2.0 AIR QUALITY

2.1 Introduction

The assessment of air quality has been carried out using a phased approach as recommended by the UK Department Of Environment And Rural Affairs (DEFRA)[1,2] whose methodology has been widely used in Ireland in assessing the impact of traffic schemes. The phased approach recommends that the complexity of an air quality assessment should be consistent with the risk of failing to achieve the air quality standards.

2.2 Baseline Environment

In the current assessment, an initial screening of possible key pollutants was carried out. A review of recent EPA and Local Authority data in Ireland [3-5], has indicated that sulphur dioxide (SO_2), smoke, carbon monoxide (CO) and lead are unlikely to be exceeded in any urban areas and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the review did indicate potential problems in regards to nitrogen dioxide (NO_2) and particulate matter less than 10 microns (PM_{10}) at busy junctions in Dublin [3-6]. Benzene, although previously reported at high levels in Dublin [5], has recently been measured at several city centre locations to be below the EU limit value [4, 6].

The current assessment thus focused firstly on identifying the existing baseline levels of NO_2, PM_{10} and benzene along the proposed route. Thereafter, the impact of the proposed cycle path on the ambient concentration of these pollutants was assessed.

Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants over the last several decades. These limit values or "Air Quality Standards" are health- or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Tables 2.1 - 2.4 and Appendix A - 2.1). The EU, in 1996, enacted the Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management. The aims of the Directive are fourfold. Firstly, the Directive's aim was to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aimed to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it aimed to make information on air quality available to the public via alert thresholds and fourthly, it aimed to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has subsequently adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has set limit values, which should replace existing limit values under Directives 80/779/EEC, 82/884/EEC and 85/203/EEC with effect from 19th July 2001. Air Quality Standards Regulations 2002, (S.I. 271 of 2002) incorporated EU Directives 1999/30/EC and 2000/69/EC (see Tables

2.2 – 2.3) into Irish legislation. Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The various thresholds have been incorporated into the significance criteria for the development and will be appropriate for assessing the significance of the cumulative impact of the development plus the baseline environment (see Appendix A - 2.1).

Council Directive 1999/30/EC (passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002) on 17th June 2002) has set limit values for SO_2, NO_X, PM_{10} and lead. A second daughter directive, EU Council Directive 2000/69/EC, has also published limit values for both carbon monoxide and benzene in ambient air. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

PM_{10}

EU Directive 1999/30/EC has set 24-hour and annual limit values for PM_{10} (see Table 2.2). The 24-hour limit value is 50 $\mu g/m^3$, which must not be exceeded more than 35 times per year (90^{th}%ile). A margin of tolerance was applied to this limit value in 2001 of 50%, and this will reduce linearly to 0% by 2005. EU Directive 1999/30/EC has set an annual limit value of 40 $\mu g/m^3$. Again a margin of tolerance was applied to this limit value in 2001, in this case of 20%, and this will reduce linearly to 0% by 2005. In addition, an indicative limit value of 20 $\mu g/m^3$ may be applicable in 2010. However, this is to be reviewed in the light of further information on health and environmental effects, technical feasibility and experience in the application of the current limit values in the EU Member States (see Table 2.2). The European Commission sponsored report "Second Position Paper on Particulate Matter – draft for discussion" (21/08/03) has recommended that the principal metric for assessing exposure to particulates should be $PM_{2.5}$ rather than PM_{10} after 2010. The report also suggests that the annual average should be in the range 12 – 20 $\mu g/m^3$ that should be compared with the PM_{10} annual limit value, to be complied with in 2005, of 40 $\mu g/m^3$. In relation to the maximum 24-hour limit value, a starting point for discussion has been set at 35 $\mu g/m^3$ as a 90^{th}%ile. These indicative limit values will be reviewed in the light of further information on health and environmental effects, technical feasibility etc.

NO_2

EU Directive 1999/30/EC has set a 1-hour and annual limit values for NO_2 (see Table 2.2). An hourly limit of 200 $\mu g/m^3$ is set which must not be exceeded more than 18 times per year (99.8^{th}%ile). The annual limit value is 40 $\mu g/m^3$. Again a margin of tolerance was applied to these limit values in 2001 of 50%, and this will reduce linearly to 0% by 2010 (see Table 2.2).

Benzene

EU Directive 2000/69/EC has set an annual limit value of 5 μg/m^3 for benzene. A margin of tolerance of 100% was applied from 2003. This will reduce linearly from 2006 to reach 0% by 2010 (see Table 2.3).

Meteorological Factors

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength [(11)]. Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, which are the main source of pollutants in Dublin; pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 5 km north-west of the nearest section of the route. Data from Dublin Airport has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 2.1). For data collated during five representative years (1998-2002), the predominant wind direction ranges from southwesterly to westerly with an average wind speed of approximately 3-5 m/s.

Historical Air Monitoring Data

A review of existing baseline air monitoring data in the region of the proposed route for the relevant key pollutants, NO_2, PM_{10} and benzene, has been detailed below.

The EPA and Local Authorities have undertaken air quality monitoring programs in recent years. The most recent annual report on air quality “Air Quality Monitoring Report 2002” (EPA, 2003)[(5)], details the range and scope of monitoring undertaken throughout Ireland. Additionally, Dublin City Council has published a report entitled “Air Quality Monitoring Report 2003” [(4)] relating to extensive measurements carried out in 2002 across Dublin.

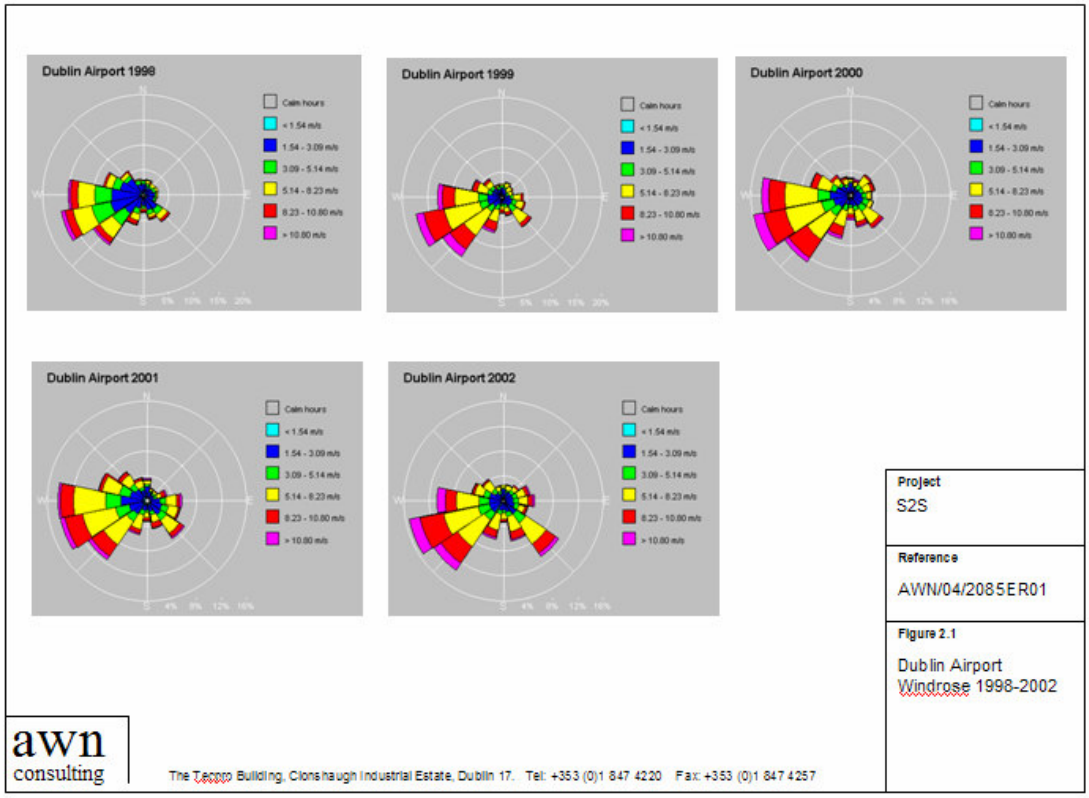

Figure 2.1 Windrose Data for Dublin Airport

NO_2

A summary of the continuous monitoring data available in Dublin in recent years is presented in Table 2.5. Data is available for several city centre and suburban stations although no station is located in the immediate vicinity of the route.

The data highlights a gradual increase in NO_2 concentration from the suburbs to the city centre with levels outside of city centre Dublin well below the air quality standards. Both Rathmines and Crumlin generally averaged between 50 – 60% of the annual limit value in recent years. City centre locations are significantly higher averaging between 75 – 95% of the limit value over the last few years. The data also indicates that the maximum 1-hour limit value is rarely exceeded even in central Dublin (with the exception of the College Green monitoring station which is incorrectly sited and hence does not comply with the relevant EU Council Directives on Ambient Air Quality (1999/30/EC and 2000/69/EC)).

An extensive monitoring program has been carried out in Dublin (RESOLUTION, part of the EU LIFE program) consisting of six seven-day monitoring periods during 2000 and 2001 at 146 locations across Dublin using diffusion tubes for NO_2 and benzene. Based on this spatially extensive study, a background map has been produced estimating typical background concentrations of NO_2 across Dublin [(6)]. The average NO_2 concentration along the route was approximately 20 - 25 µg/m^3 in the suburbs along Sutton, Raheny and Clontarf on the north side of the Liffey and Blackrock, Monkstown, Dun Laoghaire & Sandycove on the south side of the Liffey. These results correlate well with the continuous analyser data operated by the EPA and Local Authorities. Higher levels are evident in the East Wall / Ringsend / Irishtown areas of around 30 -35 µg/m^3 in

2001 (see Table 2.8) which again correlates well with EPA / Local Authority data for central Dublin.

The available data thus indicates that residential receptors along the suburban sections of the proposed route are currently experiencing ambient NO_2 concentrations which are well within the annual limit value of 40 μg/m^3. However, the evidence points to higher levels along the inner city section of the proposed route. Near the approach roads to Dublin Port, which experiences high volumes of HGV's, ambient levels may currently approach the EU ambient limit values at roadside locations. However, with the opening of the Dublin Port Tunnel in 2005, NO_2 levels would be expected to reduce along these approach roads.

PM_{10}

A summary of the PM_{10} monitoring data available in Dublin in recent years is presented in Table 2.7. The data highlights a gradual increase in annual average PM_{10} concentration from the suburbs to the city centre with levels outside of city centre Dublin well below the air quality standards. Rathmines, Phoenix Park, Marino and Crumlin generally averaged between 40 – 60% of the annual limit value in recent years. City centre locations (Winetavern Street and Coleraine Street) have marginally higher annual averages (between 55 – 65% of the limit value) over the last few years. Again, College Green monitoring station, which is incorrectly sited and so does not comply with the relevant EU Council Directives on Ambient Air Quality (1999/30/EC and 2000/69/EC), has significantly higher levels than other city centre locations.

In relation to maximum 24-hour limit value for PM_{10}, significant variations are evident, year on year at each station indicating the importance of meteorological conditions for this parameter. However, it is evident that busy intersections and roadways such as Winetavern Street are likely to approach or exceed the limit value during unfavorable years. Suburban stations however are unlikely to exceed the limit value even in particularly unfavourable years.

The available data indicates that residential receptors along the suburban sections of the proposed route are currently experiencing ambient PM_{10} concentrations which are well within the annual limit value of 40 μg/m^3. However, the evidence points to higher levels along the inner city section of the proposed route. Near the approach roads to Dublin Port, which experiences high volumes of HGV's, ambient levels may currently exceed the EU ambient limit values at roadside locations (particularly the 24-hour limit value). However, with the opening of the Dublin Port Tunnel in 2005, PM_{10} levels would be expected to significantly reduce along these approach roads.

Benzene

A summary of the benzene monitoring data available in Dublin in recent years is presented in Table 2.8. Data is available for Winetavern Street in the city centre and Crumlin station in suburban Dublin. Benzene concentrations are low in Crumlin averaging less than 40% of the EU limit value of 5 μg/m^3 while Winetavern Street is significantly higher averaging 70% of the limit value over the last three years.

As part of the EU RESOLUTION programme, benzene was measured over six seven-day monitoring periods during 2000 and 2001 at 146 locations across Dublin. The average benzene concentration along the route was between 1.0 - 3.2 μg/m^3 (see Table 2.9) with little variation between suburban locations and inner city locations (Ringsend / Irishtown / East Wall). The available data indicates that all residential receptors along the proposed route are currently experiencing ambient benzene concentrations, which are within the annual limit value of 5.0 μg/m^3.

Baseline Air Quality Survey

An assessment of the impact of the proposed scheme on existing ambient air quality has identified that the key parameter of concern will be PM_{10} and specifically during the construction phase of the project. In order to obtain site-specific baseline data, a short-term monitoring study was carried out for PM_{10} at two locations along the proposed route. This short-term study focused on identifying typical baseline levels at roadside along the proposed route.

In addition, in-house PM_{10} data which was monitored in 2001-2002 at a location in North Wall has been referenced as a typical background concentration for the inner-city region. A background concentration is one, which is remote (i.e. greater than 100m) from a significant source of pollutant such as a busy road.

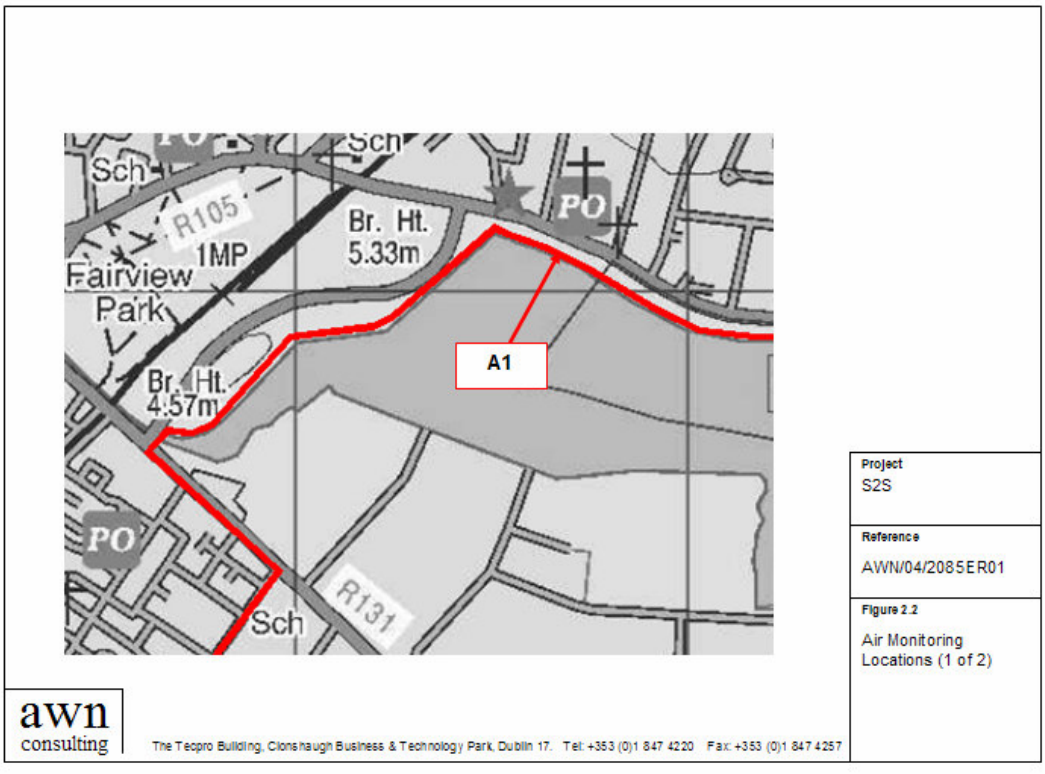

Figure 2.2 Air Quality Monitoring Location A1

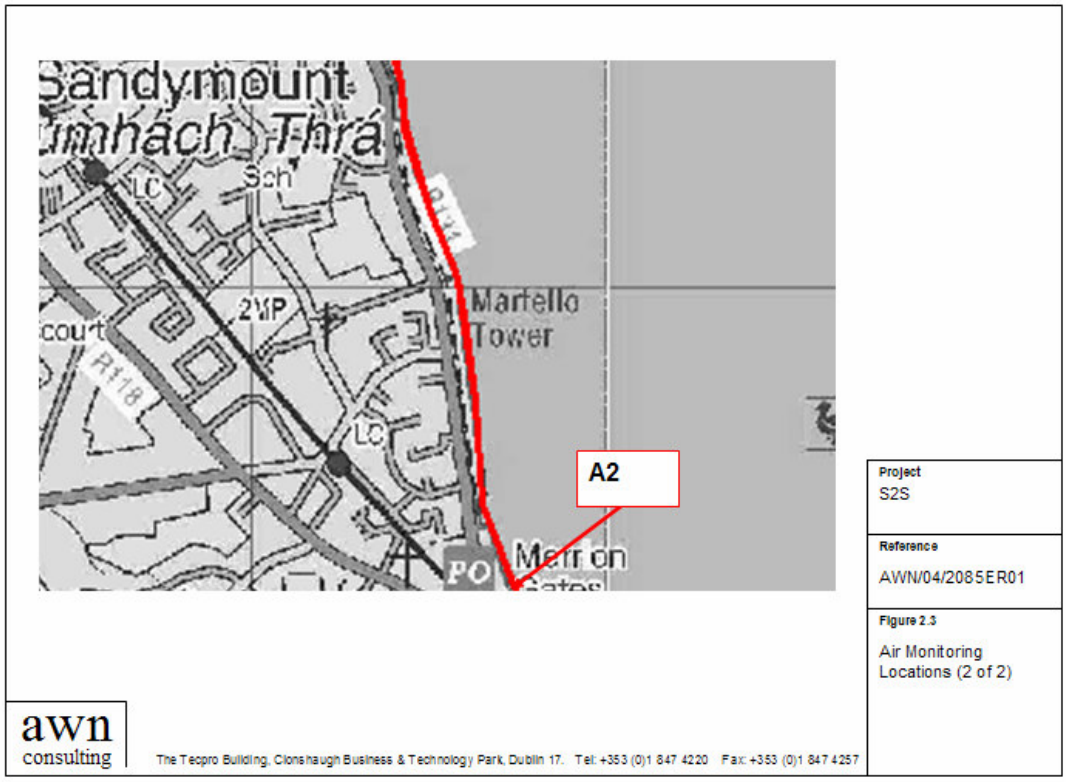

Figure 2.3 Air Quality Monitoring Location A2

Site-specific PM_{10} Survey

Roadside levels of PM_{10} were monitored, using a portable air sampler, over three 24-hour periods at two locations near the proposed cycle path (see Figures 2.2 and 2.3 Locations A1 and A2). These locations represent typical exposure of the roadside residential population along the proposed route. The results, shown in Table 2.10, allow a comparison with the EU ambient air quality 24-hour limit value.

Historical PM_{10} Survey

An AWN in-house PM_{10} monitoring program, using a PM_{10} continuous monitor, focused on assessing 24-hour average concentrations at a monitoring station in the Point Depot over an eight-week period between November 2001 and February 2002 (at a distance of 100m from roadside). PM_{10} sampling was carried out by means of an R&P Partisol®-Plus Sequential Air Sampler (Model 2025). The results are shown in Table 3.11.

Assessment of Compliance

The results of PM_{10} monitoring carried out at two locations along the proposed route are presented in Table 2.10. The monitoring results show that levels are currently significantly below the annual limit value of 40 $\mu g/m^3$ at both roadside locations.

The results from the 2001-2002 survey at the Point Depot monitoring station are shown in Table 2.11. The results show that the levels of PM_{10} are generally within the

24-hour EU limit value of 50 μg/m^3 during the eight weeks of the survey period. However, eleven excedences of the 24-hour limit value were recorded during this period representing a compliance rate of 81.7% and thus the monitoring results indicate that if the survey was carried out over a one-year period, an exceedence of the limit value would be possible (which allows a minimum compliance of 90%). The average level of PM_{10} at the background station, measured over the eight-week period is 33 μg/m^3, which is below the annual limit value of 40 μg/m^3 and indicates that compliance with the annual limit value is likely to be achieved at this location.

2.3 Constraints

There are no constraints with regard to air quality with the cycle path in place. However, there is the potential for a number of emissions to the atmosphere during the construction of the scheme. In particular, the construction activities may generate quantities of dust and PM_{10}. Construction vehicles, generators etc., will also give rise to some NO_2 emissions.

2.4 Mitigation Measures

An Environmental Management Plan (EMP) will be implemented as part of the design, planning, construction and operational stages of S2S. In terms of air quality, the EMP will ensure that any air quality issues are dealt with at an early stage of the development, and the avoidance or mitigation of any air quality impacts can be integrated into the overall design of S2S (See Appendix B of this report).

2.4.1 Construction Phase

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust and PM_{10} emissions. The dust minimisation plan will be particularly important in locations where existing PM_{10} levels are approaching the ambient air quality standards. The areas identified as being potentially particularly sensitive are in the region of North Wall / East Wall on the north side of the Liffey and Ringsend / Irishtown on the south side of the Liffey. Given the preferred route option, which is generally speaking not in the immediate vicinity of residential properties, the likely dust impacts are minimal. However in order to ensure impacts are controlled and minimized, during construction at these locations, all practical measures should be strictly enforced. An outline of the measures which will be used to mitigate dust and PM_{10} releases are outlined below.

The potential for dust / PM_{10} to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust / PM_{10} depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site surfaces shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface. Furthermore, any surface that has the potential to

give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

Public roads shall be regularly inspected for cleanliness, and cleaned as necessary. Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practise and procedures.

2.4.2 Operational Phase

No mitigating measures are necessary during the operational phase of the scheme, as the scheme will at worst have a neutral impact on air quality.

2.5 Possible Impacts

The proposed cycle and pedestrian route will help promote the use of cycling and walking alternative to vehicle transport. As such, the impact of the scheme may potentially be beneficial and at worst, since the operation of the scheme itself will have no air emissions, will be neutral.

2.6 Recommendations and Further Studies

As the impact of the cycle path will not be adverse, no additional studies or recommendations, with respect to air quality are required.

Table 2.1: EU Air Standards 85/203/EEC, 82/884/EEC & 80/779/EEC

Pollutant	Regulation	Type	Period	Value
Nitrogen Dioxide	85/203/EEC	Limit Value	98th percentile of yearly mean hourly	200 μg/m^3
		Guide Value	Concentrations	135 μg/m^3
		Guide Value	50th percentile of yearly mean hourly concentrations	50 μg/m^3
Lead	82/884/EEC	Limit Value	Annual mean	2 μg/m^3
Sulphur dioxide	80/779/EEC	Limit Value	98th percentile of yearly mean hourly concentrations	250-350[1] μg/m^3
		Limit Value	Winter (medium of daily values)	130-180[1] μg/m^3
		Limit Value	One year (medium of daily values)	80-120[1] μg/m^3
		Guide Value	98th percentile of yearly mean hourly concentrations	135 μg/m^3
		Guide Value	50th percentile of 1-hour means	50 μg/m^3
Smoke	80/779/EEC	Limit Value	One year (medium of daily values)	80 μg/m^3
		Limit Value	Winter (medium of daily values)	130 μg/m^3
		Limit Value	98th percentile of daily values	250 μg/m^3

(1) The lower daily values refer to the situation with corresponding high levels of black smoke.

Table 2.2: EU Ambient Air Standard - Council Directive 1999/30/EC

Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	1999/30/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	50% until 2001 reducing linearly to 0% by 2010	200 $\mu g/m^3$ NO_2
		Annual limit for protection of human health	50% until 2001 reducing linearly to 0% by 2010	40 $\mu g/m^3$ NO_2
		Annual limit for protection of vegetation	None	30 $\mu g/m^3$ $NO + NO_2$
Lead	1999/30/EC	Annual limit for protection of human health	100% until 2001 reducing linearly to 0% by 2005	0.5 $\mu g/m^3$
Sulphur dioxide	1999/30/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	43% until 2001 reducing linearly until 0% by 2005	350 $\mu g/m^3$
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 $\mu g/m^3$
		Annual & Winter limit for the protection of ecosystems	None	20 $\mu g/m^3$
Particulate Matter Stage 1	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50% until 2001 reducing linearly to 0% by 2005	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	20% until 2001 reducing linearly to 0% by 2005	40 $\mu g/m^3$ PM_{10}
Particulate Matter Stage 2(1)	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 7 times/year	To be derived from data and to be equivalent to Stage 1 limit value	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	50% until 2005 reducing linearly to 0% by 2010	20 $\mu g/m^3$ PM_{10}

(1) Indicative limit values to be reviewed in the light of further information on health and environmental effects, technical feasibility and experience in the application of Stage 1 limit values in the Member States.

Table 2.3: EU Ambient Air Standard - Council Directive 2000/69/EC

Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Benzene	2000/69/EC	Annual limit for protection of human health	100% until 2003 reducing linearly to 0% by 2010	5 $\mu g/m^3$
Carbon Monoxide	2000/69/EC	8-hour limit (on a rolling basis) for protection of human health	50% until 2003 reducing linearly to 0% by 2005	10 mg/m^3

Table 2.4 US National Ambient Air Quality Standards (NAAQS) & PSD Increments

Pollutant	Averaging Period	Primary & Secondary Standard (1) ($\mu g/m^3$)	*PSD Increment Class II*(2) ($\mu g/m^3$)
PM_{10}	Annual – Average over 3 years	50	17
	24-Hour – as a 99th%ile over 3 years	150	30
NO_2	Annual Mean	100	25
CO	8-Hour – 3-year average of annual 4th highest daily maximum 8-hour conc.	10,000	-
	1-Hour – not to be exceeded more than 3 times in 3 consecutive years	40,000	-
Hydrocarbon (Benzene)	3 Hours (6-9 AM) (corrected for methane)	160	-

(1) Primary standards to protect public health whilst secondary standards are set to protect public welfare
(2) Class I areas are national parks and similar areas. Class II are all areas not originally classified as Class I.

Table 2.5 Trends In Dublin City Air Quality - Nitrogen Dioxide (µg/m^3)[3-5]

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year						
			1996	1997	1998	1999	2000	2001	2002
College Street	Urban Traffic	Annual average NO_2	≈83	83	-	70	N.A.	N.A.	-
	Distance From Road = 4 m	Maximum 1-hr NO_2	(≈190)	296 (185)	-	318 (211)	N.A.	N.A.	-
Rathmines	Urban Traffic	Annual average NO_2	≈16	16	18	17	19	32	22
	Distance From Road = 3 m	Maximum 1-hr NO_2	(≈45)	76 (44)	113 (46)	64 (42)	554 (55)	155 (85)	118 (71)
Whitehall (Beaumont)	Urban Background	Annual average NO_2	-	-	-	18	N.A.	N.A.	-
	Distance From Road = 200 m	Maximum 1-hr NO_2	-	-	-	94 (53)	N.A.	N.A.	-
Crumlin	Suburban	Annual average NO_2	-	-	-	22 (over a 6 month program)		24	22
	Distance From Road = 8 m	Maximum 1-hr NO_2	-	-	-	111 (68)		149 (78)	117 (72)
Coleraine Street	Urban Traffic	Annual average NO_2	-	-	-	-	41	39	38
	Distance From Road = 3 m	Maximum 1-hr NO_2	-	-	-	-	208 (101)	193 (92)	145 (87)
Pearse Street	Urban Traffic	Annual average NO_2	-	-	-	50 (over a 4 month program)		N.A.	-
	Distance From Road = 2 m	Maximum 1-hr NO_2	-	-	-	138 (106)		N.A.	-
Winetavern Street	Urban Traffic	Annual average NO_2	-	-	-	-	≈32	33	35
	Distance From Road = 50 m	Maximum 1-hr NO_2	-	-	-	-	≈155-	1235 (214)	380 (104)

( ): represent the 98th%ile of maximum 1-hour concentrations.
≈: Indicates approximate value from a graph reproduced in the EPA report " Preliminary Assessment Under Article 5 of Council Directive 96/62/EC – Ireland"[3].

Table 2.6 **Results of EU/LIFE RESOLUTION NO_2 passive diffusion tube monitoring campaign at monitoring positions close to the route of the Sutton to Sandycove cycle lane.**

Location	Period I 24/9/00 - 1/10/00 NO_2 ($\mu g/m^3$)	Period II 26/11/00 - 3/12/01 NO_2 ($\mu g/m^3$)	Period III 28/1/01 - 4/2/01 NO_2 ($\mu g/m^3$)	Period IV 25/3/01 - 1/4/01 NO_2 ($\mu g/m^3$)	Period V 27/5/01 - 3/6/01 NO_2 ($\mu g/m^3$)	Period VI 22/7/01 - 29/7/01 NO_2 ($\mu g/m^3$)	Average ($\mu g/m^3$)
Howth Road @ Kilbarrack Rd	21.2	10.9	31.9	21.0	19.9	22.0	21
James Larkin Rd@ Prospect Av	23.9	18.9	26.4	22.7	10.7	22.3	21
Vernon Ave / Clontarf Road	29.4	26.4	27.1	28.8	13.4	22.2	25
Vernon Avenue, Clontarf	27.7	21.6	33.2	27.7	9.7	19.3	23
Kincora Av, Clontarf	36.5	32.3	37.6	27.3	-(1)	22.9	31
18 Strandville Av Clontarf	31.7	33.2	33.2	31.9	14.7	22.7	28
Church St. East , East Wall Rd	-(1)	33.4	41.6	43.9	25.0	24.3	34
Dublin Port	51.4	34.2	50.8	-(1)	31.9	-(1)	42
4 New Wapping St, North Wall	45.6	35.5	45.8	38.8	24.3	32.3	37
South Dock Road, Ringsend	34.2	24.3	29.8	27.5	19.7	21.0	26
Leahy's Terrace, Irishtown	29.0	16.2	30.6	24.1	14.9	17.2	22
Gilford Road, Sandymount	27.7	16.6	25.8	26.9	9.7	13.4	20
Herbert Av, Merrion	29.2	16.6	34.4	28.8	16.0	15.7	23
Seafield Rd, Stillorgan	23.5	18.9	29.8	28.1	13.9	14.1	21
Shandon Park, Monkstown Rd	22.7	9.2	18.0	20.6	12.6	17.4	17
The Port, Dun Laoghaire	22.3	14.9	29.2	26.2	15.9	12.6	20
					Limit Value		40(2)

(1) Sample not retrieved.
(2) EU Council Directive 1999/30/EC (as an annual average).

Table 2.7 Trends In Dublin City Air Quality – PM_{10} ($\mu g/m^3$)[3-5]

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year					
			1997	1998	1999	2000	2001	2002
College Street	Urban Traffic	Annual average PM_{10}	43	49	50	49	38	37
	Distance From Road = 4 m	24-hr PM_{10} > 50 $\mu g/m^3$	73	116	127	76	55	66
Rathmines	Urban Traffic	Annual average PM_{10}	21	19	18	19	28	19
	Distance From Road = 3 m	24-hr PM_{10} > 50 $\mu g/m^3$	9	12	3	6	23	12
Wood Quay / Winetavern St	Urban Traffic	Annual average PM_{10}	41	38	35	N.A.	28	23
	Distance From Road = 7 m	24-hr PM_{10} > 50 $\mu g/m^3$	74	66	45	N.A.	28	14
Phoenix Park	Suburban Background	Annual average PM_{10}	17	14	16	16	18	15
	Distance From Road = 250 m	24-hr PM_{10} > 50 $\mu g/m^3$	5	5	6	4	12	8
Crumlin	Urban Background	Annual average PM_{10}	-	-	18 (5 months data)		26	-
	Distance From Road = 8 m	24-hr PM_{10} > 50 $\mu g/m^3$	-	-	1 (5 months data)		9	-
Coleraine Street	Urban Traffic	Annual average PM_{10}	-			19	27	21
	Distance From Road = 3 m	24-hr PM_{10} > 50 $\mu g/m^3$	-	-	-	5	26	10
Marino	Suburban Background	Annual average PM_{10}	-	-	-	21	23	24
	Distance From Road = 250 m	24-hr PM_{10} > 50 $\mu g/m^3$	-	-	-	1	23	12

N.A. Not Available

Table 2.8 Trends In Dublin City Air Quality - Benzene (µg/m^3)[3-5]

Year	Winetavern Street	Crumlin
2000	0.9	<2.0
2001	4.9	2.1
2002	3.8	1.3
2003	1.6	N/A
EU Limit Value	5.0[1]	

(1) EU Council Directive 2000/69/EC (as an annual average).

Table 2.9 **Results of EU/LIFE RESOLUTION benzene passive diffusion tube monitoring campaign at monitoring positions close to the route of the Sutton to Sandycove Cycle Lane.**

Location	Period I 24/9/00 - 1/10/00 Benzene ($\mu g/m^3$)	Period II 26/11/00 - 3/12/01 Benzene ($\mu g/m^3$)	Period III 28/1/01 - 4/2/01 Benzene ($\mu g/m^3$)	Period IV 25/3/01 - 1/4/01 Benzene ($\mu g/m^3$)	Period V 27/5/01 - 3/6/01 Benzene ($\mu g/m^3$)	Period VI 22/7/01 - 29/7/01 Benzene ($\mu g/m^3$)	Average ($\mu g/m^3$)
Howth Road @ Kilbarrack Rd	1.7	- (1)	2.8	2.2	4.1	5.1	3.2
James Larkin Rd@ Prospect Av	1.4	0.8	1.4	2.1	1.1	1.5	1.4
Vernon Ave / Clontarf Road	1.5	0.9	1.2	2.2	0.9	1.4	1.4
Vernon Avenue, Clontarf	1.2	1.0	2.1	- (1)	1.1	1.2	1.3
Kincora Av, Clontarf	2.5	2.1	2.6	4.1	- (1)	2.9	2.8
18 Strandville Av Clontarf	1.2	1.4	2.1	2.2	1.3	1.7	1.7
Church St. East , East Wall Rd	- (1)	2.3	1.7	3.2	0.9	1.8	2.0
Dublin Port	1.4	1.0	1.7	- (1)	0.9	2.3	1.5
4 New Wapping St, North Wall	- (1)	1.3	1.8	3.5	1.0	3.3	2.2
South Dock Road, Ringsend	1.6	1.3	- (1)	2.1	2.1	2.0	1.8
Leahy's Terrace, Irishtown	1.6	1.0	1.3	3.0	1.2	1.9	1.7
Gilford Road, Sandymount	1.5	0.9	1.6	2.4	0.9	1.4	1.5
Herbert Av, Merrion	1.6	1.0	2.1	2.6	1.9	2.0	1.9
Seafield Rd, Stillorgan	1.2	1.3	1.2	- (1)	1.0	1.9	1.3
Shandon Park, Monkstown Rd	1.3	0.8	1.1	2.4	0.7	1.2	1.3
The Port, Dun Laoghaire	0.9	0.7	- (1)	1.7	0.8	1.2	1.1
					Limit Value		5 (2)

(1) Sample not retrieved.
(2) EU Council Directive 2000/69/EC (as an annual average).

Table 2.10 Monitored PM_{10} ($\mu g/m^3$) Concentrations Along The Proposed Route

Location	Date	PM_{10} ($\mu g/m^3$)
Clontarf Road	17/08/04 – 18/08/04	20
	18/08/04 – 19/08/04	(1)
	19/08/04 – 20/08/04	<7
Average		14
Merrion Gates	30/08/04 – 21/08/04	17
	31/08/04 – 01/09/04	29
	01/09/04 – 02/09/04	25
Average		24
EU Limit Value		40.0(1)

(1) EU Council Directive 1999/30/EC (as an annual average).

Table 2.11 PM_{10} Ambient Concentrations At A Monitoring Station In The Point Depot from 1/11/01 - 02/03/02.

Sample Date	PM_{10} ($\mu g/Nm^3$)	Sample Date	PM_{10} ($\mu g/Nm^3$)	Sample Date	PM_{10} ($\mu g/Nm^3$)
01/11/01	43	2411/01	12	17/12/01	38
02/11/01	25	25/11/01	13	18/12/01	40
03/11/01	20	26/11/01	22	19/12/01	32
04/11/01	16	27/11/01	21	22/03/02	2
05/11/01	23	28/11/01	22	**23/03/02**	**99**
06/11/01	16	29/11/01	24	24/03/02	29
07/11/01	10	30/11/01	15	25/03/02	22
08/11/01	16	01/12/01	12	26/03/02	44
09/11/01	32	02/12/01	13	27/03/02	37
10/11/01	22	03/12/01	9	**28/03/02**	**79**
11/11/01	17	04/12/01	17	**29/03/02**	**101**
12/11/01	12	05/12/01	22	**30/03/02**	**79**
13/11/01	32	06/12/01	-	31/03/02	5
14/11/01	28	07/12/01	25	01/03/02	9
15/11/01	25	**08/12/01**	**78**	02/03/02	23
16/11/01	34	**09/12/01**	**60**		
17/11/01	34	**10/12/01**	**52**		
18/11/01	25	**11/12/01**	**70**		
19/11/01	26	**12/12/01**	**96**		
20/11/01	21	13/12/01	45		
21/11/01	18	**14/12/01**	**61**		
22/11/01	32	**15/12/01**	**61**		
23/11/01	37	16/12/01	25		
Average				**33**	
Number of days > 50 $\mu g/m^3$				**11 (81.7th%ile)**	
EU Limit Value ($\mu g/Nm^3$)				**40$^{(1)}$, 50$^{(2)}$**	

Bold – days exceeding the maximum 24-hr limit value

(1) EU Ambient Air Standard (1999/30/EC) for PM_{10} (as an annual average).

(2) (2) EU Ambient Air Standard (1999/30/EC) for PM_{10} (maximum 24-hr limit value not to be exceeded more than 35 times per annum (90.1th%ile))