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# Appendix 5A

# Air Quality Report

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**AIR QUALITY CHAPTER FOR THE PROPOSED CORK HARBOUR MAIN DRAINAGE SCHEME  
TO BE LOCATED IN CORK CITY AND ENVIRONS.**

PREPARED BY ODOUR MONITORING IRELAND ON BEHALF OF MOTT MACDONALD CONSULTING ENGINEERS,

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## Document Amendment Record

**Client:** Mott MacDonald Consulting Engineers Ltd

**Title:** Air quality environmental impact assessment of proposed Cork Harbour Main Drainage Scheme Cork Harbour Main Drainage Scheme to be located in Cork city and Environs.

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## 11.1. Air quality environmental assessment

### 11.1.1 Introduction

Odour Monitoring Ireland were commissioned to undertake a baseline air quality survey in order to assess the potential impact to air quality from the proposed Cork Harbour Main Drainage Scheme to be located in Cork city and Environs. This study will identify, describe and assess the impact of the development in terms of its impact on air quality.

The objective of the Cork Harbour Main Drainage Scheme is to provide wastewater treatment for the towns and villages in the lower Cork Harbour area. The main population centres to be served by the scheme include Cobh, Passage West/Glenbrook, Monkstown, Ringaskiddy (including Shanbally and Coolmore), Carrigaline and Crosshaven.

A baseline air quality assessment has been carried out in the area between the time periods July to August 2007 in the vicinity of the proposed WWTP development. In addition, baseline speciated Volatile organic compound survey was performed in the vicinity of five major pumping stations located along the drainage network. These included Raffeen, West Beach, Monkstown, Church road and Carraigaloe Pumping stations. The purpose of this survey was to identify existing pollutant trends in the vicinity of the proposed development(s), and to assess the potential impact of the proposed development(s). This will establish sufficient spatial information in order to determine compliance with relevant ambient air quality legislation. Additionally, comparison with longer period limit values can be used to establish trends and are important in defining baseline air quality.

This section should be read in conjunction with the site layout plans for the site.

### 11.1.2 Study methodology-Assessment Criteria

The EU has introduced several measures to address the issue of air quality management. In 1996, Environmental Ministers agreed a Framework Directive on ambient air quality assessment and management (Council Directive 96/62/EC). As part of the measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, 1999/30/EC, has set limit values which replaced existing limit values under Directives 80/779/EEC, 82/884/EEC and 85/203/EEC in April 2001. The new directive, as relating to limit values for sulphur dioxide, lead, PM<sub>10</sub> and nitrogen dioxide, is detailed in *Table 11.1.1* EU Council Directive 2000/69/EC defines limit values for both carbon monoxide and benzene in ambient air and is presented in *Table 11.1.2*.

The National Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002) transpose those parts of the "Framework" Directive 92/30/EC on ambient air quality assessment and management not transposed by Environment Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999 (S.I. No. 33 of 1999). The 2002 Regulations also transpose, in full, the 1<sup>st</sup> two "Daughter" Directives 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air and 2000/69/EC relating to limit values for benzene and carbon monoxide in ambient air.

**Table 11.1.1.** Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC).

Pollutant	Regulation	Limit Type	Margin of Tolerance	VALUE
Nitrogen Dioxide	1999/30/EC SI 271 of 2002	Hourly limit for protection of human health - not to be exceeded more than 18 times/year-1 hour average	50% until 2001 reducing linearly to 0% by 2010 for 199/30/EC  40% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010 for SI 271 2002	200 $\mu\text{g}/\text{m}^3$ NO <sub>2</sub>
		Annual limit for protection of human health-Annual	50% until 2001 reducing linearly to 0% by 2010 for 1999/30/EC  40% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2010 for SI 271 2002	40 $\mu\text{g}/\text{m}^3$ NO <sub>2</sub>
		Annual limit for protection of vegetation-Annual	None	30 $\mu\text{g}/\text{m}^3$ NO + NO <sub>2</sub>
Lead	1999/30/EC	Annual limit for protection of human health-Annual average	100% until 2001 reducing linearly to 0% by 2005	0.5 $\mu\text{g}/\text{m}^3$
Sulphur Dioxide	1999/30/EC SI 271 of 2002	Hourly limit for protection of human health – not to be exceeded more than 24 times/year-1 hour average	43% until 2001 reducing linearly until 0% by 2005 for 199/30/EC  90 $\mu\text{g}/\text{m}^3$ from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by 30 $\mu\text{g}/\text{m}^3$ to reach 0 $\mu\text{g}/\text{m}^3$ by 1 January 2005 for SI 271 of 2002	350 $\mu\text{g}/\text{m}^3$
		Daily limit for protection of human health – not to be exceeded more than 3 times/year-24hr average	None	125 $\mu\text{g}/\text{m}^3$
		Annual & Winter limit for the protection of ecosystems-Annual	None	20 $\mu\text{g}/\text{m}^3$

**Table 11.1.1 continued.** Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC).

Particulate Matter Stage 1	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year-24 hour average	50% until 2001 reducing linearly to 0% by 2005 for 1999/30/EC  30% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2005 for SI 271 of 2002	50 µg/m <sup>3</sup> PM <sub>10</sub>
	SI 271 of 2002	Annual limit for protection of human health-Annual	20% until 2001 reducing linearly to 0% by 2005 for 1999/30/EC  12% from the date of entry into force of these Regulations, reducing on 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by 1 January 2005	40 µg/m <sup>3</sup> PM <sub>10</sub>
Particulate Matter Stage 2	1999/30/EC  SI 271 of 2002	24-hour limit for protection of human health - not to be exceeded more than 7 times/year-24 hour average	To be derived from data and to be equivalent to Stage 1 limit value for 1999/30/EC  Not to be exceeded more than 28 times by 1 January 2006, 21 times by 1 January 2007, 14 times by 1 January 2008, 7 times by 1 January 2009 and zero times by 1 January 2010 for SI 271 of 2002	50 µg/m <sup>3</sup> PM <sub>10</sub>
		Annual limit for protection of human health-Annual	50% until 2005 reducing linearly to 0% by 2010 for 1999/30/EC and SI 271 of 2002	20 µg/m <sup>3</sup> PM <sub>10</sub>

**Table 11.1.2.** Irish and EU Ambient Air Standard (SI 271 of 2002 and 2000/69/EC).

Pollutant	Regulation	Limit Type	Margin of Tolerance	VALUE
Benzene	2000/69/EC SI 271 of 2002	Annual limit for protection of human health	100% until 2003 reducing linearly to 0% by 2010 for 2000/69/EC  100% from the date of entry into force of these Regulations, reducing on 1 <sup>st</sup> January 2006 and every 12 months thereafter by 1 µg/m <sup>3</sup> to reach 0 µg/m <sup>3</sup> by 1 <sup>st</sup> January 2010	5 µg/m <sup>3</sup>
Carbon Monoxide	2000/69/EC SI 271 of 2002	8-hour limit (on a rolling basis) for protection of human health	50% until 2003 reducing linearly to 0% by 2005 for 2000/69/EC  6 mg/m <sup>3</sup> from the date of entry into force of these Regulations, reducing on 1 <sup>st</sup> January 2003 and every 12 months thereafter by 2 mg/m <sup>3</sup> to reach 0 mg/m <sup>3</sup> by 1 <sup>st</sup> January 2005	10 mg/m <sup>3</sup>

## 11.2. Receiving environment-Air

### 11.2.1 General

The objective of the Cork Harbour Main Drainage Scheme is to provide wastewater treatment for the towns and villages in the lower Cork Harbour area. The main population centres to be served by the scheme include Cobh, Passage West, Glenbrook, Monkstown, Ringaskiddy (including Shanbally and Coolmore), Carrigaline and Crosshaven.

The proposed development includes for the construction of a wastewater treatment plant, which will include for sludge treatment, and a collection system to convey the waste water to the new plant. The proposed scheme also includes for upgrading the existing drainage network to modern standards and expanding the network in order to cater for the future needs of the area. The Scheme will be designed to meet the needs of the Cork Harbour Area to the year 2030. This section describes the existing drainage system, and the characteristics of the proposed development.

The proposed wastewater treatment plant is likely to be constructed using the Design/Build/Operate (DBO) procurement system. A Contractor will be appointed to Design, Build and Operate the wastewater treatment plant for a period of 20 years to achieve the required standards within defined design constraints. Therefore the exact details of the proposed development are not available at this stage.

Nevertheless, it is possible to describe the necessary level of treatment to be provided to achieve the required effluent treatment standards. The treatment requirements and treatment options are discussed in *Section 2.5*. In order to assess the environmental impact of the development indicative designs of the proposed Cork Harbour Waste Water Treatment Plant have also been undertaken. The indicative designs achieve the required discharge standards and described in detail in *Section 2.5.5*.

The proposed site consists of portions of two large agricultural fields located on sloping ground and currently used for pasture. The land has been zoned for industrial development (South Cork County Development Plan, 2005). The site has an area of approximately 7.35 hectares.

With the exception of a small Bord Gais substation, which adjoins the south-west corner of the site, the site is bordered on all sides by adjoining agricultural fields. The boundaries of the two fields consist primarily of managed, immature to semi-mature hedgerow. A large ESB



substation is situated circa 200 metres west of the site and a sports field is located circa 100 metres to the northeast of the site.

According to the South County Cork Development Plan (2005), the site has been zoned for industrial development. It is also noted that there are proposals to construct a branch of the National Primary Route N28 to by-pass the villages of Shanbally and Ringaskiddy on lands immediately north of the site.

There are no existing site services. Access to the site will be provided via an existing access road to the Bord Gais substation currently bordering the site. The proposed site is located approximately 380 metres east of the minor road (locally known as Cogan's Road), which links to the N28 National Primary Route just east of Raffeen Bridge.

The proposed new route for the upgraded N28 from Cork to Ringaskiddy, which will run directly north of the site, will provide a buffer between the site and industrial lands to the north.

There is an area zoned for residential use ~140m east of the proposed WWTP site boundary. Planning applications for residential development have been granted in this area.

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### 11.2.2 Baseline air quality

A total of ten sample locations were chosen to represent the baseline air quality for named parameters in the vicinity of the proposed development(s). These locations are listed in *Table 11.2.1* and presented in *Figure 11.7.1*.

**Table 11.2.1.** Description of air monitoring locations.

Reference	X cord (Irish National Grid)	Y cord (Irish National Grid)	Description of monitoring
A1-WWTP	174861	63796	NO <sub>2</sub> , SO <sub>2</sub> , BTEX, PM <sub>10</sub> , Total depositional dust, H <sub>2</sub> S-Monitored using passive diffusion tubes, Partisol PM <sub>10</sub> analyser, Jerome analyser and Bergerhoff gauges.
A2-WWTP	175341	63619	NO <sub>2</sub> , SO <sub>2</sub> , BTEX, Total depositional dust, H <sub>2</sub> S-Monitored using passive diffusion tubes, Jerome analyser and Bergerhoff gauges.
A3-WWTP	175267	63938	NO <sub>2</sub> , SO <sub>2</sub> , BTEX, Total depositional dust, H <sub>2</sub> S-Monitored using passive diffusion tubes, Jerome analyser and Bergerhoff gauges.
A4-WWTP	175071	63891	NO <sub>2</sub> , SO <sub>2</sub> , BTEX, Total depositional dust, H <sub>2</sub> S-Monitored using passive diffusion tubes, Jerome analyser and Bergerhoff gauges.
A5-WWTP	174850	63999	NO <sub>2</sub> , SO <sub>2</sub> , BTEX, Total depositional dust, H <sub>2</sub> S-Monitored using passive diffusion tubes, Jerome analyser and Bergerhoff gauges.
A6-WWTP	174907	63837	Speciated VOC's and H <sub>2</sub> S-Monitored using pumped sorbent tube and Jerome analyser.
A7-WWTP	175257	63805	Speciated VOC's and H <sub>2</sub> S-Monitored using pumped sorbent tube and Jerome analyser.
A8-Raffeen PS	175442	65188	Monitored using pumped active sorbent tube. Monitoring of H <sub>2</sub> S using Jerome metre at 5 locations around the Pumping station.
A9-West beach PS	179799	66426	Monitored using pumped active sorbent tube. Monitoring of H <sub>2</sub> S using Jerome metre at 5 locations around the Pumping station.
A10-Monksland PS	176977	66081	Monitored using pumped active sorbent tube. Monitoring of H <sub>2</sub> S using Jerome metre at 5 locations around the Pumping station.
A11-Carrigaloe PS	177607	67511	Monitored using pumped active sorbent tube. Monitoring of H <sub>2</sub> S using Jerome metre at 5 locations around the Pumping station.
A12-Church Rd PS	174405	62628	Monitored using pumped active sorbent tube. Monitoring of H <sub>2</sub> S using Jerome metre at 5 locations around the Pumping station.

As a result of the existing site conditions and the potential for traffic, residential and amenity-derived pollution, the following parameters were monitored:

### 11.2.2.1 Benzene, Toluene, Ethyl benzene and ortho and para Xylene (BTEX)

Benzene, Toluene, Ethyl benzene, p/o xylene (BTEX) and other aromatic/alkanes are most likely derived from petrol driven vehicle exhausts. Heavier semi-volatile organic compounds are frequently derived from diesel-powered engines. Benzene is a known carcinogen, poisonous by inhalation and a severe eye and moderate skin irritant.

At each of the five monitoring locations (A1 to A5) (see *Figure 11.7.1 and Table 11.2.1*), the air quality was monitored for BTEX, over a 29-day period, using BTEX diffusion tubes. The sample tubes were analysed for BTEX at a UKAS accredited laboratory (ISO 17025) using gas chromatography flame ionisation detector. The results are presented in *Table 11.2.2*.

**Table 11.2.2.** Average BTEX concentrations at each location as measured by passive diffusion tubes.

Location	Benzene ( $\mu\text{g}/\text{m}^3$ ) <sup>1,3</sup>	Toluene ( $\mu\text{g}/\text{m}^3$ ) <sup>1,3</sup>	Ethyl benzene ( $\mu\text{g}/\text{m}^3$ ) <sup>1,3</sup>	p-Xylene ( $\mu\text{g}/\text{m}^3$ ) <sup>1,3</sup>	o-Xylene ( $\mu\text{g}/\text{m}^3$ ) <sup>1,3</sup>
A1 <sup>2</sup>	0.695	0.256	0.183	0.256	0.121
A2 <sup>2</sup>	0.143	0.361	0.428	0.312	0.224
A3 <sup>2</sup>	0.270	0.233	0.418	0.249	0.186
A4 <sup>2,7</sup>	-	-	-	-	-
A5 <sup>2</sup>	0.329	0.282	0.471	0.576	0.248
EPA value-Old station rd hourly median value <sup>6</sup>	0.20	-	-	-	-
<b>Limit Value</b>	<b>5<sup>4</sup></b>	<b>4700<sup>5</sup></b>	<b>10,875<sup>5</sup></b>	<b>5525<sup>5</sup></b>	<b>5525<sup>5</sup></b>

**Notes:** <sup>1</sup> denotes the lower limit of detection was 5.91 ng of sorbed compound per tube;  
<sup>2</sup> denotes sampling period July to August 2007;  
<sup>3</sup> denotes Lower limit of detection 2.88 ng;  
<sup>4</sup> denotes Irish and EU Ambient Air Standard (SI 271 of 2002 and 1999/30/EC);  
<sup>5</sup> denotes No specific ambient air limits. Rule of thumb is using 1/40<sup>th</sup> of the 8-hour Occupational Exposure Limit as stated in the National Authority for Occupational Safety and Health 2002 "Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations".  
<sup>6</sup> denotes Air Quality Monitoring Report, 2006-Old station Rd monitoring site;  
<sup>7</sup> denotes location lost to vandalism.

The results illustrated in *Table 11.2.2* for BTEX at A1 to A5 are all in compliance with Irish and EU limit values (i.e. SI 271 of 2002 and EU Directive 2000/69/EC) for Benzene. Average Benzene concentrations were up to 93% lower than the Irish and EU directive limit values. The rule of thumb for guidelines for ambient air quality of volatile organic compounds without legislative limit values is using 1/40<sup>th</sup> of the 8-hour Occupational Exposure Limit as stated in the National Authority for Occupational Safety and Health 2002 "Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations". Toluene, Ethyl benzene and Xylene isomers are well within their respective fractional exposure limit values.

### 11.2.2.2 Nitrogen dioxides (NO<sub>2</sub>)

Nitrogen is a constituent of both the natural atmosphere and of the biosphere. When industrial metabolism releases nitrogen to the environment it is considered a "pollutant" because of its chemical form: NO, NO<sub>2</sub>, and N<sub>2</sub>O. These oxides of nitrogen can be toxic to humans, to biota, and they also perturb the chemistry of the global atmosphere. In the transportation sector, the NOx emissions result from internal combustion engines. In power plants and industrial sources, NOx is produced in boilers. The overwhelming fraction of nitrogen oxide emissions arises from the high temperature combustion of fossil fuels; emissions from metal-processing plants and open-air burning of biomass are insignificant.

Nitrogen dioxide is classed as both a primary pollutant and a secondary pollutant. As a primary pollutant NO<sub>2</sub> is emitted from all combustion processes (such as a gas/oil fired boiler or a car engine). Potentially, the main sources of primary NO<sub>2</sub> for the proposed development will be from vehicle exhausts.

As a secondary pollutant NO<sub>2</sub> is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic sources (e.g. volatile organic compounds). Secondary pollution is usually derived from regional sources and may be used as an indicator of general air quality in the region. Nitrogen dioxide has been shown to reduce the pulmonary function of the lungs. Long-term exposure to high concentrations of NO<sub>2</sub> can cause a range of effects, primarily in the lungs, but also in the liver and blood.

At each of the five monitoring locations (A1 to A5) (see Figure 11.7.1 and Table 11.2.1), levels of NO<sub>2</sub> were measured using diffusion tubes, which were left on site for a 29-day period. The tubes were then analysed using UV spectrophotometer, at a UKAS accredited laboratory (ISO 17025), giving an average concentration over the 29-day period. The results are presented in Table 11.2.3.

**Table 11.2.3.** Average NO<sub>2</sub> concentrations at each location as measured by passive diffusion tubes.

Location	Sampling Period	Average NO <sub>2</sub> conc. (µg/m <sup>3</sup> ) <sup>2</sup>
A1	July to Aug 2007	6.00
A2	July to Aug 2007	4.82
A3	July to Aug 2007	4.86
A4	July to Aug 2007	6.06
A5	July to Aug 2007	6.76
EPA value-Old station Rd hourly max value <sup>2</sup>	2006	111
EPA value-Old station Rd Annual mean value <sup>2</sup>	2006	26
<b>Limit value-Annual average</b>	-	<b>40</b>
<b>Limit value 1 hour average</b>	-	<b>200</b>

**Notes:**<sup>1</sup> denotes Lower limit of detection 0.003 µgNO<sub>2</sub>;  
<sup>2</sup> denotes Air Quality Monitoring Report, 2006-Wexford station;

The dominant source of NO<sub>2</sub> in the area appears to be from motor vehicle exhausts and the burners/boiler of space heating of local light industry and business units. The measured concentrations of NO<sub>2</sub> at all monitoring locations are within the Irish and EU Ambient Air Standards. Monitoring locations A1 to A5 are an average 83% lower than currently established Irish and European ambient air regulatory levels for annual averages.

### 11.2.2.3 Sulphur dioxide (SO<sub>2</sub>)

Sulphur dioxide is a colourless gas, about 2.50 times as heavy as air, with a suffocating faint sweet odour. Sulphur dioxide occurs in volcanic gases and thus traces of sulphur dioxide are present in the atmosphere. Other sources of sulphur dioxide include smelters and utilities, electrical generation, iron and steel mills, petroleum refineries, pulp and paper mills, metallurgical processes, chemical processes and the combustion of the iron pyrites, which are contained in coal. Small sources include residential, commercial and industrial space heating.

SO<sub>2</sub> can be oxidised to sulphur trioxide, which in the presence of water vapour is readily transformed to sulphuric acid mist. SO<sub>2</sub> is a precursor to sulphates, which are one of the main components of respirable particles in the atmosphere. Health effects caused by exposure to high levels of SO<sub>2</sub> include breathing problems, respiratory illness, changes in the lung's

defences, and worsening respiratory and cardiovascular disease. People with asthma or chronic lung or heart disease are the most sensitive to SO<sub>2</sub>. It also damages trees and crops. SO<sub>2</sub>, along with nitrogen oxides, are the main precursors of acid rain. This contributes to the acidification of lakes and streams, accelerated corrosion of buildings and reduced visibility. SO<sub>2</sub> also causes formation of microscopic acid aerosols, which have serious health implications as well as contributing to climate change.

At each of the five monitoring locations (A1 to A5) (see Figure 11.7.1 and Table 11.2.1), levels of SO<sub>2</sub> were measured using diffusion tubes, which were left on site for a 29-day period. The tubes were then analysed using Ion chromatography, at a UKAS accredited laboratory (ISO 17025), giving an average concentration over the 29-day period. The results are presented in Table 11.2.4.

**Table 11.2.4.** Average SO<sub>2</sub> concentrations at each location as measured by passive diffusion tubes.

Location	Sampling Period	Average SO <sub>2</sub> conc. (µg/m <sup>3</sup> ) <sup>1</sup>
A1	July to Aug 2007	1.64
A2	July to Aug 2007	1.75
A3	July to Aug 2007	1.32
A4	July to Aug 2007	1.60
A5	July to Aug 2007	1.18
EPA value-Old station Rd hourly max value <sup>2</sup>	2006	58
EPA value-Old station Rd daily max value <sup>2</sup>	2006	24
EPA value-Old station Rd Annual mean value <sup>2</sup>	2006	4
<b>Limit value-Annual average</b>		<b>20</b>
<b>Limit value-Daily average</b>		<b>125</b>
<b>Limit value-Hourly average</b>		<b>350</b>

**Notes:**<sup>1</sup> denotes lower limit of detection 0.060 µgSO<sub>4</sub>;  
<sup>2</sup> denotes Air Quality Monitoring Report, 2006-Old station Rd,

The dominant source of SO<sub>2</sub> in the area appears to be from motor vehicle exhausts and the burners/boiler/solid fuel heating local single residences and industrial units. The measured concentrations of SO<sub>2</sub> at all monitoring locations are within the Irish and EU Ambient Air Standards. Monitoring locations A1 to A5 are an average 91% lower than currently established Irish and European ambient air regulatory annual levels.

#### 11.2.2.4 Carbon monoxide (CO)

Carbon monoxide is produced as a result of incomplete burning of carbon-containing fuels including coal, wood, charcoal, natural gas, and fuel oil. It can be emitted by combustion sources such as un-vented kerosene and gas heaters, furnaces, woodstoves, gas stoves, fireplaces and water heaters, automobile exhaust from attached garages, and tobacco smoke. Carbon monoxide interferes with the distribution of oxygen in the blood to the rest of the body. Depending on the amount inhaled, this gas can impede coordination, worsen cardiovascular conditions, and produce fatigue, headache, weakness, confusion, disorientation, nausea, and dizziness. Very high levels can cause death. The symptoms are sometimes confused with the flu or food poisoning. Foetuses, infants, elderly, and people with heart and respiratory illnesses are particularly at high risk for the adverse health effects of carbon monoxide.

Due to power and equipment safety issues existing baseline monitoring data from EPA monitoring sites was used for assessment of baseline Carbon monoxide air quality. The EPA monitoring location and results are presented in *Table 11.2.5*.

**Table 11.2.5.** Average ambient baseline CO concentrations for the proposed site development.

Location	Sampling Period	Ambient CO conc. (mg/m <sup>3</sup> )
EPA - Annual mean - Old station Rd <sup>1</sup>	2006	0.50
EPA - 8 hour median value - Old station Rd <sup>1</sup>	2006	0.40
EPA-Maximum 8 hourly value - Old station Rd <sup>1</sup>	2006	2.80
<b>Limit value-8 hour average<sup>2</sup></b>	-	<b>10</b>

**Notes:** <sup>1</sup> denotes Air Quality Monitoring Report, 2006-Old station Rd,  
<sup>2</sup> denotes Irish and EU ambient air standard (SI 271 of 2002 and 2000/69/EC) as an 8 hour running average;

CO monitoring is also very limited in Ireland. Data sets developed by the EPA indicate 8 hour running average CO levels of between 0.10 and 0.80mg m<sup>-3</sup> for 8 hour rolling averages, respectively for urban areas in Ireland. The dominant source of CO in this area would appear to be vehicle emissions, boilers (i.e. Home heating and Industrial heating), industrial processes and construction activities. The CO emissions measured in Old Station Road would be considered worst case in comparison to the proposed site location. CO emissions are on average 78% lower than Irish and EU ambient air limit values, which would be considered worst case in terms of exposure for the area (see *Table 11.2.5*).

#### 11.2.2.5 Particulate matter (PM<sub>10</sub>)

Major sources of particulates include industrial/residential combustion and processing, energy generation, vehicular emissions and construction projects. The particulate matter created by these processes is responsible for many adverse environmental conditions including reduced visibility, contamination and soiling, but also recognised as a contributory factor to many respiratory medical conditions such as asthma, bronchitis and lung cancer. PM<sub>10</sub> (Particulate Matter 10) refers to particulate matter with an aerodynamically diameter of 10 µm. Generally, such particulate matter remains in the air due to low deposition rates. It is the main particulate matter of concern in Europe and has existing air quality limits. In order to obtain a baseline PM<sub>10</sub> for the proposed work area, a PM<sub>10</sub> analyser was used to monitor the PM<sub>10</sub> ambient concentration levels at one location (A1) within the vicinity of the proposed works. Continuous monitoring was performed over a 2-day period. The monitoring location is presented in *Figure 11.7.1* and *Table 11.2.1*. Results are presented in *Table 11.2.6*.

**Table 11.2.6.** Average ambient PM<sub>10</sub> concentrations in the vicinity of the proposed development.

Location	Sampling Period	Ambient PM <sub>10</sub> conc. (µg/m <sup>3</sup> )
A1-24 hour average	July 2007	22
A1-24 hour average	July 2007	31
EPA measured conc. – Old Station Rd, annual mean value <sup>4</sup>	2006	16
Limit Value at 98.07 <sup>th</sup> percentile	-	50 <sup>1,2</sup>
Limit Value-annual mean Stage 1		40
Limit value-annual mean Stage 2		20 <sup>3</sup>

**Notes:** <sup>1</sup> denotes Irish and EU ambient air standard (SI 271 of 2002 and 1999/30/EC) as a 24-hour average;  
<sup>2</sup> denotes maximum number of exceedence 7 times in a one-year period;  
<sup>3</sup> denotes annual limit value for Stage 2 implementation 2010;

<sup>4</sup> denotes Air quality Monitoring Report, 2006-Old Station Rd.

PM<sub>10</sub> monitoring in Ireland is limited to continuous monitoring stations operated by the Local Authorities and the Irish EPA, mainly in large urban centres. Average 24-hour ambient air concentrations monitored at Old Station Rd, Cork would be considered worst case in this area. The EPA measured an annual mean of 16 µg m<sup>-3</sup> at this monitoring station. The dominant source of PM<sub>10</sub> in the area appears to be vehicle emissions, boilers (i.e. Home heating and Industrial heating), industrial processes and construction activities. The average ambient PM<sub>10</sub> concentrations are higher to those monitored by the EPA. Maximum-recorded ambient PM<sub>10</sub> concentrations were on average 38% lower than the Irish and EU 24 hour ambient air quality limit value.

#### 11.2.2.6 Total Depositional Dust

Total dust deposition was measured at the site using Bergerhoff gauges specified in the German Engineering Institute VDI 2119 entitled "Measurement of Dustfall Using the Bergerhoff Instrument (Standard Method)." Samples were collected at five locations (i.e. A1 to A5) over a 30-day period, as shown in *Figure 11.7.1*. The purpose of these monitors is to assess the baseline total depositional dust impact in the vicinity of the current site. The glass jars containing the dust were submitted to an accredited test house for analyses. The results are presented in *Table 11.2.7*.

**Table 11.2.7.** Total depositional dust levels at each monitoring location.

Sample Reference	Sampling period	Total Dust Deposition (Summer sampling period) (mg/m <sup>2</sup> day)
A1	July to Aug 2007	66
A2	July to Aug 2007	78
A3	July to Aug 2007	94
A4	July to Aug 2007	62
A5	July to Aug 2007	87
EPA recommended Limit value	-	350

Currently in Ireland there are no statutory limits for dust deposition, however, EPA guidance suggest, "a soiling of 10mg/m<sup>2</sup>/hour is generally considered to pose a soiling nuisance" (TA Luft 2002). This equates to 240mg/m<sup>2</sup>/day of Total Depositional Dust. The EPA recommend a maximum level of 350mg/m<sup>2</sup>day of dust deposition when measured according to TA Luft standard, which includes both soluble and insoluble matter (i.e. EPA compliance monitoring is based on the TA Luft Method). This value was not exceeded at any of the sample locations with all measured values at least 73% lower than the maximum recommended limit value.

#### 11.2.2.7 Hydrogen sulphide

H<sub>2</sub>S is commonly associated with wastewater handling operations. It is used as an indicator gas for the assessment of significant odour nuisance in the vicinity of waste water facilities. The current California Ambient Air Quality standard for hydrogen sulphide, based on a 1-hour averaging time, is 42 µg m<sup>-3</sup> (30 ppb). On this basis, the proposed REL of 10 µg m<sup>-3</sup> (8 ppb) is likely to be detectable by many people under ideal laboratory conditions, but it is unlikely to be recognized or found annoying by more than a few. It is therefore expected to provide reasonable protection from odour annoyance in practice. Based on a review of 26 studies, the average odour detection threshold ranged from 0.00007 to 1.4 ppm (Amoore, 1985). Hydrogen sulphide is noted for its strong and offensive odour. The geometric mean of these studies is 0.008 ppm. In general, olfactory sensitivities decrease by a factor of 2 for each 22 years of age above 20 (Venstrom and Amoore, 1968); the above geometric mean is based on the average age of 40. Laboratory experiments performed by Sheridan (2003) in California measured H<sub>2</sub>S detection threshold at 2 µg m<sup>-3</sup> while the recognition odour threshold was 22 µg m<sup>-3</sup>. At the current California Ambient Air Quality Standard (CAAQS) of 30 ppb, the level

would be detectable by 83% of the population and would be discomforting to 40% of the population. These estimates have been substantiated by odour complaints and reports of nausea and headache (Reynolds and Kauper 1985) at 0.030 ppm H<sub>2</sub>S exposures from geyser emissions. The World Health Organization (WHO) recommends that in order to avoid substantial complaints about odour annoyance among the exposed population, hydrogen sulphide concentrations should not be allowed to exceed 0.005 ppm (5 ppb; 7 µg m<sup>-3</sup>), with a 30-minute averaging time. The OEHHA (2000) adopted a level of 8 ppb (10 µg m<sup>-3</sup>) as the chronic Reference Exposure Level (cREL) for use in evaluating long-term emissions from hot spots facilities. The only instrument capable of providing comparison with such reference levels is a Jerome meter analyser. These are real time data-logging H<sub>2</sub>S analyser for the measurement of ambient hydrogen sulphide concentration levels (Sheridan, 2003).

An ambient H<sub>2</sub>S profile monitoring exercise was carried out in the vicinity of the proposed WWTP site and five pumping stations using a pre-calibrated H<sub>2</sub>S analyser (Jerome metre). Samples were taken approximately 1.2 meter above ground level. The analyser is a real time analyser with a range of detection from 3 ppb to 50 ppm. Samples were collected at twelve locations (i.e. A1, to A12). Figures 11.7.1, to 11.7.6 and Table 11.2.1 illustrate each monitoring location. In order to maintain clarity within the document all 5 individual monitoring locations in the vicinity of the pumping stations are presented as one value as the ambient H<sub>2</sub>S concentration were below instrumental limits of detection. The purpose of this monitoring is to assess the baseline H<sub>2</sub>S in the vicinity of the sites. The results are presented in Table 11.2.8.

**Table 11.2.8.** Hydrogen sulphide levels at each monitoring location.

Monitoring location	Sampling period	Ambient air conc (µg/m <sup>3</sup> )
A1-WWTP	July 2007	<4.50
A2-WWTP	July 2007	6.0
A3-WWTP	July 2007	6.0
A4-WWTP	July 2007	7.50
A5-WWTP	July 2007	<4.50
A6-WWTP	July 2007	<4.50
A7-WWTP	July 2007	<4.50
A8-Raffeen PS	July 2007	<4.50
A9-West beach PS	July 2007	<4.50
A10-Monksland PS	July 2007	<4.50
A11-Carrigaloe PS	July 2007	<4.50
A12-Church Rd PS	July 2007	<4.50
<b>Recommended limit</b>	-	<b>7.50</b>

Currently in Ireland, there are no statutory limits for hydrogen sulphide concentrations in ambient air, however, guidance from the California Air Resources Board suggest an ambient air concentration level of less than 7.50 µg/m<sup>3</sup> to limit odour nuisance. This value was not exceeded at any of the sample locations. Elevated ambient concentrations above the lower limits of detection of the instrument method were detected at location A2, A3 and A4. There were no scheduled point emissions of Hydrogen sulphide in the vicinity of the site although; concentrations could be attributed to traffic movement on the nearby main road. Hydrogen sulphide is generated from side product reactions of exhaust emissions with the catalytic converter on diesel engines.

#### 11.2.2.8 Speciated Volatile organic compounds (VOC's)

Speciated VOC's to include alkanes, Mercaptans, organic acids, aromatics and nitrogen containing organics in ambient air at elevated concentrations can lead to the formation of odours. In order to ascertain the baseline levels of speciated VOC's in the vicinity of the



proposed site location, ambient pumped sampling of VOC's was performed in order to ascertain the baseline profile of such compounds in order to generate a baseline profile during no operation of the WWTP.

In order to pre-concentrate speciated VOC upon each sorbent, a pre-calibrated controlled volume of sample air was drawn through each tube by a pre-calibrated SKC constant flow sampling pump for a period range of 180 minutes (i.e. Active sampling/pumped sampling). Each SKC pump was pre-calibrated with their specific sorbent using a Bios Primary flow calibrator (NIST traceable certified) with calibration flow checked following the completion of the sample run. Each pump was calibrated to a flow rate of between 71 and 200 ml min<sup>-1</sup> depending on the sample, sample pump and sorbent tube as recommended by the sorbent manufacturer, analysing laboratory and sampling/test methodology. When sampling was completed all tubes were sealed and stored in flexible air tight containers and transported to the gas chromatography laboratory and analysed by means of thermal desorption GCFID/GCMS in a UKAS accredited laboratory.

Samples were taken approximately 1.20 meter above ground level using two-bed silcosteel packed sorbent tubes on the 12<sup>th</sup> July 2007. Samples were collected at two locations across the proposed WWTP site (i.e. A6 and A7), and at one location in the vicinity of each of the five pumping stations (i.e. A8 to A12) as shown in *Figures 11.7.1 to 11.7.6 and Table 11.2.1*. The purpose of this monitoring is to assess the baseline speciated VOC concentration level and profile in the vicinity of the proposed site. The results are presented in *Tables 11.2.9 to 11.2.15*.

**Table 11.2.9.** Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A6-WWTP.

Compound identity	Ambient air conc. ( $\mu\text{g}/\text{m}^3$ )
3-Butyn-1-ol	1.75
Benzaldehyde	0.58
Acetophenone	0.63
Nonanal	0.38
Decanal	0.40
Cyclododecane	0.56
Hexadecanal	0.99
Cyclohexadecane	13.20
<b>Total VOC's</b>	<b>26.02</b>

**Table 11.2.10.** Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A7-WWTP.

Compound identity	Ambient air conc. ( $\mu\text{g}/\text{m}^3$ )
Benzaldehyde	0.65
Acetophenone	0.65
Nonanal	0.84
Decanal	0.66
Tetradecane	0.65
1-Hexadecene	0.57
Oxirane, tetradecyl-	1.49
Cyclohexadecane	4.09
<b>Total VOC's</b>	<b>25.64</b>

**Table 11.2.11.** Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A8-Raffeen PS.

Compound identity	Ambient air conc. ( $\mu\text{g}/\text{m}^3$ )
2,5-Furandione, dihydro-3-methylene-	7.43
3(2H)-Thiophenone, dihydro-2-methyl-	1.02
2,2-Dichlorocyclopropanecarboxamide	6.05
Cyclohexan-1,4,5-triol-3-one-1-carboxylic acid	1.61
2,4-Diethyl-6-methyl-1,3,5-trioxane	12.20
1-Tetradecene	2.03
Cyclohexadecane	5.54
Oxirane, heptadecyl-	1.45
1-Nonadecene	16.90
<b>Total VOC's</b>	<b>74.03</b>

**Table 11.2.12.** Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A9-West beach PS.

Compound identity	Ambient air conc. ( $\mu\text{g}/\text{m}^3$ )
2,5-Furandione, dihydro-3-methylene-	5.62
Formamide, N,N-dimethyl-	2.54
Ethanol, 2-butoxy-	2.19
Benzaldehyde	1.26
Acetophenone	0.82
Cyclotetradecane	1.03
1-Decanol, 2-hexyl-	19.44
1-Hexacosene	1.11
1-Heptadecanol	4.93
<b>Total VOC's</b>	<b>64.95</b>

**Table 11.2.13.** Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A10-Monkstown PS.

Compound identity	Ambient air conc. ( $\mu\text{g}/\text{m}^3$ )
2,5-Furandione, dihydro-3-methylene-	4.23
Nonanal	3.32
Ethanol, 2-butoxy-	1.19
2-Propanol, 1-[2-(2-methoxy-1-methylethoxy)-1-methylethoxy]-	1.16
Acetophenone	1.25
Cyclotetradecane	1.20
1-Decanol, 2-hexyl-	6.89
2,4-Diethyl-6-methyl-1,3,5-trioxane	5.42
1-Heptadecanol	2.23
<b>Total VOC's</b>	<b>54.23</b>

**Table 11.2.14.** Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A11-Carrigaloe PS.

Compound identity	Ambient air conc. ( $\mu\text{g}/\text{m}^3$ )
2,5-Furandione, dihydro-3-methylene-	5.42
2-Octanamine	0.66
Benzaldehyde	1.42
Acetophenone	1.22
2-Propanol, 1-[2-(2-methoxy-1-methylethoxy)-1-methylethoxy]-	1.17
2,4-Diethyl-6-methyl-1,3,5-trioxane	2.43
Cyclohexadecane	5.05
1-Hexadecanol	2.38
<b>Total VOC's</b>	<b>36.78</b>

**Table 11.2.15.** Speciated VOC profile and concentrations in the vicinity of the proposed site location at monitoring location A12-Church Road PS.

Compound identity	Ambient air conc. ( $\mu\text{g}/\text{m}^3$ )
Propane, 1-(ethenylthio)-	0.72
Benzaldehyde	1.03
Acetophenone	0.84
Nonanal	1.17
Decanal	2.18
Cyclohexadecane	6.20
Hexadecanal	3.39
Cyclohexadecane	6.45
Eicosane	0.52
<b>Total VOC's</b>	<b>49.37</b>

Currently in Ireland, there are no statutory limits for total volatile organic compound concentrations in ambient air, however, research data gathered by Odour Monitoring Ireland suggest an ambient air concentration level of less than  $250 \mu\text{g}/\text{m}^3$  to limit odour impact. The compounds detected in ambient air would be typical of emissions detected close to busy roadways and in agricultural locations. No background concentrations of Mercaptans or Sulphur containing organics were detected and the absence of such compounds suggests in general that odour air quality is good in the vicinity of the site. The profiles can be compared with any additional profiles measured when the facilities are operational in order to ascertain any increases in ambient air concentrations of speciated VOC's. The overall background level of speciated VOC's as total VOC's is generally low in the vicinity of all site locations.

### 11.3. Characteristics of the proposal

The proposed development consists principally of the construction of a large sized urban wastewater treatment plant to serve the population centres of Cork Lower Harbour and its' environs. The proposed wastewater treatment plant is an essential element of the Cork Lower Harbour Main Drainage Scheme. Associated works, which will be carried out as part of the proposed development, include:

- The widening of sections of the minor road to the west of the site
- The widening and upgrading of the site access road
- Marine crossing
- New wastewater pumping stations

- The laying of rising mains, surface water sewers and gravity wastewater sewers to direct the wastewater to the new treatment works
- New wastewater treatment works-

The treated wastewater will be discharged to Cork Lower Harbour via the existing IDA outfall. The overall area of the two fields on which this proposed wastewater treatment plant will be constructed is approximately 17.5 hectares. However, the fields are traversed by overhead high voltage electrical cables. By providing sufficient clearance from these power lines a suitable area of approx. 7.35 ha is available between the power lines. This area is considered adequate for the construction of the proposed wastewater treatment plant, including facilities for organic-material removal, nutrient removal, basic sludge treatment (if required) and appropriate landscaping measures.

The principal elements of a treatment plant of the type and scale proposed include preliminary, primary and secondary treatment of the wastewater stream with further provision for treatment of surplus sludge arising from the primary and biological stages of the treatment process. The specific details of each process are contained elsewhere within the EIS.

## 11.4. Potential Impacts of the Proposal

### 11.4.1 Construction Phase

There is the potential for a number of emissions to atmosphere during the construction of the development with wind blown dust been most significant. Wind blown dust emissions may arise during the construction phase of the proposed development, which may impact upon the surrounding environment. The deposition of dust and mud on the local roads is both unsightly and dangerous. Dust may be a particular problem during periods of dry windy weather.

Potential sources of dust from construction and operation include the following:

- Vehicles carrying dust on their wheels,
- Un-vegetated stockpiles of construction materials,
- The handling of construction materials for the construction phase of the development,
- The generation of dust from the recycling activities to be carried out indoors within the facility.

The construction and operation vehicles, generators, etc., will also give rise to petrol and diesel exhausts emissions, although this is of minor significance compared to dust.

### 11.4.2 Operation Phase

#### 11.4.2.1 Scheduled Emissions

Regarding operations at the proposed development, the activities to be located in the development are waste water treatment activities. All equipment generating dust emissions will contain localised dust abatement equipment where necessary in order to prevent the release of dust to atmosphere. Scheduled emission point from odour control units will occur to atmosphere from the WWTP and pumping stations. Emissions of odour will be dealt with in detail in *Section 12*.

### 11.4.2.2 **Climate**

There is a potential for impacts to climate as a result of any development that requires fuel and energy. These impacts are the generation of greenhouse gas emissions (principally carbon dioxide and oxides of nitrogen) from traffic and electrical supply.

The potential effects of climate change on a global scale have been investigated by the Intergovernmental Panel on Climate Change (IPCC). The resulting impacts in Ireland are outlined in the National Climate Change Strategy and recently by the EPA and include the following:

- Significant increases in winter rainfall, of the order of 10% in the southeast, with a corresponding increase in the water levels in rivers, lakes and soils. Serious flooding more frequent than at present.
- Lower summer rainfall, of the order of 10% in the southern half of the country. Less recharge of reservoirs in the summer leading to more regular and prolonged water shortages than at present. Loss of bog land due to regular water deficits.
- Increased agricultural production, with new crops becoming more viable and potentially reduced agricultural costs. Grass growth could enjoy beneficial effects with an increase in 20% possible with higher temperatures and changes in rainfall patterns.
- The development will be designed to take account of changes in rainfall intensity and mean sea level rise.

These figure for climate change refer to year 2100. The specimen design is for up to 2030.

It is recognised that Ireland cannot, on its own, prevent or ameliorate the impacts of climate change. However, the National Climate Change Strategy states that Ireland must meet its responsibilities with regard to reducing CO<sub>2</sub> emissions in partnership with the EU and the global community. In terms of this specimen design, the generation of biogas and utilisation of generated biogas in a gas utilisation engine/boiler will offset CO<sub>2</sub> eq. emissions generated by the WWTP.

### 11.4.3 “Do-nothing” Scenario

The baseline survey results suggest that air quality in the vicinity of the proposed development is average/good and shows typical levels for a rural and suburban area with all pollutants within the relevant Irish and EU limits. The air quality may improve slightly in future years due to improvements in engine technology and greater controls on petrol, diesel, coal and gas composition and purity. If the proposed development were not to take place, the current air pollutant concentrations will remain unchanged followed by potential decreases in future years for the reasons outlined above. In relation to dust, non-development of the site would result in no movement of soils/sands and no construction activity and therefore no dust creation as a result of construction works. Impacts associated with odours as demonstrated in *Section 12* are considered negligible as a result of the mitigation measures to be used at the proposed WWTP and Pumping stations. This will be discussed in more detail in *Section 12*.