust deposition measures total dust settling on a particular location and is an indicator of nuisance whereas PM10 monitoring is a health related matter. The monitoring locations are outlined on the enclosed site location map (Figure 9.5.1). The results of the monitoring are summarised below in Table 9.5.1:


**Figure 9.5.1 - GHEP Monitoring Locations**

| Dust Monitoring Results | | | |
|---|---|---|---|
| **Location** | **GHEP (D1)** mg/m$^2$/day | **GHEP (D2)** mg/m$^2$/day | **TA Luft limit** mg/m$^2$/day |
| **2005** | 127 | 167 | 350 |
| **2006** | 119 | 103 | 350 |
| **2007** | 116 | 238 | 350 |
| **2008** | 97 | 174 | 350 |
| **2009** | 253 | 205 | 350 |
| **2010** | 201 | 128 | 350 |
| **2011** | 76 | 146 | 350 |
| **2012** | 200 | 95 | 350 |
| **2013(ytd)** | 146 | 130 | 350 |

**Table 9.5.1 - Dust Monitoring Results**

As can be seen from the table the existing dust deposition levels in the vicinity of the site are well within acceptable limits.

### *9.5.1 Air Quality Testing*

In order to test air quality on a short term basis in 2011 air quality sampling was carried out at 5 locations surrounding the proposed development on 19th May 2011.

Testing was carried out for Sulphur Dioxide and Nitrogen Dioxide at 5 locations around the city using Drager long term diffusion tubes. The sampling locations are shown in Figure 9.5.2 below:

The sampling locations were:

- Mellows Park
- Harbour Enterprise Park
- Ballyloughane Beach
- Dun Aengus Apartment in the Docks
- Frenchville

**Air Quality Monitoring Locations**


**Figure 9.5.2 - Air Quality Monitoring Locations**

The limit of detection using this method is I ppm for Sulphur Dioxide and 2ppm for Nitrogen Dioxide. As can be seen in Table 9.5.2 in each case the level of pollutant was below the level of detection confirming the existing 'Good' air quality status in Galway.

**Air Quality Monitoring Results**

| Location | Result |
|---|---|
| Mellows Park | ND |
| Harbour Enterprise Park | ND |
| Ballyloughane Beach | ND |
| Dun Aengus Apartments | ND |
| Grattan Road | ND |

**Table 9.5.2 - Air Quality Monitoring Results**

## 9.6 ODOURS

The operations at the existing enterprise park are port related and can give rise to at least three distinct odour related sources.

- Fish Processing related odours
- Hydrocarbon related odours
- Waste management related odours

The port is a busy fishing port with the full range of fishing boats, from large trawlers to small day-fishing boats using the facilities. There are fish processing operations located at both the existing docks area and at the Harbour Enterprise Park, with the potential for additional facilities in the future.

The bulk of material handled at the port is hydrocarbon based, being fuel oil or bitumen. These substances can give rise to considerable odours if handled incorrectly. Fortunately the port is equipped with solvent recovery technology which has the effect of minimising emissions during the unloading of vessels.

The harbour serves as a transfer point for goods to and from the Aran Islands including waste. Existing port users include Galway Metal Company who export waste metal from the port. Barna Waste export wrapped baled waste.

The potential odour emissions from these activities are controlled by the individual companies concerned and the Harbour Company.

### *9.6.1 Odour Monitoring*

Galway Harbour Company carries out ambient odour monitoring at the existing enterprise park, along the railway line and at Mellows Park on a regular basis. The results of the monitoring are forwarded to Galway City Council. (Locations marked Odour 1 and Odour 2 above).

The results of the odour monitoring carried out indicate that generally odours are well controlled. There are odours detected onsite on a frequent basis; these are localised and not persistent. Occasionally odours can be detected offsite but such conditions are generally confined to a specific incident on the GHEP combined with specific weather conditions.

There have been sporadic complaints of odour issues since the enterprise park began operations but not in any significant quantity and not in the recent past.

The results of this monitoring indicate that there are no noticeable odour problems outside the enterprise park area.

## 9.7 PREDICTION OF AIR QUALITY IMPACTS

### *9.7.1 Introduction*

In order to determine the quantum of potential impacts the following scale has been devised:

- **Major**

Air pollution levels in excess of a statutory/standard/guideline limit value or has a significant reduction in the current impact on sensitive receptors.

- **Moderate**

Air pollution levels likely to cause disturbance at sensitive locations or has a reduction on current impact.

- **Minor**

Air pollution levels in excess of 'Do-Nothing' but unlikely to cause disturbance or cause any change to current perception.

- **Negligible**

No change in air pollution levels at sensitive locations

### *9.7.2 Air Quality Impacts*

There are two assessment criteria for Air Quality impacts:

- Particulate
- Air Emissions

Particulate and Air Emissions are assessed under two criteria

(a) health related effects and (b) nuisance effects. Health related effects are assessed with reference to Council Directive 199/30/EC relating to limit values for air quality

(b) dust as a nuisance is assessed to VDI 2119 Measurement of Particulate Precipitations (Bergerhoff Method) and referred to the German TA Luft standard.

Four types of air quality emissions will arise as a result of the proposed development;

(a) Dust associated with the infill/construction of the enterprise park
(b) Odours associated with the infill/construction of the enterprise park
(c) Emissions resulting from the use of the industrial park
(d) Emissions arising from the port activity

### *9.7.3 Construction related dust emissions associated with the infill construction of the enterprise park*

Two construction methods are proposed at the site; importation and placement of excavated material. Infill of dredging spoil by pumping and settlement and importation of rock by barge. Biospheric Engineering Ltd. Have previous experience of this type of construction method at Burtonport, Co. Donegal where a significant area of land was reclaimed using dredging spoil.

Respirable particles (PM10), i.e. those less than 10 micrometers in diameter, have the potential to cause effects on human health. Due to the "coarse" nature of the material being brought onto the site, PM10 emissions will be minimal. The only significant source of PM10 emissions will be the exhaust of the construction equipment on site. Based on standard working methods the construction equipment will comprise of a number of vehicles drawing the material to the site and a tracked excavator to place the material in addition to the dredging equipment which will pump the material into lagoons via a pipe. The separation distances between the site and the dust sensitive locations indicate that the impact of such emissions will be minimal.

Due to the nature of the proposed development and the location of the proposed site it is expected that the larger dust particles will have settled from the atmosphere within the site boundary. This is based on the fact that the material proposed for the infill is coarse type material with a high percentage of the material comprising rocks and concrete with very small fractions passing through a 63 micrometers sieve. The separation distance to the nearest dust sensitive locations is such that coarse particulate emanating from the site is unlikely to reach those locations.

The nearest proposed activity to a dust sensitive location is the filling of material at the inner end of the proposed extension to the enterprise park. The dust model has therefore been confined to modelling the activity in this area.

### *9.7.4 Dust Modelling Methodology*

The Emission Factor and Inventory Group in the U.S. Environmental Protection Agency's Office of Air Quality Planning and Standards develops and maintains emission estimating tools to support many industrial processes. The primary estimating tool is an Emission Factor published in the AP-42 series of publications. An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant.

AP-42 does not contain an exact equivalent operation to the proposed activity. The nearest equivalent activities relate to aggregate extraction and handling, and quarrying/construction operations. Section 13.2.4 of AP-42 Aggregate Handling and Storage Piles is used to provide an emission factor for the placement of material.

The quantity of dust emissions from aggregate storage operations varies with the volume of aggregate passing through the storage cycle. When freshly processed aggregate is loaded into a storage pile, the potential for dust emission is at a maximum. Fines are easily disaggregated and released to the atmosphere upon exposure to air currents, either from aggregate transfer itself or from high winds. As the aggregate pile weathers, however, potential for dust emissions is greatly reduced. Moisture causes aggregation and cementation of fines to the surfaces of larger particles. Any significant rainfall soaks the interior of the pile, and then the drying process is very slow.

Total dust emissions from aggregate storage piles result from several distinct source activities within the storage cycle:

1. Loading of aggregate onto storage piles;
2. Equipment traffic in storage area;
3. Wind erosion of pile surfaces and ground areas around piles;
4. Load out of aggregate for placement.

In the case of this development there will be no loading in and the wind erosion will not result in significant emissions due to the short timescale of the proposed operation at this area. The emission factor is therefore significantly conservative. The quantity of particulate emissions generated per tonne of material transferred, may be estimated, using the following expression derived from AP-42:

$$E = k(0.0004)\frac{\left[\frac{U}{2.2}\right]^{1.3}}{\left[\frac{M}{2}\right]^{1.4}}(kg/Tonne)$$

Where:

E = emission factor
K = particle size multiplier
U = mean wind speed
M = material moisture content

The source emission rate is therefore directly related to the tonnage of material handled on site. This tonnage has been set at 1.84 million Tonnes based on the quantity of material to be dredged at the site. Given the wet nature of the incoming material, this throughput is equivalent to the average annual throughput over the past number of years. The dust emissions will be similar and the existing monitoring results provide an indication of the potential impact.

The impact of dust emissions is therefore classified as negligible to minor

### *9.7.5 Construction related odours associated with the infill/construction of the enterprise park*

Any dredging activity is likely to generate a certain level of odour. Hydrogen Sulphide ($H_2S$) is one of the main components of odour emissions from dredging activities. $H_2S$ has a strong smell of “rotten eggs” and is readily detectable by both smell and electronic means. Due to the prevalence and detectability of $H_2S$ in dredging odours it is generally used as a surrogate indicator for odours of this nature.

Concentrations of $H_2S$ can be recorded using a Jerome $H_2S$ analyser which utilises a gold film sensor for the detection of hydrogen sulphide. The instrument is capable of measuring $H_2S$ concentrations in the range 1ppb (part per billion) to 50 ppm (part per million). The odour threshold for $H_2S$ is of the order of 0.01ppm. Objective measurements of odour level are therefore readily determined using the Jerome $H_2S$ analyser.

$H_2S$ odours are likely to be limited to the operation of the Trailer Suction Hopper Dredger (TSHD) as the gas is concentrated in the upper sediment layers. The methodology to be employed for the TSHD will involve the discharge of $H_2S$ into a confined discharge area. Should an odour issue arise, treatment facilities can be deployed to this area. Based on measurements taken at a variety of sources the likely concentration of $H_2S$ from the deposition of dredged material will be of the order of 1.4 mg/s/m2 over the deposition area of 50m x 50m. This value was input into the SCREEN3 dispersion model to calculate the concentrations outside the site.

For this air quality assessment the SCREEN3 dispersion model was used to calculate fugitive dust concentrations. The SCREEN3 model was developed to provide an easy to use method of obtaining conservative pollutant concentration estimates. Model estimates are based on the document “Screening Procedures for Estimating the Air Quality Impact of Stationary Sources” (US EPA, 1992). The SCREEN3 model gives conservative results as compared to more accurate dispersion models, such as ISC3 or AERMOD, giving higher concentration values at points of impingement.

The SCREEN3 model can perform the point, area or volume source and short term calculations as required under the US EPA screening procedures document, including:

- Estimating maximum ground-level concentrations and the distance to the maximum;
- Incorporating the effects of simple elevated terrain on maximum concentration;
- Modelling simple area sources using a numerical integral approach;
- Modelling the effects of simple volume sources using a virtual point source procedure;
- Calculating the maximum concentration at any number of user-specified distances in flat or elevated simple terrain;
- Examining a full range of meteorological conditions, including all stability classes and wind speeds to find maximum impacts; and
- Explicitly calculating the effects of multiple reflections of the plume off the elevated inversion and off the ground when calculating concentrations under limited mixing conditions.

The SCREEN3 model output gives concentrations downwind from the source depending on model input parameters.

The modelling was conducted for the most common meteorological conditions, class D neutral stability (wind >3m/s with clouds) and the wind speeds for which the concentrations will be the highest within this stability class.

The resulting calculation is illustrated graphically on Figure 9.7.1 $H_2S$ concentrations. The level of detection is 142 µg/m$^3$. Using the graph to interpolate, the odour will not be detectable beyond a range of 650m. This is greater than the distance from the centre of the proposed site to any sensitive location so it is highly unlikely that odours due to the dredging operations will cause any difficulty at locations outside the harbour site boundary.

Due however to the nature of $H_2S$ odours the potential impact is classified as Minor to Moderate and justifies the requirement for ongoing monitoring and control measures during the dredging phase.

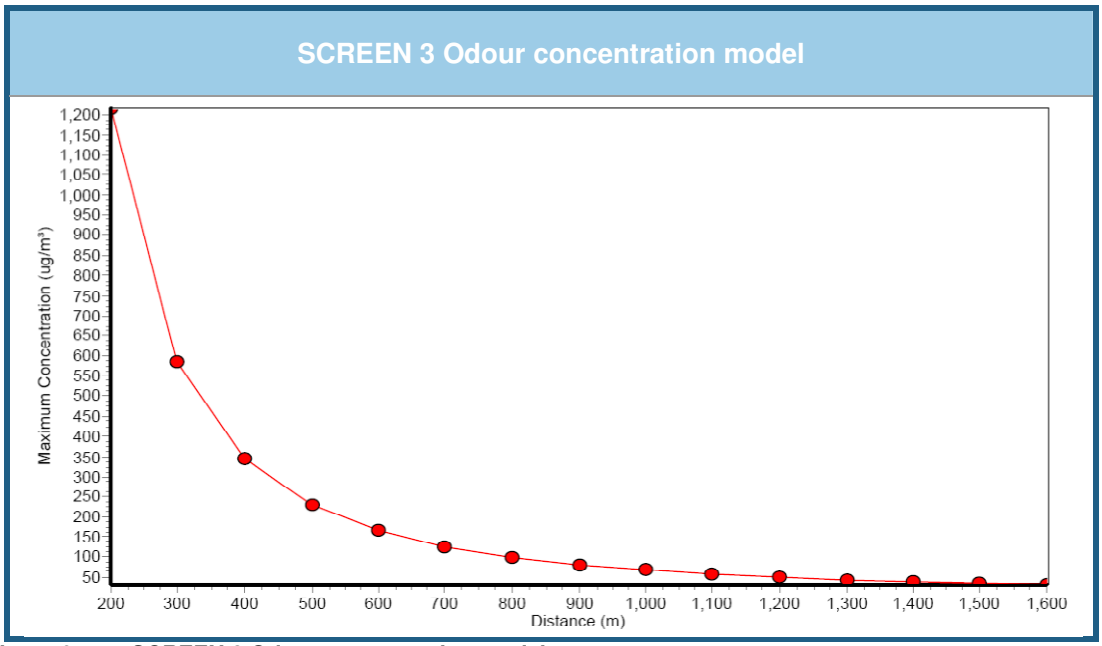


**Figure 9.7.1 - SCREEN 3 Odour concentration model**

### *9.7.6 Emissions as a result of the enterprise park operations*

Dust emissions arising from the activities on the enterprise park will be significantly controlled by ensuring that all significant dust generating activities will be carried out in enclosed environments. There are no proposals for outdoor storage of bulk materials such as coal, aggregates or ores, any such storage will take place under cover.

Emissions from exhaust stacks on industrial premises on the enterprise park are subject to regulation under the Air Pollution Act 1987 and other relevant statutes such as the Environmental Protection Agency Act 1992 and the Waste Management Act 1996 as amended, depending on the type of industrial activity taking place. Licences and Permits issued under such enactments will control emissions within air quality standards.

The impact is classified as negligible.

### *9.7.7 Emissions arising from the port activity*

Current port activity involves the berthing, loading and unloading of ships in the inner dock area, which is close to significant residential development. The current and previous City Development Plans indicate the desirability of relocating activities such as unloading coal, etc to another location remote from the residential area for air quality purposes in addition to safety concerns.

The air quality impacts of the traffic using the existing dock area can be divided into two categories of emission; (i) those resulting from traffic and (ii) those resulting from port activity.

#### 9.7.7.1 Traffic related emissions

The compounds released to the air by motor vehicles are involved in a wide variety of environmental effects over different geographical ranges and time periods. Some compounds have an immediate and very local effect. For example a plume of black smoke is instantly unpleasant to those of us who see it. On a longer timescale repeated exposure to vehicle smoke can cause soiling to buildings and materials in its vicinity.

There are some compounds that have the potential to damage health or the environment or both. Geographically the main direct effects are limited to the area near the road, in the absence of other pollution sources the rapid dispersion and dilution of the exhaust pollutants quickly reduces their concentrations to levels at which risks are minimal.

In recognition of the contribution of vehicle emissions to air pollution measures have been taken to reduce the quantities emitted. Since the early 1970s limits have been applied to permissible levels of carbon monoxide, hydrocarbons and oxides of nitrogen in petrol vehicle exhausts. These levels have been reduced several times since their introduction.

Road vehicles give rise to the emission of a wide variety of pollutants some of which are considered more significant due to their harmful effects and the volumes produced per vehicle. Emissions from motor vehicles represent a significant proportion of total emissions in Ireland of certain pollutants.

Road transport contributes the major part of carbon monoxide (CO) emissions over Ireland as a whole and is the largest single source of oxides of nitrogen (NOx) and black smoke emissions. Road transport emissions of hydrocarbons (HC), from both exhaust and evaporative emissions, are also a significant factor of the total. The contribution of road transport to national emissions of sulphur dioxide, in contrast, is very small due to reductions in sulphur content of transport fuel.

From the analysis carried out in the Traffic (Chapter 13.4) and Noise & Vibration (Chapter 10) it is clear that traffic volumes associated with the development both on and off site will amount to

small incremental changes over the Do Nothing scenario. A parallel result applies in relation to air quality.

The increased industrial park area will result in some increased traffic to and from the industrial units. The level of this traffic will not be such as to have a significant negative effect on air quality. The proposed development will have no impact on non port-related traffic in the existing Docks area so the predicted impact on PM10, $NO_x$, $SO_2$ and $CO_2$ emissions from that is negligible to minor.

#### 9.7.7.2 Emissions from port activity

Emissions from the port activity can be further divided into three classes of emission (a) emissions resulting from cargo handling, (b) cargo vapour emissions and (c) emissions from ships engines

9.7.7.2.1 Emissions from cargo handling

During cargo handling operations in ports and harbours, discharges and emissions can and do occur, often accidentally. Handling of dry bulk cargo including coal or crushed limestone may cause the release of dust. Handling of liquid bulks may require discharge through pipelines, which provides the potential for leaks, emissions and spillages. Sources of atmospheric pollution can stem from cargo vapour emissions.

Release of cargoes into the marine environment may have direct environmental effects, as in the case of the loss of toxic substances, or indirect effects, such as the loss of non-toxic organic-rich substances which may result in oxygen depletion on their breakdown.

There are vast amounts of dry bulk cargoes shipped around Europe and the dust generation from the physical handling of these cargoes has been found harmless to the marine environment. Concern is often due to its highly visible nature. Some dry bulk cargoes have high concentrations of organic material and/or nutrients, such as fertilisers and animal feed, with high biological oxygen demands, large spillages of these may cause localised nutrient enrichment and oxygen depletion.

In Galway cargoes may include harmful substances including oil products including bitumen, where accidents may result in their release which can adversely affect the marine environment.

The MARPOL Convention has classified the environmental effect of harmful substances carried by sea in bulk or in packages. The environmental hazards of harmful substances include damage to living resources (toxicity), bioaccumulation, hazard to human health (oral intake, inhalation and skin contact) and reduction of amenities. The severity of the pollution of the marine environment, air, soil or groundwater will depend upon the nature of the substance and the amount and concentration released into the port environment. Although discharges and emissions from dust and fumes may occur from everyday operational activities in ports and harbours, research has indicated they are unlikely to be present in sufficient concentrations to cause ecological harm if Health & Safety regulations are complied with and good operational practice adopted. The potential impacts of oil spills and discharges are discussed in Chapter 7 and the NIS and from an air quality perspective the impact is classified as negligible to minor.

9.7.7.2.2 Cargo vapour emissions

Emissions of volatile organic compounds (VOC) from oil and chemical tankers are of increasing concern due to the part they play in the formation of photochemical oxidants. Estimates of global emissions of VOC when handling and transporting crude oil and oil products is in the range 0.1-0.15% of all cargo transported (Martens [334], Endresen et al [108]). These emissions are

generally geographically limited, due to the fact that oil transport takes place within a fairly well defined system of international sea routes, and that most of the evaporation takes place during loading, rather than during the unloading process. In order to minimize such emissions during unloading in Galway the oil terminal has been fitted with a solvent recovery unit which recovers the gaseous emissions from the storage tanks during the unloading and filling process. Emissions of VOCs can therefore be regarded as minimal.

Historically significant quantities of fertiliser were offloaded at Galway docks as dry cargo. Imports of fertiliser and animal feed have virtually ceased in recent years. The port currently imports 15,000 Tonnes of Coal and exports a similar quantity of steel scrap, limestone dust exports are a new cargo type. The particulate matter resulting from the bulk handling of this cargo may have significant short-term effects on air quality in the immediate vicinity of the port. Due to the coarse nature of the materials the major impact will be within one hundred metres of the handling point.

The quantity of material emitted is directly related to the “particulate” (less than 63 micrometers in size) content of the cargo. Using a loss factor of 0.05% the emission in the existing Docks area is of the order of 7.5 Tonnes per annum. The majority of this material will land on the dockside and is swept up in routine cleaning operations. This remaining loss results in windblown dust in the wider Docks area.

9.7.7.2.3 Emissions from ships

A European wide study of emissions from ships engines was carried out by ENTEC consultants under the EMEP (European Monitoring and Evaluation Programme). This study included data from over 600,000 ship movements within the EU shipping area. Data from 46,000 vessels calling to 6,000 ports were included in the data set. This study represents a very comprehensive examination of emissions from ship engines by any examination.

The data of interest to this study is reproduced in Table 2.12 of the final report and gives the following emission factors for “in port” operation of ships;

There is no information currently available with regard to the size distribution of particles emitted from ship engine exhaust, although work is underway in Sweden. However, in common with most large diesel engines, it is anticipated that greater than 80% of emitted particulate matter will be $PM_{10}$ or less. A recent study of Air Quality in Cork Harbour by O’Connor et al has confirmed this.

| Emission Factors for in-port operations | | | | | |
|---|---|---|---|---|---|
| Vessel Type | NOx | SO2 | CO2 | HC | PM Total |
| | In g/kWh<br>*g/k Wh = grams per kilowatt hour*<br>*(kW – engine size x running hours)* | | | | |
| Liquefied Gas | 7.5 | 13.4 | 884 | 0.9 | 2.1 |
| Chemical | 13.3 | 12.1 | 710 | 1.5 | 2.2 |
| Oil | 12.1 | 12.8 | 754 | 1.4 | 2.2 |
| Other Liquid | 13.3 | 12 | 707 | 1.5 | 2.2 |
| Bulk dry | 13.8 | 12 | 706 | 1 | 1.5 |
| Bulk dry/oil | 13.4 | 11.9 | 715 | 0.9 | 1.4 |
| Self-discharging bulk | 13.1 | 12.3 | 727 | 0.5 | 1 |
| Other bulk | 13.6 | 12 | 709 | 1 | 1.5 |
| General cargo | 13.3 | 12.1 | 716 | 0.9 | 1.5 |
| Passenger/general cargo | 13.2 | 12.2 | 721 | 0.6 | 1.1 |
| Container | 13.7 | 12.1 | 710 | 1 | 1.5 |
| Refrigerated cargo | 13.5 | 12.1 | 714 | 0.7 | 1.2 |
| Roro cargo | 13 | 12.3 | 723 | 0.9 | 1.4 |
| Passenger/Roro cargo | 11.3 | 11.2 | 746 | 1 | 1.8 |
| Passenger | 11.6 | 12.6 | 750 | 1 | 1.8 |
| Other dry cargo | 11.8 | 12.9 | 761 | 0.7 | 1.4 |
| Fish catching | 13.4 | 12.2 | 722 | 0.4 | 0.8 |
| Other fishing | 11.3 | 13.2 | 776 | 1.1 | 2 |
| Offshore supply | 12 | 11.9 | 734 | 1.1 | 1.7 |
| Other offshore | 12 | 12.2 | 737 | 0.9 | 1.6 |
| Research | 11.8 | 12.5 | 736 | 1.2 | 2 |
| Towing/Pushing | 11.8 | 12 | 734 | 1 | 1.8 |
| Dredging | 11.9 | 12.4 | 736 | 1.2 | 2 |
| Other activities | 11.2 | 12.5 | 738 | 0.5 | 1.9 |

**Table 9.7.1 - Emission Factors for in-port operations**

#### 9.7.7.3 Predicted Ship Exhaust Emissions

Ships using the port currently are of a size averaging 3,000 to 4,000 Tonnes capacity with an average engine size of 3000kW and remain in port (including manouevring) for 24 hours. Based on existing volumes the cumulative emissions in Galway port can be calculated for the current situation.

Estimates of shipping visits based on vessel size and volume of goods through the port have been made for a number of scenarios (based on proposed throughput as outlined in Chapter 2) as follows:

- 2011 Shipping volumes (current situation)
- 2017 High growth scenario
- 2017 Medium growth scenario
- 2017 Low growth scenario
- 2017 Do Nothing scenario
- 2022 High growth scenario
- 2022 Medium growth scenario
- 2022 Low growth scenario
- 2022 Do Nothing scenario
- 2027 High growth scenario
- 2027 Medium growth scenario
- 2027 Low growth scenario
- 2027 Do Nothing scenario
- 2032 High growth scenario
- 2032 Medium growth scenario
- 2032 Low growth scenario
- 2032 Do Nothing scenario
- 2037 High growth scenario
- 2037 Medium growth scenario
- 2037 Low growth scenario
- 2037 Do Nothing scenario

The detailed results are contained in Appendix 9.1

The analysis contained within this report was based on projected tonnages which were developed earlier. Since the completion of this analysis, these projections have been amended, with future year tonnages anticipated to be lower than those utilised in this chapter. As such, it is considered that the analysis contained within this report is conservative in this regard.

##### 9.7.7.3.1 Do Nothing Scenario

The Do Nothing scenario indicates that volumes of goods through the port will begin to decline from 2015. This results in two options in determining air quality impacts. One of the following scenarios is possible:

- Galway (and the region) continues to grow and goods that until now have been imported through Galway Port will be diverted to Dublin, Cork or Foynes ports and transported by road to the region.

- Galway and the region decline in line with the fall off in goods through the port.

The Do-Nothing scenario does not include these additional emissions as the determination of which option is likely to prevail is beyond the scope of this analysis and both options are calculated for illustrative purposes.

In order to simplify the analysis, data relating to $CO_2$ emissions has been isolated, the case for the other in-port emissions is on a pro rata basis and the detailed figures are provided in the appendix of this chapter. $CO_2$ is useful in that it is an emission that has been examined for various forms of transport of goods and there is a wealth of data regarding emissions of $CO_2$ for different modes of transport. Typical $CO_2$ emissions for different modes of freight transport are illustrated in Figure 9.7.2. As can be seen from the graph coastal shipping has a far lower $CO_2$ footprint than HGV transport.

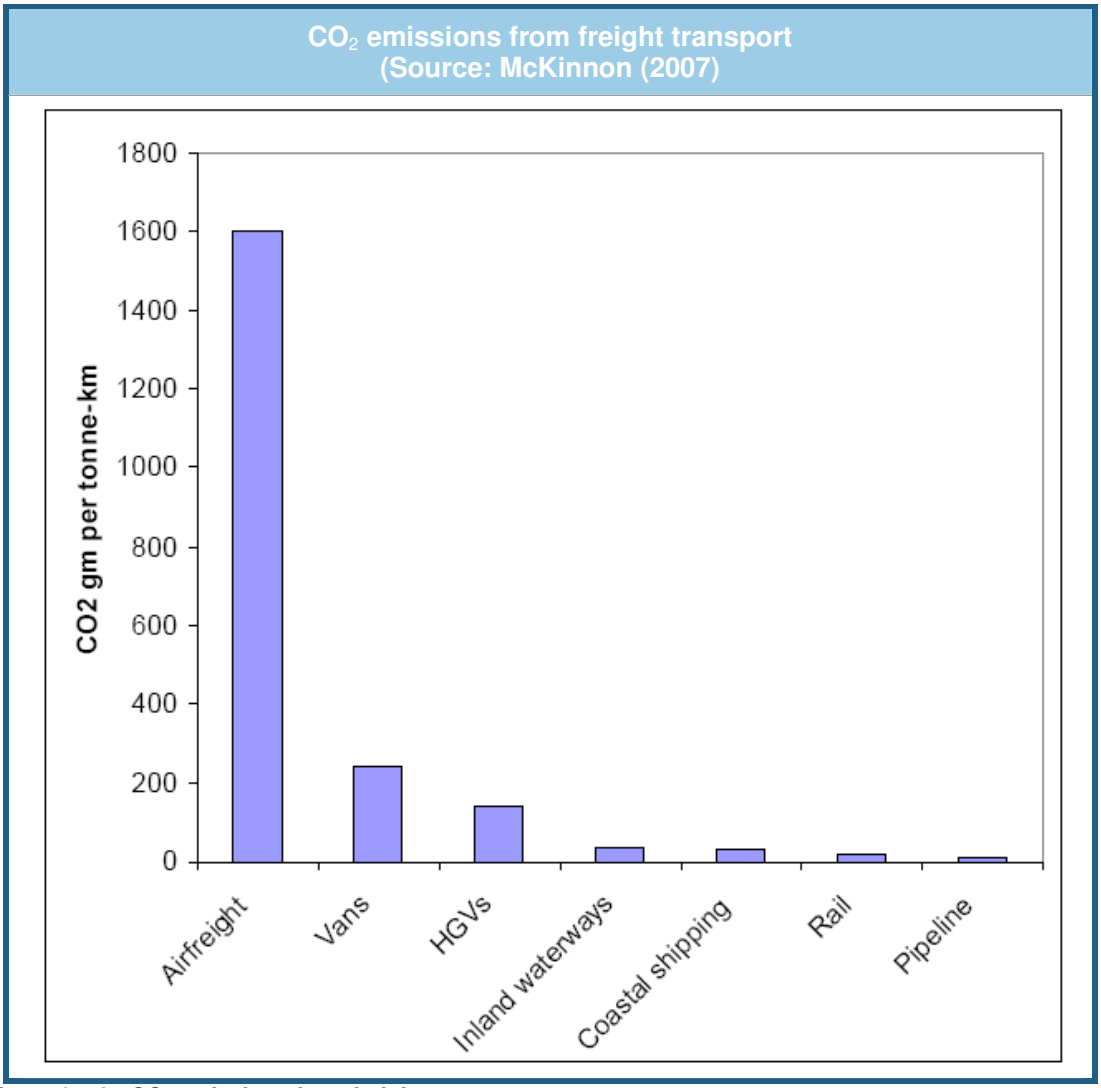


**Figure 9.7.2 - $CO_2$ emissions from freight transport**

In the Do Nothing scenario it is reasonable to assume that with declining volumes of goods coming into the region the use of rail for freight transport will not develop so that goods in this scenario will be transported to the region by HGV.

9.7.7.3.2 Proposed Development Scenario

Due to its dependence on fossil fuel combustion and the fact that it is one of the least regulated anthropogenic emission sources, emissions from the marine transport sector can contribute significantly to air pollution and climate change. In international and European air quality and climate policymaking, the need for international regulation on ship emissions has been identified. Against this backdrop the current EU environmental policy process is focusing on the shipping

sector from a more thematic perspective such as implementing stricter sulphur regulations in 2012, the review of air quality legislation in 2013, and the proposal on Monitoring, Reporting and Verification (MRV) of maritime carbon dioxide ($CO_2$) emissions in 2013.

At the EU level, a so-called port state control system has been set up that ensures that all ships calling into EU ports are subject to inspection and ships that are found in non-compliance with EU legislation or international conventions can be refused entry to EU ports or even be detained. Such a system was laid down in Directive 2009/16/EC.

IMO's Marine Environment Protection Committee (MEPC) revised the MARPOL Annex VI by reducing the global sulphur limit of marine fuels from 4.5% to 3.5 % (in 2012), and stepwise to 0.5 % in 2020 (or 2025, pending review of fuel availability). Sulphur limits in so-called Emission Control Areas (ECAs) for SOX and PM are set at 1.00 %, beginning on 1 July 2010 (from 1.50 %) and should be further reduced to 0.10 % (effective from 1 January 2015).

While the above relates to marine transport generally, the beneficial effect will also accrue to port related activities.

In the proposed development scenario the throughput of oil, bitumen and other cargo is expected to increase. By providing access to larger non-tidal berthing facilities larger vessels can use the port facilities, resulting in a reduced number of vessel passages per Tonne of cargo through the port. The average size of vessel would increase from 4,000 to 20,000 Tonnes, with larger more efficient engines.

Due to the elimination of the tidal restriction on the port it is estimated that fishing activity based in Galway will increase. The use of larger more efficient vessels, coupled with the international and European measures outlined above, will have a pro-rata reduction in emission rates for the main pollutants.

The emission figures can be divided into two broad categories (i) Carbon Dioxide and (ii) Airborne Pollutants. The Carbon Dioxide content has greater impact on a global scale as it is a greenhouse gas and contributes to global warming. In broad terms the new dock proposal will see a significant reduction in gross emissions from the current level, with a gradual return to current levels by 2036 under the Moderate growth scenario.

This is due to the facility using larger vessels and transporting more tonnage of goods per tonne of pollutants emitted in addition to the more efficient non-tidal nature of the proposed new harbour, facilitating a quicker turnaround of vessels.

In the do-nothing scenario, if the expected growth in the region continues the pollutant levels will increase at a greater rate than even the high growth scenario. Only in the case of declining growth in the region will the level of pollutants continue to decrease.

The level of emissions is reasonably high in gross terms but must be viewed in the context of the efficiency in moving bulk cargo such as oil/fuel by ship rather than by road. To move an equivalent quantity of materials by road would generate a multiple of the emissions generated by moving the same quantity by sea.

The proposed new port area provides for more efficient dispersal of lower emission values which will have a significant positive impact on air quality. In the do nothing scenario the emission values in the existing docks area will result in a significant deterioration in air quality in that area while it is used as a commercial port.

9.7.7.3.3 Shore-side Electricity Supply

The EU Commission has issued a recommendation (2006/339/EC) that ports provide shoreside electricity to reduce atmospheric emissions from ships. The provision of such facilities reduces the emissions due to eliminating the requirement for the ship to run its engines when in port for routine power. This effectively eliminates emissions of NOx, $CO_2$, $SO_2$, HC and PM at the harbour.

Emissions do take place where the electricity is generated but economies of scale and pollution abatement equipment mean that the emission level is considerably less than that emitted by a ships engine. The emission (at the generating station) is controlled and monitored by the Environmental Protection Agency resulting in much improved environmental protection.

With the provision of shoreside electricity the emissions outlined above can be taken as zero; however the practical implementation of shore-side electricity is some years away. The new port facility is having infrastructure built in to facilitate the implementation of shore-side electricity in the future. This comprises of additional space for an electricity sub-station and ducting to carry cabling to the berthing facilities.

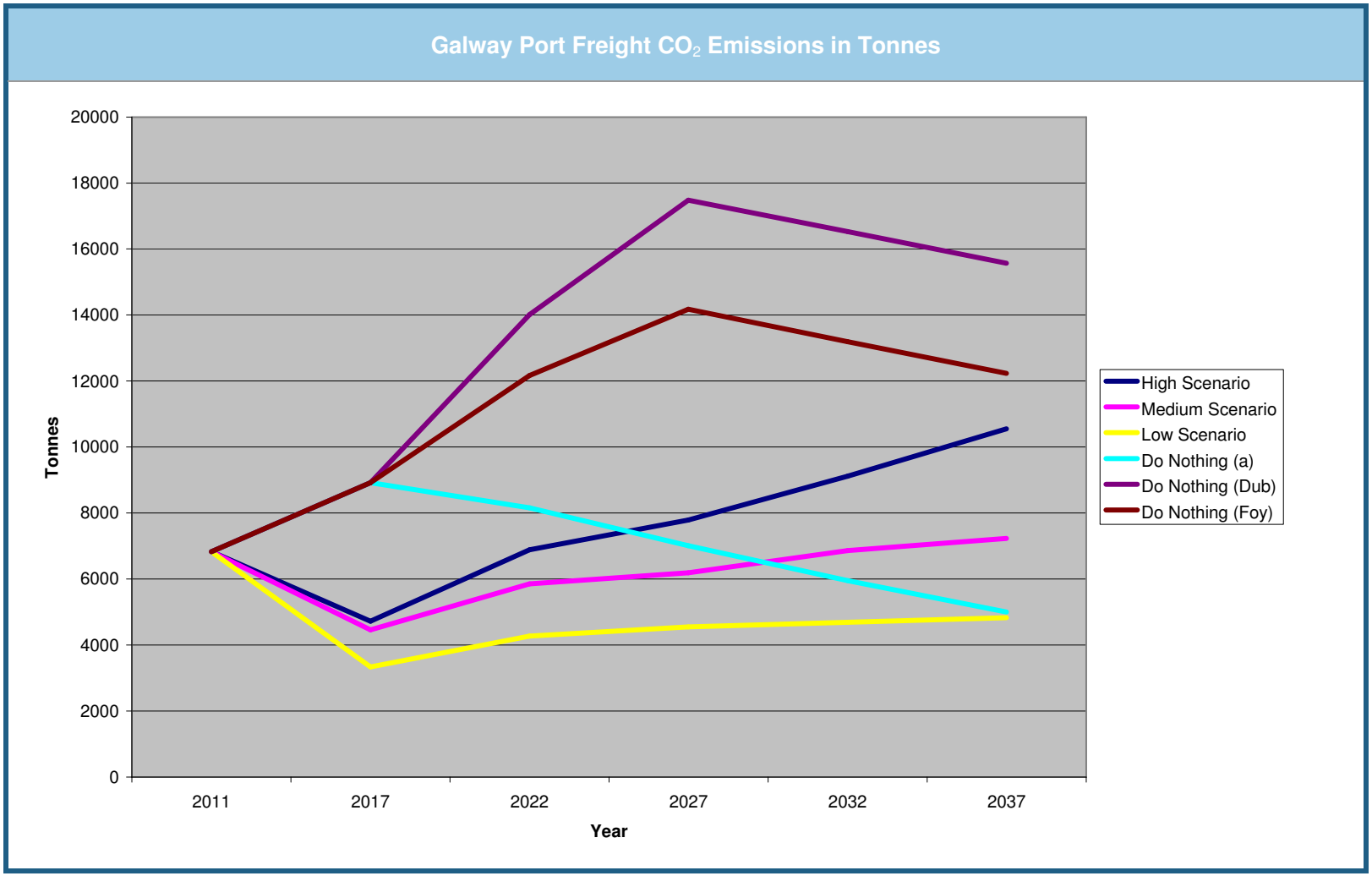


**Figure 9.7.3 - Galway Port Freight CO2 Emissions in Tonnes**

## 9.8 SUMMARY OF AIR QUALITY IMPACTS

Air Quality in the vicinity of the site is generally good. Apart from short-term impacts of dust or odour emissions relating to incidents while occasionally unloading cargo no significant adverse impact is evident.

In a Do Nothing scenario the air emissions in the existing Docks area would not improve.

| Air Quality Impacts | |
|---|---|
| **Key Process** | **Potential Impact** |
| Port Operation Generally | The operation of the port in a sensitive area such as a Special Area of Conservation requires the operation of an environmental management system. Existing codes of conduct and safety procedures should be incorporated into the Harbours' environmental management system and consideration should be given to certification of the environmental management system to International standards such as ISO 14000. |
| Non-toxic contamination | Operational and accidental spills and releases of dusts during the handling of dry bulk cargo (for example coal) may cause a temporary local deterioration in air quality. Generally, the levels of most dry-bulk cargo dusts generated will have little or no effect. Discharges and dust emissions into the marine environment may temporarily increase turbidity and spillage of organic cargoes may cause the localised removal of oxygen from the water, possibly disturbing marine animals. |
| Toxic contamination | Accidental release of hazardous substances during the handling of cargoes, such as oil, pesticides or industrial chemicals, may cause the pollution or contamination of marine habitats and disturbance or damage to communities. The impacts depend on the types and quantities of dusts entering the marine environment. Generally, the levels of most dry-bulk cargo dusts generated will have little or no effect, with the possible exception of high levels of organic dusts, which may cause the localised removal of oxygen from the water. |

**Table 9.8.1 - Air Quality Impacts**

The overall impact of the proposed development is therefore classified as negligible to minor.

## 9.9 MITIGATION MEASURES

### *9.9.1 Introduction*

The approach taken to mitigation on this project is based on the best practice hierarchical approach. This approach can be summarised as follows:

#### 9.9.1.1 Prevention

Where possible the proposal has engineered low impact air quality solutions into the final design. The dredging operation has been designed so that discharge from the TSHD is located in a confined area and the overall lagoon construction methodology compartmentalises the emission sources. The design also incorporates lagoon covering at the earliest possible stages.

#### 9.9.1.2 Reduction

Where it has not been possible to prevent impacts, steps have been taken to reduce the impact through minimisation of cause of impact at source, abatement at source. The facility to treat $H_2S$ emissions (if required) has been incorporated into the lagoon design. A comprehensive environmental monitoring and management programme is proposed as part of the project development.

#### 9.9.1.3 Remedy/Offset

Where residual impacts remain, that cannot be prevented or reduced, remedial or compensatory action is taken.

The following mitigation strategies will be implemented during the construction phase of the enterprise park.

#### 9.9.1.4 Specific Mitigation Measures

9.9.1.4.1 Construction phase – material transport

Transport of material to the site will be by means of trucks on the public roads. Roads within the site will be hard surfaced with a base coat of asphalt as soon as practicable to minimise haul road dust within the site. The internal roads will be maintained and cleaned on a regular basis. A self-contained mechanical wheel wash will be installed on site and relocated to appropriate locations during the construction phase. If required during periods of dry weather a water bowser will be utilised to dampen the road surface.

9.9.1.4.2 Construction Phase - Dredging

Transport of materials will be via pumping or by barge. Settlement ponds will have a wetted surface, supplemented by water sprays during dry weather and post pumping to minimise dust emissions.

9.9.1.4.3 Active face/Operational area/Open face

Where fine material is imported to site such materials will be carefully placed to minimise fugitive dust emissions. Temporary cover using materials such as coarse or damp soil, clay or geotextile cover will be used where appropriate the exposed area of fine material will be minimised to an appropriate maximum size.

9.9.1.4.4 Site Monitoring

A site dust monitoring programme will be put in place during the construction phase with secure monitoring locations to ensure compliance with dust deposition limits. There are already two monitoring points near the site, results can continue to be reported compared to the historical trend.

9.9.1.4.5 Site management

A dust management plan will be implemented during the construction phase, using resident data, meteorological data and site operator knowledge to investigate any dust complaints/potential dust complaints and implement remedial action using a developed common sense strategy.

9.9.1.4.6 Construction phase – Construction Operations

Onshore construction activities will generally be limited to the hours of 7.00 am to 8 p.m. Monday to Saturday. Due to tidal constraints some anti-social working hours will be required. An operations plan for such activities including a specific assessment will be carried out in advance of the activities taking place and appropriate mitigation measures including monitoring arrangements will be included in a construction management plan for such activities.

9.9.1.4.7 Construction phase – Odour Containment

An odour management plan will be implemented during the construction phase, using resident data, meteorological data and site operator knowledge to mitigate potential odour issues and implement remedial action using a developed common sense strategy. The management plan will include but not be limited to odour monitoring proposals, odour control mechanisms and odour complaint procedures.

9.9.1.4.8 Operation phase – Ship Loading/Unloading

Ship unloading will be carried out in a manner that minimises cargo spillage. To this effect all loading/unloading will be subject to appropriate operation specific control and containment protocols. Operatives will undergo training on spillage reduction measures and emergency spill containment and clean-up measures. Such training will be documented and updated on a regular basis.

9.9.1.4.9 Operation phase – Services in port

The port will be equipped with infrastructure to support the installation of shore-side electricity for vessels using the port. This will provide essential services for the vessels and eliminate the requirement for ships engines to run continuously while in port

9.9.1.4.10 Operation phase – Enterprise Park Industries

Many of the industries proposed for the enterprise park will require licences from the Environmental Protection Agency to operate. Where a licence is not required, the Harbour Company will require site leases to include environmental protection conditions equivalent to those required in Environmental Protection Agency licences.

9.9.1.4.11 Operation phase – Monitoring Proposals

Monitoring proposals for dust and odour emissions will be submitted for agreement to the planning authority prior to the operation of the new port. Such measures will include but not be limited to monitoring at the site perimeter and at nearby residential locations on an ongoing basis.

9.9.1.4.12 Operation phase – Site Management

An environmental management system complying with ISO 14000 will be developed for the port and enterprise park developments.

## 9.10 CONCLUSIONS

The overall impact of the proposal will be to retain the 'Good' air quality status in the Galway Bay area. There will be a decrease in air emissions per Tonne of goods transported at the new harbour area due to the use of larger more efficient vessels and reduced turnaround capability. Future shipping traffic will be of shorter duration as docking, entering and leaving the port will be quicker and fewer vessels will be required for the same throughput of cargo.
Air pollutants from the proposed development are within the levels set by European air quality guidelines as transposed into Irish law and no deterioration in air quality is anticipated, even in the long term high growth scenario. Significant mitigation measures will be employed during the construction phase to avoid potential impacts to air quality.

## 9.11 REFERENCES


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