

# Review and Assessment of Air Quality City and County of Swansea

The Environment Act 1995: Part IV

Local Air Quality Management

## Progress Report July 2007

Title	<b>Progress Report 2007</b>
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Date	July 2007
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**Appendix 1 - Map - Hafod Air Quality Management Area**

**Appendix 2 - Map of Air Quality Monitoring Locations**

**Appendix 3 - Sample GPRS ATC Traffic Data**

## **Executive Summary**

This report contains the latest Progress Report required under the Local Air Quality Management timetable for review and assessment purposes. The report details the latest monitoring works undertaken during 2005-2006, outlines future developments that may impact upon air quality and the current progress being made within the Action Plan prepared for the Hafod Air Quality Management Area.

Passive nitrogen dioxide tube monitoring undertaken has indicated continued exceedence of the annual mean objective of  $40\mu\text{g}/\text{m}^3$  within the existing Hafod Air Quality Management Area. Monitoring has also indicated the possibility of widespread exceedences of the annual mean objective outside of the existing Hafod Air Quality Management Area within the Sketty, Llansamlet, Morriston, Fforestfach and St Thomas areas. No decision to proceed to Detailed Assessments within these areas will be made until the results are confirmed after a local bias correction factor has been determined. This work remains ongoing.

The City and County of Swansea participates in the UK Heavy Metals Monitoring Network and has monitoring stations within the Glais and Clydach areas monitoring the high level stack discharge from the nickel refinery within Clydach. Monitoring results during 2005-2006 have confirmed the likelihood of exceedence of the 4<sup>th</sup> Daughter Directive critical threshold monitoring target values. Additional monitoring stations are to be established both upwind and downwind of the release point and adopted onto the UK Metals Monitoring network.

Swansea has seen an upsurge in re-development works within the city, both on greenfield and brownfield sites - most notably the dock redevelopment at SA1. This development site has undoubtedly been the catalyst for the re-development and regeneration now being witnessed within Swansea. Several other re-development schemes are outlined within this report. More notably, the authority led regeneration proposals for the Tawe Riverside Development Corridor have the potential to impact significantly on conditions both within and outside of the existing Hafod Air Quality Management Area.

As a result of the considerable testing and development works now ongoing in respect of the Traffic Management Systems with Air Quality Monitoring Feedback modelling works contained within the authorities Action Plan for the Hafod Air Quality Management Area it is envisaged that the system will be proven by December 2007. However, further expansion and development of the system will be severely restricted by the budgetary constraints that the authority is now working to. There is no Capital allocation for 2007/2008 or subsequent years for this project and there is also a reduction in the Pollution Control Revenue budget for the financial year 2007/2008. This is also relevant to the hard physical works on the ground planned within the Hafod Air Quality Management Area.

# **1 The Swansea area**

The City and County of Swansea unitary authority covers a mixed area of extensive coastline, rural villages and the City of Swansea itself. The latest Census (June 2000) estimate for the population of Swansea is 230,300. The 2000 Census also indicates that 46,700 (20.3%) of the population were less than 17 years of age with 41,205 (17.9%) of the population being aged 65 or over.

To the west of the City of Swansea stands the gateway to the Gower Peninsula, an officially designated Area of Outstanding Beauty that boasts wide-open beaches and rugged shorelines. To the east of the City and County of Swansea lies the only major operational traditional “heavy industry” in the form of the Corus Steelworks complex at Port Talbot. Heavy industry has declined steadily within the boundaries of the authority during the last century. This former industrial activity has left its scars – most notably to the Lower Swansea Valley. From the early 1970’s the areas once blighted by slag heaps have undergone extensive remediation and greening. New “light industry” and retail outlets have moved back into the Lower Swansea Valley following the establishment of Enterprise Zone’s and industrial parks. Considerable regeneration is now ongoing within the Swansea area notably the docks re-development and within the city centre/marina area.

The major source of pollution is now vehicular. The topography of the Lower Swansea Valley is complex and it is thought that this aggravates pollution loading in the area.

Swansea is connected to major road and rail links. The M4 motorway travels through northern area of the authority, connecting Swansea with Carmarthenshire in the west and to Cardiff and Bristol to the east. The major

artery routes of the A483, A4067 and A48 connect Swansea city centre with the M4 motorway junctions to the north. Local traffic also use these routes as primary routes into the city centre.

Swansea is well served with rail links to the majority of the UK. The Inter-City 125 service from London Paddington terminates at Swansea. Local services operate from Swansea to mid and West Wales. A major locomotive-servicing centre operates within Swansea at Landore Diesel Sheds, primarily to service the power units of the Inter City 125 service. The majority of diesel locomotives operated by First Great Western are also serviced and maintained at this facility.

The older and established areas of Swansea comprise of traditional terraced housing. These areas tend to be, but are not exclusively within approximately 3 miles of the city centre. Areas of high density terraced housing still exist around the centres of population established during the Industrial Revolution.

As would be expected, new housing provision tends to be either of detached or semi-detached and during the last 20 – 30 years these developments have mainly been located in areas greater than 3 miles away from the city centre. This trend is changing however and within the last 5 years Swansea has seen the SA1 development within the old docks area provide a springboard for new housing development both within the SA1 development site and more lately within the marina area. This regeneration is now also extending into the heart of the city centre with several residential developments taking the place of several retail/business premises or occupying the upper floors of former wholly retail premises.

The Tawe Riverside Corridor Proposals will, if implemented see, the regeneration of a large section of the lower Swansea Valley from the Quay

Parade bridges upto the Morfa Retail Park. This area is subject to past historical industrial contamination from primarily metals processing and has been neglected for several decades. Some sites have been developed for industrial use but large sections of land remained in the same state following the lower Swansea Valley project of the late 1970's and early 1980's which dealt with the legacy of contamination by clearing derelict sites and undertaking limited remediation with extensive landscaping.

These new developments are outlined within section 6 and are provided for information within this report. A map indicating current air quality monitoring locations can be seen within annexe 2.

## **2 Statutory Background**

Part IV of the Environment Act 1995 required the production of a national strategy for air quality. The same Act places a duty on local authorities to carry out periodic reviews of air quality to determine if they will meet the objectives set out in the National Air Quality Strategy (NAQS). The National Air Quality Strategy was first published in March 1997 with the Air Quality Regulations providing the legal footing for the air quality objective's set out in the NAQS. The NAQS uses health-based standards to control the levels of seven designated air pollutants.

The NAQS has evolved over time and has seen the NAQS revised and republished as "The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Working Together for Clean Air". The revision integrated European air quality standards into UK policy and, eventually legislation for both England and the devolved administrations. In Wales the Air Quality Regulations 1997 have been superseded by the Air Quality (Wales) Regulations 2000 which themselves have been amended with the Air Quality (Amendment) (Wales) Regulations 2002 and came into effect on 31<sup>st</sup> December 2002.

### **2.1 Previous Review and Assessment Works**

The local authority review and assessment process is multi-staged. This Authority carried out its first stage review in 1999. The conclusion reached was to progress to a second and third stage review for Benzene, Particulate Matter (PM<sub>10</sub>), Sulphur Dioxide (SO<sub>2</sub>) and Nitrogen Dioxide (NO<sub>2</sub>).

In between these stages, the authority had to deal with and resolve a burning, disused coal spoil tip at the former Brynlliw Colliery site. This absorbed most resources available between 1999 and 2000.

Along with all other local authorities, this authority has completed its stage 2 and stage 3 reviews. The third stage review and assessment concluded that despite the indication that the air quality objective for benzene would not be met that the declaration of an AQMA was not appropriate. Given the fundamental changes proposed to the Lower Swansea Valley's infrastructure and the technical improvements proposed in the reduction in the benzene content in fuel, it was recommended that a further benzene monitoring study be carried out for a period of at least 12 months. During the stage 3 process, it was determined that the authority would not breach the objectives laid down for Particulate Matter (PM<sub>10</sub>) and Sulphur Dioxide (SO<sub>2</sub>).

Section 83(1) of the Environment Act 1995 requires the Authority to designate as Air Quality Management Areas (AQMA's) those areas where it is likely that the standards for any of the identified pollutants would be exceeded. As a result of the detailed work carried out in the authorities' third stage review and assessment it was found that areas of the Hafod were likely to fail the NO<sub>2</sub> annual mean objective of 40µg/m<sup>3</sup> by the compliance date of 31<sup>st</sup> December 2005.

On the 12<sup>th</sup> September 2001 the Authority declared The Hafod Air Quality Management Area (NO<sub>2</sub>), cited as the City & County of Swansea (Hafod Air Quality Management Area (NO<sub>2</sub>)) Order 2001. The Order came into force on the 14<sup>th</sup> September 2001. Annexe 1 contains a map indicating the AQMA area.



The Stage 4 review required under Section 84(1) of the Environment Act 1995 confirmed the earlier findings and that the declaration of the Hafod AQMA was justified as several locations were projected to fail the nitrogen dioxide (NO<sub>2</sub>) annual mean objective in 2005.

Section 84 of the Environment Act 1995 requires the formulation of a written plan in pursuit of the achievement of air quality standards and objectives within the designated AQMA and has become known as the “Action Plan”. The City and County of Swansea have undertaken a considerable amount of feasibility and infrastructure work in formulating its Action Plan resulting in delays in production of the report. The completed Action Plan was submitted for consideration to the Welsh Assembly Government in December 2004.

In 2004, the authority commenced works on the second round of review and assessment. In accordance with the policy and technical guidance documents, the second round of review and assessment was carried out in two stages;

- An Updating and Screening Assessment (USA) - intended to identify aspects that have changed since the first round of review and assessment (from 1999 in Swansea's case) and identify those that require further assessment; namely
- A Detailed Assessment of those pollutants that have been identified as requiring further work and investigation

The Updating and Screening Assessment was submitted to the Welsh Assembly Government in July 2004 with a recommendation to proceed to a detailed assessment for nitrogen dioxide at identified narrow congested streets and busy junctions. The USA also concluded that particulate matter PM<sub>10</sub> should also be investigated using real-time techniques at the identified narrow, congested

streets and busy junctions, despite the 2010 provisional objectives not being set in regulation.

A brief summary of the results and conclusions of the Detailed Assessment into NO<sub>2</sub> levels can also be found within the Progress Report 2004 – section 2.3.2.3 page 95. The Detailed Assessment itself was submitted to the Welsh Assembly Government during December 2005. This assessment concluded that there was no justification in declaring additional AQMA's. At the time of submission, there was a debate with the auditors and Welsh assembly Government over the bias factor used to correct the nitrogen dioxide passive diffusion tube data. The authority used the bias factor quoted by Harwell Scientifics to correct for tube bias. Whilst the Detailed Assessment report was eventually accepted by the Welsh Assembly Government and the auditors as a result of the authority providing additional supporting information and justification for the use of the Harwell Scientific bias factor it was agreed that the authority would undertake co-location studies with its chemiluminescent analysers at 3 sites namely, the Swansea AURN on Carmarthen Road, and at the Morfa and Morrision Groundhog sites. This work commenced during December 2006 and was delayed until the Swansea AURN had been relocated and commissioned to prevent any additional uncertainties.

The Progress Report for 2004/05 was submitted for consideration during July 2005

The infrastructure required for a real-time assessment of PM<sub>10</sub> is still being developed. The authority have purchased ten Met One E-Type light scattering PM<sub>10</sub> dust samplers and are in the process of deploying these at the identified narrow, congested roads and busy junctions mentioned within the last USA submitted in July 2004 and the Detailed Assessment. Identification of suitable

sites is now almost complete but what has proved time consuming are the practical considerations of the site location itself together with the provision of suitable services i.e. un-metered electricity feeds and suitable mounting points. It is recognised that these analysers do not have formal UK type approval but due to both the expense and considerable practical considerations of deploying Rupprecht & Patashnick Co., Inc. FDMS/TEOM's, these E Type samplers will provide a more accurate assessment than use of the DMRB screening tool would be able to provide. It is both hoped and envisaged that by the time these sites are established that the other infrastructure works to develop the capability to model air quality across the authority will be complete. The modelling will supplement the data collected by the E Type samplers.

Additional works underway include the collection of real-time classified counts of traffic data via the Vodafone GPRS network together with the construction of an emissions database. It is these latter items, particularly communications problems with the GPRS system that have delayed the modelling capabilities to date. The USA dated April 2006 was submitted for consideration to the Welsh Assembly Government in July 2006.

**2.2 Summary of LAQM Actions to date**

Details on the various stages completed by the authority in the Local Air Quality Management process are given below. Brynlliw Colliery remediation is shown for information purposes due to the delays in the LAQM process that this introduced. The Internet addresses (URL's) that these reports can be downloaded from are given where appropriate.

Report	Date Completed	Internet URL
<a href="#">1<sup>st</sup> Stage Review</a>	1999	<a href="http://www.swansea.gov.uk/index.cfm?articleid=5563">http://www.swansea.gov.uk/index.cfm?articleid=5563</a>

Brynlliw Colliery Remediation	1999-2000	
<a href="#">2<sup>nd</sup> &amp; 3<sup>rd</sup> Stage Review</a>	2001	<a href="http://www.swansea.gov.uk/index.cfm?articleid=5565">http://www.swansea.gov.uk/index.cfm?articleid=5565</a>
<a href="#">Declaration of Hafod AQMA</a>	September 2001	<a href="http://www.swansea.gov.uk/index.cfm?articleid=5557">http://www.swansea.gov.uk/index.cfm?articleid=5557</a>
<a href="#">Stage 4 Review</a>	October 2003	<a href="http://www.swansea.gov.uk/index.cfm?articleid=5568">http://www.swansea.gov.uk/index.cfm?articleid=5568</a>
<a href="#">2<sup>nd</sup> Round Review USA</a>	July 2004	<a href="http://www.swansea.gov.uk/index.cfm?articleid=5561">http://www.swansea.gov.uk/index.cfm?articleid=5561</a>
<a href="#">Hafod AQMA Action Plan</a>	December 2004	<a href="http://www.swansea.gov.uk/index.cfm?articleid=9930">http://www.swansea.gov.uk/index.cfm?articleid=9930</a>
<a href="#">Progress Report 2004</a>	July 2005	<a href="http://www.swansea.gov.uk/index.cfm?articleid=9929">http://www.swansea.gov.uk/index.cfm?articleid=9929</a>
Detailed Assessment	December 2005	
Progress Report 2006	July 2006	

## 2.3 Guidance

The Department for Environment, Food and Rural Affairs (DEFRA) has issued guidance documents to assist local authorities in conducting their duties under the Environment Act 1995. In accordance with Section 88(2) of the Environment Act 1995, local authorities are required to have regard to this guidance when carrying out any their duties under, or by virtue of Part IV of the Act.

Guidance has been issued in the form of Policy Guidance LAQM.PG (03) and Technical Guidance LAQM.TG (03).

LAQM.PG (03) replaces the second set of policy guidance documents published in March 2000 namely LAQM.G1(00), LAQM.G2(00), LAQM.G3 (00), and LAQM.G4(00).

LAQM.TG (03) replaces the guidance issued previously as LAQM.TG1 (00), TG2 (00), TG3 (00) and TG4 (00). LAQM.TG(03) has undergone further review. An update has been produced in January 2006 resulting in LAQM.TG(03) not being re-published in its entirety. The revisions and updates are provided as a series of FAQ's, supported where necessary by new LAQM tools. The revisions and updates focus upon experiences from the previous rounds of review and assessments and concern the following issues:

- Background pollution maps and future year calculation tools
- Emissions of sulphur dioxide from steam locomotives
- Emissions of sulphur dioxide from shipping
- Emissions of PM<sub>10</sub> from poultry farms
- Data ratification procedures
- NO<sub>x</sub>:NO<sub>2</sub> relationships

The new guidance sets out the legislative framework for local air quality management (LAQM). It is seen as an integral part of delivering the Air Quality Objectives set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland published in January 2000, The Air Quality (Wales) Regulations 2000 and the Air Quality (Wales) (Amendment) Regulations 2002.

Following the first round of review and assessments DEFRA and the Devolved Administrations commissioned a detailed evaluation of first round of reviews and assessments undertaken by local authorities. The main aim was to look at aspects of the LAQM process that worked well and aspects that could usefully be improved upon.

The formulation of the new guidance was the subject of considerable consultation and aims to build on the experiences previous reviews and assessments. Where applicable, all guidance has been considered in the production of this Progress Report.

## **2.4 The Air Quality (Wales) Regulations 2000 as amended by the Air Quality(Amendment)(Wales) Regulations 2002**

The 2000 and 2002 Regulations provide the statutory basis for the system of Local Air Quality Management (LAQM) and prescribe the standards and objectives to be achieved for those pollutants set in regulation. The Regulations also provide dates by which these standards and objectives are to be achieved. The 2002 Amendment Regulations introduce a second air quality objective for benzene of  $5\mu\text{g}/\text{m}^3$  or less, when expressed as an annual mean, to be achieved by 31<sup>st</sup> December 2010. The 2002 Amendment Regulations also alter the air quality objective for carbon monoxide (CO), which is to be achieved by 31<sup>st</sup> December 2003 to a maximum daily running 8 hour mean of  $10\text{mg}/\text{m}^3$  or less.

The pollutants set in regulation together with the target dates for compliance are set out in table 1 below. Table 1 also includes the permitted exceedences allowed under the regulations.

Pollutant	Air Quality Objective		Permitted Exceedences	Compliance Date
	Concentration	Measured As		
Benzene	16.25µg/m <sup>3</sup>	Running Annual Mean	N/a	31/12/2003
	5µg/m <sup>3</sup>	Annual Mean	N/a	31/12/2010
1,3-Butadiene	2.25µg/m <sup>3</sup>	Running Annual Mean	N/a	31/12/2003
<sup>1</sup> Carbon Monoxide	10mg/ m <sup>3</sup>	Max daily running eight hour mean	N/a	31/12/2003
Lead	0.5µg/m <sup>3</sup>	Annual Mean	N/a	31/12/2004
	0.25µg/m <sup>3</sup>	Annual Mean	N/a	31/12/2008
<sup>2</sup> Nitrogen Dioxide	200µg/m <sup>3</sup>	1 Hour Mean	18	31/12/2005
	40µg/m <sup>3</sup>	Annual Mean	N/a	31/12/2005
Particles PM <sub>10</sub>	50µg/m <sup>3</sup>	24 Hour mean	35	31/12/2004
	40µg/m <sup>3</sup>	Annual Mean	N/a	31/12/2004
Sulphur Dioxide	350µg/m <sup>3</sup>	1 hour Mean	24	31/12/2004
	125µg/m <sup>3</sup>	24 Hour Mean	3	31/12/2004
	266µg/m <sup>3</sup>	15 Minute mean	35	31/12/2005

Table 1 – Objectives included in the Air Quality (Wales) Regulations 2000 and Air Quality (Wales) (Amendment) Regulations 2002

<sup>1</sup> As amended by the Air Quality (Wales) (Amendment) Regulations 2002

<sup>2</sup> The objectives for nitrogen dioxide are provisional

## 2.5 UK Objectives not as yet set in Regulation

The new particles objectives (PM<sub>10</sub>) for 2010 announced by the Welsh Assembly Government on the 18<sup>th</sup> September 2002 are provisional objectives and will not, for the time being, be included in Regulation for purposes of LAQM in Wales. These particle objectives may be set in regulation once the EU has decided its new limit value. Therefore, the City and County of Swansea are only required to review and assess PM<sub>10</sub> particles as prescribed in the Air Quality (Wales) Regulations 2000. However, both the guidance and Welsh

Assembly Government recommends that local authorities include a provisional assessment of whether or not the new particles objectives are likely to be met in their reviews and assessments. The new provisional particles PM<sub>10</sub> objectives are set out below in table 2.

Pollutant	Air Quality Objective		Permitted Exceedences	Compliance Date
	Concentration	Measured As		
Particles PM <sub>10</sub>	50µg/m <sup>3</sup>	24 Hour mean	7	31/12/2010
	20µg/m <sup>3</sup>	Annual Mean	N/a	31/12/2010

*Table 2 – Provisional Particles PM<sub>10</sub> Objectives for 2010*

The council has taken limited regard to this advice given the current status of European negotiations and the consultations taking place over the UK Strategy

## **2.6 The Purpose of the Progress Report**

Progress Reports have been introduced into the LAQM system following a detailed evaluation of the first round of local authority review and assessment (see 1.3 above). A need was identified to develop a longer-term vision for both LAQM and the review and assessment process. The process was seen as being too start-stop, with some local authorities completing their first round of review and assessment and then doing little or nothing for several years until the next round of reviews commenced. Updating and Screening Assessments are now required at intervals of three years whilst Progress Reports maintain the continuity and are to be produced in the intervening years.

Progress reports should ensure a continuity in the LAQM process and should help local authorities:-



- by helping retain a profile for LAQM within the authority, including the retention of staff with a knowledge of air quality issues
- by providing a means for communicating air quality information to members and the public
- by maximising the usefulness and interpretation of the monitoring effort being carried out by the local authority
- by maximising the value of investment in monitoring equipment
- by making the next round of review and assessment that much easier, as there will be a readily available up-to date source of information
- by helping local authorities respond to requests for up-to-date information on air quality
- by providing information to assist in other policy areas, such as transport and land use planning
- by providing a ready source of information on air quality for developers carrying out environmental assessments for new schemes
- by demonstrating progress with implementation of air quality Action Plans and/or air quality strategies
- by providing a timely indication of the need for further measures to improve air quality, rather than delaying until the next full round of review and assessment

There is a separate requirement for those authorities who are implementing air quality Action Plans to prepare annual Progress Reports on the actions completed or those that are still being implemented in the pursuit of compliance with the air quality objectives within the AQMA. As has been mentioned above, this authorities Action Plan for the Hafod AQMA was submitted to the Welsh Assembly Government in December 2004. As recommended within the Progress Report Guidance LAQM.PRG (03) details of the progress made to date with the

identified actions points listed within the authorities Action Plan are included within this report and can be seen within chapter 7.

This Progress report has been prepared having had regard to the guidance issued under Progress Report Guidance LAQM.PRG (03).

## **3 New Monitoring Data**

### **3.1 Automatic Real-Time Data within Hafod AQMA**

#### **3.1.1 Morfa Groundhog**

The Morfa station has been operational since August 2000 and is located in a fairly open area on a grass bank to the Morfa / Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. The station is within the boundary of the Hafod AQMA and has been given a site classification Kerbside (U1)<sup>1</sup>.

As with the majority of monitoring stations, the location finally chosen for monitoring has to be a compromise between the ideal desired location and the practicalities of siting a station of this size. It is recognised that this station having being sited adjacent to a roundabout is not ideally placed. However, in saying this, the station satisfies the majority of the monitoring criteria required by this authority with receptor locations (dwellings) being located within 25m. Due to its location in a fairly open aspect of the lower valley area, this station does not truly reflect the conditions experienced within the narrow congested streets within the Hafod Air Quality Management Area.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring CO, SO<sub>2</sub> and NO<sub>x</sub>. The R&P TEOM

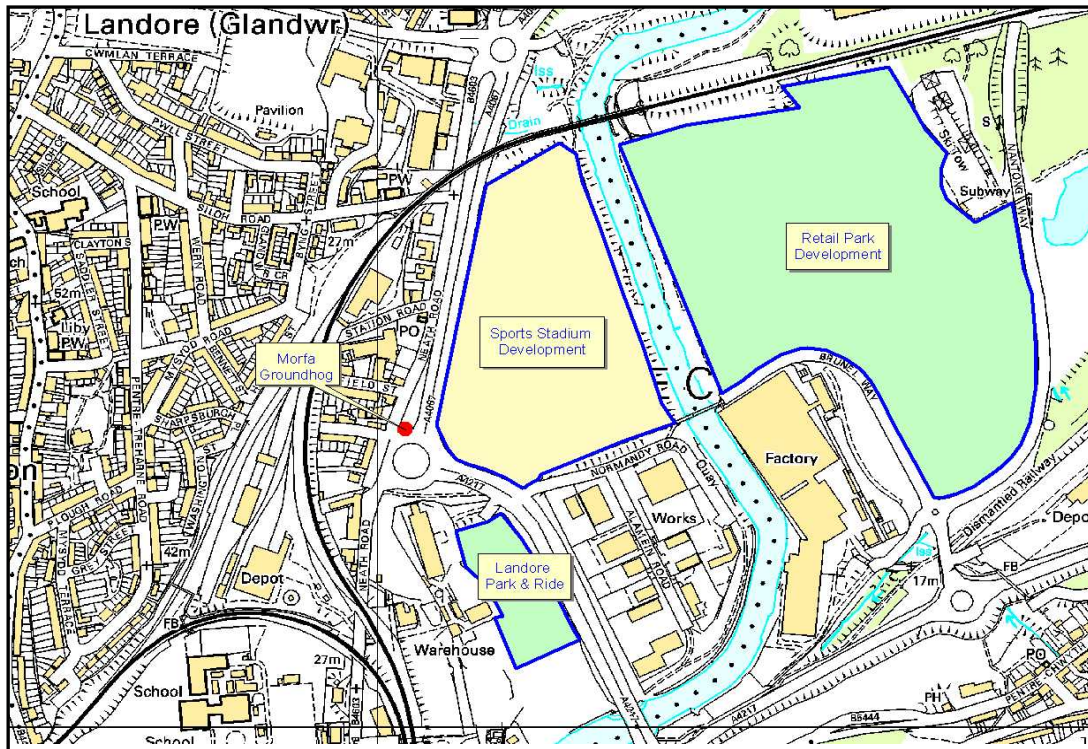
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<sup>1</sup> Source LAQM.TG(03) Appendix A page A1-42

measuring PM<sub>10</sub> was upgraded to a Thermo FDMS unit again measuring PM<sub>10</sub> on the 28<sup>th</sup> November 2006 with data capture for the FDMS unit commencing at 13:00 . The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine fortnightly manual calibrations. The analyser's are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analysers are also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. Since the awarding of the contract by the Welsh Assembly Government to NETCEN to run the Welsh Air Quality Forum in April 2004, all equipment on site is fully audited twice yearly by NETCEN together with the calibration gases stored on site. The L10 cylinders are replaced on a regular basis and are to a certified and traceable standard.

A map showing the location of the Morfa Groundhog station is given below as map 1



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Map 1 Location of Morfa Groundhog station

### 3.1.2 Results of automatic monitoring 2005 – 2006

### 3.1.3 Nitrogen Dioxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time NO<sub>x</sub> analyser. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified<sup>2</sup>. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the annual mean.

<sup>2</sup> LAQM TG(03) Appendix A - Monitoring page A1-37

Following rescaling works using the factors derived from the routine calibration of the analyser, NO<sub>2</sub> is determined by NO<sub>x</sub> - NO = NO<sub>2</sub>. All existing stored NO<sub>2</sub> data is overwritten (within the working ASCII file only) with the rescaled derived NO<sub>2</sub> data.

All results are presented in µg/m<sup>3</sup> by multiplying the logged result in ppb by the conversion factor of 1.91<sup>3</sup> to produce results expressed in µg/m<sup>3</sup>.

Data from 2005 and 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 3. For the sake of completeness, data is also shown from 2003 and 2004. A graph of the 2005-2006 measurements is shown below as chart 1.

Morfa Groundhog											
Annual Mean (40µg/m <sup>3</sup> )				Max 1-hour (200µg/m <sup>3</sup> )				Exceedences of 1-hour std (18 permitted)			
2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
36.6	33.5	33.9	38.1	155.1	201.6	169.7	177.6	0	1	0	0

Table 3 - Nitrogen Dioxide monitoring data - Morfa Groundhog 2003 - 2006

<sup>3</sup> LAQM.TG(03) Appendix B - Conversion factors page A1-44

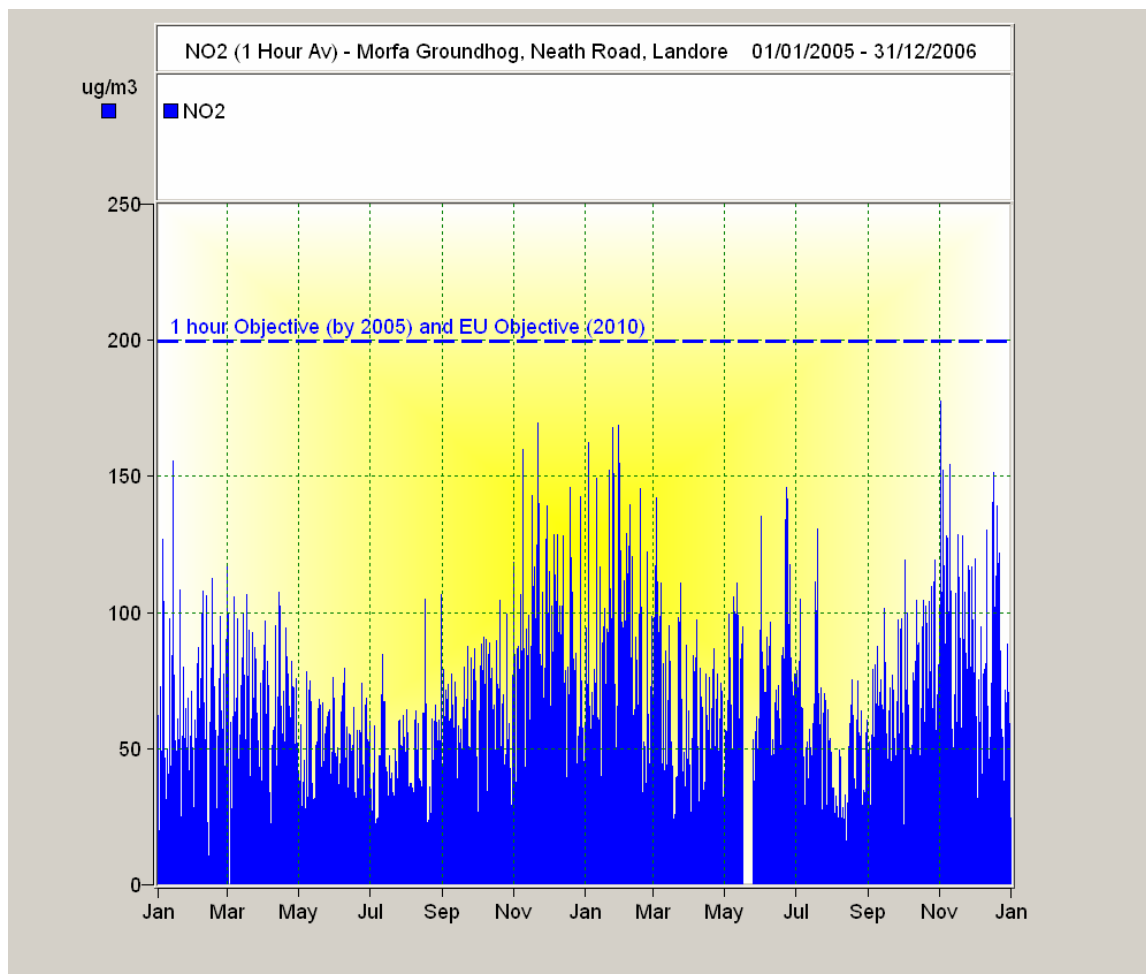


Chart 1 – NO<sub>2</sub> 1 hour means 2005-2006 – Morfa Groundhog

The annual NO<sub>2</sub> means for 2005 and 2006 are below the 40µg/m<sup>3</sup> objective for both 2005 and the provisional objective in 2010. Hourly NO<sub>2</sub> data capture for 2005 is 98.93 %, and for 2006 is 95.89%. These data capture rates permit the direct compilation of hourly exceedences rather than the use of the 99.8<sup>th</sup> percentile of hourly means<sup>4</sup>.

However, what is most noticeable is the reversal of the previously identified reduction trend in annual mean NO<sub>2</sub> concentrations both nationally and locally here in Swansea with the NO<sub>2</sub> mean for 2006 being exceptionally close to the EU objective level in 2010. This new upward trend with NO<sub>2</sub> concentrations has

<sup>4</sup> LAQM TG(03) box 6.2 page 6-16 (applies to data outside AQMA – assumption made that this approach is valid within AQMA as well)

been observed at numerous other roadside sites throughout the UK. From literature already published on this reversal of the NO<sub>2</sub> reduction trend it is thought likely that oxidation catalysts fitted to newer EURO classification vehicles are emitting greater concentrations of primary NO<sub>2</sub> direct from the exhaust tailpipe.

If this trend continues, then, despite the fact that the Morfa Groundhog is located within a fairly open aspect of the lower Swansea valley area it could result in failure to comply with the EU objective in 2010. It should be restated that the Morfa Groundhog is at present located within the boundary of the Hafod AQMA and should this trend continue, there would be no requirement to either amend the existing AQMA or to extend the boundary.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls)). Using 2006 as the base year a projection of 32.95µg/m<sup>3</sup> is obtained for 2010 which remains below the EU objective of 40µg/m<sup>3</sup>. The Year Adjustment Calculator v2.2a is dated 19<sup>th</sup> January 2006 and was probably issued prior to the full impact of the increased primary NO<sub>2</sub> emissions being recognised.

Ideally, monitoring data should be available for at least 5 years before trends in NO<sub>2</sub> concentrations can be meaningfully discussed. Monitoring commenced at this site during August 2000 so just over 5 years of monitoring data is available. The annual means from 2001 to 2006 are presented below within table 4 for a brief discussion on trends to be made. In addition and as an additional indicator, the maximum hourly concentrations recorded for each year are detailed.



Morfa Groundhog	Annual Mean (40µg/m <sup>3</sup> )						
	2001	2002	2003	2004	2005	2006	2010
	38.63	34.13	36.6	33.5	33.9	38.1	32.9
	Maximum Hourly Concentration (200µg/m <sup>3</sup> )						
	191.5	124.9	155.1	201.6	169.7	177.6	

Table 4 - Morfa Groundhog NO<sub>2</sub> monitoring results 2001 - 2006

The data presented within table 4 suggests that a gradual decline in NO<sub>2</sub> concentrations had started to be observed from 2001 levels. The exceptions to this are the annual mean result from 2003 and more recently for 2006. However, it has been observed not only here in Swansea<sup>5</sup> but also nationally<sup>6</sup> that meteorological conditions experienced during 2003 were atypical of previous years. The slight elevation of the NO<sub>2</sub> annual mean during 2003 can in all probability be attributed to "abnormal" meteorological conditions within the lower Swansea valley. There are no indications from the meteorological data recorded during 2006 to indicate that there were any prolonged periods of atypical weather. Breuer plot 1 below shows a domination of the period by the expected prevailing south westerly fetch together with periods of north-easterlies – a source not traditionally associated with elevated levels in Swansea.

Previous review and assessment works have projected forward to the key dates of 2005 and 2010. The various projections and source are indicated below in table 5

<sup>5</sup> City & County of Swansea Updating and Screening Assessment - July 2004 page 64

<sup>6</sup> Met Office - Air Quality Wales - Welsh Air Quality Forum Bulletin Issue 5 September 2003

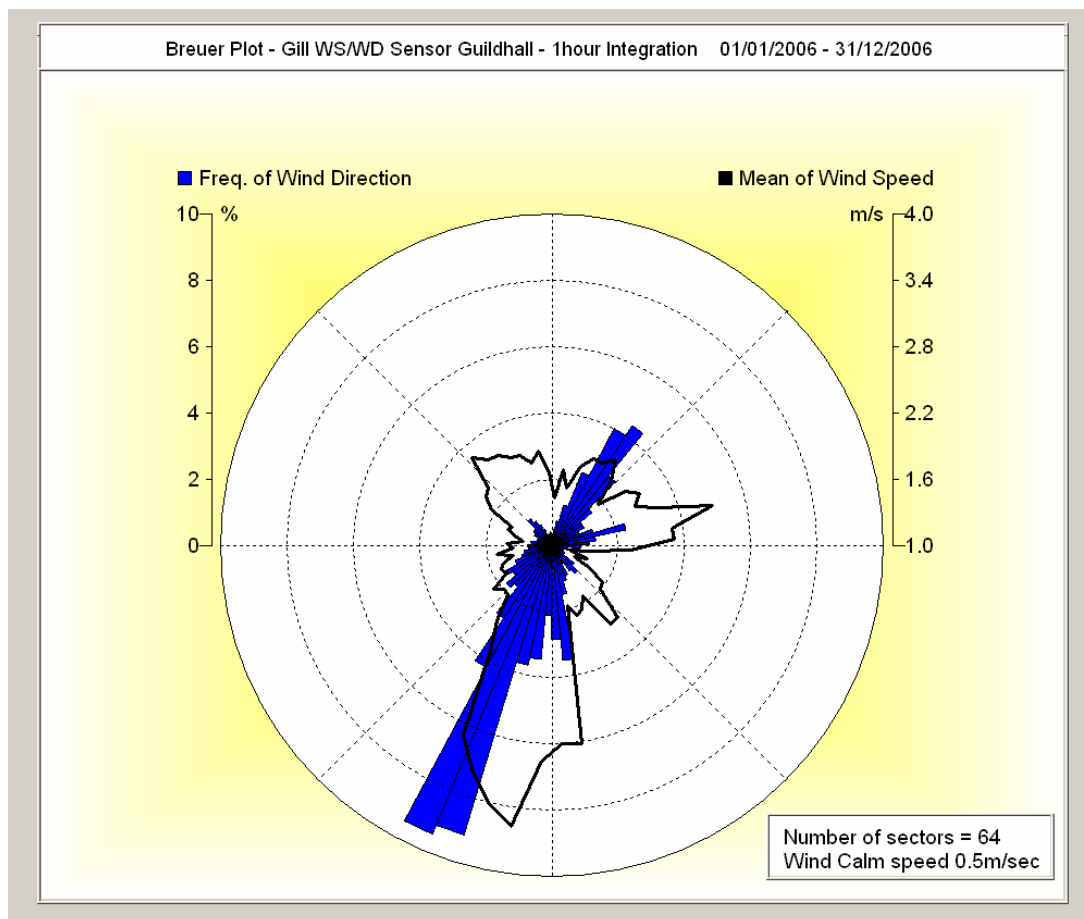
LAQM Report	Base year data	Annual Mean in Base Year	Projection for 2005 $\mu\text{g}/\text{m}^3$	Projection for 2010 $\mu\text{g}/\text{m}^3$
Stage 4 Review	2001	38.63	34.6	
Stage 4 review	2002	34.13	32	
USA 2004	2003	36.6	30.33	
Progress Report 2004	2004	33.5	32.66	26.87
USA 2006	2005	33.9		28.52
Progress Report 2007	2006	38.1		32.95

Table 5 – Morfa Groundhog Previous Projections 2005 and 2010

The data ranged from underestimating the 2005 annual mean by -10.5% (2003 base data) to an overestimate of 2% (from the 2001 base data). The 2001 base data produced the closest estimate. 2002 base data produced an underestimate of -5.6% and 2003 base data an underestimate of -3.6%.

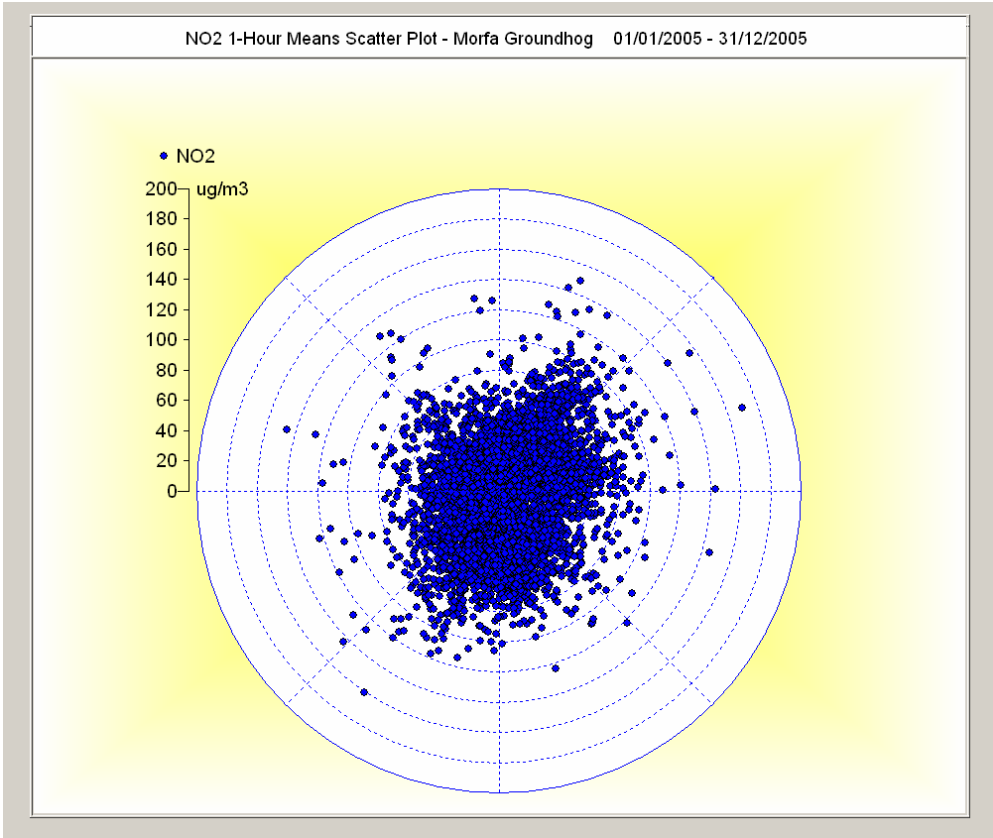
It must be noted that the method for projecting forward these predictions and the tools developed to enable this forward look have evolved over time i.e. the latest Year Adjustment Calculator (2006) uses 2004 as its base year.

Scatter Plot 1 for 2005 and Scatter Plot 2 for 2006 below indicate the spread of  $\text{NO}_2$  data. Whilst there is evidence of elevated levels during 2006 from the north-east sector, these are mirrored in other directions and are not thought to significantly account for the increase in annual mean concentration during 2006.

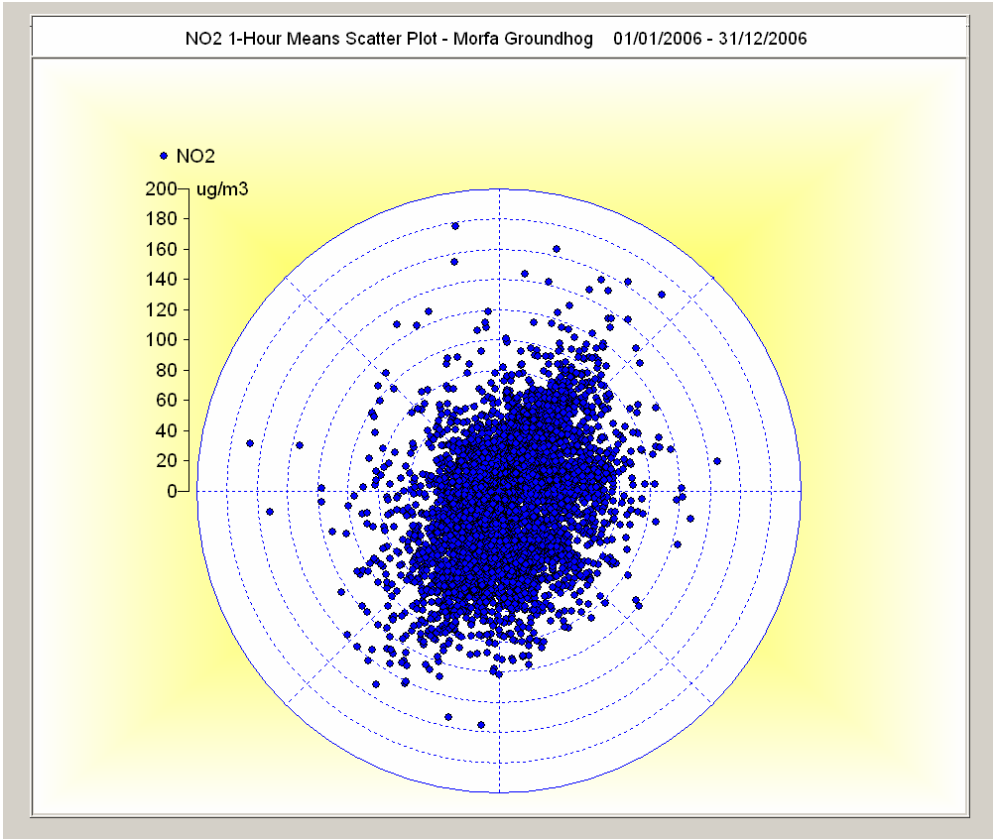


Breuer Plot 1 – Swansea Meteorological Conditions 2006

The meteorological station located on the fringes of Swansea Bay foreshore at the Guildhall has been used to generate the above plot as the 9m mast located at the Morfa Groundhog site is experiencing significant shielding to winds from a northern section between approximately 320° to 30° which is thought to be due to a section of trees. The largest of these trees have recently been felled in an attempt to improve the situation but it's unlikely that a free field of measurement can be obtained and then maintained.



Scatter Plot 1 – NO<sub>2</sub> data 1-hour mean 2005



Scatter Plot 2 – NO<sub>2</sub> data 1-hour means 2006

Again, meteorological data from the Guildhall station has been used within scatter plots 1 and 2 above. Whilst it is accepted that this is not ideal due to the complex topographical induced meteorological features of the lower Swansea valley it represents the best local indicative meteorological data available.

It is now possible that a reversal in this downward trend is starting to be observed with a pronounced elevation in the annual mean concentration for 2006. As mentioned above, this, at present, is thought most likely to be attributable to the newer EURO classification vehicles directly emitting increased concentrations of primary NO<sub>2</sub>. Whilst the upward “trend” has only been observed during the last year if the reasons for the sudden increase in concentrations are verified then, this would have implications for future years and compliance with EU objectives within other areas of Swansea not previously thought to be at risk of failing.

### **3.1.4 Particulate Matter PM<sub>10</sub>**

The new particles objectives (PM<sub>10</sub>) for 2010 announced by the Welsh Assembly Government on the 18<sup>th</sup> September 2002 are provisional objectives broadly in line with the Stage 2 limit values. These provisional objectives will not, for the time being, be included in Regulation for purposes of LAQM in Wales. These particle objectives may be set in regulation once the EU has decided its new limit value. Therefore, the City and County of Swansea are only required to review and assess PM<sub>10</sub> particles as prescribed in the Air Quality (Wales) Regulations 2000. However, both the guidance and Welsh Assembly Government recommends that local authorities include a provisional assessment of whether or not the new particles objectives are likely to be met in their

reviews and assessments. The new provisional particles  $PM_{10}$  objectives are set out in table 2 above.

Monitoring already undertaken has shown that the 24-hour objective was more stringent than the annual mean objective. The opposite will be true in 2010 with the annual mean objective being more stringent than the 24-hour objective.

However, there is currently great debate on future UK policy in regards to particulate matter. It is clear that the delayed publication of the Air Quality Strategy (AQS) review puts a significant question mark against the adoption of the provisional  $PM_{10}$  objectives outlined above. The planned consultation for the AQS review was scheduled to commence during the autumn of 2005 but has been significantly delayed (eventually being produced during April 2006.)

Added to the above, the City & County of Swansea are having regard to the Clean Air for Europe (CAFÉ) proposals and are actively considering our position on  $PM_{2.5}$  reduction schemes. CAFÉ propose protection of public health by effecting overall reduction in population exposure to particulate matter and not just concentrating efforts at identified local “hot-spots”. Latest evidence from the World Health Organisation (WHO) and the Commissions own Scientific Committee on Health and Environmental Risk has strongly suggested that the smallest of the fine particles ( $PM_{2.5}$ ) need to be regulated. This is why the Commission of the European Communities Strategy and accompanying CAFÉ proposal to revise the Ambient Air Quality Directive would, for the first time introduce controls on human exposure to  $PM_{2.5}$ . As there is a lack of evidence at present to identify a threshold below which  $PM_{2.5}$  would not pose a risk, this pollutant should not be regulated in the same way as pollutants are presently. The proposed approach would establish an absolute concentration cap for  $PM_{2.5}$  in ambient air in the most polluted areas at a level that would prevent

unduly high risks to the population. This would be coupled with an obligation on Member States to reduce average human exposure in the urban background over the period 2010-2020. As far as possible, Member States would have to aim for a 20% reduction.

CAFÉ with DEFRA support appear to be effecting a change with the EU policy position on particulate matter. Until these uncertainties are clarified and a clear direction forwards identified, there seems to be little to be gained in undertaking works to project current PM<sub>10</sub> levels forwards to the provisional objectives date in 2010. As such therefore, this Progress Report will only evaluate particulate matter within the objectives currently set within existing regulation.

However, the City & County of Swansea are commencing a PM<sub>2.5</sub> survey to establish some basic background and kerbside data for the County. A Thermo FDMS PM<sub>2.5</sub> unit has been co-located alongside a Thermo FDMS PM<sub>10</sub> unit at the relocated Swansea AURN site during October 2006 for comparison purposes.

### **3.1.4.1 Rupprecht & Patashnick Co., Inc. TEOM**

A Rupprecht & Patashnick Co., Inc. TEOM measured particulate Matter PM<sub>10</sub> at the Morfa Groundhog site until the 18<sup>th</sup> October 2006 at 11am. On this date, the existing R&P TEOM system was removed from site pending an upgrade to the Thermo Inc FDMS PM<sub>10</sub> system. The Thermo FDMS system was installed on the 28<sup>th</sup> November 2006, (see 3.1.4.2 below) providing equivalency with the EU reference gravimetric method. In hindsight, it may have been prudent to delay the upgrade until January 2007 and obtain a full year of measurement with the existing R & P TEOM PM<sub>10</sub> system.

The logged 15-minute means from the R & P Co. Inc TEOM have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified<sup>7</sup>. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate both the daily 24-hour means and the annual mean. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly means were specified to be present<sup>8</sup>.

All results are presented in  $\mu\text{g}/\text{m}^3$  and have been corrected with the interim default correction factor of 1.3 to estimate gravimetric concentration. For ease of comparison, results from the previous years (2003 and 2004) are shown alongside the results for 2005 and 2006 within table 6 below. A chart representing the 24-hour daily means from 2005-2006 is given below as chart 2 and a Breuer Plot representing the scatter of the 24-hour means during 2005 as Scatter Plot 3 and for 2006 Scatter Plot 4.

Morfa Groundhog PM <sub>10</sub> (TEOM)	Annual Mean (40 $\mu\text{g}/\text{m}^3$ )				24-hour Exceedences (50 $\mu\text{g}/\text{m}^3$ ) (35 permitted)			
	2003	2004	2005	2006	2003	2004	2005	2006
	30.7	29.17	27.13	29.27 *	40	28	8	17 *

Table 6 PM<sub>10</sub> (TEOM) Monitoring Results 2003-2006 Morfa Groundhog

\* Data capture for 2006 75.89% due to upgrade to Thermo FDMS unit 18<sup>th</sup> October 2006

The atypical meteorological conditions experienced during 2003 have been discussed in greater detail within the Updating and Screening Assessment dated July 2004 and can be viewed at <http://www.swansea.gov.uk/index.cfm?articleid=5561> along with further discussion within the Progress Report for 2004 dated July 2005 at <http://www.swansea.gov.uk/index.cfm?articleid=9929>

<sup>7</sup> LAQM.TG(03) Monitoring A1-37

<sup>8</sup> LAQM.TG(03) Monitoring A1-38



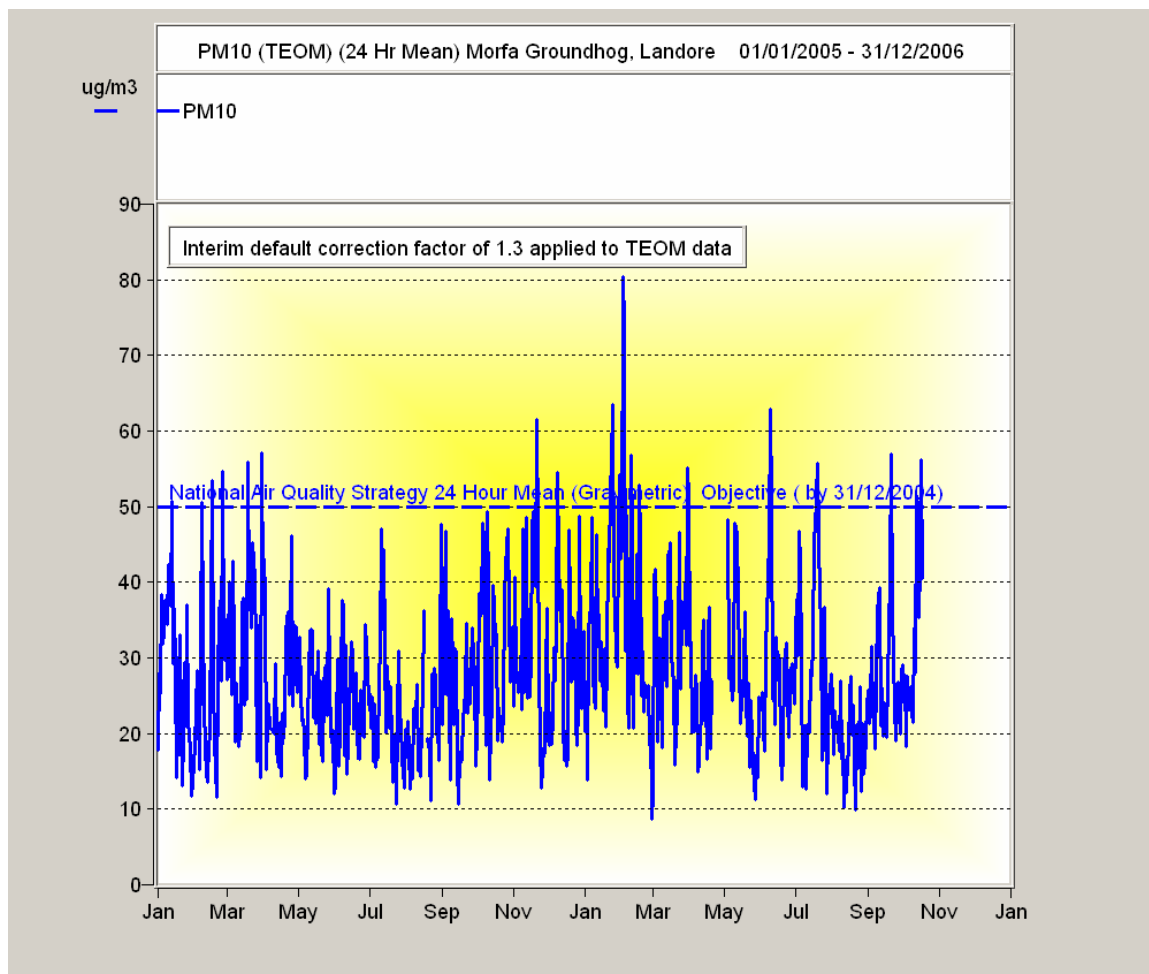
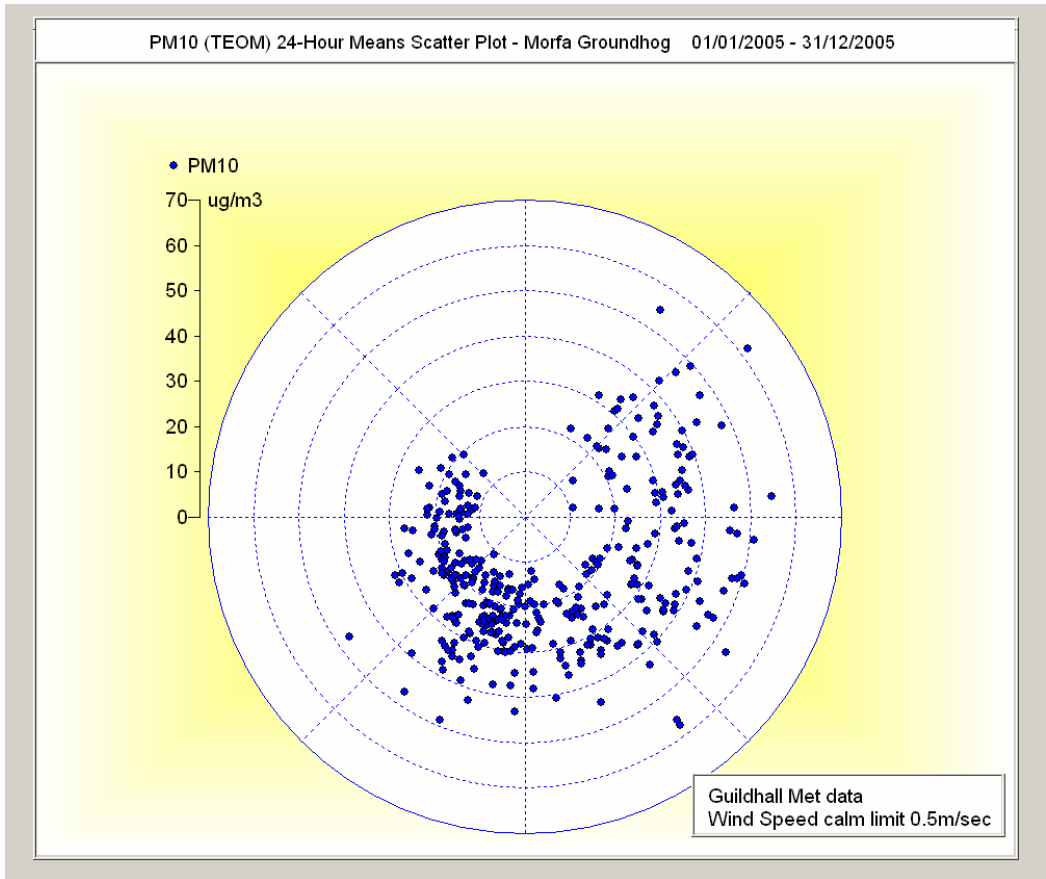


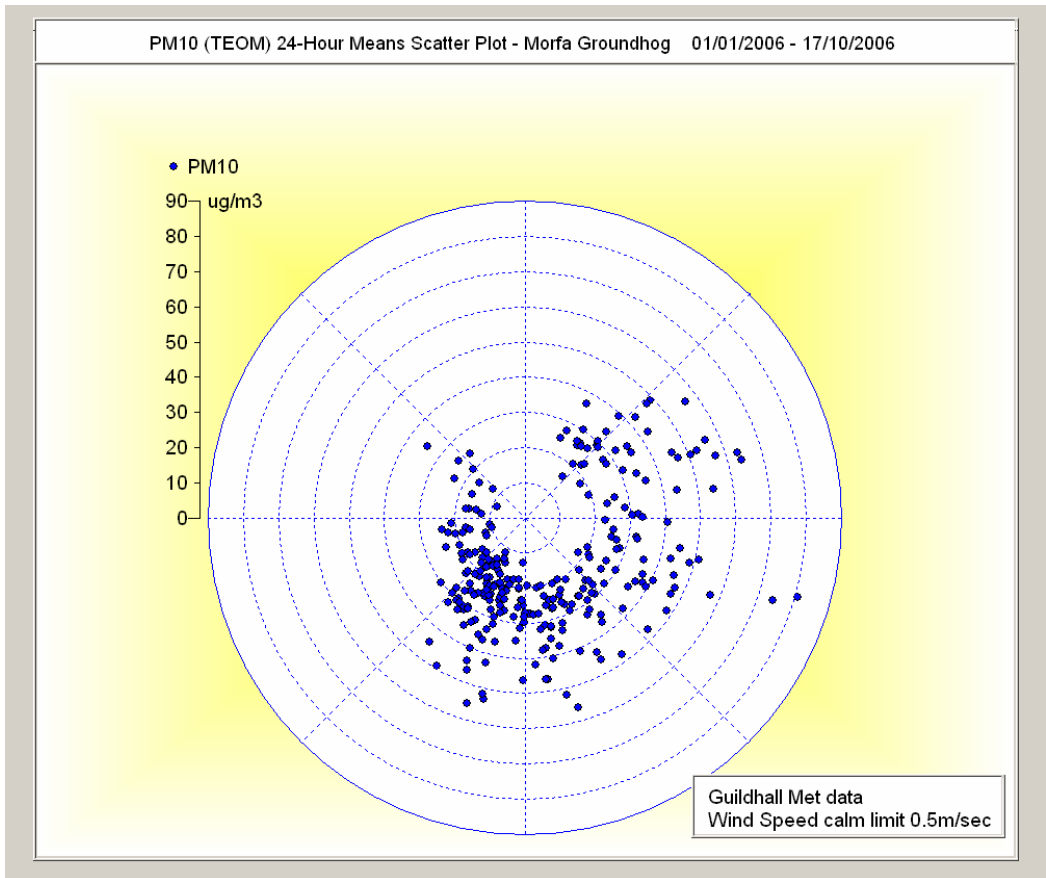
Chart 2 – 24-Hour PM<sub>10</sub>(TEOM) means – Morfa Groundhog 2005-2006

From table 2, it is evident that the data is showing compliance with the UK objective for 2005 (and also 2006) both in respect of the annual mean concentrations and permitted number of exceedences. The results for 2006 do not represent a full year of measurements with only 75% data capture due to the upgrade of the R & P TEOM commencing 18<sup>th</sup> October 2006.

Again, meteorological data from the Guildhall station has been used within scatter plots 3 and 4 below. Whilst it is accepted that this is not ideal due to the complex topographical induced meteorological features of the lower Swansea valley it represents the best local indicative meteorological data available



Scatter Plot 3 – PM<sub>10</sub> Morfa Groundhog 24-hour mean scatter 2005



Scatter Plot 4 – PM<sub>10</sub> Morfa Groundhog 24-hour mean scatter 2006

Breuer plots 2 and 3 above indicate the possible shielding of PM<sub>10</sub> by the tree line as mentioned above within 3.1.3. This shielding (as probably expected) is not evident in the scatter plots (see scatter plots 1 and 2 above) generated using ambient gas data from the site when combined with meteorological data from the station at the Guildhall. The scatter indicates no dominating direction during 2005 but hints at the more elevated levels during 2006 to be from a south-easterly and north-easterly direction.

In previous analyses undertaken of PM<sub>10</sub>, elevated levels of PM<sub>10</sub> emanating from a south-easterly direction has been associated with the heavy industry located in Port Talbot: notably, the Corus steel plant.

The extensive construction works under way within the area during 2003-2004 are evident from within the data. Accepting that 2003 exhibited atypical meteorological conditions the reduction in daily exceedences is clearly evident during 2005. This reduction was despite increased traffic loadings within the area. However, whilst the number of exceedences did not breach the objective (accepting the limitations of the dataset mentioned above) during 2006 at least double the amount of daily exceedences compared to 2005 were recorded. What is unsure at the moment is if this increase in exceedences can be attributed to the periods of south-easterly winds and influence of heavy industry, or, if it is another indication of the effect of the newer EURO classification vehicles locally.

The maximum daily mean for 2005 was 61.51µg/m<sup>3</sup> recorded on the 21<sup>st</sup> November 2005 with the maximum daily mean for 2006 being 80.37µg/m<sup>3</sup> recorded on the 3<sup>rd</sup> February 2006.

Data capture for 2005 was 99.45% and, as mentioned above for 2006 75.89%. Direct compilation of 24-hour exceedences rather than the use of the 90<sup>th</sup> percentile of 24-hour means is therefore only valid for 2005.<sup>9</sup> The 90<sup>th</sup> percentile for 2006 is 46.13

Data has not been projected forwards to 2010 within this Progress Report – see 3.1.4 above for details. Previous data reported within the Progress Report 2004 dated July 2005 have been projected forwards to 2010 from the 2004 annual mean. This work can be found on pages 17-18 at <http://www.swansea.gov.uk/index.cfm?articleid=9929>

### **3.1.4.2 Thermo Inc FDMS PM<sub>10</sub>**

The Thermo FDMS system was installed on the 28<sup>th</sup> November 2006, providing equivalency with the EU reference gravimetric method – section 5.5.3<sup>10</sup>

The dataset collected from the FDMS system is not directly comparable to the historical R&P TEOM dataset even given that the use of the advised interim default correction factor was advised to estimate the EU reference gravimetric method. This correction factor has been called into dispute by various studies at diverse locations throughout the UK deriving differing correction factors.

The data collected for 2006 from the FDMS unit amounts to a mere month at best and is reported here merely for information purposes. Additionally, brief operational issues that have been identified are outlined here for information as

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<sup>9</sup> LAQM.TG(03) Box 8.4 page 8-22

<sup>10</sup> DEFRA and devolved administrations report UK Equivalence Program for Monitoring of Particulate Matter dated 5<sup>th</sup> June 2006 at [http://www.airquality.co.uk/archive/reports/cat05/0606130952\\_UKPMEquivalence.pdf](http://www.airquality.co.uk/archive/reports/cat05/0606130952_UKPMEquivalence.pdf)

the operation of the FDMS units differs substantially from that of the R&P Teom units.

The FDMS units are required to operate within an ambient enclosure temperature range between 18-22°C<sup>11</sup>. Opinions vary as to the exact optimum temperature but Swansea's experience indicates around 18-20°C to be adequate and one that is capable of being maintained relatively stably by the installed air conditioning system.

The FDMS unit provides hourly integration data and has been configured as per DEFRA's FDMS parameter protocol. The RS232 port on the FDMS control unit allows the collection of up to 8 parameters via telemetry. The parameters collected from the FDMS units are : Volatile Mass, Non Volatile Mass, External Dew Point, Sample Dew Point, Filter loading, Noise, Status, External Ambient Air temperature. The control unit refers to these parameters in different terminology. However, the FDMS unit will not directly produce a PM<sub>10</sub> mass concentration. The PM<sub>10</sub> mass concentration is obtained via post processing of the volatile and non volatile mass parameters by creating a calculated channel within the database to subtract volatile mass from the non volatile mass.

AEA Energy and Environment has produced a new LSO operating procedure for the FDMS units. One of the more problematic issues with use of the FDMS units that this authority has found is the routine changing of both the purge filter (within the chiller unit) and the "normal" tapered element filter within the sensor unit. The chiller unit is held at approximately 4°C - upon removal of the filter housing, condensation can be seen on the filter holder. It is this authorities experience that should the new 47mm Pallflex TX40 MFAB filter be installed

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<sup>11</sup> UK Equivalence Program for Monitoring of Particulate Matter dated 5<sup>th</sup> June 2006 section 5.5.2

without ensuring the filter holder is dry then this can (and most certainly does) produce very noisy/spiky data. Correct orientation of the 47mm Pallflex TX40 MFAB filter within the filter holder is critical as incorrect orientation will result in poor quality data being returned. The 47mm filter and tapered element sensor unit filter should always be exchanged at the same time. Whilst the TEOM units did take up to 1-2 hours to stabilise after the sensor unit filter exchange and status code 4 OK being reached, the FDMS units can, and do, take even longer to stabilise. Should the site suffer a power failure or air conditioning failure then it is recommended that 3 hours data post resolution of either condition should be deleted from the dataset.

It should be noted that none of the data presented below has as yet been validated and ratified by QA/QC procedures. Chart 3 below shows the period 28<sup>th</sup> November – 31<sup>st</sup> December 2006.

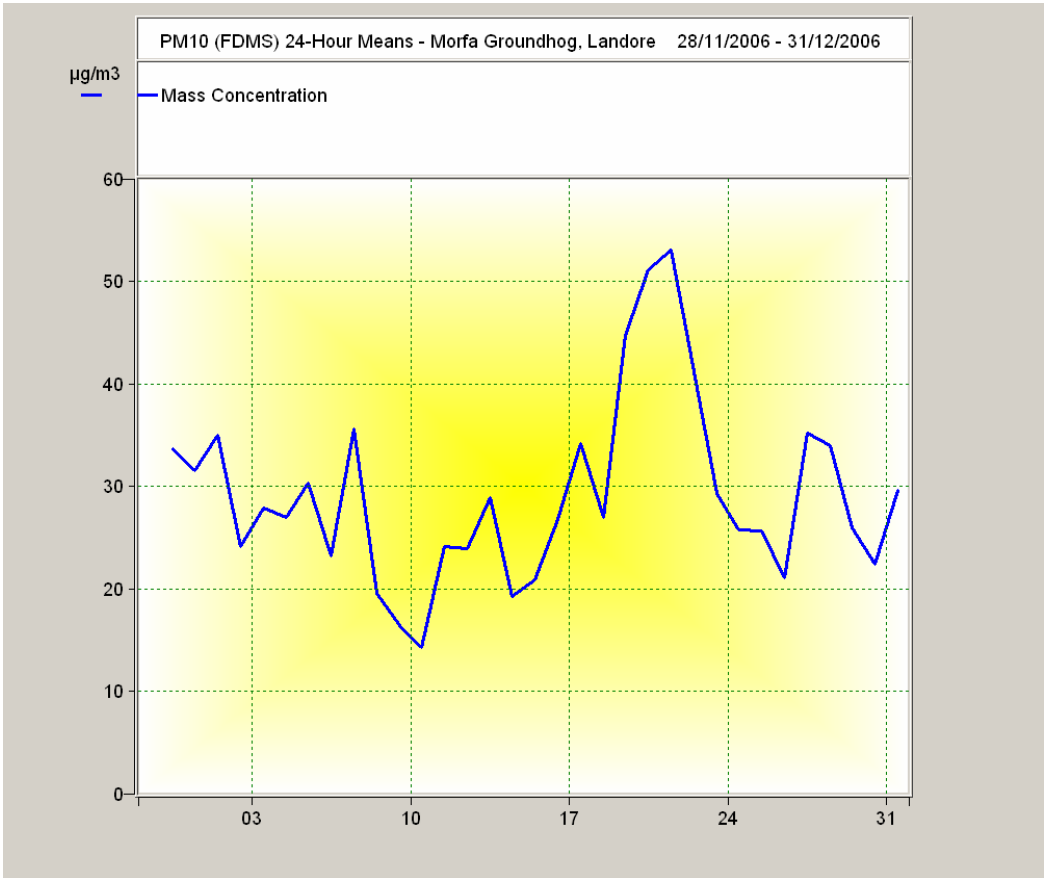


Chart 3 – PM<sub>10</sub> FDMS Morfa Groundhog 28<sup>th</sup> November – 31<sup>st</sup> December 2006

Data collected from the FDMS units has an integration period of 1-hour. PM<sub>10</sub> mass concentration is obtained via post processing of the volatile and non volatile mass parameters by the software package Opsis Enviman ComVisioner. The calculated hourly mean mass concentration data have then been further processed by the software package Opsis Enviman Reporter. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the calculated hourly means were specified to be present<sup>12</sup>.

The provisional mean for the 34 day period within the above data is 29.21µg/m<sup>3</sup> with the maximum 24-hour mean of 53.12µg/m<sup>3</sup> being recorded on the 21<sup>st</sup> December 2006. In total, there are two provisional, 24-hour means above 50µg/m<sup>3</sup> with the other exceedence occurring on the 20<sup>th</sup> December 2006.

### **3.1.5 Carbon Monoxide**

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time CO analyser. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the running eight hour means.

The running 8-hour mean for a particular hour, is the mean of the hourly average concentrations for that hour and the preceding 7 hours. The average period is stepped forward by one hour for each value, so running mean values are given for the periods 00:00 – 07:59, 01:00 – 08:59 etc. There are, therefore, 24

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<sup>12</sup> LAQM.TG(03) Monitoring A1-38

possible 8-hour means in a day (calculated from hourly data). In order for a running average to be valid, 75% data capture is required i.e. 6 hourly averages out of every 8 must be valid. The maximum daily running 8-hour mean is the maximum 8-hour running mean measured on any one day.<sup>13</sup>

All results are presented in mg/m<sup>3</sup> by multiplying the logged result in ppm by the conversion factor of 1.16<sup>14</sup> to produce results expressed in mg/m<sup>3</sup>. For ease of comparison with results from the previous year, the results obtained from 2003 and 2004 are shown within table 7 below. The date for compliance with the Air Quality (Amendment)(Wales) Regulations 2002 objective standard was the 31<sup>st</sup> December 2003. The EU objective of a maximum daily 8-hour running mean of 10mg/ m<sup>3</sup> with a compliance date of 2005 has also been achieved.

Year	Max 8-hour running mean
2003	3.17 mg/m <sup>3</sup>
2004	4.19 mg/m <sup>3</sup>
2005	2.92 mg/m <sup>3</sup> *
2006	3.08 mg/m <sup>3</sup>

*\* Results for October-December 2005 have now been ratified – different result presented within USA dated April 2006 as there was only provisional data available for this period*

*Table7 CO 8-hour means maximum concentrations 2003 - 2006*

Data capture for 2005 and 2006 are both above the 90% data capture rate mentioned within LAQM(TG)03<sup>15</sup>

A chart representing the 8-hour running means during 2005-2006 is given below as chart 4.

<sup>13</sup> Source LAQM.TG(03) – Monitoring – Calculation of exceedance statistics, paragraph A1.104 page A1-37.

<sup>14</sup> Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44

<sup>15</sup> Technical Guidance LAQM.TG(03) box 2.2 Monitoring. Page 2-5



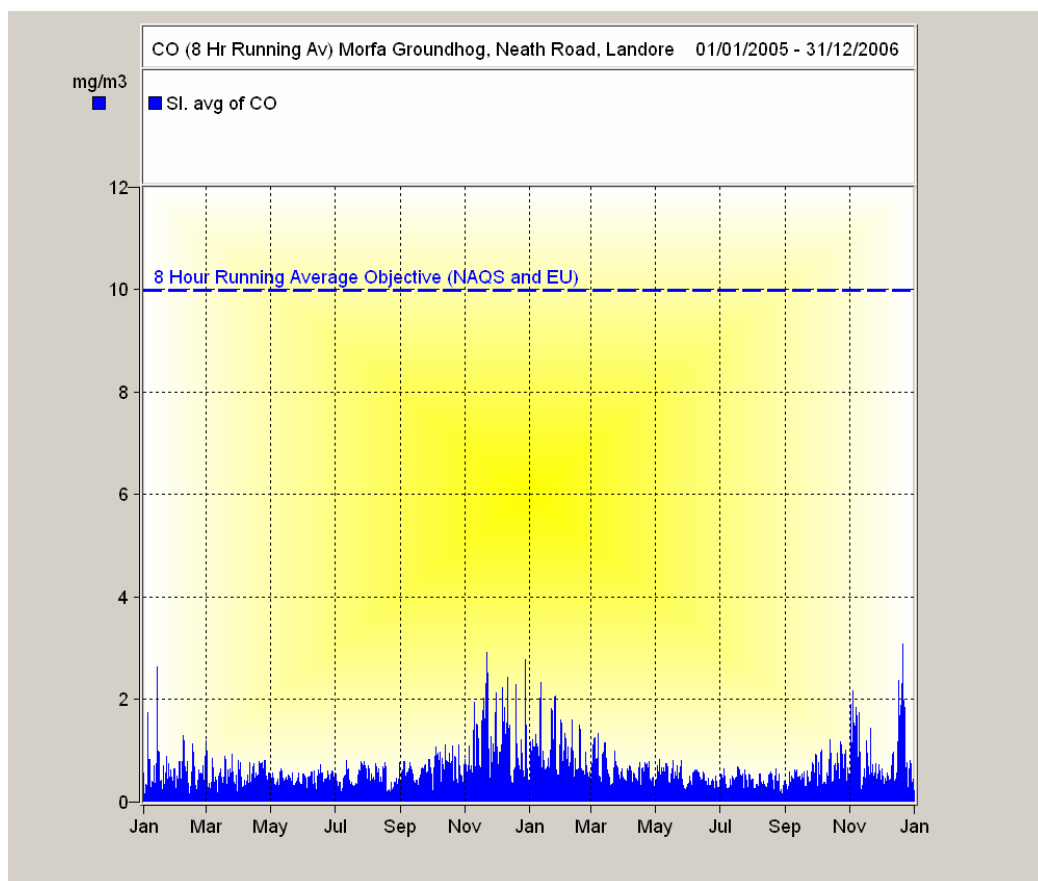


Chart 4 – 8-Hour Running CO Means 2004-2005 – Morfa Groundhog

There appears no discernible trend with the data at present except to say that concentrations have remained below the objective level of a maximum daily 8-hour running mean of 10mg/ m<sup>3</sup> recorded at this site since it was established in 2000 despite the Retail and Sports Stadium developments nearby during 2003-2004.

### 3.1.6 Sulphur Dioxide

An Advanced Pollution Instrumentation (API) real-time SO<sub>2</sub> analyser measures SO<sub>2</sub> at the Morfa Groundhog site. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore

excludes that hour from any analysis. The derived hourly means have then been used to calculate the daily 24-hour means. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly means were specified to be present<sup>16</sup>.

All results are presented in  $\mu\text{g}/\text{m}^3$  by multiplying the logged result in ppb by the conversion factor of 2.66<sup>17</sup> to produce results expressed in  $\mu\text{g}/\text{m}^3$ .

Data from 2005 and 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 8. One exceedence of the 15-minute objective was observed.

Morfa Groundhog	Max 15-Min Mean $\mu\text{g}/\text{m}^3$ (266 $\mu\text{g}/\text{m}^3$ )	Max 1-hour Mean $\mu\text{g}/\text{m}^3$ (350 $\mu\text{g}/\text{m}^3$ )	Max 24-Hour Mean $\mu\text{g}/\text{m}^3$ (125 $\mu\text{g}/\text{m}^3$ )
2005	73.59	50.37	15.35
Exceedences	0	0	0
Date of Max	22/04/2005	21/04/2005	9/12/2005
Time of Max	01:30am	15:00	-
Wind Direction @ Max conc.	76°	131°	125°
2006	266.73	154.68	21.84
Exceedences	1	0	0
Date of Max	06/06/2006	06/06/2006	3/11/2006
Time of Max	13:00	13:00	-
Wind Direction @ Max conc.	152°	154°	170°

Table 8 – SO<sub>2</sub> results – Morfa Groundhog 2005 - 2006

Data capture at the base 15-minute logged means for 2005 is 97.65% and for 2006 is 98.37%, allowing direct comparison with the objective standards and not the percentile values.<sup>18</sup>

<sup>16</sup> LAQM.TG(03) Monitoring A1-38

<sup>17</sup> Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44

<sup>18</sup> Technical Guidance LAQM.TG(03) page 7-7 box 7.2

It is worthwhile noting that whilst traffic sources may contribute slightly to SO<sub>2</sub> concentrations at this site, local knowledge and past analysis would point to industrial sources being the prime contributors.

The Landore Railway Diesel Sheds carry out a 24-hour operation, servicing the Inter-City 125 High Speed Trains (HST). This operation involves long safety checks whilst each HST power unit is stationary of at least 20 minutes and is located within 250m of the Morfa Groundhog site to the south-west. The fuel used is of a low sulphur content. The only other major industrial sources are the Corus Steelworks plant at Port Talbot and Aberthaw Power Station located within the Vale of Glamorgan. The Corus plant is located to the east / south-east of the Swansea conurbation with Aberthaw Power Station being located further east and south - see map 2 below.

It is interesting to note that all of the monitoring stations within the City & County of Swansea measuring SO<sub>2</sub> picked up the short lived episode on the 6<sup>th</sup> June 2006. Not all monitoring stations recorded such elevated levels as seen at Morfa ③ with the exception of the Morryston Groundhog ④ which recorded higher concentrations. Monitoring data from the other two stations at the Swansea AURN ① and the St.Thomas DOAS ② showed a time differential within the episode across Swansea. Ratified data from the Neath Port Talbot AURN ⑤ located at Croeswen Hospital has been downloaded from the Welsh Air Quality Forum archive and imported into the Opsi Enviman Databases for analysis. This data showed that whilst SO<sub>2</sub> levels raised slightly at the Port Talbot AURN they did not reach the levels experienced within parts of Swansea.



Map 2 Swansea Sulphur Dioxide Monitoring Stations

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With the wind direction leading up to, and during the episode from a south easterly direction, and with the absence of highly elevated levels being recorded locally within Port Talbot (expected if the source were to be Aberthaw Power Station and accepting the proximity of the monitoring to the Corus site), this would tend to suggest a release at the Corus plant as the more likely origin. This can be further substantiated by visual observations and telephone enquiries to the Pollution Control Division during the afternoon of the 6<sup>th</sup> June 2006 as an orange haze was seen to drift over Swansea Bay. Environment Agency staff were contacted during the episode and by chance were on-site at the Corus plant and reported that the sintering plant and other likely release points were not

operational that afternoon. No information has been obtained to date relating to the activities that afternoon at Aberthaw Power Station.

The plume appears to mainly have affected those monitoring stations to the north of Swansea city centre at Morfa and Morryston with other stations including Port Talbot experiencing elevated levels approximately 1 hour after those seen at the northerly stations. During the episode recorded at Morfa and Morryston the levels at the Swansea AUN and St Thomas DOAS decreased to background levels, only to rise later as mentioned. Data from all monitoring stations during this episode is reproduced below for information within table 9.

Date	Time	Swansea AUN [ug/m3]	St Thomas [ug/m3]	Morfa [ug/m3]	Morryston [ug/m3]	Port Talbot [ug/m3]	Wind Direction [Deg]
06/06/2006	10:30	13	21	19	19	37	146
06/06/2006	10:45	21	47	21	17	74	146
06/06/2006	11:00	32	60	54	17	67	141
06/06/2006	11:15	35	35	39	41	35	142
06/06/2006	11:30	35	29	21	32	13	144
06/06/2006	11:45	24	52	18	19	13	148
06/06/2006	12:00	43	61	39	16	13	150
06/06/2006	12:15	45	42	72	51	19	153
06/06/2006	12:30	21	11	44	64	21	150
06/06/2006	12:45	5	3	51	45	32	152
06/06/2006	13:00	5	3	267	83	77	152
06/06/2006	13:15	5	7	219	271	85	156
06/06/2006	13:30	5	28	85	173	37	157
06/06/2006	13:45	11	29	48	48	45	153
06/06/2006	14:00	16	74	37	26	96	165
06/06/2006	14:15	45	70	51	11	98	148
06/06/2006	14:30	72	7	14	17	93	151
06/06/2006	14:45	5	3	6	2	67	143
06/06/2006	15:00	5	4	6	0	74	156
06/06/2006	15:15	5	3	4	0	19	155
06/06/2006	15:30	5	2	4	0	19	165
06/06/2006	15:45	5	2	6	1	13	219
06/06/2006	16:00	5	1	4	1	19	212

Table9 – 15 minute SO<sub>2</sub> monitoring data 6<sup>th</sup> June 2006

Graphs representing the various averaging periods for 2005-2006 are shown below as chart 5 (15 minute means) chart 6 (1-hour means) and chart 7 (24-hour

means). Breuer Plot 5 represents data from 2005-2006 with an averaging period of 15 minutes.

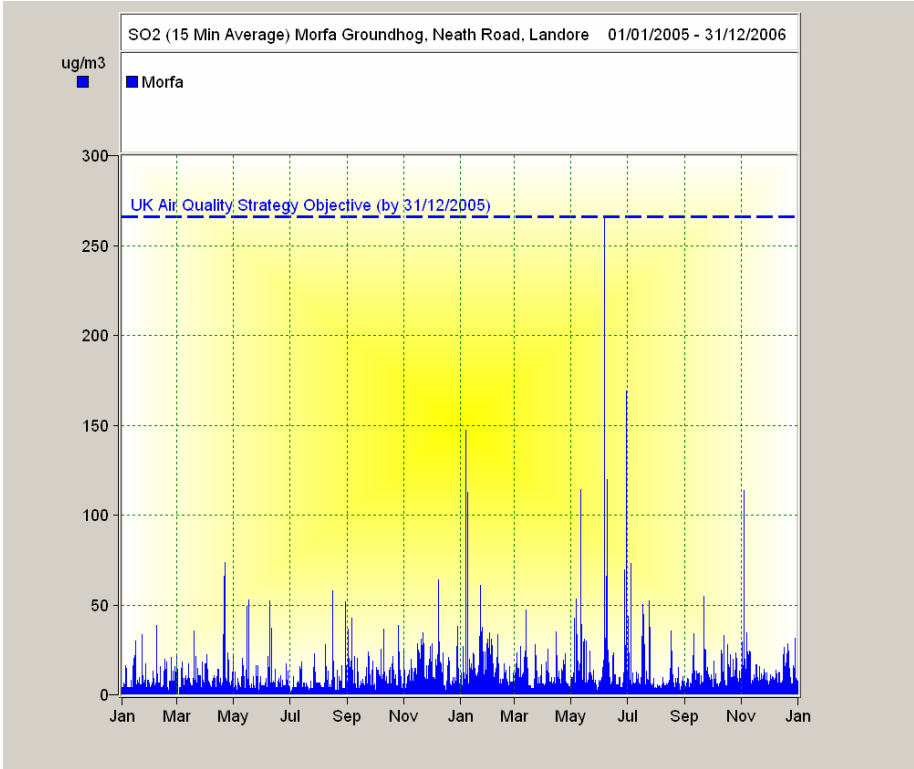


Chart 5 – Morfa Groundhog 15-minute SO2 means 2005-2006

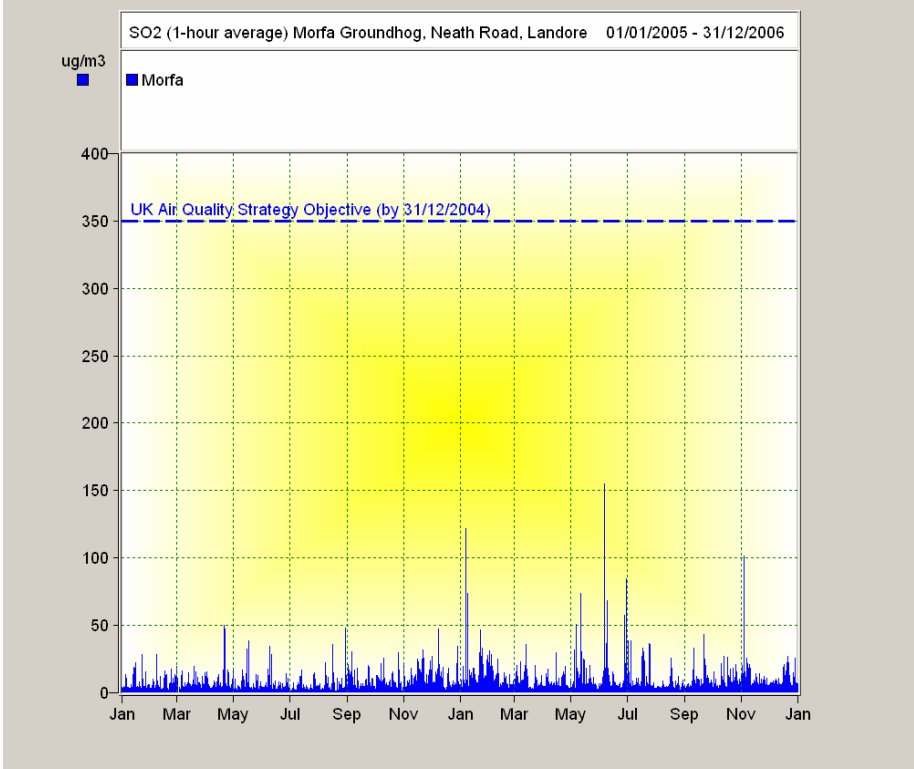


Chart 6 – Morfa Groundhog 1-hour SO<sub>2</sub> mean 2005-2006

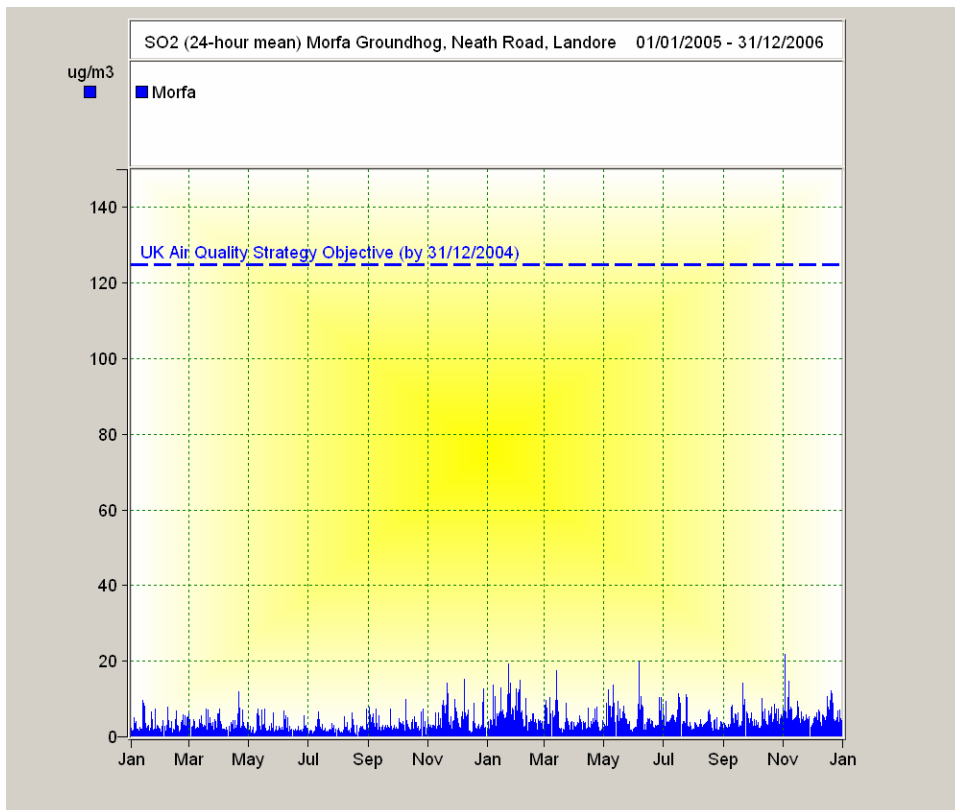
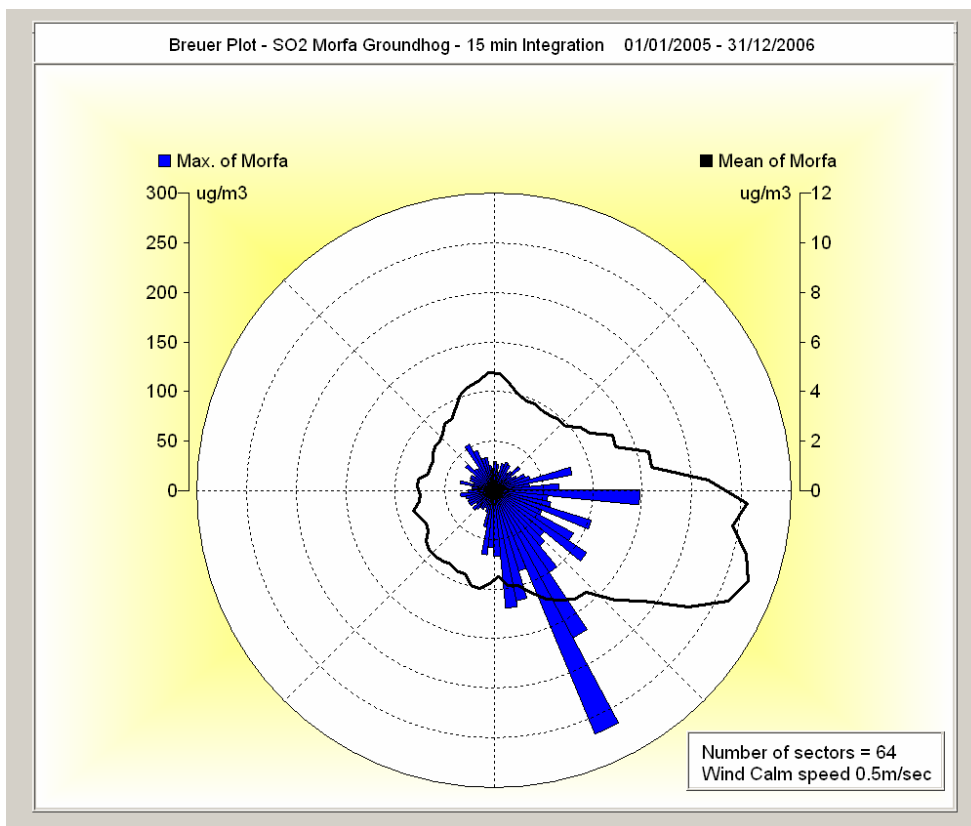
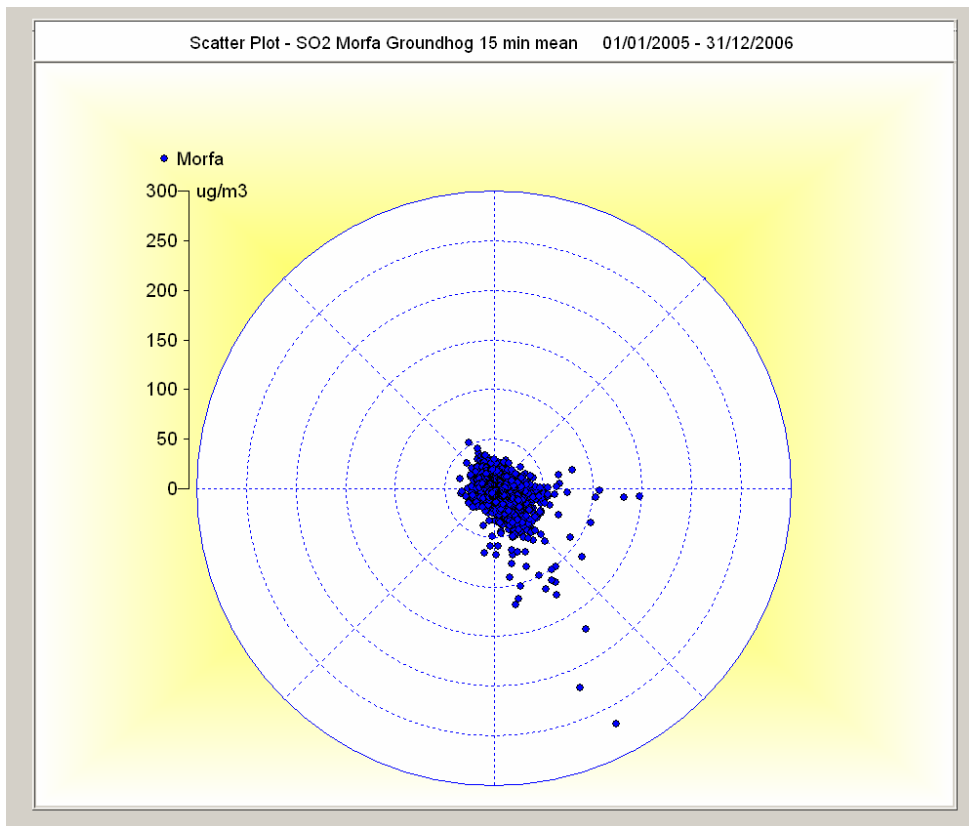


Chart 7 – Morfa Groundhog 24-hour means 2005-2006

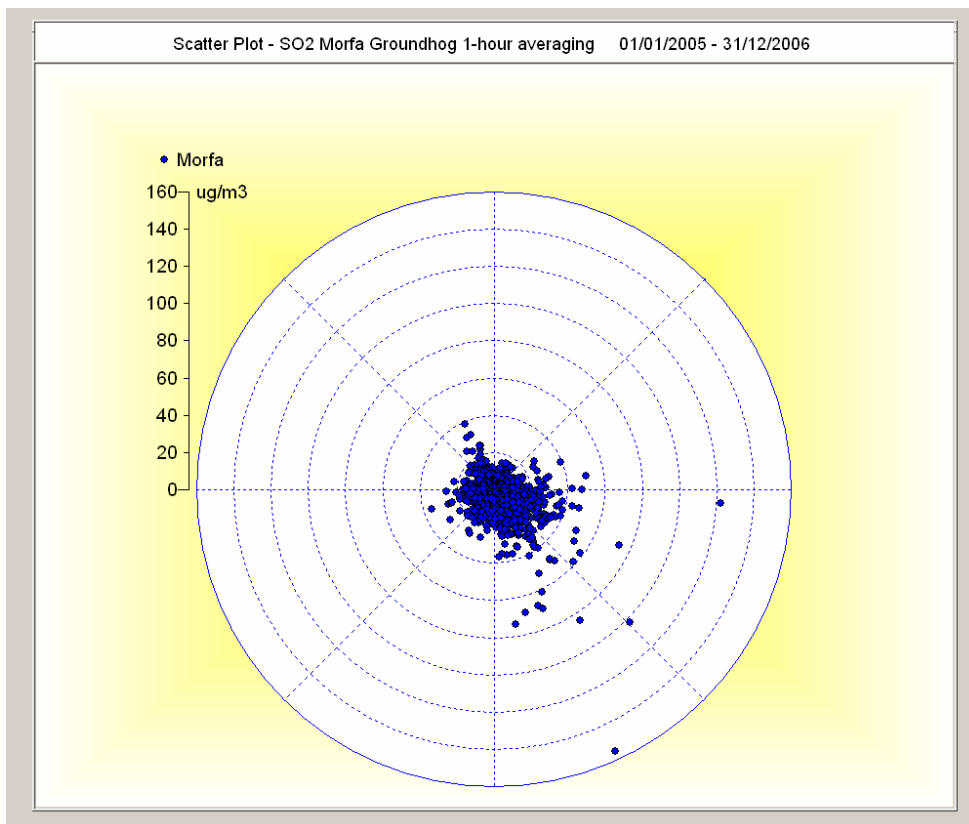


Breuer Plot 5 – SO<sub>2</sub> 15-minute data Morfa Groundhog

Scatter plots 5, 6 and 7 below represent the averaging periods for 2005-2006.

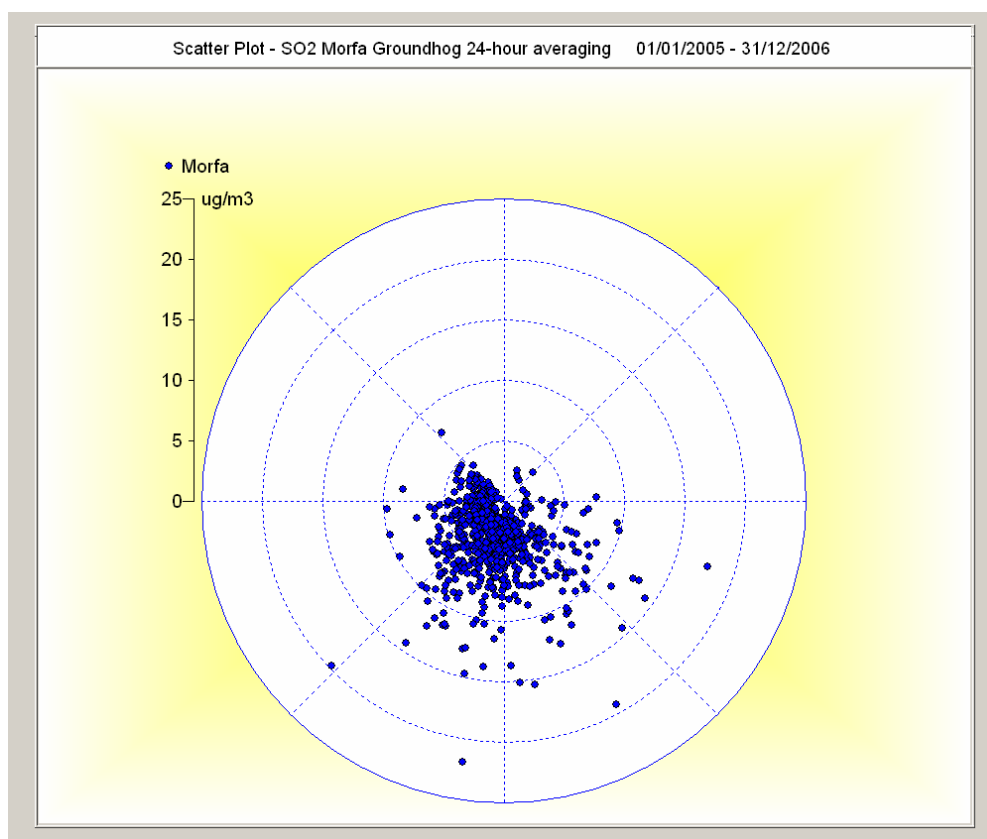


Scatter Plot 5 – Morfa Groundhog SO2 15-minute means 2005-2006



Scatter Plot 6 – Morfa Groundhog SO2 1-hour averaging 2005-2006





Scatter Plot 7 – Morfa Groundhog SO<sub>2</sub> 24-hour averaging 2005-2006

There is at present, no straightforward way to project forward to future years the number of likely exceedences etc. Compliance with each of the objective standards has been calculated from 2001 to 2006 and is presented below as table 10, enabling a brief discussion on SO<sub>2</sub> trends to be made.

Morfa Groundhog	Max 15-Min Mean $\mu\text{g}/\text{m}^3$ ( $266\mu\text{g}/\text{m}^3$ )	Max 1-hour Mean $\mu\text{g}/\text{m}^3$ ( $350\mu\text{g}/\text{m}^3$ )	Max 24-Hour Mean $\mu\text{g}/\text{m}^3$ ( $125\mu\text{g}/\text{m}^3$ )	Annual Mean
2001	130.44	98.42	30.85	6.01
Exceedences	0	0	0	-
2002	120.71	90.44	25.00	4.78
Exceedences	0	0	0	-
2003	274.48	153.21	26.37	5.05
Exceedences	1	0	0	-
2004	111.18	73.15	21.8	3.67
Exceedences	0	0	0	-
2005	73.60	50.37	15.35	3.47
Exceedence	0	0	0	-
2006	266.73	154.68	21.84	5.36
Exceedences	1	0	0	-

Table 10 - Morfa Groundhog SO<sub>2</sub> - 2001 - 2006

As the maximum averaging periods given above will vary from year to year, probably the easiest way to initially assess trends with the SO<sub>2</sub> concentrations is to look at the annual means returned from each of the years under consideration. Again, accepting that the meteorological conditions prevailing during 2003 were atypical, the same analysis has been carried out for 2006 with a similar opinion being formed to that of 2003 in that there was a greater than expected prevalence of south-easterly winds. A clear trend emerges from the annual mean data for years with typical meteorology with almost a halving of the concentrations being observed between 2001 and 2005. Whilst it has been stated above that the maximum concentrations over the various averaging periods will fluctuate from year to year, this decrease in the SO<sub>2</sub> concentrations is also evident from the maximum concentrations recorded for all of the averaging periods. There continues therefore, to be a downward trend with regards to ambient SO<sub>2</sub> levels recorded within Swansea with all of the objective targets being met. Factors that may account for the continued reductions may include increased and improved abatement techniques employed within the Corus plant at Port Talbot, the continuing decline in the burning of coal as a domestic heating source and the reduction in the sulphur content of fuels i.e. diesel.

### **3.2 The OPSIS Hafod Differential Optical Absorption Spectroscopy (DOAS) Monitoring Station**

The OPSIS DOAS open path light source measures the pollutants Nitric Oxide, Nitrogen Dioxide, Ozone and Benzene along a 250-metre section of Neath Road, within the Hafod district of the lower valley area. These measurements take place at first floor level - a height of approximately 3 - 4 metres and less than 0.5m away from the front facade of the terraced dwellings. The DOAS transmitter ❶ is fixed externally to the front wall of a terraced dwelling that fronts onto Neath Road at one end of the open path measurement. The receiver module ❷ is located on the front wall of another dwelling that also fronts onto Neath Road at the other end of the open path measurement length. The receiver focuses the light received and transmits the light via fibre optic cable into a spectra analyser. Map 3 below shows an aerial photograph of the location of the transmitter and receiver heads.

The transmitter emits a light beam from a xenon lamp and contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser that measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored.

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants, as the carriageway is approximately 2 metres away from the front facade of these dwellings. The highway at this location can loosely be referred to as a "street canyon". Valid

data capture commenced on the 8<sup>th</sup> January 2004 at 16:00hrs. The station has been given a site classification Roadside (U2)<sup>19</sup>.



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*Map 3 - Aerial View Hafod OPSIS DOAS - Location of Transmitter and Receiver Heads*

The DOAS system returns data in the form of 5-minute means. In order to compile a valid hourly mean, a minimum of 100% of the 5-minute means was required to be present. Data capture of less than 100% for the hour therefore excludes that hour from any subsequent analysis. In addition to the above, conditions were imposed on the minimum acceptable light levels and maximum standard deviations of the measurements permitted before the 5-minute mean was accepted as valid.

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<sup>19</sup> Source LAQM.TG(03) Appendix A page A1-42

It should be noted that the data presented here represents the spatial average over the whole of the 250-meter measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations.

Monitoring data from the site has been subject to interruption as the property owner at the transmitter site undertook extensive renovation works to the property. The transmitter head was removed from the front façade during these works to prevent damage. Data is therefore absent for significant periods of 2005 and 2006. The equipment was removed from the façade of the property at 11:00 on the 22<sup>nd</sup> April 2005 and was replaced at 10:00 16<sup>th</sup> May 2006. There is therefore significant data loss for both 2005 and 2006 with in total just over a years worth of monitoring data being lost. This is frustrating and regrettable but the loss is outside of the control of this authority.

To compound and frustrate matters further an Area Renewals project is scheduled to commence in December 2007 to properties at the receiving end of the open path measurement. This renewal project may require that the receiver is removed to prevent damage. Discussions will take place with the contractors to establish if limited monitoring will be feasible through any scaffolding but it is highly likely that additional significant periods of monitoring data may be lost during 2008.

As there is such significant data loss only basic information is presented here in both tabular and graphical form for nitrogen dioxide and ozone as no conclusions can be drawn as yet from the data.

# Nitrogen Dioxide

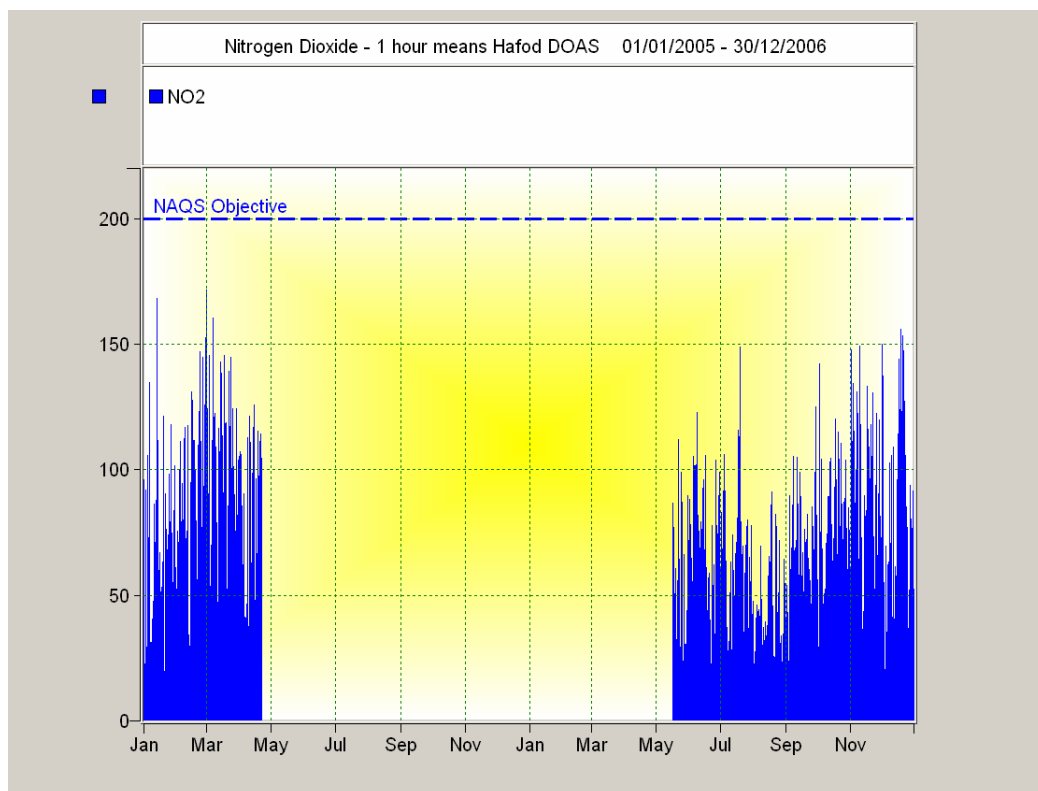


Chart 8 – NO<sub>2</sub> Concentrations Hafod DOAS 2005-2006

Hafod DOAS Nitrogen Dioxide	Annual Mean (40µg/m <sup>3</sup> )	
	2005	2006
	55.39 *	40.60 *
	Maximum Hourly Concentration (200µg/m <sup>3</sup> )	
	171.72	156.14
	Data Capture %	
	30.29%	61.55%

\* Data capture falls below minimum

Table 11 Hafod DOAS NO<sub>2</sub> Concentrations 2005-2006

# Ozone

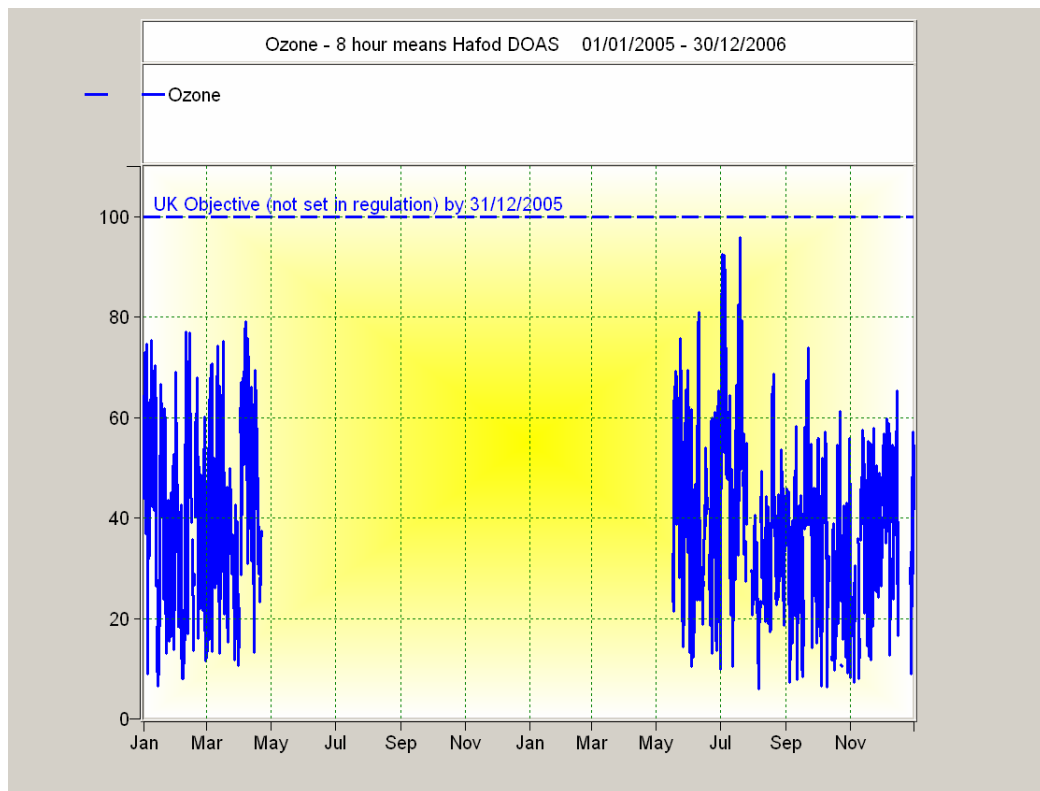


Chart 9 Hafod DOAS 8-hour Ozone means 2005-2006

Hafod DOAS Ozone	Max 8-hour Mean ( $\mu\text{g}/\text{m}^3$ )	Data capture	Exceedences of 8-hour objective $100\mu\text{g}/\text{m}^3$ (10 permitted)
2005	79.02	28.5%	0
2006	95.95	53.85%	0

Table 12 DOAS 8-hour Ozone means 2005-2006

### **3.3 Automatic Monitoring Data from outside of an Air Quality Management Area.**

#### **3.3.1 Morriston Groundhog**

Morriston Groundhog has been operational since September 2000 and is located adjacent to the southbound slip road to the busy A4067 dual carriageway at Morriston Underpass. The Hafod AQMA boundary is approximately one mile south of this location. Receptor locations can be found to the right of the station in the form of terraced housing. To the left of the site and on the opposite side of the dual carriageway is Morriston Primary School. The school buildings abut the red brick retaining wall to the northbound Morriston slip road exit. The A4067 carries on for approximately one mile northbound where it meets the M4 motorway at junction 45. The station has been given a site classification Kerbside (U2)<sup>20</sup>. Map 4 below is an aerial view of the site and the surrounding locations.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring O<sub>3</sub>, H<sub>2</sub>S, CO, SO<sub>2</sub> and NO<sub>x</sub>, with an R&P TEOM measuring PM<sub>10</sub>. The R&P TEOM measuring PM<sub>10</sub> was upgraded to a Thermo FDMS unit again measuring PM<sub>10</sub> on the 27<sup>th</sup> October 2006 with data capture for the FDMS unit commencing at 17:00. The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform

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<sup>20</sup> Source LAQM.TG(03) Appendix A page A1-42



routine fortnightly manual calibrations. The analyser's are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analysers are also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis. The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled according to the calibration factors obtained on a fortnightly basis. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. Since the awarding of the contract by the Welsh Assembly Government to NETCEN to run the Welsh Air Quality Forum in April 2004, all equipment on site is fully audited twice yearly by NETCEN together with the calibration gases stored on site. The L10 cylinders are replaced on a regular basis and are to a



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*Map 4 - Aerial view - Morryston Groundhog*

certified and traceable standard.

### 3.3.1.2 Nitrogen Dioxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time NO<sub>x</sub> analyser. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified<sup>21</sup>. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the annual mean.

All results are presented in µg/m<sup>3</sup> by multiplying the logged result in ppb by the conversion factor of 1.91<sup>22</sup> to produce results expressed in µg/m<sup>3</sup>.

Data from 2005 and 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 14. For the sake of completeness, data is also shown from 2003 and 2004. A graph of the 2005-2006 measurements is shown below as chart 11.

Morrison Groundhog				Max 1-hour (200µg/m <sup>3</sup> )				Exceedences of 1-hour std (18 permitted)			
Annual Mean (40µg/m <sup>3</sup> )				2003	2004	2005	2006	2003	2004	2005	2006
2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
32.2	21.4	29.9	31.8	158.8	136.9	144.1	167.2	0	0	0	0

Table 14 - Nitrogen Dioxide monitoring data - Morrison Groundhog 2003 - 2006

<sup>21</sup> LAQM.TG(03) Monitoring A1-37

<sup>22</sup> Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44

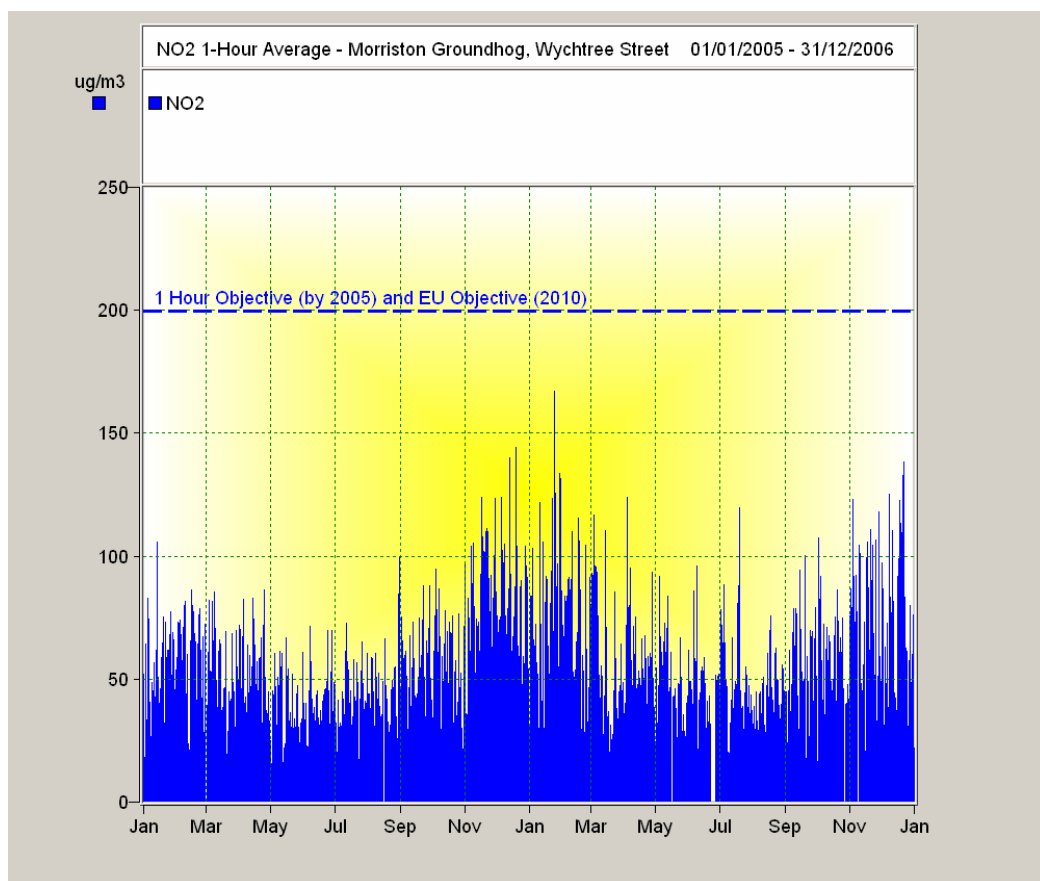
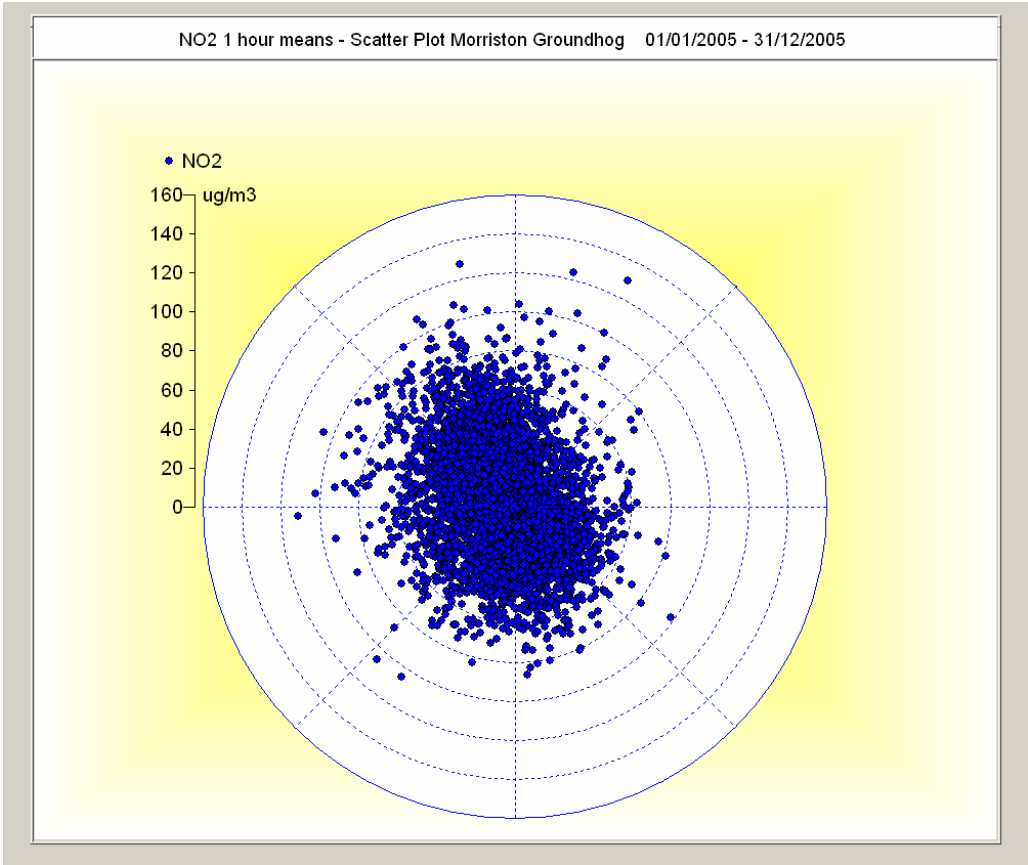


Chart 11 - NO<sub>2</sub> 1 hour means 2005-2006 – Morriston Groundhog

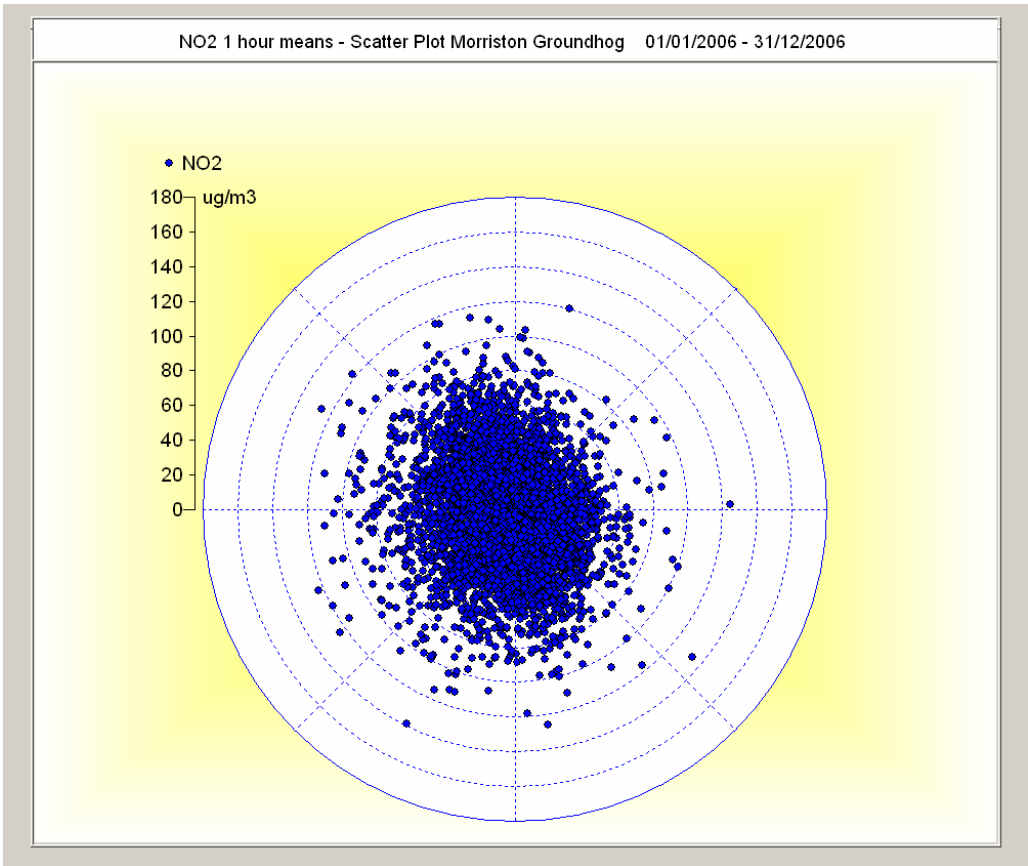
The annual NO<sub>2</sub> means for 2005 and 2006 are below the 40µg/m<sup>3</sup> objective for both 2005 and the provisional objective in 2010. Hourly NO<sub>2</sub> data capture for 2005 is 98.45 %, and for 2006 is 96.66%. These data capture rates permit the direct compilation of hourly exceedences rather than the use of the 99.8<sup>th</sup> percentile of hourly means<sup>23</sup>.

Scatter Plots 8 and 9 below show the scatter in the data for the respective years. There is not discernable pattern from the data except slightly elevated concentrations from the north-east sector.

<sup>23</sup> LAQM TG(03) box 6.2 page 6-16



Scatter Plot 8 – 1 hour NO<sub>2</sub> Morriston Groundhog 2005



Scatter Plot 9 – 1 hour NO<sub>2</sub> Morriston groundhog 2006

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls)). Using 2006 as the base year a projection of 27.53µg/m<sup>3</sup> is obtained for 2010 which remains below the EU objective of 40µg/m<sup>3</sup>. The Year Adjustment Calculator v2.2a is dated 19<sup>th</sup> January 2006 and was probably issued prior to the full impact of the increased primary NO<sub>2</sub> emissions being recognised.

Ideally, monitoring data should be available for at least 5 years before trends in NO<sub>2</sub> concentrations can be meaningfully discussed. Monitoring commenced at this site during September 2000 so just over 6 years of monitoring data is available. The annual means from 2001 to 2006 are presented below within table 15 for a brief discussion on trends to be made. In addition and as an additional indicator, the maximum hourly concentrations recorded for each year are detailed.

Morriston Groundhog	Annual Mean (40µg/m <sup>3</sup> )						
	2001	2002	2003	2004	2005	2006	2010
	31.0	27.2	32.2	21.4	29.9	31.8	27.53
Morriston Groundhog	Maximum Hourly Concentration (200µg/m <sup>3</sup> )						
	183.9	127.01	158.8	136.9	144.1	167.2	

Table 15 - Morriston Groundhog NO<sub>2</sub> monitoring results 2001 - 2006

What is most noticeable again, is the apparent reversal of the previously identified reduction trend in annual mean NO<sub>2</sub> concentrations both nationally and locally here in Swansea - see Morfa Groundhog site above. This new upward trend with NO<sub>2</sub> concentrations has been observed at numerous other roadside sites throughout the UK. Accepting that 2003 exhibited atypical

meteorological conditions it is evident that the 2006 annual mean is now slightly greater than the 2001 annual mean. From literature already published on this reversal of the NO<sub>2</sub> reduction trend it is thought likely that oxidation catalysts fitted to newer EURO classification vehicles are emitting greater concentrations of primary NO<sub>2</sub> direct from the exhaust tailpipe.

Again, it may be interesting to revisit the predictions made for 2005 from previous review and assessment. The various projections and source are indicated below in table 16.

LAQM Report	Base year data	Annual Mean in Base Year	Projection for 2005 $\mu\text{g}/\text{m}^3$	Projection for 2010 $\mu\text{g}/\text{m}^3$
Stage 4 Review	2001	31	24.37	
Stage 4 review	2002	27.2	26	
USA 2004	2003	32.2	25.02	
Progress Report 2004	2004	21.4	30.41	20.49
USA 2006	2005	29.9		25.15
Progress Report 2007	2006	31.8		27.53

*Table 16- Moriston Groundhog Previous Projections 2005 and 2010*

The data ranged from underestimating the 2005 annual mean by -18.5% (2001 base data) to an overestimate of 1.7% (from the 2004 base data). The 2004 base data produced the closest estimate. 2002 base data produced an underestimate of -13% and 2003 base data an underestimate of -16.3%.

It must be noted that the method for projecting forward these predictions and the tools developed to enable this forward look have evolved over time i.e. the latest Year Adjustment Calculator (2006) uses 2004 as its base year.

### 3.3.1.3 Rupprecht & Patashnick Co., Inc. TEOM

A Rupprecht & Patashnick Co., Inc. TEOM measured particulate Matter PM<sub>10</sub> at the Morriston Groundhog site until the 27<sup>th</sup> October 2006 at 11am. On this date, the existing R&P TEOM system was removed from site and upgraded to the Thermo Inc FDMS PM<sub>10</sub> system. The Thermo FDMS system was installed on the same date with valid data commencing from 17:00 hours providing equivalency with the EU reference gravimetric method. In hindsight, it may have been prudent to delay the upgrade until January 2007 and obtain a full year of measurement with the existing R & P TEOM PM<sub>10</sub> system.

The logged 15-minute means from the R & P Co. Inc TEOM have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified<sup>24</sup>. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate both the daily 24-hour means and the annual mean. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly means were specified to be present<sup>25</sup>.

All results are presented in  $\mu\text{g}/\text{m}^3$  and have been corrected with the interim default correction factor of 1.3 to estimate gravimetric concentration. For ease of comparison, results from the previous years (2003 and 2004) are shown alongside the results for 2005 and 2006 within table 17 below. A chart representing the 24-hour daily means from 2005-2006 is given below as chart 12 and a Scatter Plot representing the scatter of the 24-hour means during 2005 as Scatter Plot 10 and for 2006 Scatter Plot 11.

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<sup>24</sup> LAQM.TG(03) Monitoring A1-37

<sup>25</sup> LAQM.TG(03) Monitoring A1-38

Morrison Groundhog PM <sub>10</sub> (TEOM)	Annual Mean (40µg/m <sup>3</sup> )				24-hour Exceedences (50µg/m <sup>3</sup> ) (35 permitted)			
	2003	2004	2005	2006	2003	2004	2005	2006
	25.7	22.68	22.47	24.54 *	21	6	0	3 *

Table 17 PM<sub>10</sub> (TEOM) Monitoring Results 2003-2006 Morrison Groundhog

\* Data capture for 2006 80.8% due to upgrade to Thermo FDMS unit 27<sup>th</sup> October 2006



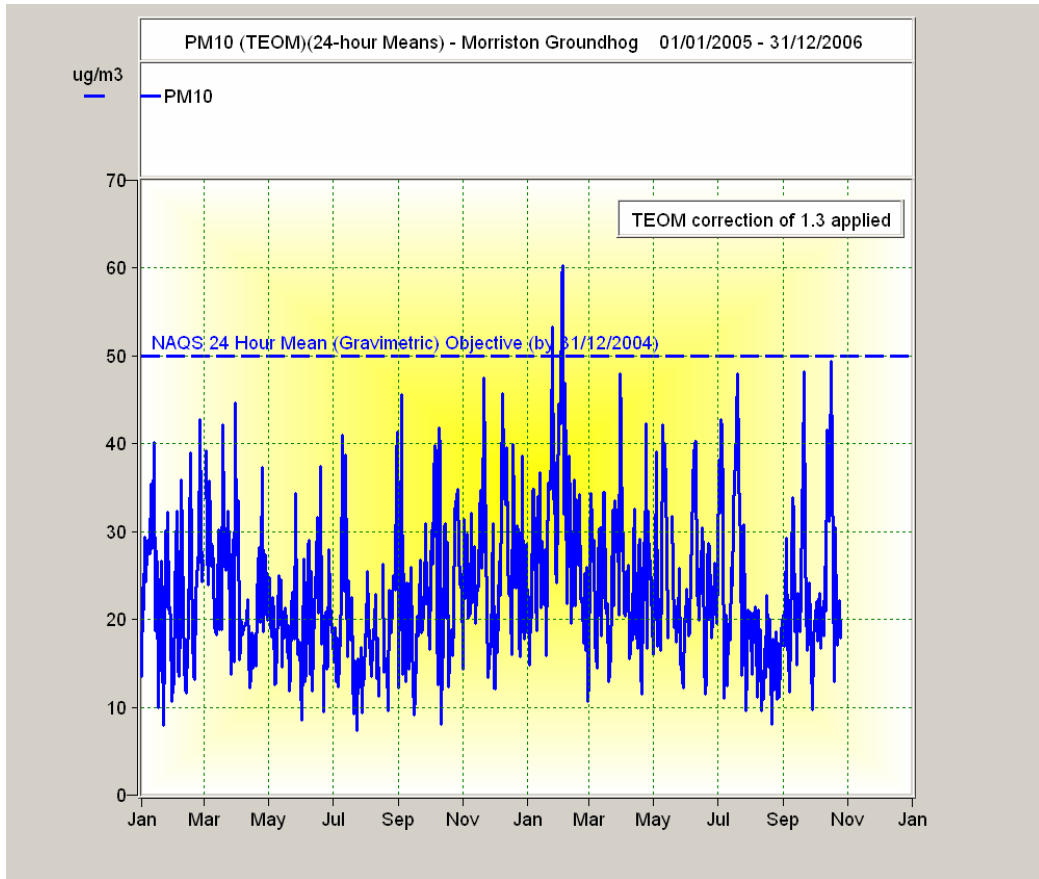
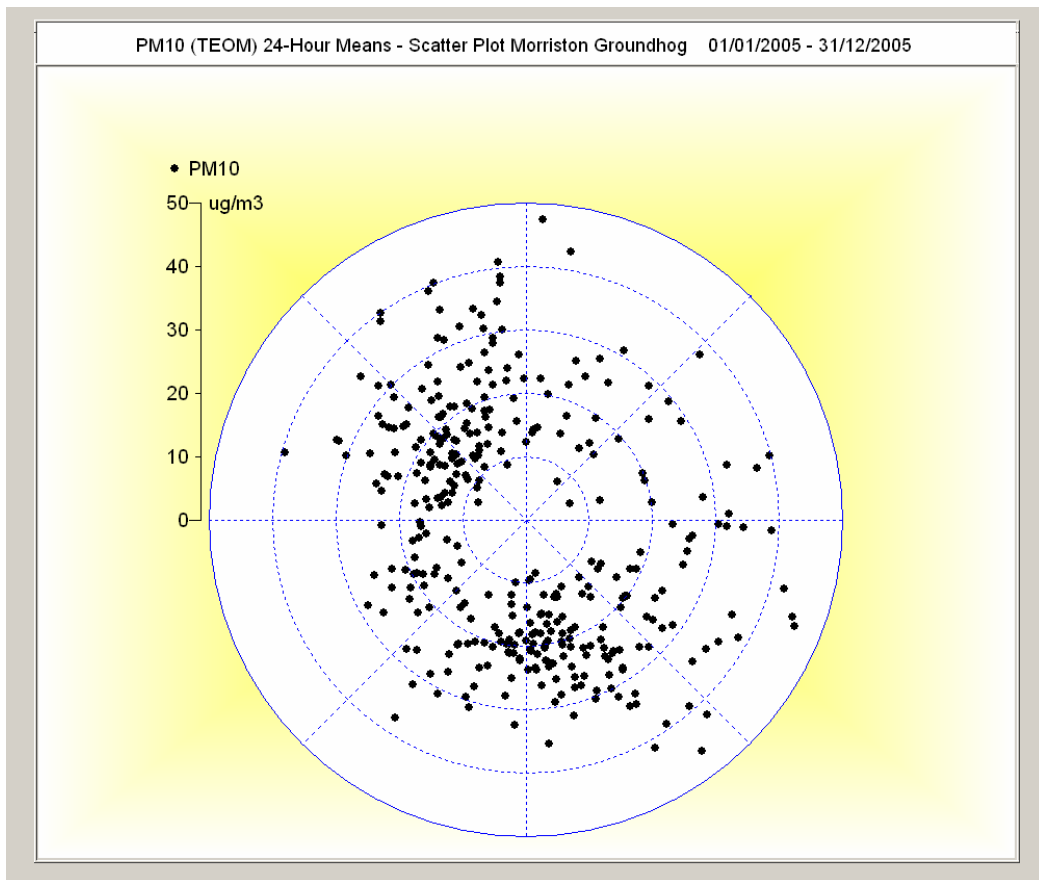
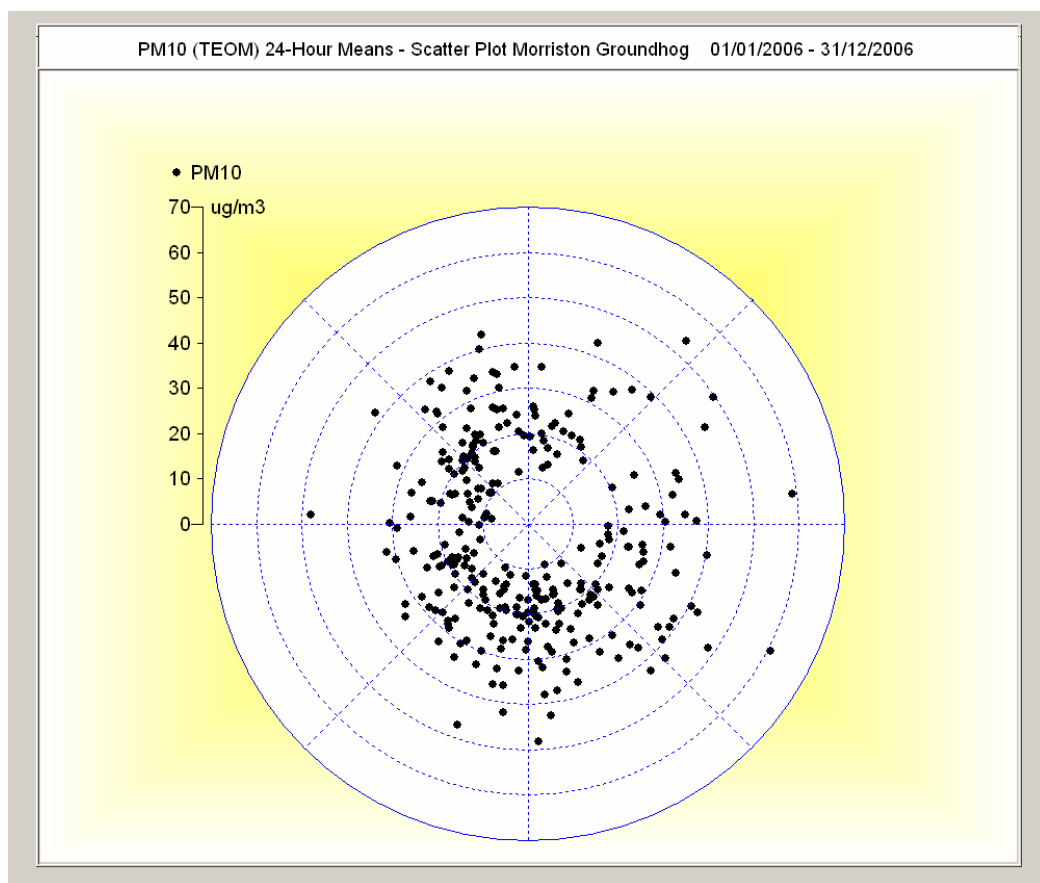


Chart 12- 24-Hour PM<sub>10</sub>(TEOM) means – Morriston Groundhog 2005-2006



Scatter Plot 10 – PM<sub>10</sub>(TEOM) 24-hour means – Morriston Groundhog 2005



Scatter Plot 11 – PM10 (TEOM) 24-hour means – Morriston Groundhog 2006

Data has not been projected forwards to 2010 within this report – see 3.1.4 above for details. Previous data reported within the Progress Report 2004 dated July 2005 have been projected forwards to 2010 from the 2004 annual mean. This work can be found on pages 41-42 at <http://www.swansea.gov.uk/index.cfm?articleid=9929>

In previous analyses undertaken of PM<sub>10</sub>, elevated levels of PM<sub>10</sub> emanating from a south-easterly direction has been associated with the heavy industry located in Port Talbot: notably, the Corus steel plant.

Annual means, together with the maximum daily mean and number of exceedences are given below as table 18.

Morriston Groundhog	Year					
	2001	2002	2003	2004	2005	2006
Annual Mean (40µg/m <sup>3</sup> )	23.3 *	23.56 **	25.7	22.68	22.47	24.54 ***
24-hour Exceedences (50µg/m <sup>3</sup> )	9 *	4 **	21	6	0	3 ***
Max 24-Hour mean	58.17 *	68.01 **	73.31	69.61	47.46	60.31 ***
90 <sup>th</sup> Percentile	36.71	34.25	-	-	-	36.71
Wind Direction at Max Loading	145°	70°	158°	276°	3°	117°
Date of Max	5 <sup>th</sup> March	12 <sup>th</sup> April	9 <sup>th</sup> August	5 <sup>th</sup> Nov	21 <sup>st</sup> Nov	4 <sup>th</sup> Feb

\* 2001 data capture 82.74%

\*\* 2002 data capture 85.75%

\*\*\* 2006 data capture (TEOM) 80.62%

Table 18 Morriston Groundhog PM10 trends (TEOM)

Data capture for 2001 was 82%, for 2002 was 85% and, as mentioned above for 2006 due to the upgrading of the equipment was 80%. Direct compilation of 24-hour exceedences rather than the use of the 90<sup>th</sup> percentile of 24-hour means is therefore only valid for 2003-2005.<sup>26</sup> The 90<sup>th</sup> percentile for 2001, 2002 and 2006 are given above within table 18.

Accepting that 2003 exhibited atypical meteorological conditions the reduction in daily exceedences is clearly evident. Whilst the number of exceedences have not breached the objective during the period of monitoring (TEOM) what is unsure at the moment is if this reduction can remain at the current very low levels.

<sup>26</sup> LAQM.TG(03) Box 8.4 page 8-22

### 3.3.1.4 Thermo Inc FDMS PM<sub>10</sub>

The Thermo FDMS system was installed on the 27<sup>th</sup> October 2006, providing equivalency with the EU reference gravimetric method – section 5.5.3<sup>27</sup>

The dataset collected from the FDMS system is not directly comparable to the historical R&P TEOM dataset even given that the use of the advised interim default correction factor was advised to estimate the EU reference gravimetric method. This correction factor has been called into dispute by various studies at diverse locations throughout the UK deriving differing correction factors.

The data collected for 2006 from the FDMS unit amounts to just over two months at best and is reported here merely for information purposes.

Additionally, brief operational issues that have been identified are outlined here for information as the operation of the FDMS units differs substantially from that of the R&P Teom units.

The FDMS units are required to operate within an ambient enclosure temperature range between 18-22°C<sup>28</sup>. Opinions vary as to the exact optimum temperature but Swansea's experience indicates around 18-20°C to be adequate and one that is capable of being maintained relatively stably by the installed air conditioning system.

The FDMS unit provides hourly integration data and has been configured as per DEFRA's FDMS parameter protocol. The RS232 port on the FDMS control unit allows the collection of up to 8 parameters via telemetry. The parameters

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<sup>27</sup> DEFRA and devolved administrations report UK Equivalence Program for Monitoring of Particulate Matter dated 5<sup>th</sup> June 2006 at [http://www.airquality.co.uk/archive/reports/cat05/0606130952\\_UKPMEquivalence.pdf](http://www.airquality.co.uk/archive/reports/cat05/0606130952_UKPMEquivalence.pdf)

<sup>28</sup> UK Equivalence Program for Monitoring of Particulate Matter dated 5<sup>th</sup> June 2006 section 5.5.2

collected from the FDMS units are : Volatile Mass, Non Volatile Mass, External Dew Point, Sample Dew Point, Filter loading, Noise, Status, External Ambient Air temperature. The control unit refers to these parameters in different terminology. However, the FDMS unit will not directly produce a PM<sub>10</sub> mass concentration. The PM<sub>10</sub> mass concentration is obtained via post processing of the volatile and non volatile mass parameters by creating a calculated channel within the database to subtract volatile mass from the non volatile mass.

AEA Energy and Environment has produced a new LSO operating procedure for the FDMS units. One of the more problematic issues with use of the FDMS units that this authority has found is the routine changing of both the purge filter (within the chiller unit) and the “normal” tapered element filter within the sensor unit. The chiller unit is held at approximately 4°C - upon removal of the filter housing, condensation can be seen on the filter holder. It is this authorities experience that should the new 47mm Pallflex TX40 MFAB filter be installed without ensuring the filter holder is dry then this can (and most certainly does) produce very noisy/spiky data. Correct orientation of the 47mm Pallflex TX40 MFAB filter within the filter holder is critical as incorrect orientation will result in poor quality data being returned. The 47mm filter and tapered element sensor unit filter should always be exchanged at the same time. Whilst the TEOM units did take up to 1-2 hours to stabilise after the sensor unit filter exchange and status code 4 OK being reached, the FDMS units can, and do, take even longer to stabilise. Should the site suffer a power failure or air conditioning failure then it is recommended that 3 hours data post resolution of either condition should be deleted from the dataset.

It should be noted that none of the data presented below has as yet been validated and ratified by QA/QC procedures. Chart 13 below shows the period 28<sup>th</sup> October – 31<sup>st</sup> December 2006.

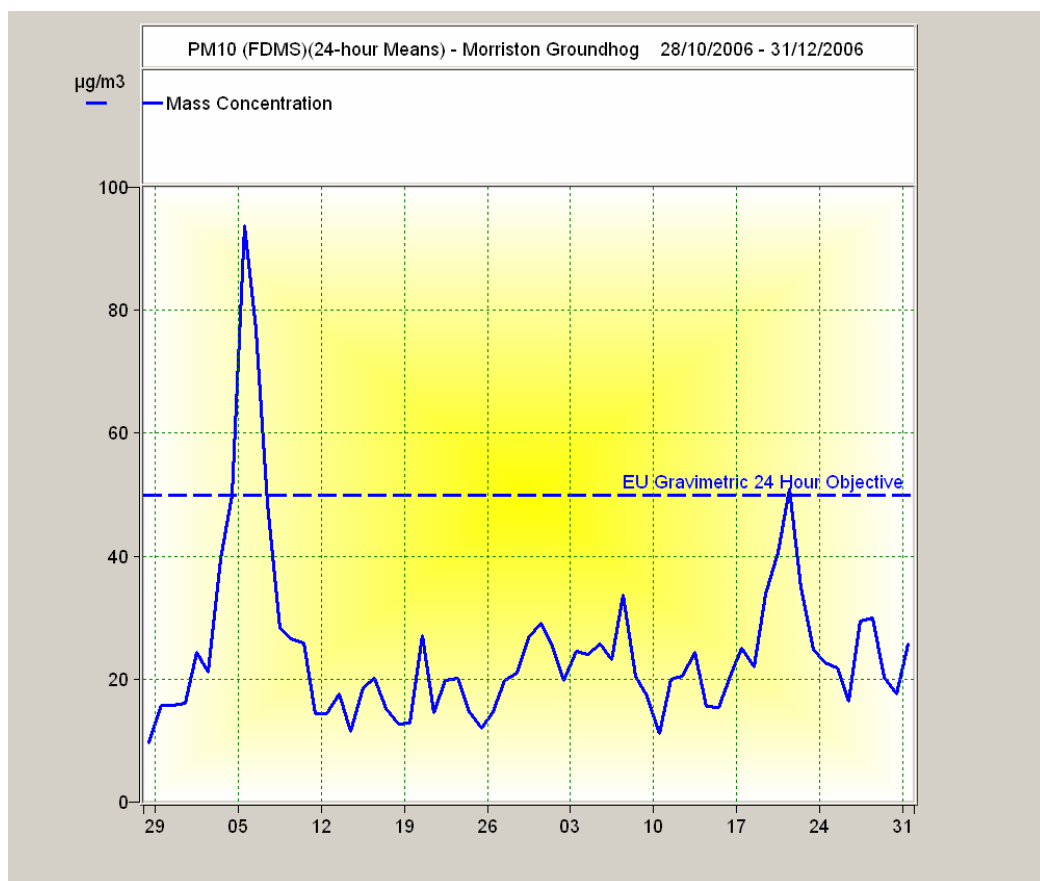


Chart 8 – Morriston Groundhog PM<sub>10</sub> FDMS data 28<sup>th</sup> October - 31<sup>st</sup> December 2006

Data collected from the FDMS unit has an integration period of 1-hour. PM<sub>10</sub> mass concentration is obtained via post processing of the volatile and non volatile mass parameters by the software package Opsis Enviman ComVisioner. The calculated hourly mean mass concentration data have then been further processed by the software package Opsis Enviman Reporter. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the calculated hourly means were specified to be present<sup>29</sup>.

The provisional mean for the 65 day period within the above FDMS data is 24.72µg/m<sup>3</sup> with the maximum 24-hour mean of 93.77µg/m<sup>3</sup> being recorded on the 5<sup>th</sup> November 2006. In total, there are three provisional, 24-hour means above 50µg/m<sup>3</sup>.

<sup>29</sup> LAQM.TG(03) Monitoring A1-38

### 3.3.1.5 Carbon Monoxide

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time CO analyser. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the running eight hour means.

The running 8-hour mean for a particular hour, is the mean of the hourly average concentrations for that hour and the preceding 7 hours. The average period is stepped forward by one hour for each value, so running mean values are given for the periods 00:00 – 07:59, 01:00 – 08:59 etc. There are, therefore, 24 possible 8-hour means in a day (calculated from hourly data). In order for a running average to be valid, 75% data capture is required i.e. 6 hourly averages out of every 8 must be valid. The maximum daily running 8-hour mean is the maximum 8-hour running mean measured on any one day.<sup>30</sup>

All results are presented in  $\text{mg}/\text{m}^3$  by multiplying the logged result in ppm by the conversion factor of 1.16<sup>31</sup> to produce results expressed in  $\text{mg}/\text{m}^3$ . The CO 8-hour running mean data has been examined for 2005 -2006 and the results are summarised below in table 19. The results for 2005-2006 are also shown as chart 9 below

For ease of comparison with results from the previous year, the results obtained from 2001 - 2004 are also shown within table 19 below. The data for

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<sup>30</sup> Source LAQM.TG(03) – Monitoring – Calculation of exceedence statistics, paragraph A1.104 page A1-37.

<sup>31</sup> Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44

compliance with the Air Quality (Amendment)(Wales) Regulations 2002 objective standard was the 31<sup>st</sup> December 2003. The date for compliance with the EU objective of a maximum daily 8-hour running mean of 10mg/ m<sup>3</sup> was 2005. All objectives have been comfortably met before the compliance dates.

Year	Max 8-hour running mean
2001	4.61 mg/m <sup>3</sup>
2002	2.31 mg/m <sup>3</sup> *
2003	2.07 mg/m <sup>3</sup>
2004	2.83 mg/m <sup>3</sup>
2005	1.96 mg/m <sup>3</sup>
2006	1.36 mg/m <sup>3</sup>

Table 19 – Morriston Groundhog CO 8 hour rolling means 2001-2006

\* Data capture for 2002 88.73%

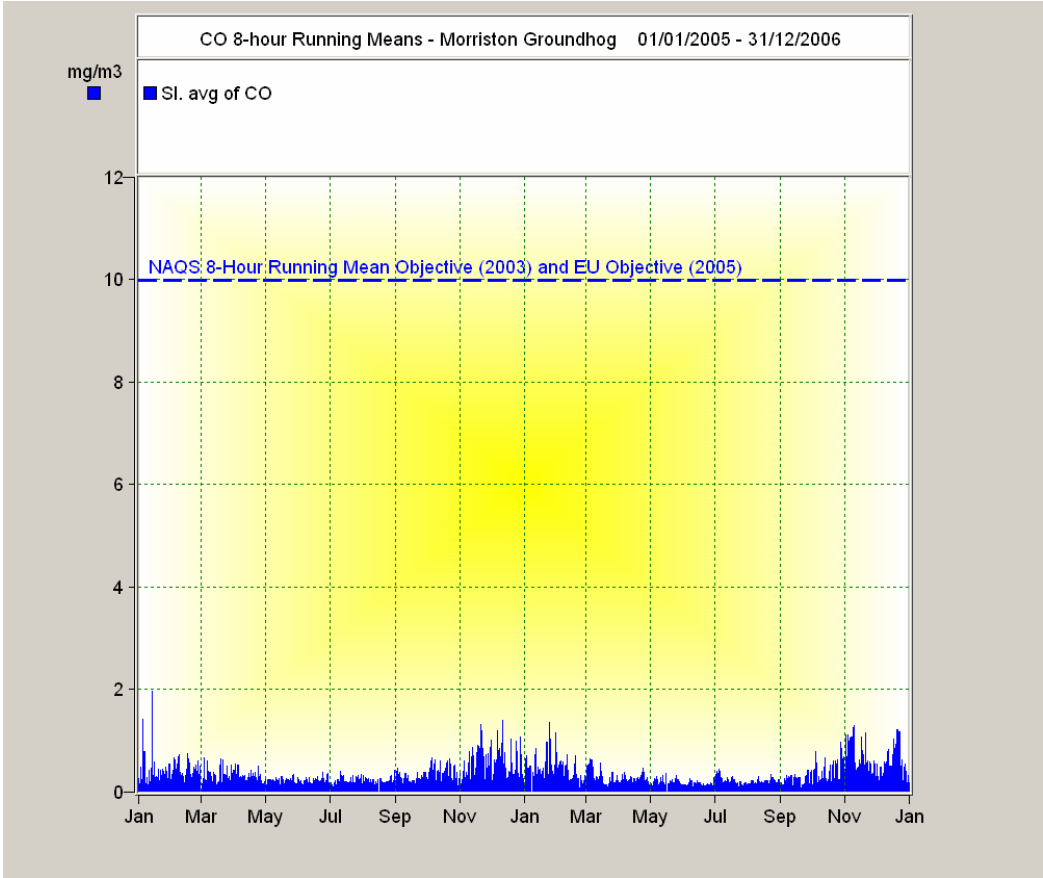


Chart 9 Morriston Groundhog CO 8-hour running means 2005-2006

Data capture for the 8-hour running means during 2005 was 98.8% and for 2006 was 98.5 % allowing direct comparison with the objective standard.



Previously, there was no marked discernable trend within the data except to say that the levels had remained consistently low during the period of monitoring but in the last two years there now appears to be a tendency to indicate a further downward trend – probably as a result of the introduction into the fleet of more vehicles fitted with catalytic converters.

### **3.3.1.6 Sulphur Dioxide**

An Advanced Pollution Instrumentation (API) real-time SO<sub>2</sub> analyser measures SO<sub>2</sub> at the Morriston Groundhog site. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the daily 24-hour means. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the hourly means were specified to be present<sup>32</sup>.

All results are presented in µg/m<sup>3</sup> by multiplying the logged result in ppb by the conversion factor of 2.66<sup>33</sup> to produce results expressed in µg/m<sup>3</sup>.

Data from 2005 and 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 20. One exceedence of the 15-minute objective was observed during 2006 – this short lived “local” episode is discussed in greater detail within 3.1.6 Morfa Groundhog above. Graphs representing the various averaging periods for 2005 - 2006 and detailed

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<sup>32</sup> LAQM.TG(03) Monitoring A1-38

<sup>33</sup> Technical Guidance LAQM.TG(03)Appendix B - Conversion factors page A1-44

within table 20 below are shown below as chart 10 (15-minute means), chart 11 (1-hour means) and chart 12 (24-hour means).

Data capture at the base 15-minute logged means for 2005 is 97.47% and for 2006 is 97.66% allowing direct comparison with the objective standards and not the percentile values<sup>34</sup>

Morrison Groundhog	Max 15-Min Mean $\mu\text{g}/\text{m}^3$ (266 $\mu\text{g}/\text{m}^3$ )	Max 1-hour Mean $\mu\text{g}/\text{m}^3$ (350 $\mu\text{g}/\text{m}^3$ )	Max 24-Hour Mean $\mu\text{g}/\text{m}^3$ (125 $\mu\text{g}/\text{m}^3$ )
2005	84.52	55.34	15.06
Exceedences	0	0	0
Date of Max	18/05/2005	30/08/2005	09/12/2005
Time of Max	06:15	12:00	-
Wind Direction @ Max conc.	69°	142°	170°
2006	270.9	143.8	18.29
Exceedences	1	0	0
Date of Max	06/06/2006	06/06/2006	03/11/2006
Time of Max	13:15	13:00	-
Wind Direction @ Max conc.	156°	155°	179°

Table 20 Morrison Groundhog SO<sub>2</sub>2005-2006

<sup>34</sup> Technical Guidance LAQM.TG(03) page 7-7 box 7.2

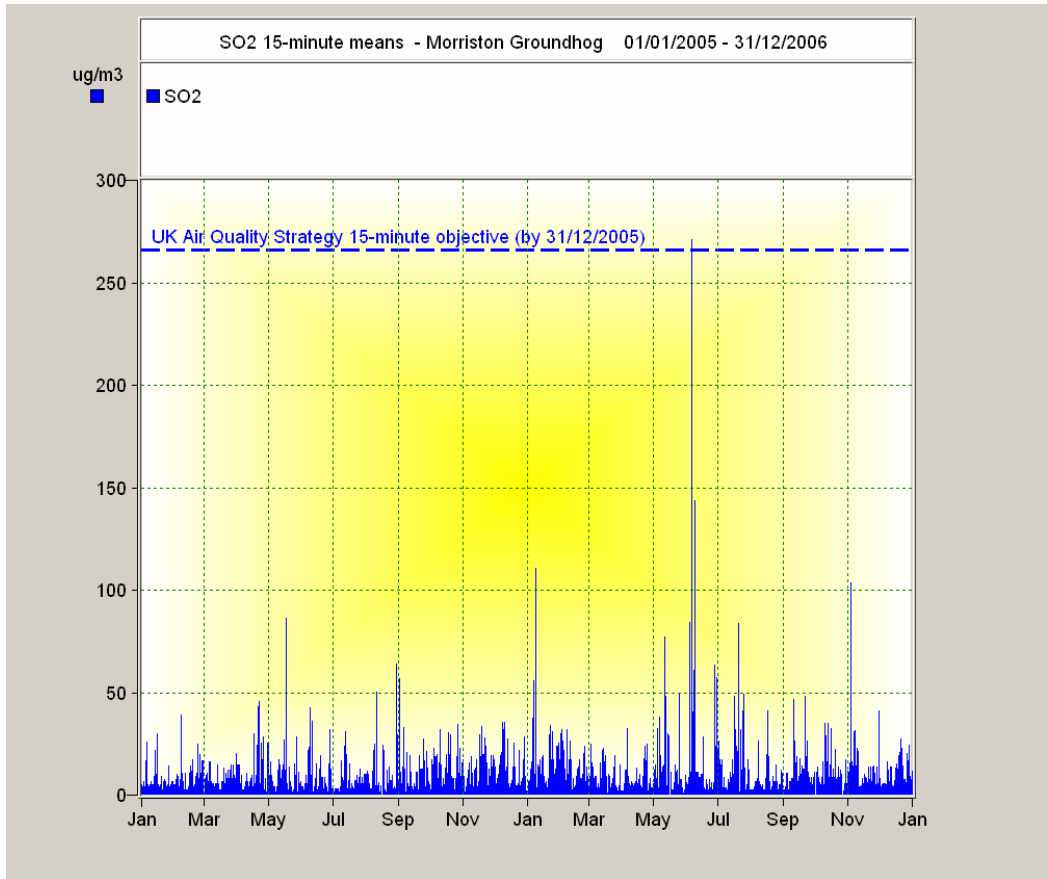


Chart 10 – Morriston Groundhog SO<sub>2</sub> 15-minute means 2005-2006

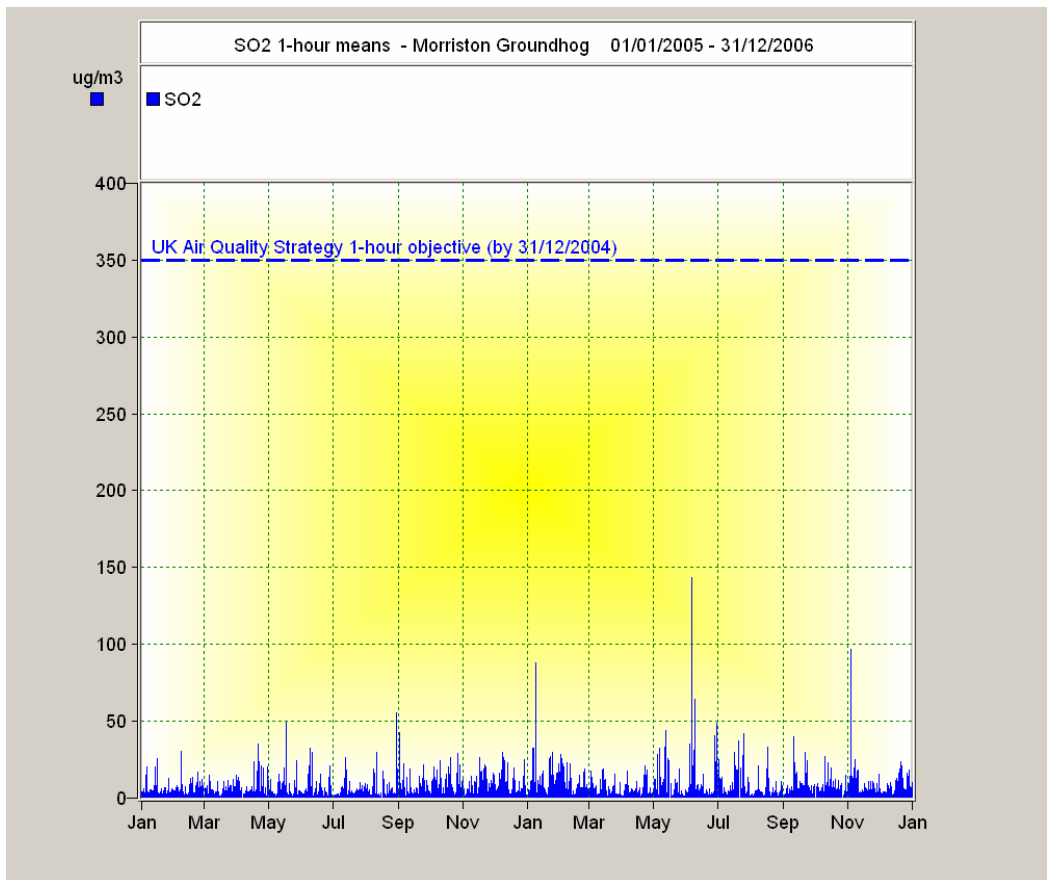


Chart 11 – Morriston Groundhog SO<sub>2</sub> 1-hour means 2005-2006

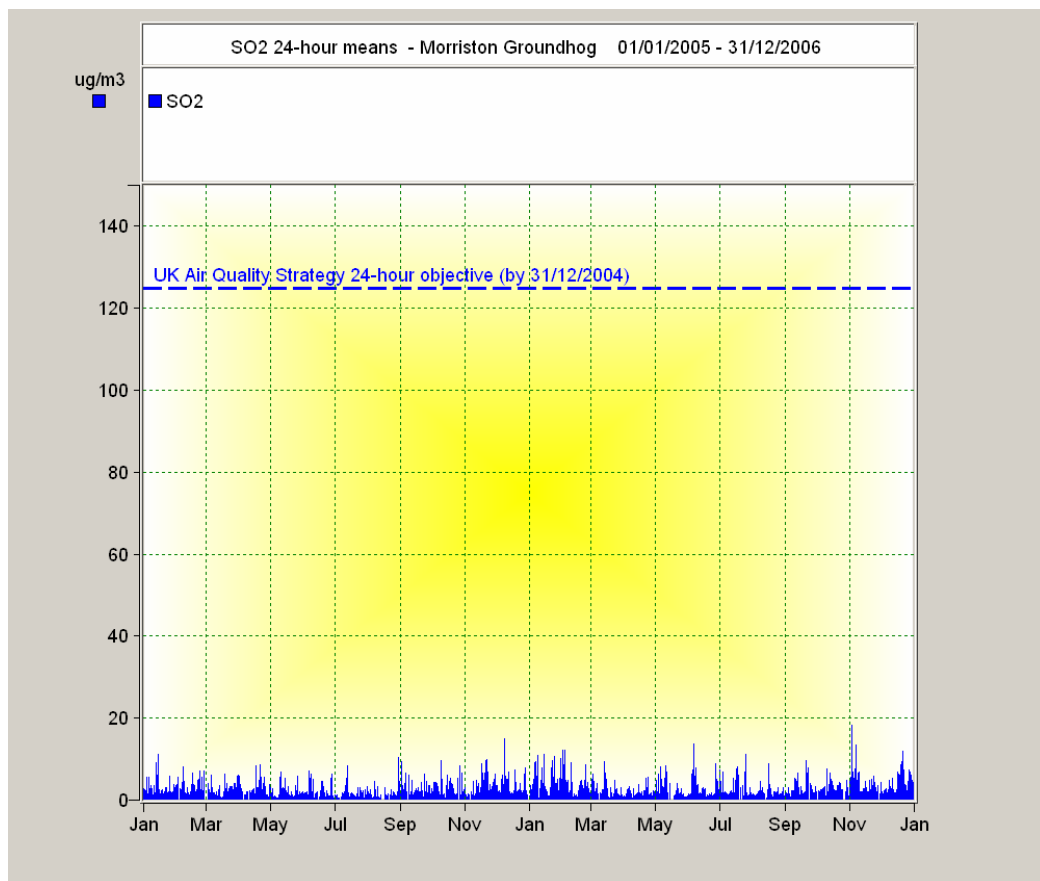
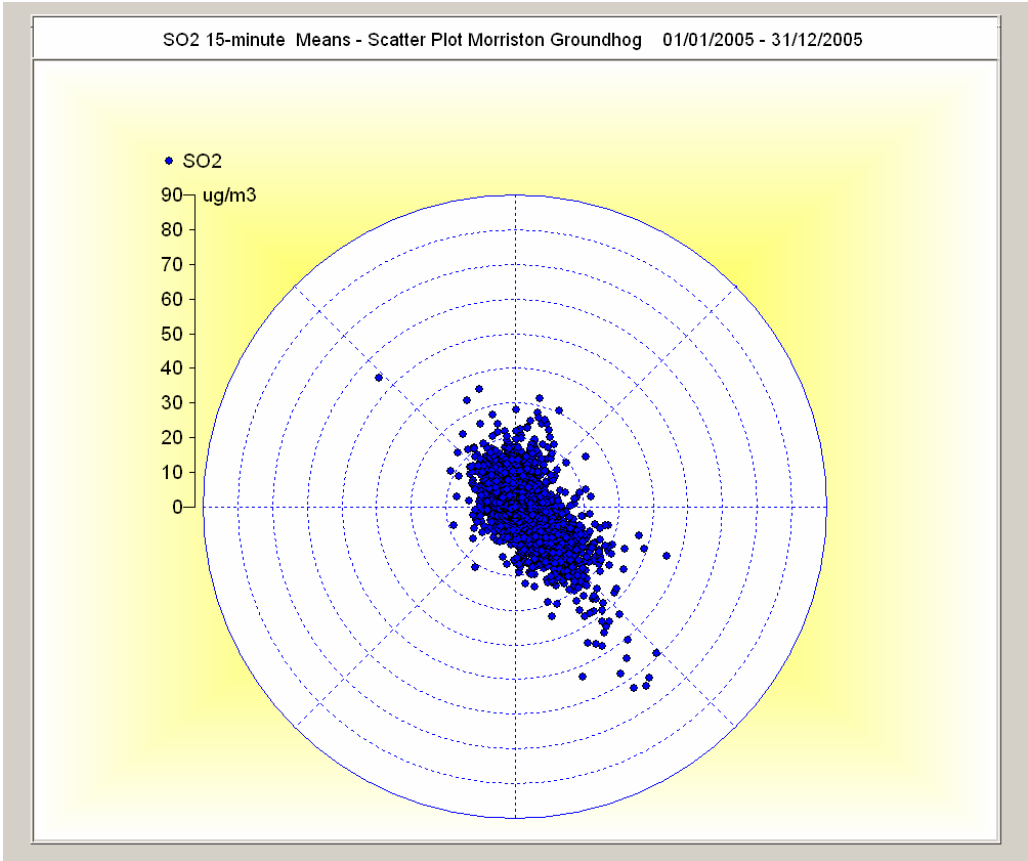
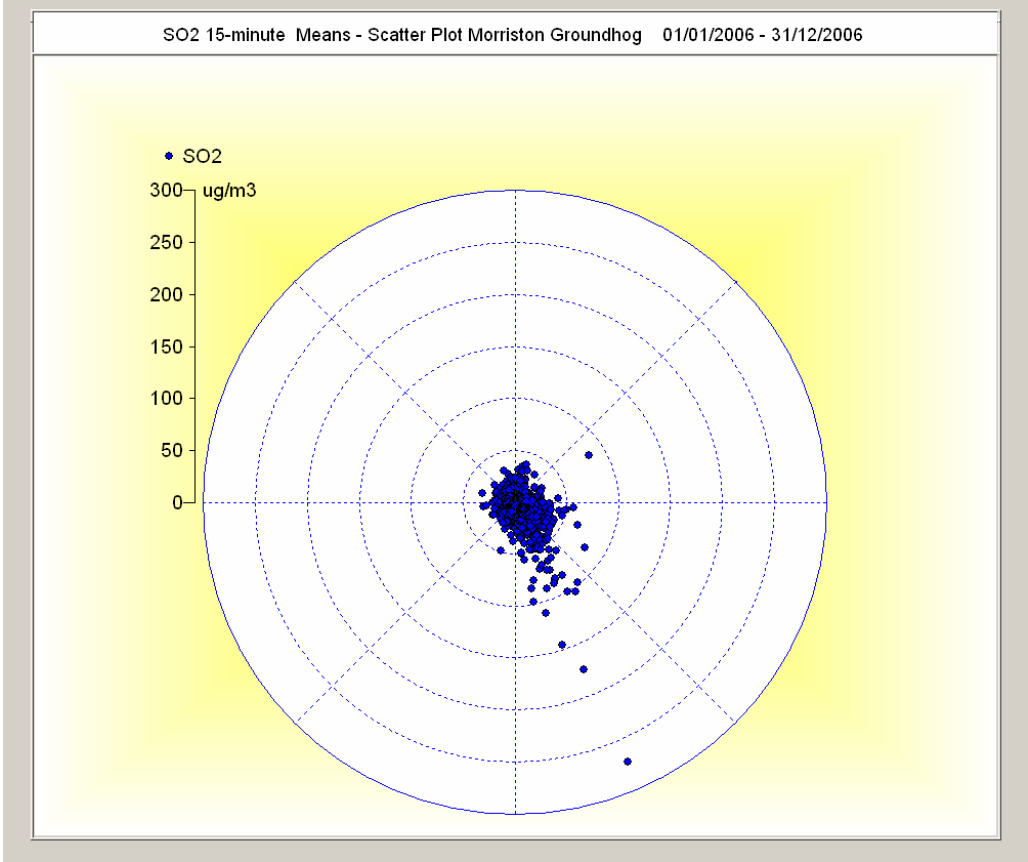


Chart 12 – Morriston Groundhog SO<sub>2</sub> 24-hour means 2005-2006

Whilst the data for 2005 does not exceed any limits, the scatter of the 15-minute means for 2005 is interesting in that it does show the predominantly south-easterly source of higher SO<sub>2</sub> concentrations. Scatter plots for 2005 (scatter plot 12) and 2006 (scatter plot 13) are shown below. Scatter plot 13 clearly shows and reinforces that elevated concentrations of SO<sub>2</sub> are from this south-easterly sector.

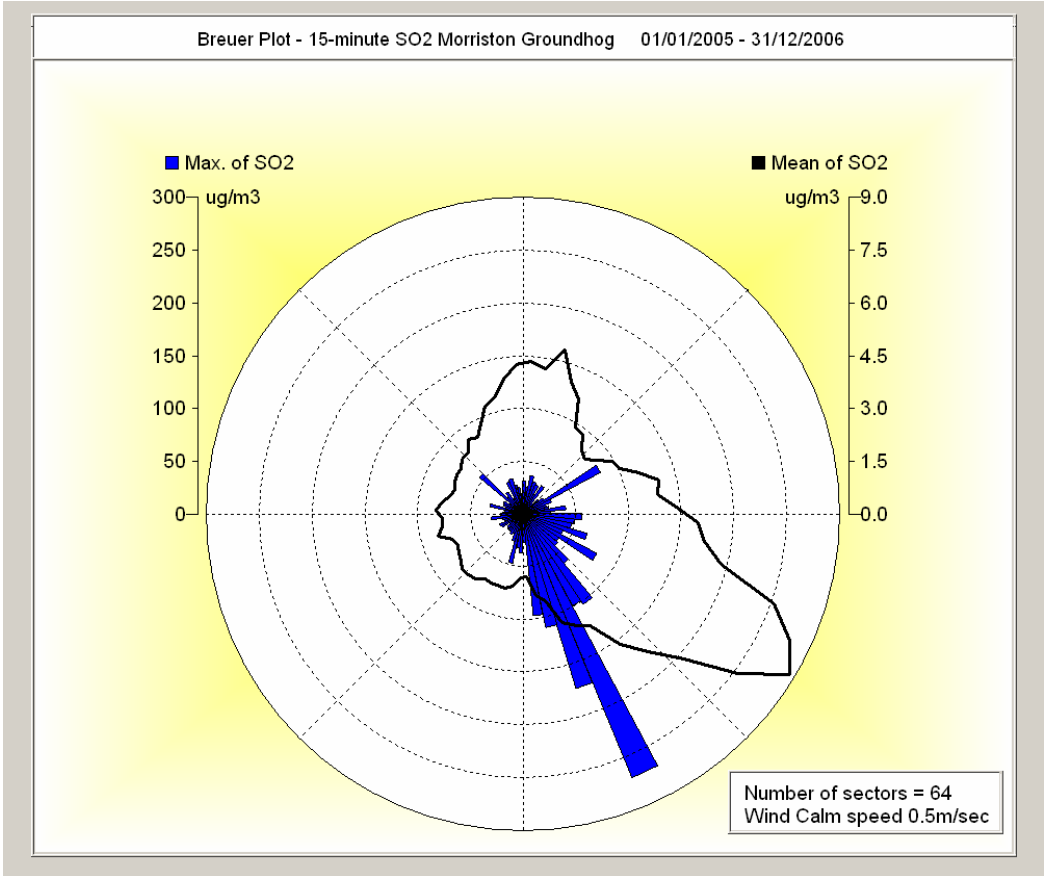


Scatter Plot 12 – Morriston Groundhog 15-Minute SO<sub>2</sub> data 2005



Scatter Plot 13 – Morriston Groundhog 15-minute SO<sub>2</sub> data 2006

Breuer Plot 6 below shows good correlation to Breuer Plot 5 produced for SO<sub>2</sub> being received at the Morfa Groundhog site (see 3.1.6 above). It is therefore clear that both the Morfa and Morriston monitoring stations within the lower Swansea valley are experiencing elevated levels of SO<sub>2</sub> from a south-easterly direction which would again confirm that industrial sources within Neath-Port Talbot as the more likely source of exceedences and elevated concentrations.



Breuer Plot 6 – SO<sub>2</sub> Concentrations Morriston Groundhog 2005-2006

As well as the south easterly mean/max tail within Breuer Plot 6 there is an indication (from the mean trace) of another source located to the north-east of the site. Morganite Electrical Carbon Ltd is located within approximately 500m of the Morriston site and its location is shown below within map 5.





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*Map 5 – Location of Morriston Groundhog and Morganite Electrical Carbon Ltd*

As part of the construction of the emissions database for Swansea which is ongoing, 28 emission points to air have been identified within the Morganite complex. Of these, 6 emit SO<sub>2</sub>. The latest data for 2006 would indicate that approximately 175.37 tonnes of SO<sub>2</sub> are emitted annually from the various processes. Whilst this is a relatively small quantity compared to other “local” sources, the release is being identified within the monitoring data.

Additionally, whilst both Breuer Plots 5 and 6 both indicate maximum SO<sub>2</sub> concentrations from a very similar direction (within the 135-190° sector), both plots would tend to indicate that additional and probably different local sources to the east of the sites (within the 90 - 135° sector) are impacting and influencing the mean concentration trace.

There is at present, no straightforward way to project forward to future years the number of likely exceedences etc. Compliance with each of the objective values has been calculated from 2001 to 2006 and is presented below as table 21, enabling a brief discussion on SO<sub>2</sub> trends to be made.

Morriston Groundhog	Max 15-Min Mean $\mu\text{g}/\text{m}^3$ (266 $\mu\text{g}/\text{m}^3$ )	Max 1-hour Mean $\mu\text{g}/\text{m}^3$ (350 $\mu\text{g}/\text{m}^3$ )	Max 24-Hour Mean $\mu\text{g}/\text{m}^3$ (125 $\mu\text{g}/\text{m}^3$ )	Annual Mean
2001	158.95	94.15	29.37	4.98
Exceedences	0	0	0	-
2002	122.30 #	72.06 #	24.25#	3.48#
Exceedences	0	0	0	-
2003	189.30	114.27	21.4	3.32
Exceedences	0	0	0	-
2004	98.12	68.02	18.73	3.08
Exceedences	0	0	0	-
2005	84.52	55.34	15.06	3.05
Exceedences	0	0	0	-
2006	270.9	143.8	18.29	3.52
Exceedences	1	0	0	-

Table 21 - Morriston Groundhog SO<sub>2</sub> - 2001 - 2006  
# Data capture for 2002 87.31%

As the maximum concentrations recorded within the various averaging periods given above will vary from year to year again, the easiest way to initially assess trends with the SO<sub>2</sub> concentrations is to look at the annual means returned from each of the years under consideration. Again, a similar pattern to that seen at the Morfa Groundhog site is apparent from the data. Accepting that the meteorological conditions prevailing during 2003 were atypical, the same analysis has been carried out for 2006 with a similar opinion being formed to that of 2003 in that there was a greater than expected prevalence of southeasterly winds. Whilst these atypical conditions during 2006 have resulted in the only exceedence recorded at the Morriston site, it is clear that SO<sub>2</sub> concentrations at Morriston continue to show an overall reduction trend.



### 3.3.1.7 Ozone

Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2005-2006. The objective for ozone is an 8-hour mean not to exceed  $100\mu\text{g}/\text{m}^3$  on more than 10 occasions with a compliance date of 31<sup>st</sup> December 2005

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time  $\text{NO}_x$  analyser. The logged 15-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the 8-hour means. In order to form a valid 8-hour mean 75% of the hourly means were required to be present i.e. 6 out of every 8.

The results from the monitoring during 2005-2006 are presented below as table 22 and show non-compliance during 2006 with the objective standard.

Morriston Groundhog	Max 8-hour Mean ( $\mu\text{g}/\text{m}^3$ )	Data capture	Exceedences of 8-hour objective $100\mu\text{g}/\text{m}^3$ (10 permitted)
2005	112.48	98.6 %	1
2006	152.20	98.8 %	15

Table 22 - Ozone 8-hour means - Morriston Groundhog 2005-2006

A chart of the ozone measurements undertaken during 2005-2006 is given below as chart 13

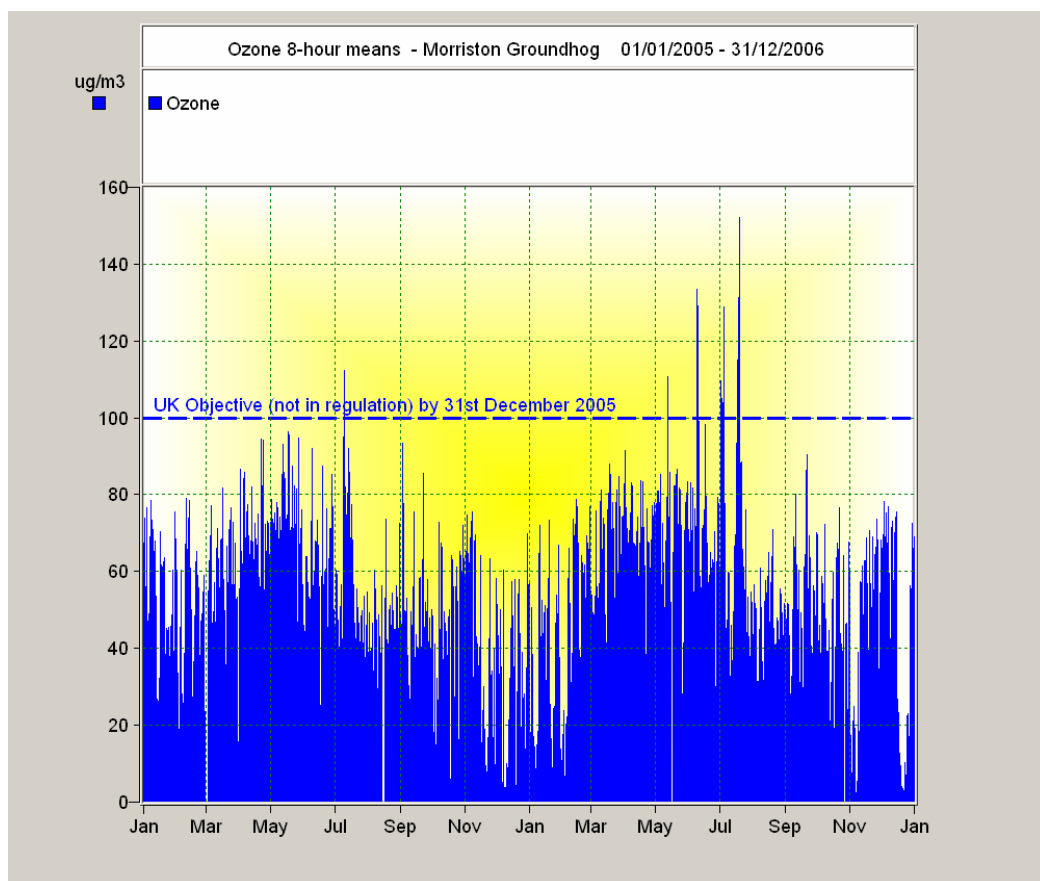


Chart 13 – Ozone 8-hour means Morriston groundhog 2005-2006

During 2006, the 15 exceedences occurred at the Morriston Groundhog during 3 distinct periods: 9<sup>th</sup> - 10<sup>th</sup> June, 1<sup>st</sup> - 4<sup>th</sup> July and the 17<sup>th</sup> - 19<sup>th</sup> July 2006. In order to determine if these elevated levels were due to local circumstances or part of a much wider regional episode, ratified and verified data has been downloaded from the Air Quality Archive for the Cardiff and Neath Port Talbot AUN Stations and imported into the Enviman databases.

Chart 14 below details the above periods from 4 monitoring stations namely Morriston, Swansea AURN, Neath Port Talbot AURN and Cardiff AURN. It is evident that elevated levels were recorded during the periods mentioned at all monitoring sites and that the exceedences monitored at Morriston were part of much wider regional episodes. The general assumption is that NO<sub>x</sub> precursors to an ozone episode would emanate from Eastern Europe. Data within chart 15

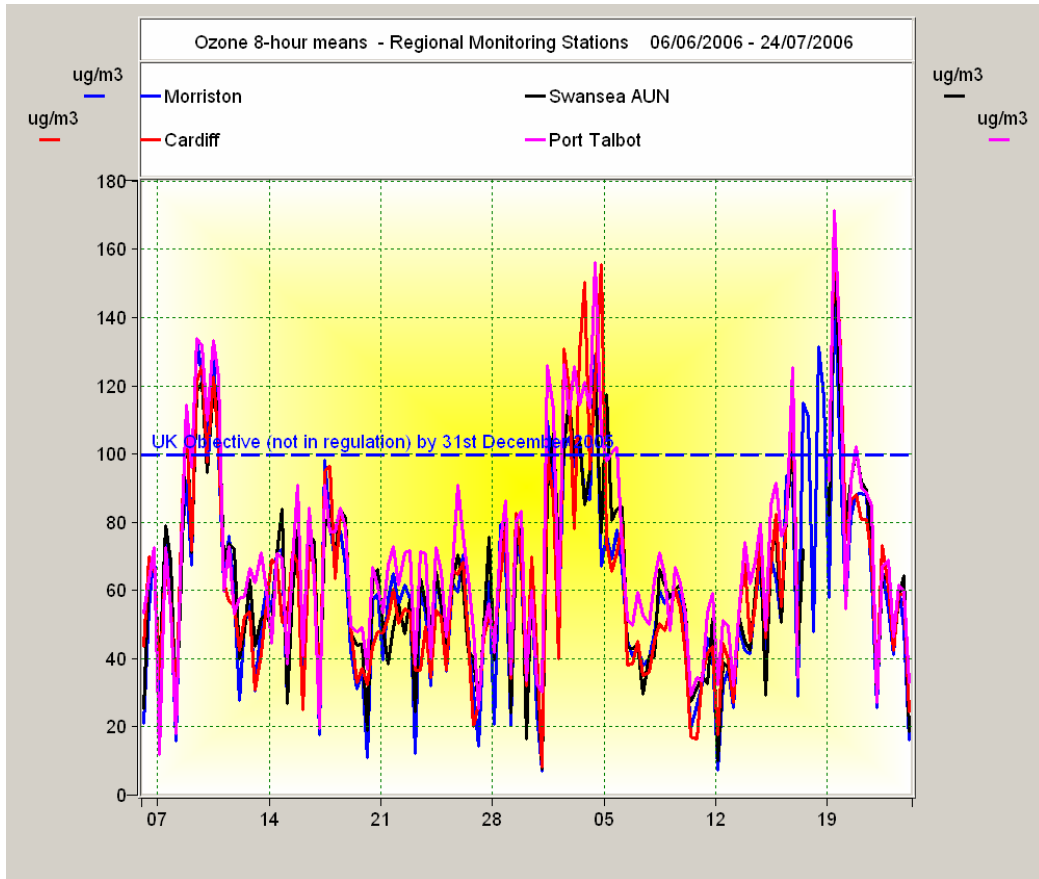


Chart 14 – Regional Ozone 8-Hour means 6<sup>th</sup> June to 24<sup>th</sup> July 2006

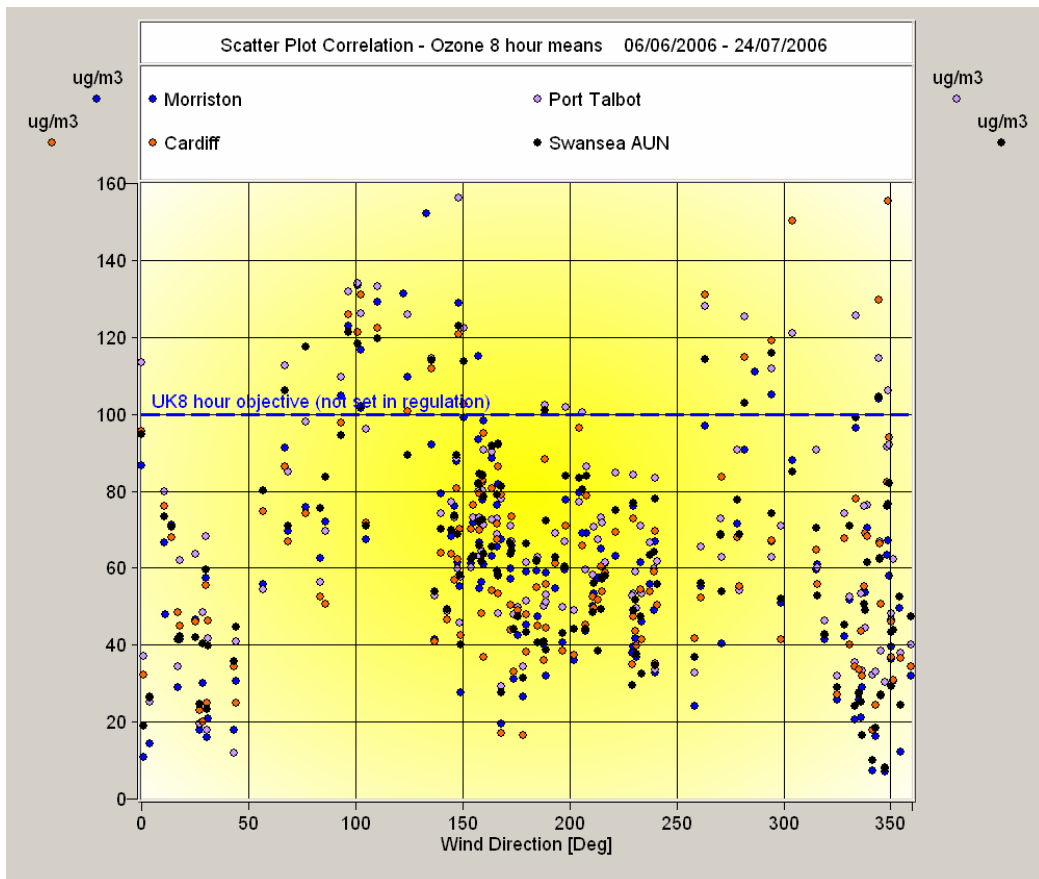
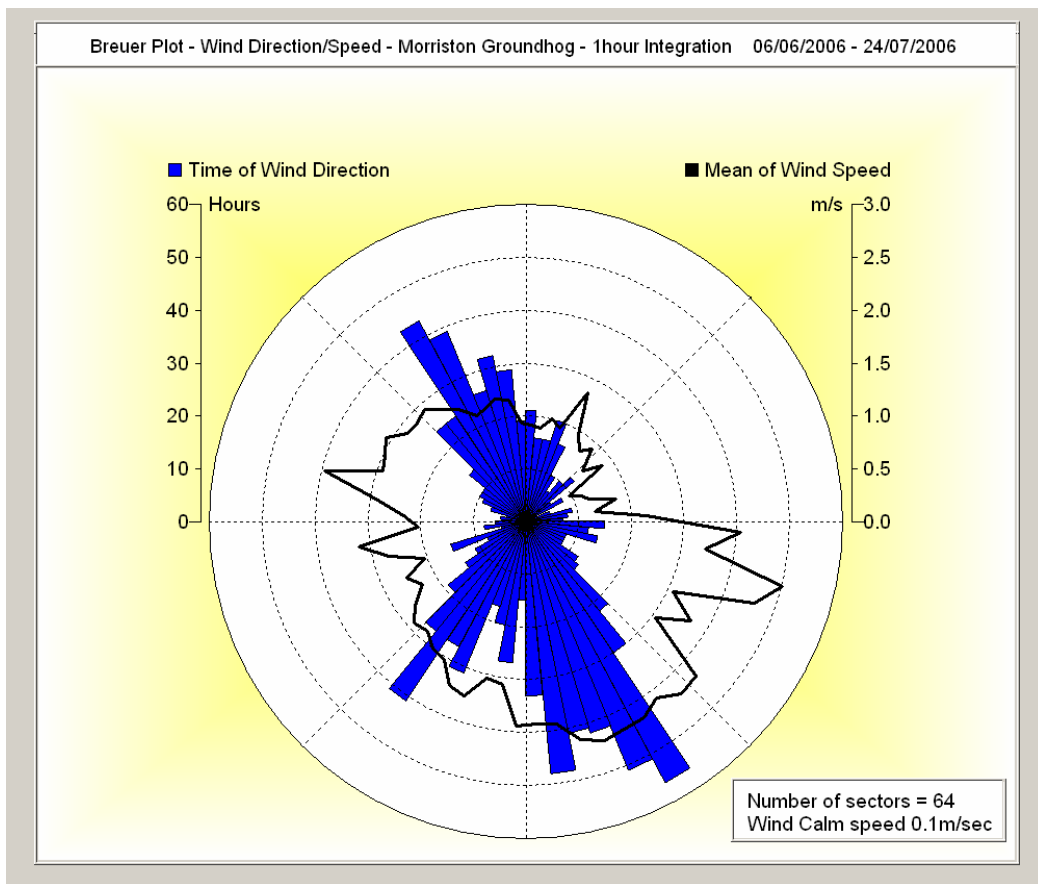


Chart 15 Scatter Plot Correlation 8 Hour Ozone Means 6<sup>th</sup> June to 24<sup>th</sup> July 2006

would tend to support this with wind directions between approx 70° - 160° indication corresponding 8 hour mean ozone exceedences, but, additionally within chart 15 is evidence that ozone exceedences were observed during wind directions from within the 260° - 350° range.

A Breuer Plot for the period 6<sup>th</sup> June – 24<sup>th</sup> July 2006 is shown below as Breuer Plot 7. Breuer Plot 7 shows 3 distinct periods where the wind direction was from



Breuer Plot 7 – Wind Direction Morriston Groundhog 6<sup>th</sup> June – 24<sup>th</sup> July 2006

a north-westerly direction, a south-westerly and a south-easterly direction. The period 9<sup>th</sup> - 10<sup>th</sup> June, was predominantly from a south-easterly direction. The period 1<sup>st</sup> - 4<sup>th</sup> July was predominantly from a north-westerly with a small element of a south-easterly direction with the period 17<sup>th</sup> - 19<sup>th</sup> July 2006 being predominantly from a south-easterly with a small period of north-westerly winds. An indication of the period of time in hours where the wind was within

the above directions is given within Breuer Plot 7. Despite there being an intervening significant period of south-westerly winds, chart 15 above indicates as expected, that this direction does not result in elevated ozone levels as the fetch is from a relatively clean air mass within the Irish Sea and beyond.

Critically for the above periods there were dates where data was absent from the analysis. This mainly spanned the last period between 17<sup>th</sup>- 19<sup>th</sup> July for the Swansea AUN, Neath Port Talbot and Cardiff AUN sites. The Swansea AUN was being audited by AEA Energy and Environment on the 10<sup>th</sup> July between 11:00 to 14:00 hours with Neath Port Talbot being audited on the same day between 07:00 and 09:00 hours. The Cardiff station appears to have been audited on the 12<sup>th</sup> July between 08:00 – 10:00hrs. All 3 stations had their 6 monthly service and calibration checks by respective equipment support contractors between the 17<sup>th</sup> - 19<sup>th</sup> July with all services being complete by 12:00 hrs on the 19<sup>th</sup> July.

### **3.3.1.8 Hydrogen Sulphide (H<sub>2</sub>S)**

There are some local industrial emissions sources of H<sub>2</sub>S within the Enterprise Zone. These discharges are to both air and water. Odour complaints from local businesses have been received in the past by the authority resulting from the discharges into the main foul sewerage system. However, the more predominant local source is from vehicles fitted with catalytic converters.

The Expert Panel on Air Quality has not published any regulatory standards and the World Health Organisation does not propose a health-based guideline value, although there are very clear health risks to exposure above odour threshold. European Directive 80/778/EEC requires that hydrogen sulphide should be

undetectable organoleptically. Results from the 2005-2006 monitoring are presented below as chart 16.

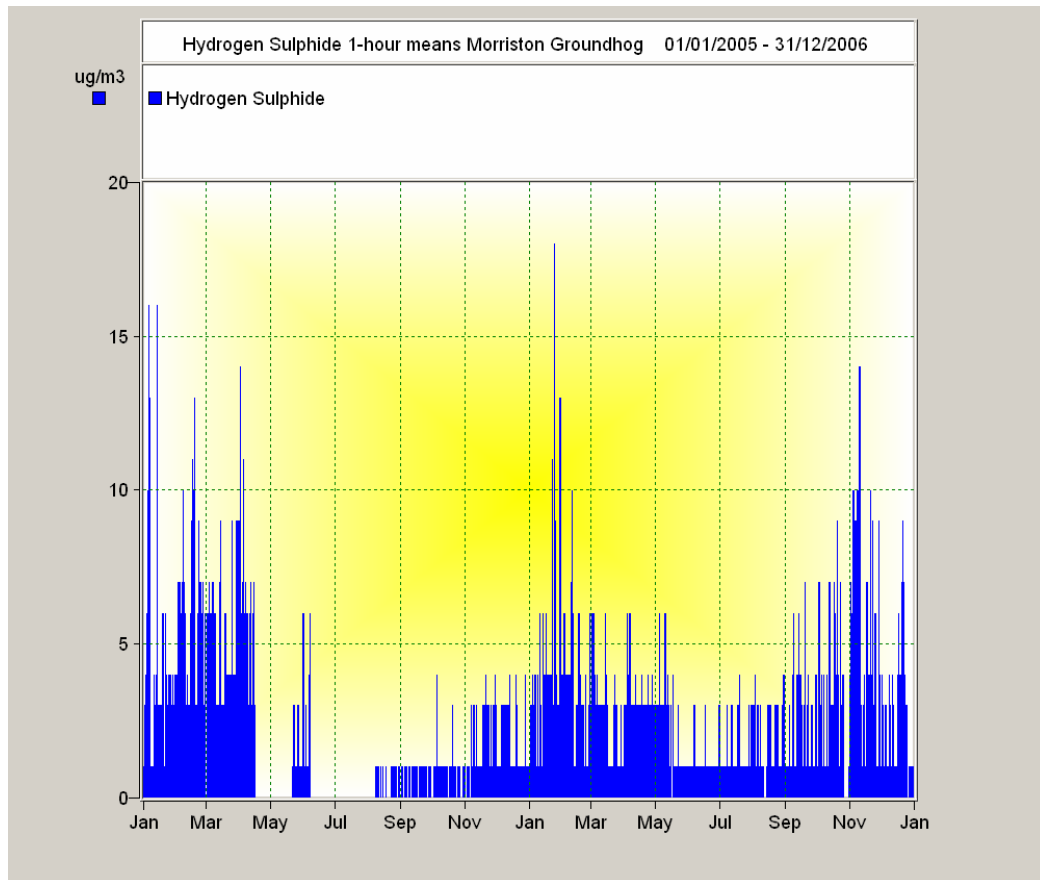


Chart 16 Hydrogen Sulphide 1-hour means Morriston groundhog 2005-2006

### 3.3.2 Swansea AURN

The Swansea AURN was located in the heart of the city centre on the pedestrian area of Princess Way. Due to the redevelopment of the David Evans complex, the monitoring station was scheduled for decommissioning on the 14<sup>th</sup> August 2006. The data logger failed on the 3<sup>rd</sup> August 2006 following a power surge at the site and in effect, data from the site ceased on this date as it was decided not to undertake any repairs to the data logger.

Every effort has been made to re-establish the monitoring station within the city centre. However, DEFRA has amended the siting criterion which has resulted in a suitable site being unable to be identified. The station has now been relocated roadside on Carmarthen Road at Waun Wen. For ease of reference, data upto the decommissioning point is included here along with data from the relocated site at Carmarthen Road. The relocated site is detailed and outlined below but is now sited just within the boundary of the Hafod Air Quality Management Area.

Due to the extensive regeneration works ongoing within the city centre it is highly likely that monitoring will be required in the near future. Discussions are ongoing as how best to meet the monitoring criteria. At present it is thought that this will be on a much reduced scale than before due to the new siting criteria.

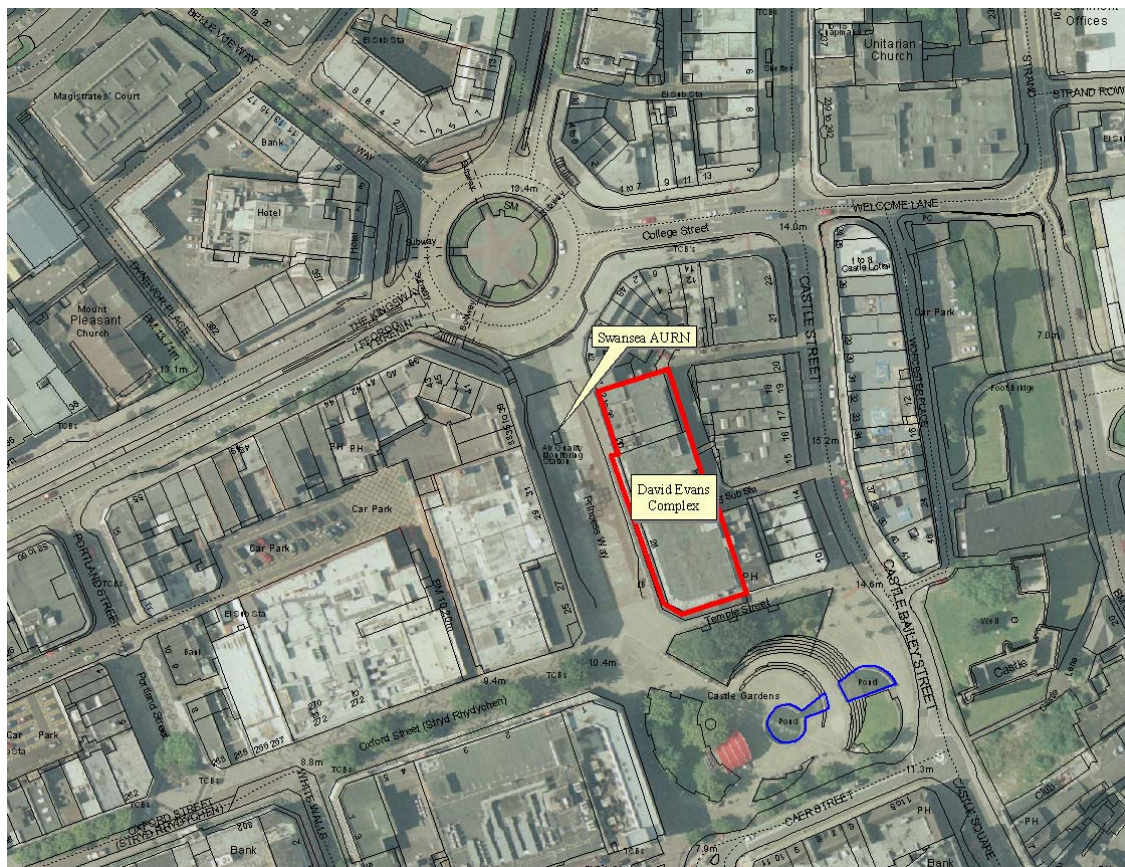
The station at Princess Way had been affiliated onto the UK National Network during late 1994 and had been operational ever since until 3<sup>rd</sup> August 2006. The site was relocated during 1995 from its original location at Castle Gardens to its location at Princess Way. The station had been given a site classification Urban Centre (U3)<sup>35</sup>. Map 6 below is an aerial view of the site and the surrounding

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<sup>35</sup> Source LAQM.TG(03) Appendix A page A1-42



locations.



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Map 6 – Aerial View – Swansea AURN, Princess Way, Swansea

The site was influenced by traffic using the nearby Princess Way/Kingsway roundabout but remained representative of typical population exposure in town or city centres. The main city centre shopping areas are to the south and south west of the site location.

All equipment was housed within an air-conditioned unit and operated continuously. The equipment comprised of Advanced Pollution Instruments (API) real-time analysers measuring O<sub>3</sub>, CO, SO<sub>2</sub> and NO<sub>x</sub>, with an R&P TEOM measuring PM<sub>10</sub>. The API gas analysers had been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition



officers from this authority performed routine fortnightly manual calibrations. The analyser's are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analysers were also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger recorded. All manual calibration data is then forwarded to Beuro Veritas and AEA Energy and Environment to perform data management procedures. The data is then further subjected to full network QA/QC procedure's undertaken by AEA Energy and Environment on behalf of the Department of Environment, Food and Rural Affairs (DEFRA).

Hourly ratified data for the period 2005 - 2006 covering the pollutants Carbon Monoxide, Ozone, Nitrogen Dioxide and Particulate Matter PM<sub>10</sub> (TEOM) has been downloaded from the Air Quality Archive at [http://www.airquality.co.uk/archive/flat\\_files.php?site\\_id=SWAN&zone\\_id=9](http://www.airquality.co.uk/archive/flat_files.php?site_id=SWAN&zone_id=9) along with ratified 15-minute Sulphur Dioxide data from the same location. These data have then been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation.

### **3.3.2.1 Nitrogen Dioxide**

Measurements were undertaken with an Advanced Pollution Instrumentation (API) real-time NO<sub>x</sub> analyser. The QA/QC procedures undertaken by NETCEN have resulted in ratified hourly data expressed in µg/m<sup>3</sup> being provided. The ratified hourly means have been used to calculate the objectives for the hourly and annual means.

Results obtained for 2005 and 2006 are shown within table 23 below. A graph of the hourly means is given below as Chart 17. Ratified data capture of the 1-hour means is also given within table 23.

Swansea AURN	Annual Mean (40µg/m <sup>3</sup> )		Max 1-hour (200µg/m <sup>3</sup> )		Exceedences of 1-hour std (18 permitted)	
	2005	2006	2005	2006	2005	2006
	33.8	30.61 *	138	126 *	0	0
Ratified Data capture %			94.39	54.46		
99.8 <sup>th</sup> Percentile				103.05		

Table 23 - Swansea AURN- NO<sub>2</sub> Monitoring Data 2005-2006

\* Data capture for 2006 below 90%

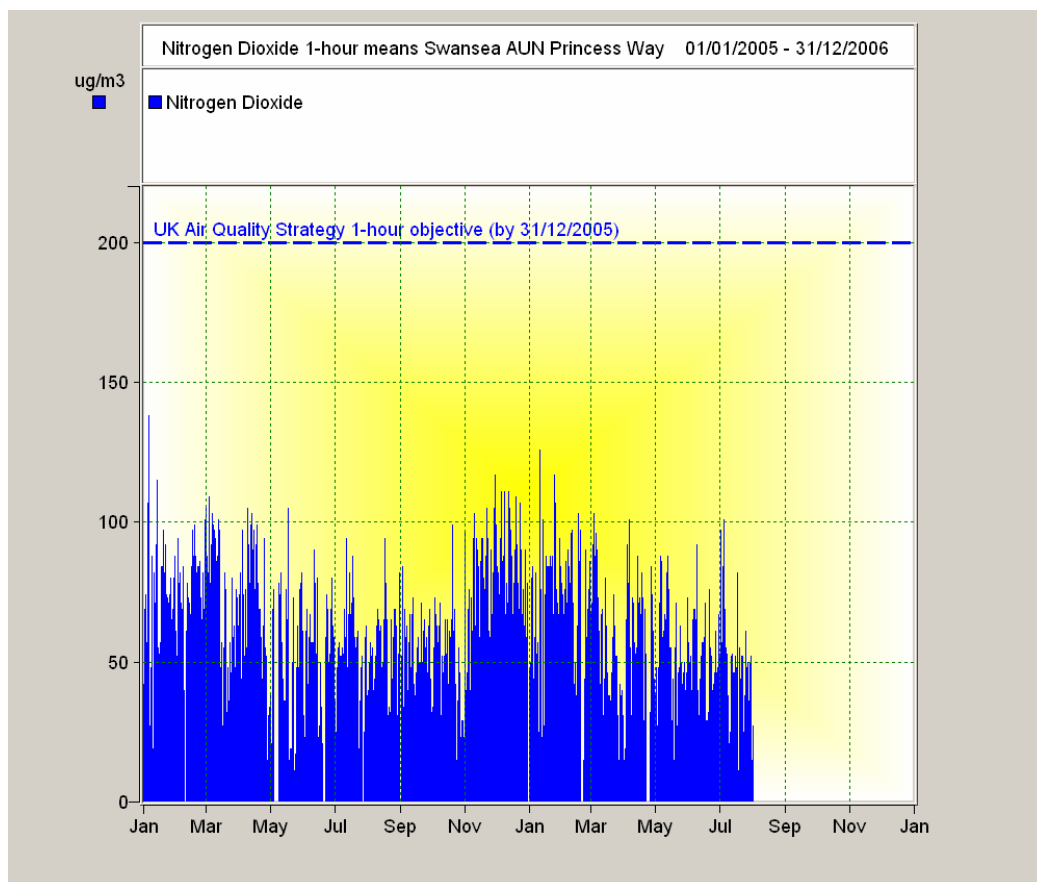


Chart 17 NO<sub>2</sub> 1-hour means Swansea AUN Princess Way, Swansea.

Data capture for 2006 was 54.46%, and, as mentioned above, was due to a combination of the logger failure but more so due to planned relocation of the site due to nearby development works. Direct compilation of the 1-hour exceedences rather than the use of the 99.8<sup>th</sup> percentile of 1-hour means is

therefore only valid for 2005<sup>36</sup>. The 99.8<sup>th</sup> percentile for 2006 is given within table 23.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls)). Using 2005 as the base year a projection of 28.43µg/m<sup>3</sup> is obtained for 2010 which remains below the EU objective of 40µg/m<sup>3</sup>. The Year Adjustment Calculator v2.2a is dated 19<sup>th</sup> January 2006 and was probably issued prior to the full impact of the increased primary NO<sub>2</sub> emissions being recognised.

Ideally, monitoring data should be available for at least 5 years before trends in NO<sub>2</sub> concentrations can be meaningfully discussed. Monitoring commenced at this site during 1995 so over 10 years of monitoring data is available. The annual means from 1995 to 2006 are presented below within table 24 for a brief discussion on trends to be made. In addition and as an additional indicator, the maximum hourly concentrations recorded for each year are detailed.

Swansea AURN	Annual Mean (40µg/m <sup>3</sup> )												
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Projected 2010
	41.3	43.19	38.03	36.15	34.08	33.37	35.42	31.25	33.96	36.95	33.8	30.61 *	28.43 **
Max 1-hr	180	145	145	166	130	136	120	105	164	143	138	126 *	-

\* Data capture for 2006 54%

\*\* based on base year of 2005

Table 24 – Annual Mean NO<sub>2</sub> concentrations 1995 – 2006 Swansea AURN

<sup>36</sup> LAQM.TG(03) Box 6.2 page 6-16

Chart 18 below graphically presents the annual mean data from 1995-2006

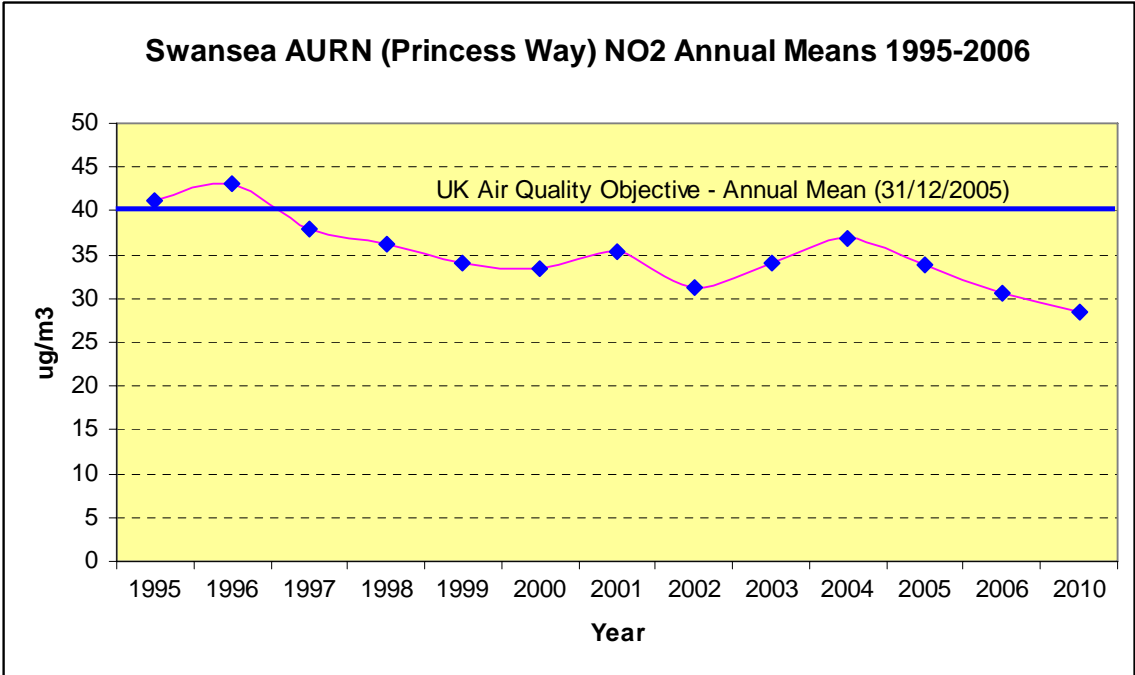


Chart 18 – Swansea AURN (Princess Way) Annual NO<sub>2</sub> Means 1995 - 2006

The data point for 2006 should be treated with caution due to the poor data capture resulting from the planned decommissioning of the station during August. If this uncertainty is accepted then it is clear that annual mean concentrations at the former AUN site have remained below the objective level since 1996. The projection (from 2005 data) for 2010 indicates a further reduction in annual mean concentrations. What is noticeable at this site, and it may be partly explained by the lack of data during late 2006, is the absence of the reversal in reduction trend seen at other sites within Swansea and also nationally.

Again, it may be interesting to revisit the predictions made for 2005 from previous review and assessment. The various projections and source are indicated below in table 25.

LAQM Report	Base year	Annual Mean in Base Year	Projection for 2005 $\mu\text{g}/\text{m}^3$	Projection for 2010 $\mu\text{g}/\text{m}^3$
Stage 4 Review	2001	35.42	32.08	
Stage 4 review	2002	31.25	29.13	
USA 2004	2003	33.96	32.3	
Progress Report 2004	2004	36.95	36.19	31.01
USA 2006	2005	33.8		29.56
Progress Report 2007	2006	30.61*		28.43 **

\* Data capture for 2006 54%

\*\* Calculated from 2005 annual mean

Table 25- Swansea AUN (Princess Way) Previous Projections 2005 and 2010

As can be seen, the prediction made from the 2003 base measured data (and accepting that 2003 exhibited atypical meteorological conditions) is, in fact relatively accurate along with one of the earliest predictions from the 2001 measured data.

The data ranged from underestimating the 2005 annual mean by -13.8% (2002 base data) to an overestimate of 7% (from the 2004 base data). The 2003 base data produced the closest estimate being an underestimate of 4.4%. It must be noted that the method for projecting forward these predictions and the tools developed to enable this forward look have evolved over time i.e. the latest Year Adjustment Calculator (2006) uses 2004 as its base year.

### 3.3.2.2 Particulate Matter $\text{PM}_{10}$ (TEOM)

A Rupprecht & Patashnick Co., Inc. TEOM measured Particulate Matter  $\text{PM}_{10}$  at this site. The QA/QC procedures undertaken by NETCEN have resulted in ratified hourly data (corrected with default interim factor of 1.3) expressed in  $\mu\text{g}/\text{m}^3$  being provided. The ratified hourly means have then been used to calculate both the daily 24-hour means and the annual mean. In order to

calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the daily hourly averages were specified to be present.

All results are presented in  $\mu\text{g}/\text{m}^3$  and have been corrected by AEA Energy and Environment with the interim default correction factor of 1.3 to estimate gravimetric concentration. For ease of comparison with results from previous years, the results obtained for 2005 and 2006 are shown alongside those for 2003 and 2004 within table 26 below. A chart representing the 24-hour daily means from 2005-2006 is given below as chart 19.

Swansea AURN PM <sub>10</sub> (TEOM)	Annual Mean (40 $\mu\text{g}/\text{m}^3$ )				24-hour Exceedences (50 $\mu\text{g}/\text{m}^3$ ) (35 permitted)			
	2003	2004	2005	2006	2003	2004	2005	2006
	24.88	25.88 *	24.74	27.59 **	11	3*	1	7 **

\* Data capture 2004 23.22%

\*\* Data capture for 2006 56.99%

Table 26 – Particulate Matter PM<sub>10</sub> (TEOM) Swansea AURN (Princess Way) Monitoring data 2003-2006

Monitoring commenced at this site during June 1994 but ratified data is only available from 1<sup>st</sup> December 1994. Analysis has therefore been performed from 1995 to 2006, providing 11 years of measurements to assess trends. Table 27 details annual means between 1995 and 2006 and chart 20 plots the trends over this time period.

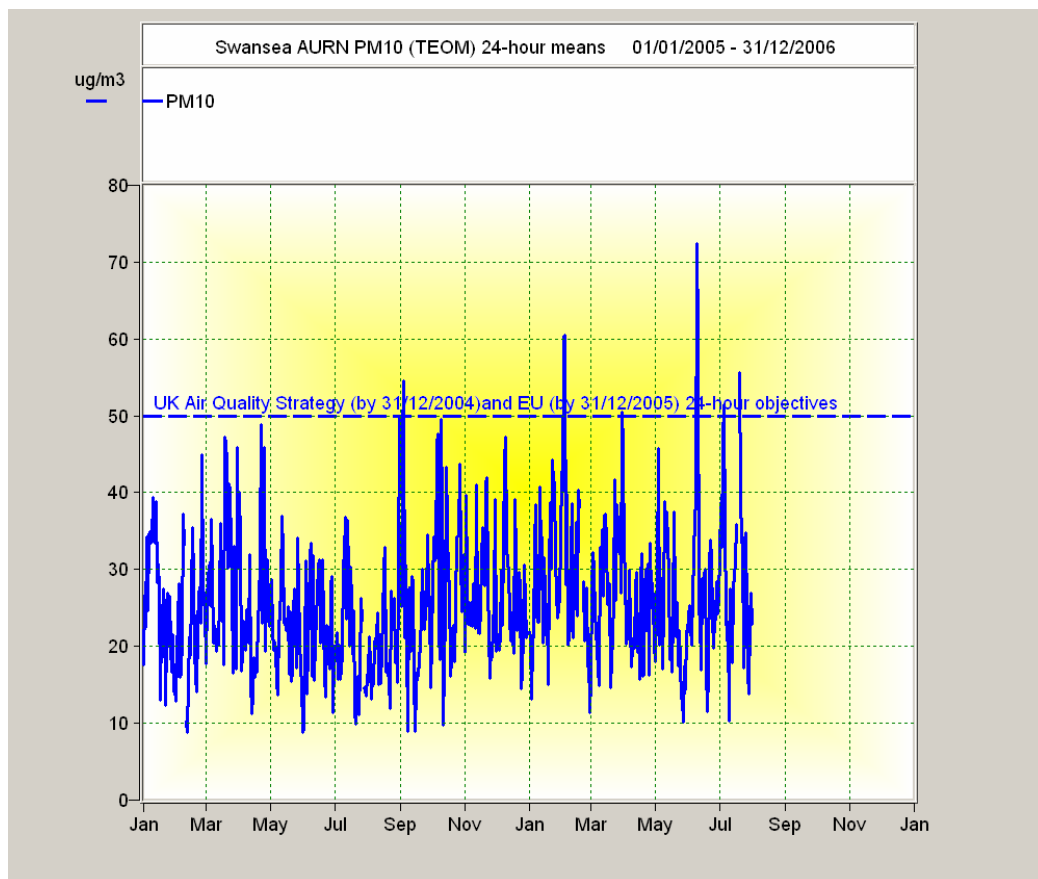


Chart 19 – Swansea AURN (Princess Way) PM<sub>10</sub> (TEOM) monitoring data 2005-2006

Data within table 27 indicates that compliance with all objectives has been attained since 1996 with what appears to be an overall reduction trend. However, data capture for two out of the last 3 years means that an accurate assessment is not clear as to whether emissions of primary NO<sub>2</sub> were being observed at this site.

Swansea AURN	Year											
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Annual Mean	34.54	30.49	31.05	27.15	21.86	25.52	25.46	25.03	24.91	25.88*	24.74	27.59**
Max 24-Hour	90.08	107.4	73.08	102.5	54.88	81.38	70.13	68.29	67.25	56.67*	54.58	72.42**
24-Hour Exceedences (35 Permitted)	51	34	25	18	1	13	7	5	11	3*	1	7**
Data capture %	94.52	96.72	96.99	95.62	95.62	96.45	93.15	98.08	97.53	23.2*	98.90	56.99**

\* Data capture 2004 23.2%

\*\* Data capture 2006 56.99%

Table 27 Particulate matter PM<sub>10</sub> trends Swansea AURN (Princess Way) 1995-2006

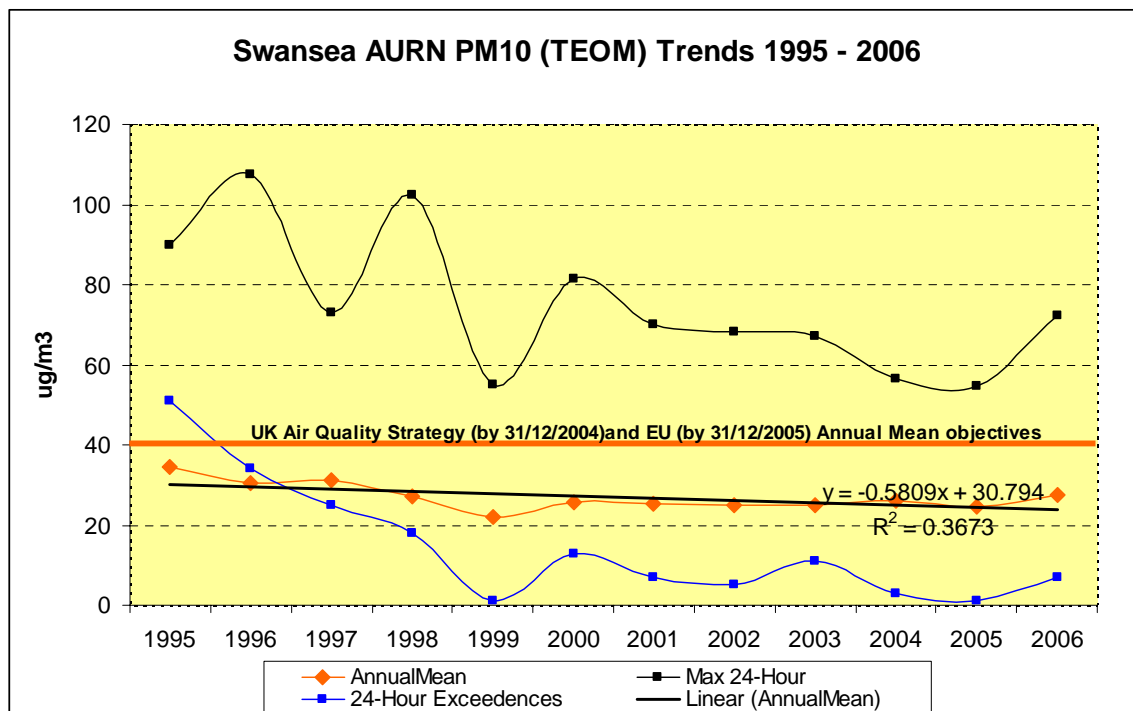


Chart 20 Swansea AURN (Princess Way) PM<sub>10</sub> (TEOM) trends 1995 - 2006



### 3.3.2.3 Carbon Monoxide

Measurements were undertaken with an Advanced Pollution Instrumentation (API) real-time CO analyser. . The QA/QC procedures undertaken by NETCEN have resulted in ratified hourly data expressed in  $\text{mg}/\text{m}^3$  being provided. The ratified hourly means have then been used to calculate the maximum running 8-hour means. In order for a running average to be valid, 75% data capture is required i.e. 6 hourly averages out of every 8 must be valid. The running 8-hour mean for a particular hour, is the mean of the hourly average concentrations for that hour and the preceding 7 hours. The average period is stepped forward by one hour for each value, so running mean values are given for the periods 00:00 – 07:59, 01:00 – 08:59 etc. There are, therefore, 24 possible 8-hour means in a day (calculated from hourly data). The maximum daily running 8-hour mean is the maximum 8-hour running mean measured on any one day.<sup>37</sup> A chart representing the 8-hour running means during 2005-2006 is given below as chart 21.

There have been no exceedences of the maximum daily 8-hour running mean of  $10\text{mg}/\text{m}^3$  recorded at this site either during 2005-2006 or any other period of measurement. The date for compliance with the Air Quality (Amendment)(Wales) Regulations 2002 objective standard was the 31<sup>st</sup> December 2004.

Data capture for the 8-hour running means during 2005 was 97.37% and for 2006 was 51.81% allowing direct comparison with the objective standard for 2005 only. For information a table showing the maximum 8-hour running means between 2001 and 2006 is given below as table 28.

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<sup>37</sup> Source LAQM.TG(03) – Monitoring – Calculation of exceedence statistics, paragraph A1.104 page A1-37.

An error has been discovered within the Updating and Screening Assessment 2006 produced by the authority where maximum 8-hour running means are presented for CO at the Swansea AURN (Princess Way) site - it has become evident that whilst the ratified data has been provided by AEA Energy and Environment in the units mg/m<sup>3</sup>, a further formulae had been applied to the data as if it were supplied in ppm i.e. the mg/m<sup>3</sup> has been further multiplied by the conversion factor of 1.16. This error has now been identified and is corrected within table 28 below.

The EU objective of a maximum daily 8-hour running mean of 10mg/ m<sup>3</sup> with a compliance date of 2005 has also been comfortably achieved.

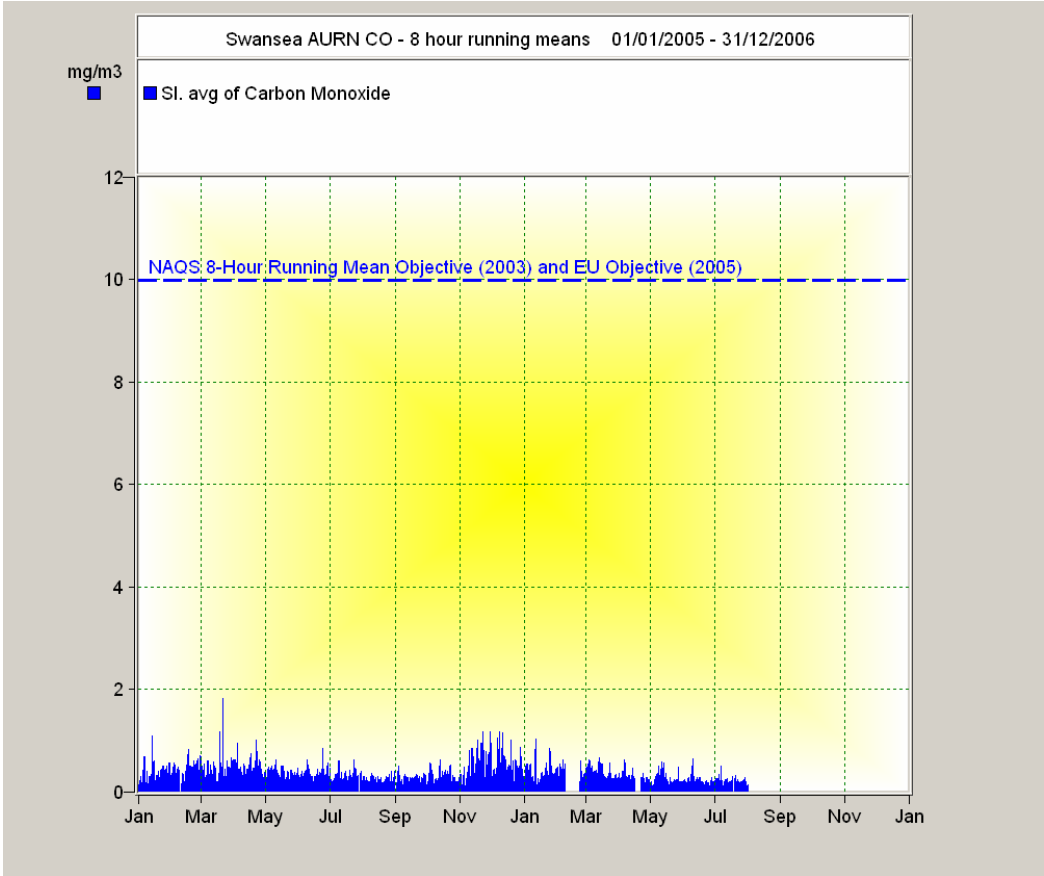


Chart 21 CO 8-hour running means 2005-2006 Swansea AURN (Princess Way)

Year	Swansea AURN *
2001	2.74 mg/m <sup>3</sup>
2002	1.96 mg/m <sup>3</sup>
2003	2.16 mg/m <sup>3</sup>
2004	2.65 mg/m <sup>3</sup>
2005	1.84 mg/m <sup>3</sup>
2006	1.04 mg/m <sup>3</sup>

Table 28 Swansea AURN (Princess Way) 8-hour running maximum CO values 2001 - 2006

\* Corrected from USA 2006 report

### 3.3.2.4 Sulphur Dioxide

Measurements were undertaken with an Advanced Pollution Instrumentation (API) real-time SO<sub>2</sub> analyser. The QA/QC procedures undertaken by AEA Energy and Environment have resulted in ratified 15-minute data expressed in µg/m<sup>3</sup> being provided. The ratified 15-minute means have been used to calculate the objectives for the 15-minute objective with the ratified 1-hourly means being used to calculate both the hourly and 24-hour objectives. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the ratified hourly means were specified to be present<sup>38</sup>.

Data from 2005 and 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 29.

Ratified data capture at the base 15-minute logged means for 2005 is 89.75% and for 2006 is 50.66%, meaning direct compilation of the number of exceedences is not permitted<sup>39</sup>. The 99.9<sup>th</sup> percentile for 2005 and 2006 is given for each year under consideration with the 15-minute dataset.

<sup>38</sup> LAQM.TG(03) Monitoring A1-38

<sup>39</sup> Technical Guidance LAQM.TG(03) page 7-7 box 7.2

The ratified data capture at 1-hour integration for 2005 is surprisingly 91.54% and for the 24-hour dataset is 90.96% allowing direct compilation of the number of exceedences rather than use of the 99.7<sup>th</sup> and 99<sup>th</sup> percentiles respectively. However, data capture for all integration periods for 2006 falls well below the 90% required and therefore the respective percentiles are presented for 2006.

Maximum concentrations within table 29 are provided for information

No exceedence of the 15-minute objective was observed during 2006 despite other monitoring stations within Swansea experiencing a short lived episode - this “local” episode is discussed in greater detail within 3.1.6 Morfa Groundhog above.

Graphs representing the various averaging periods for 2005 - 2006 and detailed within table 29 below are shown below as chart 22 (15-minute means), chart 23(1-hour means) and chart 24 (24-hour means).

Swansea AURN	Max 15-Min Mean $\mu\text{g}/\text{m}^3$ (266 $\mu\text{g}/\text{m}^3$ )	Max 1-hour Mean $\mu\text{g}/\text{m}^3$ (350 $\mu\text{g}/\text{m}^3$ )	Max 24-Hour Mean $\mu\text{g}/\text{m}^3$ (125 $\mu\text{g}/\text{m}^3$ )
2005 *	80	69	22.54
99.9 <sup>th</sup> percentile	43	-	-
Date of Max	-	22/04/2005	22/04/2005
Time of Max	-	03:00	-
Wind Direction @ Max conc.	-	64°	73°
2006 **	218	117	21.5
99.9 <sup>th</sup> percentile	73.76	-	-
99.7 <sup>th</sup> percentile	-	37.01	-
99 <sup>th</sup> percentile	-	-	16.75

Table 29 Swansea AURN (Princess Way) SO<sub>2</sub> Monitoring data 2005-2006

\*Data capture (15-minute means) for 2005 89.75%

\*\*Data capture (15-minute means) for 2006 50.66%

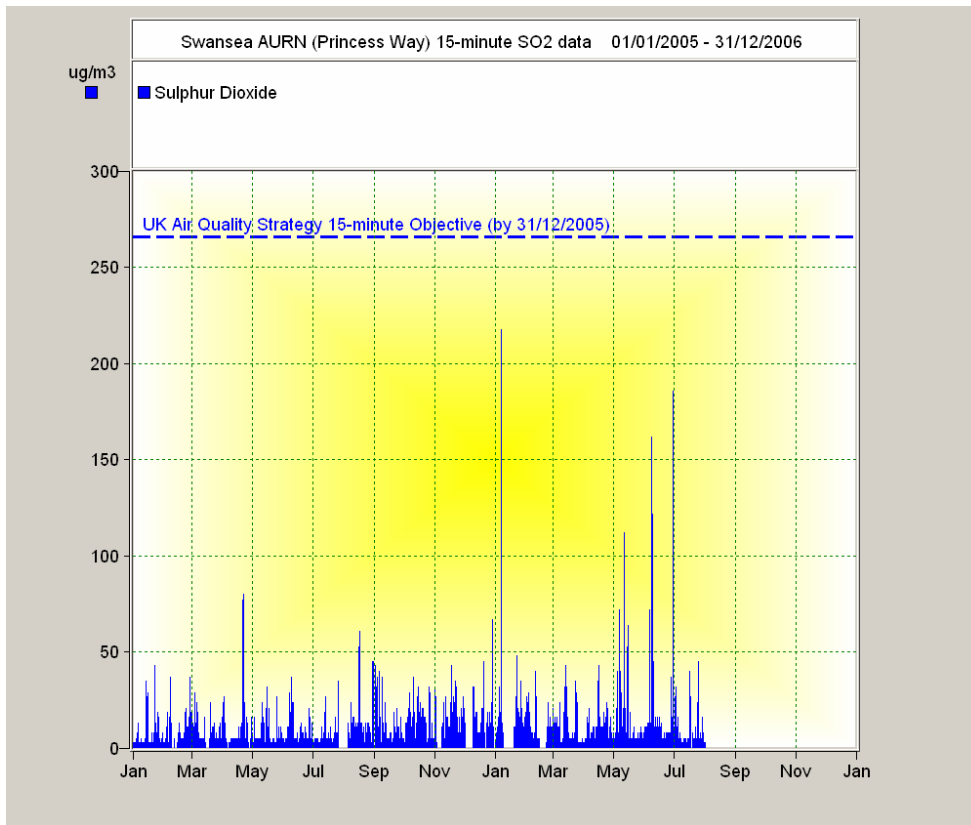


Chart 22 – Swansea AURN (Princess Way) 15- minute SO<sub>2</sub> data 2005-2006

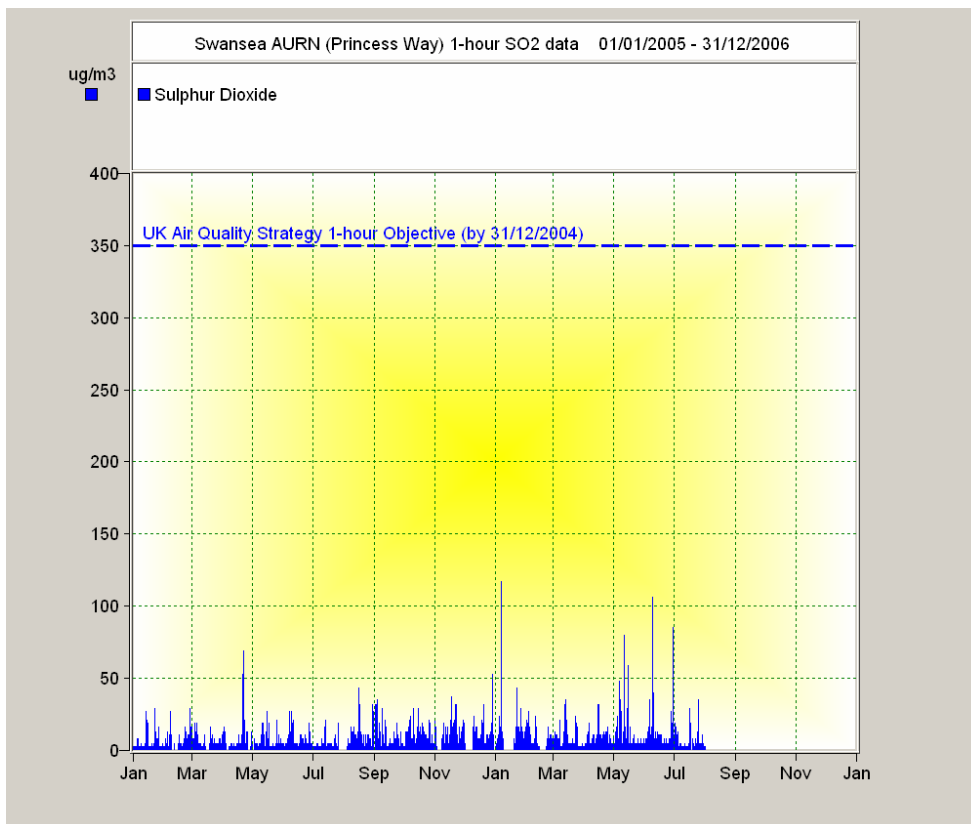


Chart 23 – Swansea AURN (Princess Way) 1-hour SO<sub>2</sub> data 2005-2006

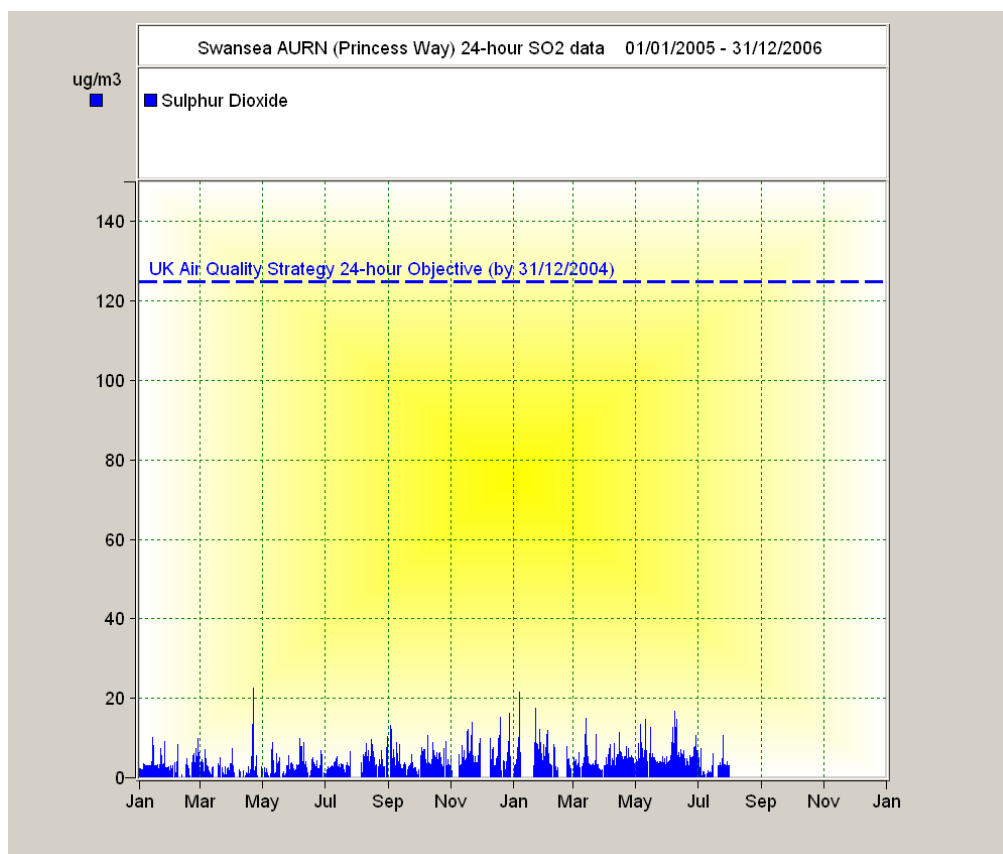


Chart 24- Swansea AURN (Princess Way) 24-hour SO<sub>2</sub> data 2005-2006

There is no straightforward way at present to project forwards to future years the number of likely exceedences etc and indeed there are no new objective dates post 2005. As maximum data for the differing averaging periods will inevitably vary year on year, probably the easiest way to assess any trend with the data is to examine the annual means returned. Table 30 below summarises the annual means between 2001 and 2006.

Year	Mean µg/m <sup>3</sup>
2001	5.96
2002	4.47
2003	4.41
2004	2.50
2005	3.89 *
2006	5.30**

Table 30 – Sulphur Dioxide annual means – Swansea AURN (Princess Way) 2001 – 2006

\* 15 minute data capture 89.75%

\*\* 15 minute data capture 50.66%

Meteorological conditions during 2003 are known to have been atypical but despite this, these conditions have not had such a notable effect at this site as seen at the Morfa Groundhog during 2003. A clear overall downward trend is still evident from the data up until 2004. Data capture for 2005 and 2006 has produced slightly unreliable annual mean data but clearly even with the uncertainties highlighted concentrations remain low. This trend is also evident from the maximum concentrations recorded for all of the averaging periods during this period.

### **3.3.2.5 Ozone**

Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2004. The objective for ozone is an 8-hour mean not to exceed  $100\mu\text{g}/\text{m}^3$  on more than 10 occasions with a compliance date of 31<sup>st</sup> December 2005

Measurements are undertaken with an Advanced Pollution Instrumentation (API) real-time ozone ( $\text{O}_3$ ) analyser. The ratified 1-hour means provided by NETCEN have been imported into the software package OPSIS Enviman Reporter. The hourly means have been used to calculate the 8-hour means. In order to form a valid 8-hour mean 75% of the hourly means were required to be present i.e. 6 out of every 8.

The results from the monitoring during 2005-2006 are presented below as table 31 and shows non-compliance during 2006 with the objective standard.

Swansea AURN (Princess Way)	Max 8-hour Mean ( $\mu\text{g}/\text{m}^3$ )	Data capture %	Exceedences of 8-hour objective $100\mu\text{g}/\text{m}^3$ (10 permitted)
2005	102.5	97.44	2
2006 *	123.0	55.80	16

Table 31 - Ozone 8-hour means – Swansea AURN (Princess Way) 2005-2006

\* Data capture 2006 55.80% due to decommissioning of site during August 2006

A chart of the ozone measurements undertaken during 2005-2006 is given below as chart 25

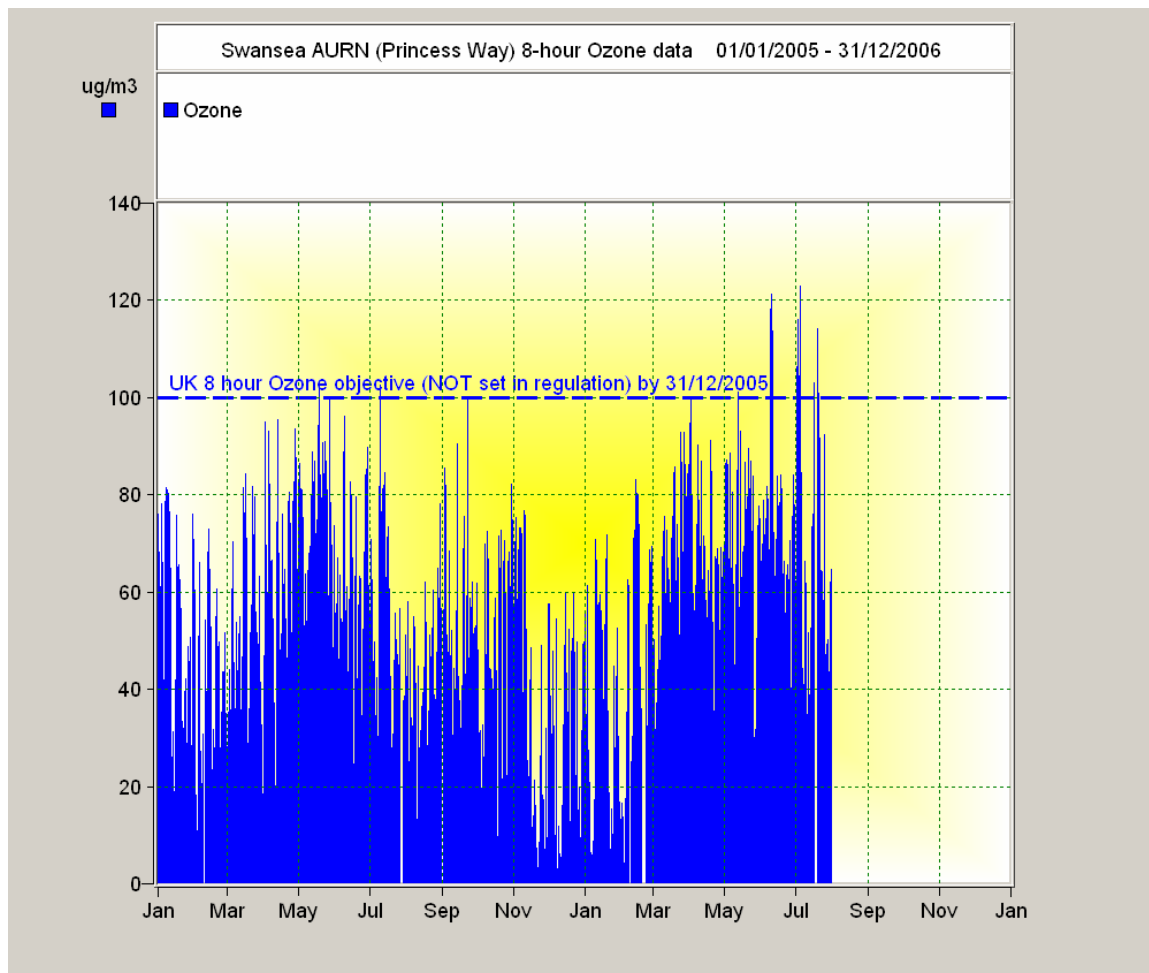


Chart 25 – 8-hour Ozone means Swansea AURN (Princess Way) 2005-2006



The exceedences monitored during 2006 at the Princess Way site are part of a regional episode that has been outlined and discussed in greater detail within section 3.3.1.7 above.

Table 32 below details the maximum concentrations recorded and exceedences of the 8-hour mean objective for the period 1995 - 2006 at the Swansea AURN.

The only exceedences of the objective were during 1995, 2003 and 2006.

Prevailing meteorological conditions during 2003 are known to have been atypical. The ozone episodes of 2003 have been investigated by AEA Energy and Environment (formally NETCEN) and are the subject of a report at

[http://www.airquality.co.uk/archive/reports/cat12/marchapril03\\_episode.pdf](http://www.airquality.co.uk/archive/reports/cat12/marchapril03_episode.pdf)

This report deals with the ozone episode during March - April 2003 which also saw elevated levels of PM<sub>10</sub> episodes - in this instance, air mass back trajectories indicated the ozone precursors originated from within Eastern Europe.

Year	Max 8-hour Mean ( $\mu\text{g}/\text{m}^3$ )	Data capture %	Exceedences of 8-hour objective $100\mu\text{g}/\text{m}^3$ (10 permitted)
1995	181.00	96.53	21
1996	114.75	97.18	7
1997	113.75	96.89	3
1998	112.25	96.35	3
1999	127.50	98.17	7
2000	123.75	97.81	7
2001	138.75	94.34	5
2002	100.75	98.36	1
2003	144.50	97.99	30
2004	126.25	97.00	5
2005	102.5	97.44	2
2006	123.00	55.80 *	16

Table 32 – Ozone Concentrations 1995 - 2006 Swansea AURN (Princess Way)

\* Data capture 2006 55.80% due to the decommission of the site during August 2006

### 3.4 St.Thomas DOAS, Pentreguinea Road

The St.Thomas OPSIS Differential Optical Absorption Spectroscopy (DOAS) has been installed during September 2005 along a 280m path length of Pentreguinea Road within the St.Thomas area to measure the pollutants sulphur dioxide, nitrogen dioxide, and ozone. Valid data capture commenced on the 12<sup>th</sup> September 2005 at 09:30am. This section of Pentreguinea Road has an annual average daily traffic flow (AADT) of approximately 22,500 vehicles and forms the eastside link up/down the Swansea Valley from Whiterock bridge to Quay Parade bridges. This route is intended for use within the Action Plan to attempt traffic management during forecast pollution episodes by diverting traffic from the central Neath Road corridor (see Sec 7 action point 10).

Measurements take place at a height of approximately 3-4 metres and less than 2m away from the front facade of the majority of terraced dwellings. The DOAS transmitter is fixed on top of a concrete column located north of the junction of Kilvey Terrace and Pentreguinea Road as shown in photo 1 below. The receiver module is located on top of a concrete column and site housing at the other end of the open path measurement length as shown in photo 2 below.



*Photo 1 - St Thomas DOAS Transmitter*



*Photo 2 - St Thomas DOAS Receiver Station*

The transmitter emits a light beam from a xenon lamp that contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser that measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored.

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants. The location of the open path monitoring can be seen within map 7 below.

Quay Parade Bridges are to the south of this location. Congestion extends from Quay Parade bridges up Pentreguinea Road with congestion being seen as far north as the new Morfa Shopping Parc in Landore. There are numerous dwellings located along this section of Pentreguinea Road with an application already received for residential development on the former St. Thomas Station Yard Site located between Pentreguinea Road and the River Tawe (see map 7 below and see sec 6.3.2). This application for planning was refused by the authority but has subsequently been granted upon appeal. Construction is due to commence shortly. Congestion extends outwards from Quay Parade bridges at peak times over all links.

The station has been given a site classification Roadside (U2)<sup>40</sup>. **All monitoring results presented are provisional at present until OPSIS are able to audit and verify the QA/QC procedures undertaken.**

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<sup>40</sup> Source LAQM.TG(03) Appendix A page A1-42



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*Map 7 – Aerial View of St.Thomas OPSIS DOAS and surrounding area*

The DOAS system returns data initially in the form of 5-minute means. In order to compile valid 15-minute and hourly means, a minimum of 75% of the 5-minute means were required to be present. In addition to the above, conditions were imposed on the minimum acceptable light levels and maximum standard deviations of the measurements permitted before the 5-minute mean was accepted as valid.

It should be noted that the data presented here represents the spatial average over the whole of the 280-metre measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations. It should also be noted that the DOAS methodology of monitoring does not comply with the EU Directive methods of measurement (chemiluminescent for NO<sub>2</sub>, UV fluorescence for SO<sub>2</sub> etc) at present but the system has recently achieved MCERTS certification and TUV certification.

## 2.4.1 Nitrogen Dioxide

Data available from 12<sup>th</sup> September 2005 and the whole of 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 33. A chart of the data can be seen below as chart 26. Data capture for 2006 is 94.7%

St Thomas DOAS					
Annual Mean (40µg/m <sup>3</sup> )		Max 1-hour (200µg/m <sup>3</sup> )		Exceedences of 1-hour std (18 permitted)	
2005 *	2006	2005 *	2006	2005 *	2006
62.16	44.48	148.81	157.74	0	0

\* Results for information only as data capture commenced 12<sup>th</sup> September 2005

Table 33 -St Thomas DOAS – NO<sub>2</sub> 1-hour data 12<sup>th</sup> September 2005 – 31<sup>st</sup> December 2006

**All monitoring results presented are provisional at present until OPSIS are able to audit and verify the QA/QC procedures undertaken.**

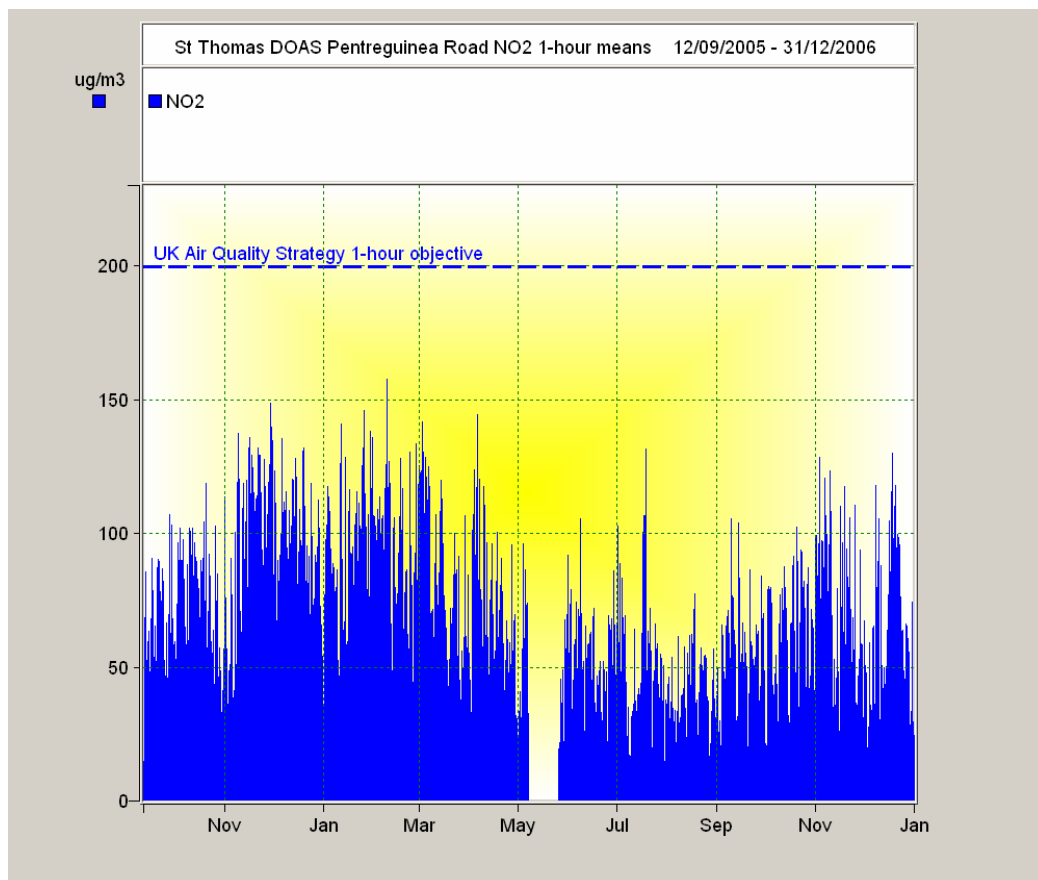


Chart 26 – St Thomas DOAS 1-hour NO<sub>2</sub> data

### 3.4.2 Sulphur Dioxide

Data available from 12<sup>th</sup> September 2005 and the whole of 2006 has been analysed for each of the objectives averaging periods and the results are presented below within table 34.

Charts of the data can be seen below within chart 27 (15 minute means), chart 28 (1-hour means) and chart 29 (24-hour means). Data capture for 2006 is 94.2%

**All monitoring results presented are provisional at present until OPSIS are able to audit and verify the QA/QC procedures undertaken.**



St Thomas DOAS	Max 15-Min Mean $\mu\text{g}/\text{m}^3$ ( $266\mu\text{g}/\text{m}^3$ )	Max 1-hour Mean $\mu\text{g}/\text{m}^3$ ( $350\mu\text{g}/\text{m}^3$ )	Max 24-Hour Mean $\mu\text{g}/\text{m}^3$ ( $125\mu\text{g}/\text{m}^3$ )
2005 *	92.64	82.16	35.72
Exceedences	0	0	0
Date of Max	29/12/2005	29/12/2005	9/12/2005
Time of Max	12:15	12:00	-
Wind Direction @ Max conc.	74°	74°	85°
2006	279.02	141.89	34.76
Exceedences	1	0	0
Date of Max	29/06/2006	09/01/2006	23/01/2006
Time of Max	09:45	11:00	-
Wind Direction @ Max conc.	177°	121°	68°

\* Results for 2005 given for information purposes only

Table 34 – St Thomas DOAS SO<sub>2</sub> data 12<sup>th</sup> September 2005 – 31<sup>st</sup> December 2006

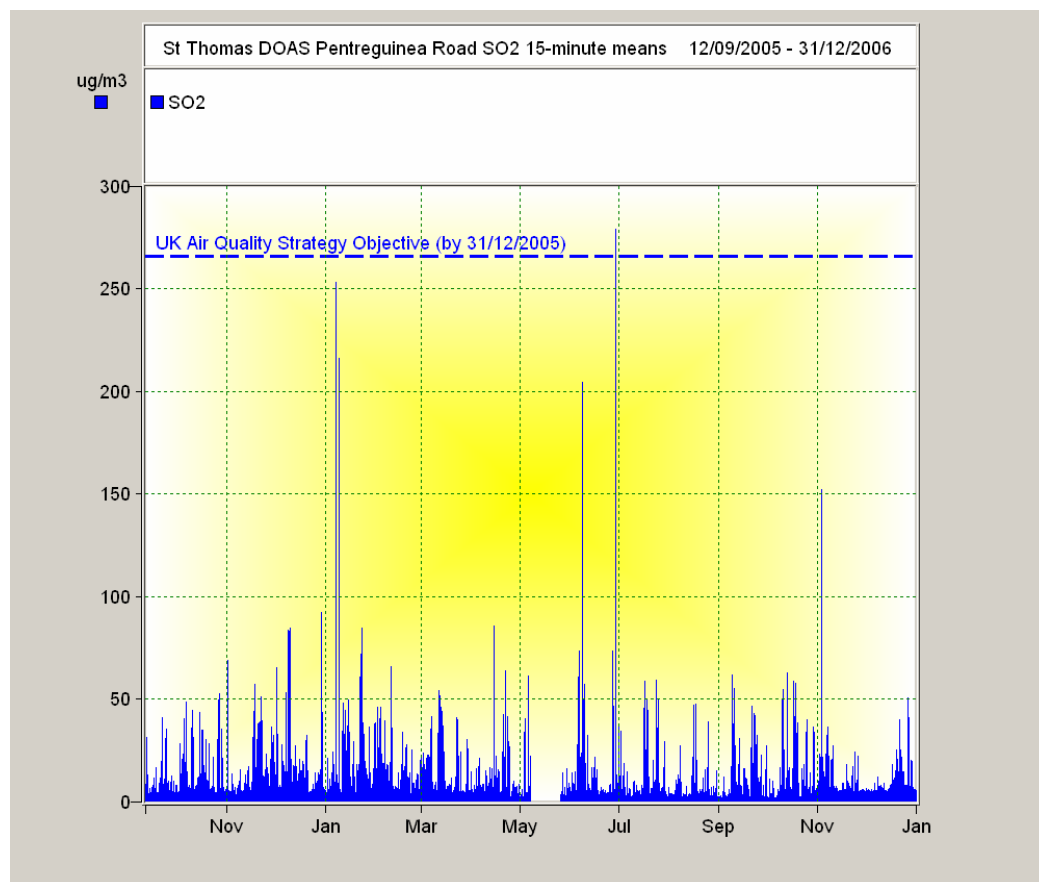


Chart 27 St Thomas DOAS 15-minute SO<sub>2</sub> data 12<sup>th</sup> September 2005 – 31<sup>st</sup> December 2006

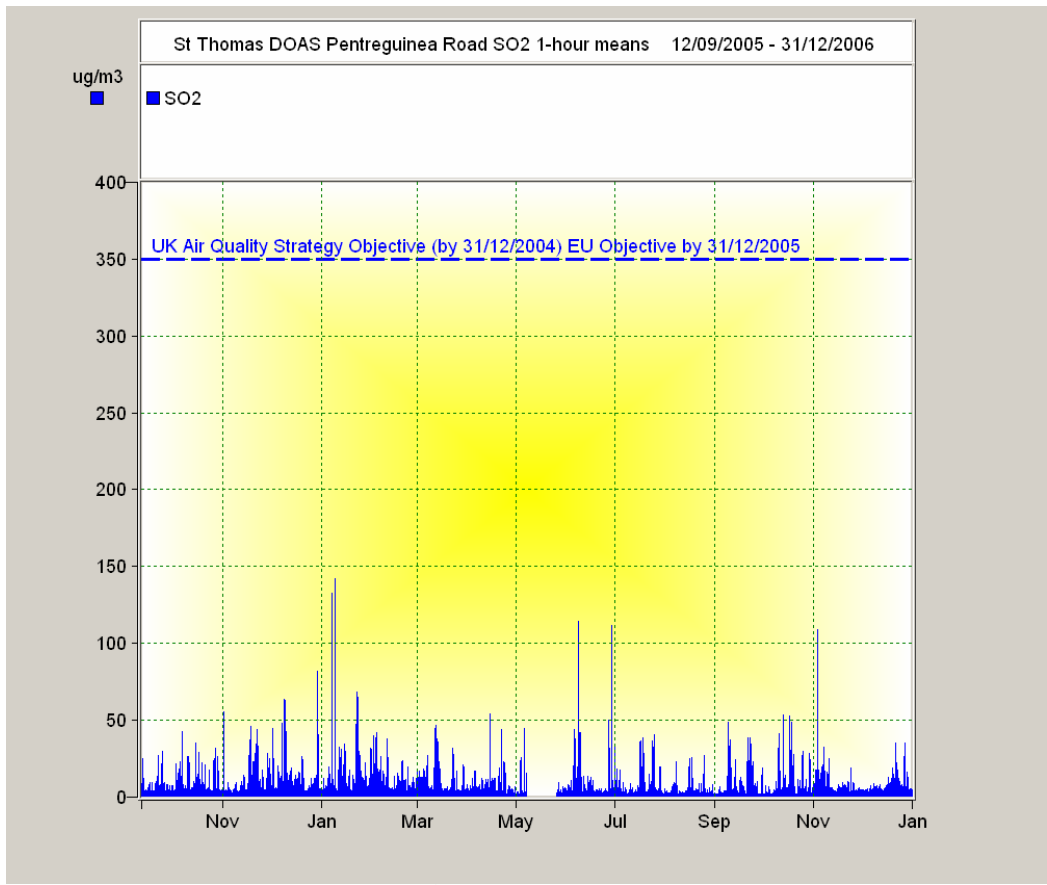


Chart 28 – St Thomas DOAS SO2 1-hour data 12<sup>th</sup> September 2005 – 31<sup>st</sup> December 2006



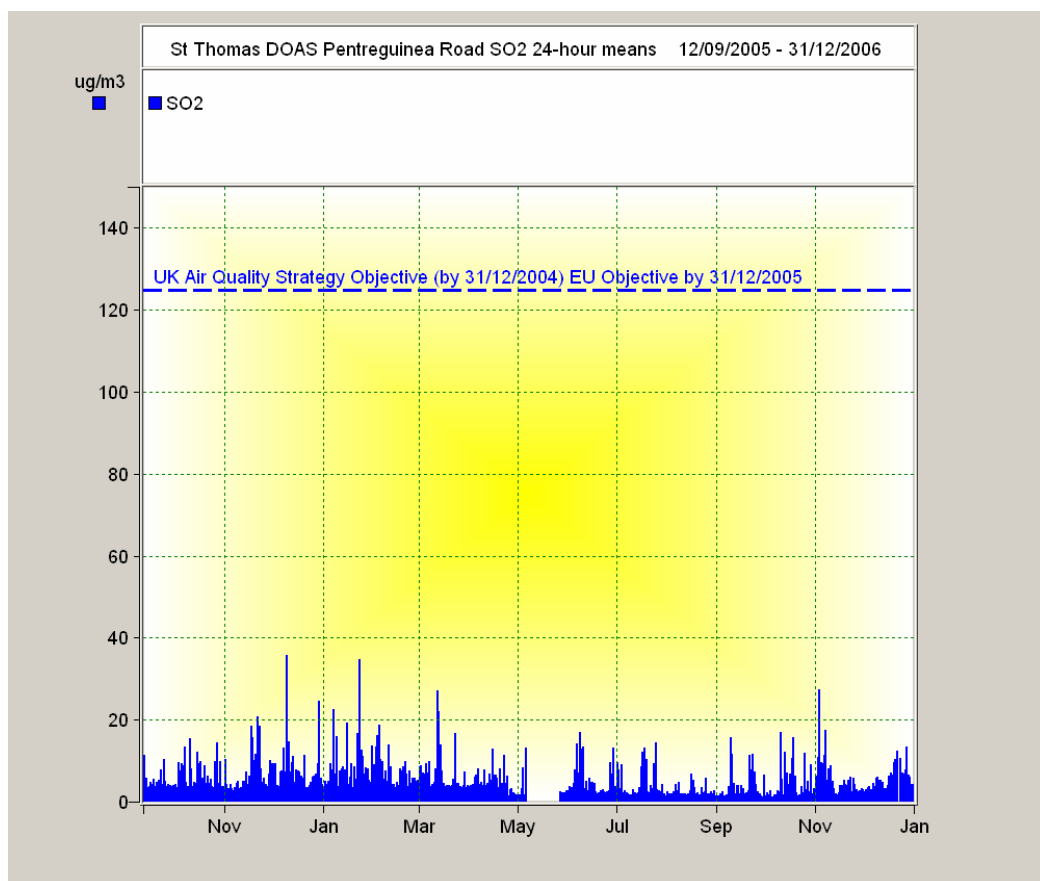


Chart 29 St Thomas DOAS SO2 24-hour data 12<sup>th</sup> September 2005 – 31<sup>st</sup> December 2006

### 3.4.3 Ozone

Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made from 12<sup>th</sup> September 2005 to 31<sup>st</sup> December 2006.

The provisional objective for ozone is an 8-hour mean not to exceed  $100\mu\text{g}/\text{m}^3$  on more than 10 occasions with a compliance date of 31<sup>st</sup> December 2005

The logged 5-minute means have been compiled into hourly averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 9, 5-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate the 8-hour means. In

order to form a valid 8-hour mean 75% of the hourly means were required to be present i.e. 6 out of every 8.

The results from the monitoring during 2005-2006 are presented below as table 35 and show non-compliance during 2006 with the objective standard. A chart of the data is given below as chart 30.

St Thomas DOAS	Max 8-hour Mean ( $\mu\text{g}/\text{m}^3$ )	Data capture	Exceedences of 8-hour objective $100\mu\text{g}/\text{m}^3$ (10 permitted)
2005*	133.34	-	12
2006	150.63	94.52	47

Table35 – St Thomas DOAS Ozone 8-hour means 2005-2006

\*data capture commenced 12<sup>th</sup> September 2005

**All monitoring results presented are provisional at present until OPSIS are able to audit and verify the QA/QC procedures undertaken.**

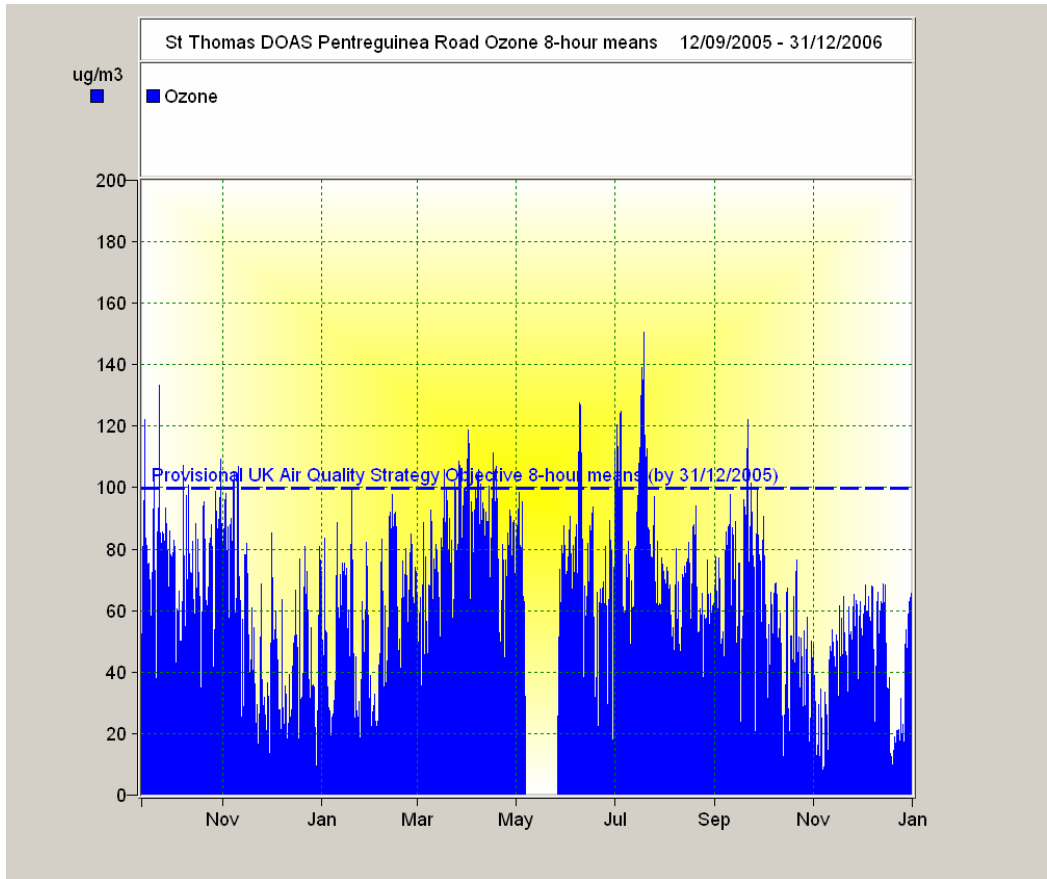


Chart 30 – St Thomas DOAS Ozone 8-hour means

## **4 Non Automatic Monitoring Data**

The authority operates a network of passive nitrogen dioxide diffusion tubes. Some sites have provided data to the UK Non-Automatic (NO<sub>2</sub>) Network until this network ceased to operate on a weekly and monthly basis in December 2005. The remainder of the sites form part of specific studies within areas of concern. The datasets from these studies may therefore be for a limited time frame whilst conditions are assessed.

The contract for the supply and analysis of all passive diffusion tubes has been awarded to Harwell Scientifics of 551 South Becquerel Avenue, Harwell International Business Centre, Didcott, Oxon.

This contract laboratory has been operating for over 17 years and has extensive UKAS accreditation. In addition all work is accredited to BS EN ISO 9001. Its predecessor the EMS Division, Harwell, carried out Swansea's original NO<sub>2</sub> mapping in 1985/86.

Data is presented below in both its "raw" format and bias corrected format

There has been great debate surrounding the use of a locally derived bias factor when correcting diffusion tubes for bias. Indeed, previous auditor's comments have indicated that such a local derived correction factor should be obtained for Swansea. The auditor's comments have been taken on board and currently 3 diffusion tubes are located on the sample intake at each of the authority's chemiluminescent analyser sites at the Swansea AURN, Morfa and Morryston Groundhog sites. This survey has been running for approximately 8 months. When sufficient data has been gathered, works will commence to derive a

“Swansea bias factor”. The authority has raised concerns over the use of the “national bias factor” as suggested in the relevant guidance in place of the laboratory derived factor. This situation has been discussed in greater detail in both the Detailed Assessment Report dated December 2005 and the Supplementary Detailed Assessment Reports dated April 2006 produced by the authority.

In order that the fullest consideration is given to the data, all data presented within the sections below includes the “raw” data as well as the Harwell Scientific Services derived bias factor for the year under consideration, in addition to the Harwell Scientific Services 2000-2006 bias mean (0.83). The national average of all laboratories using the 50% TEA in Acetone method (61 studies during 2000-2006 with a mean bias of 0.98) is also given for an additional comparison.

Again, in response to previous auditor’s comments, an indication is given against each site as to whether it is located within the existing Hafod Air Quality Management area. Additionally, sites where the bias corrected annual means are between 38- 40 $\mu\text{g}/\text{m}^{-3}$  are treated with caution and assumed that they may well be at risk of breaching the 40 $\mu\text{g}/\text{m}^{-3}$  objective.

#### **4.1 UK Non-Automatic (NO<sub>2</sub>) Network Sites**

The last data available from the authority’s supply of data into this network is included here for information as a full complete year of 2005 is available. This data is duplicated from the Updating and Screening Assessment dated April 2006. From this work, two sites have been carried on as part of the routine monthly sampling underway – Site 1N Hafod Post Office is now also reported

as site 59 within section 4.1.5.2 below with Site 5N Uplands Crescent now being continued as site 58 within section 4.1.5.2 below

### 4.1.1 Hafod Post Office - 1N

This authority has operated a monthly roadside measurement site at the Hafod Post Office at Neath Road, Hafod since the mid 1970's and provided data to the UK Non Automatic Network. The site is located on the façade of the Post Office building within the narrow and congested section of Neath Road that is the centre of the authorities Hafod Air Quality Action Plan. Map 8 below shows the site in relation to the OPSIS DOAS transmitter ❶ along Neath Road.



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Map 8 - Location of Hafod Post Office Passive NO<sub>2</sub> Tube Sampling

The Post Office site is situated within a section of terraced domestic dwellings. The façade of the Post Office building is within 2m of the roadway. Early measurements at this site concentrated on smoke and SO<sub>2</sub> by way of the smoke and SO<sub>2</sub> bubbler method. This method of sampling ceased some 10 years ago.

Annual Means for the Hafod Post Office site between 1993 and 2006 are shown below in table 36 for completeness and to view the entire dataset for this site. Table 36 also shows the corrected annual mean after correction for tube bias. The bias factor that has been used is 0.78 from 1993 to 2000. From 2000, bias factors are available for Harwell Scientific Services at <http://www.uwe.ac.uk/aqm/review/diffusiantube300307.xls>. Therefore, the bias factors that have been used are the average of the co-location studies for the individual years 2000-2006 namely, 0.79 for 2000, 0.78 for 2001, 0.84 for 2002, 0.87 for 2003, 0.88 for 2004, 0.88 for 2005 and 0.78 for 2006.

Year	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services Bias factor Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias corrected Annual mean 2000-2006 (0.83)	National bias factor from 61 studies (0.98) using 50% TEA in Acetone
1993	65	50.70	-	-
1994	61	47.58	-	-
1995	73	56.94	-	-
1996	65	50.70	-	-
1997	59	46.02	-	-
1998	55	42.90	-	-
1999	69	53.82	-	-
2000	61	48.19	50.63	59.78
2001	61	47.58	50.63	59.78
2002	66	55.44	54.78	64.68
2003	69	60.03	57.27	67.62
2004	58.8	51.74	48.80	57.62
2005	65.6	57.73	54.45	64.29
2006	65.31 *	50.94	54.21	64.00

Table 36 - Hafod Post Office Passive NO<sub>2</sub> Tubes 1993-2006

\* Data capture for 2006 66%

Table 36 shows that NO<sub>2</sub> levels measured at the façade of the Post Office building within the block of terraced housing have remained fairly consistent over the last decade or so. All bias corrected annual means indicate continuing exceedence of the annual mean objective level and is further evidence justifying the declaration of the Hafod Air Quality Management Area.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls)). Using 2006 as the base year (Harwell Scientific Services Bias factor Corrected Annual Mean µg/m<sup>-3</sup> of 50.94) a projection of 44.10µg/m<sup>3</sup> is obtained for 2010 which remains above the EU objective of 40µg/m<sup>3</sup>

#### **4.1.2 Uplands - 2N and 5N**

A measurement site (2N) at Uplands Crescent, Uplands has been operational since 1993 and provided data to the UK Non Automatic Network. The location of the site however changed from January 2001. Between January 1993 and December 2000 the sampling site was located to the pine end/façade of a commercial premise. The siting over the years became unsuitable, as the side of the commercial premises was becoming increasingly prone to large overhanging trees. The site lies outside of the existing Hafod Air Quality Management Area.

The site was relocated during January 2001 when improvement works at the commercial premise forced its relocation. The Uplands site (5N) has been relocated roadside and now provides a worse case scenario measurement.





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Map 9 - Location of Uplands 2N and 5N NO<sub>2</sub> Tube Sampling

For reference purposes, annual mean data from the previous site Uplands 2N between 1993 and 2000 is shown below as table 37. Annual mean data is shown below for site Uplands 5N from 2001 to 2006 as table 38

It would not be valid to compare the two datasets and form a view on the overall NO<sub>2</sub> trends in the area due to the relocation of the passive sampling tube even though the site classification has remained broadly the same. It is thought probable that because of the amount of foliage overhanging the Uplands 2N site that this in itself would not truly be indicative or reflect NO<sub>2</sub> levels at the façade due to the shielding etc. of the trees.

The bias factor that has been used is 0.78 from 1993 to 1999. From 2000, bias factors are available for Harwell Scientific Services at <http://www.uwe.ac.uk/aqm/review/diffusiontube300307.xls>. Therefore, the bias factors that have been used are the average of the co-location studies for the individual years 2000-2006 namely, 0.79 for 2000, 0.78 for 2001, 0.84 for 2002, 0.87 for 2003, 0.88 for 2004, 0.88 for 2005 and 0.78 for 2006.

Year	Measured NO <sub>2</sub> Annual Mean $\mu\text{g}/\text{m}^{-3}$	Bias Corrected Annual Mean $\mu\text{g}/\text{m}^{-3}$
1993	31.03	24.20
1994	35.45	27.65
1995	32.17	25.09
1996	33.07	25.80
1997	30.75	23.99
1998	27.29	21.29
1999	30.56	23.84
2000	28.16	22.25

Table 37 - Upland Site 2N NO<sub>2</sub> Tube Data 1993 – 2000

Year	Measured NO <sub>2</sub> Annual Mean $\mu\text{g}/\text{m}^{-3}$	Harwell Scientific Services bias factor Corrected Annual Mean $\mu\text{g}/\text{m}^{-3}$	Harwell Scientific Services bias corrected Annual mean 2000-2006 (0.83)	National bias factor from 61 studies (0.98) using 50% TEA in Acetone
2001	49.3	38.45	40.92	48.31
2002	51.09	42.92	42.40	50.07
2003	53.53	46.57	44.43	52.46
2004	46.75	41.14	38.80	45.82
2005	42.01	36.97	34.87	41.17
2006	37.06	28.91	30.76	36.32

Table 38 - Uplands Site 5N NO<sub>2</sub> Tube Data 2001 - 2006

It is possible to use a conservative method to estimate the concentrations from the data presented within table 38 to the façade of the nearest property (as if it were a continuation of site 2N). Using guidance from

<http://www.uwe.ac.uk/aqm/review/mfaqroad.html> paragraph 7, the following conservative façade measurements presented within table 39 are obtained by assuming a kerb to façade distance between 5-10m.

Year	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias factor Corrected Annual Mean µg/m <sup>-3</sup>	Corrected to façade µg/m <sup>-3</sup>
2001	49.3	38.45	34.61
2002	51.09	42.92	38.62
2003	53.53	46.57	41.91
2004	46.75	41.14	37.03
2005	42.01	36.97	33.27
2006	37.06	28.91	26.02

Table 39 – Corrected Façade Measurements Uplands Site 5N NO<sub>2</sub> Tube Data 2001 - 2006

A GPRS Automatic Traffic Counter has been installed to this section of Uplands Crescent during 2004. The loops within the roadway are within 10m of the monitoring location. An analysis has been undertaken of the first two full years of traffic flow measurement to establish if any shift in percentage classification could solely account for the apparent reduction in NO<sub>2</sub> being recorded at this site during 2006. The analysis for 2005 and 2006 is shown below.

Vehicle class contribution to total flow and mean speed in class

**Year 2005**

<b>AWDT:</b>	<b>20832</b>	
<b>ADT:</b>	<b>19752</b>	
<b>Mean Speed</b>	<b>31.8 km/h</b>	
Vehicle class:	Flow %:	Mean speed (km/h):
Motorcycles	0.5	24.1
Cars or light Vans	93.9	38.8
Cars or light Vans with Trailer	1	28.2
Heavy Van, Mini bus, L/M/HGV	3.9	34.3
Articulated lorry, HGV+Trailer	0.2	30.5
Bus	0.5	27.6

**Year 2006**

<b>AWDT:</b>	<b>22848</b>	
<b>ADT:</b>	<b>21864</b>	
<b>Mean Speed</b>	<b>32.8km/h</b>	
Vehicle class:	Flow %:	Mean speed (km/h):
Motorcycles	0.7	29.7
Cars or light Vans	93.4	38.7
Cars or light Vans with Trailer	0.4	29
Heavy Van, Mini bus, L/M/HGV	4.2	35.1
Articulated lorry, HGV+Trailer	0.2	28.8
Bus	1.1	29.1

It would appear that there has been no major shift in traffic composition that could simply account for this reduction. In fact a slight increase has been seen in the percentage flow in the Heavy Van, Mini bus, Light/Medium/Heavy Goods vehicles classification as well as the Bus classification during 2006. The Annual Weekday Daily Traffic (AWDT) and the Annual Daily Traffic (ADT) both show an increase during 2006 over 2005. The slight reduction can therefore more likely be attributed to meteorological conditions.

The levels of NO<sub>2</sub> being recorded have moved from showing non compliance with the annual mean objective during 2002-2004 to full compliance during the last two years - this is even more definitive if the corrected façade measurements are taken into consideration.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls) ). Using 2006 as the base year a projection of 25.03µg/m<sup>3</sup> is obtained for 2010 which is below the EU objective of 40µg/m<sup>3</sup>.

### **4.1.3 Moorside Road, West Cross - Site 4N**

A measurement site located to the façade of a private dwelling has been operational at West Cross since 1993. The site has a classification of Suburban (SU)<sup>1</sup> and can be seen within map 10 below. The site is located in a residential area to the west of the city centre and is outside of the Hafod AQMA.

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<sup>1</sup> Source LAQM.TG(03) Appendix A page A1-43





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Map 10 - Location of West Cross 4N NO<sub>2</sub> Tube Sampling

Annual mean data is shown below for West Cross site 4N between 1993 and 2005 as table 40. This site has consistently recorded levels below the annual mean objective standard as would be expected with its site classification.

The bias factor that has been used is 0.78 from 1993 to 1999. From 2000, bias factors are available for Harwell Scientific Services at <http://www.uwe.ac.uk/aqm/review/diffusiontube300307.xls>. Therefore, the bias factors that have been used are the average of the co-location studies for the individual years 2000-2006 namely, 0.79 for 2000, 0.78 for 2001, 0.84 for 2002, 0.87 for 2003, 0.88 for 2004, and 0.88 for 2005

Year	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias Corrected Annual mean 2000-2006 (0.83)	National bias factor from 61 studies (0.98) using 50% TEA in Acetone
1993	21.33	16.64	-	-
1994	15.47	12.07	-	-
1995	19.04	14.85	-	-
1996	19.58	15.27	-	-
1997	17.80	13.88	-	-
1998	12.55	9.79	-	-
1999	13.93	10.87	-	-
2000	13.19	10.42	10.95	12.93
2001	15	11.70	12.45	14.70
2002	18.92	15.89	15.70	18.54
2003	18.57	16.16	15.41	18.20
2004	11.92	10.49	9.89	11.68
2005	15.7	13.82	13.03	15.39

Table 40 – West Cross Site 4N Annual Mean data 1993 - 2005

Consideration was given to decommissioning this site during 2005 as the property has been offered for sale. This coupled with the consistent low readings and the demise of the Non UK Automatic Network has seen it ceasing as a measurement site following completion of the December 2005 measurement period. The full dataset is presented here for sake of completeness.

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls) ). Using 2005 as the base year a projection of 12.09µg/m<sup>3</sup> is obtained for 2010 which is below the EU objective of 40µg/m<sup>3</sup>.

#### **4.1.4 Manselton**

A measurement site (3N) at Elgin Street, Manselton had been operational since 1993 and has provided data to the UK Non Automatic Network. The location of the site however changed from October 2004. Between January 1993 and August 2004 the sampling site was located to the façade of a garage fronting onto Elgin Street, Manselton. However, the property was sold during the August/September period and sampling tubes were lost due to redevelopment of the property and associated garage. The site was therefore relocated to the façade of a terraced dwelling in an adjacent street.

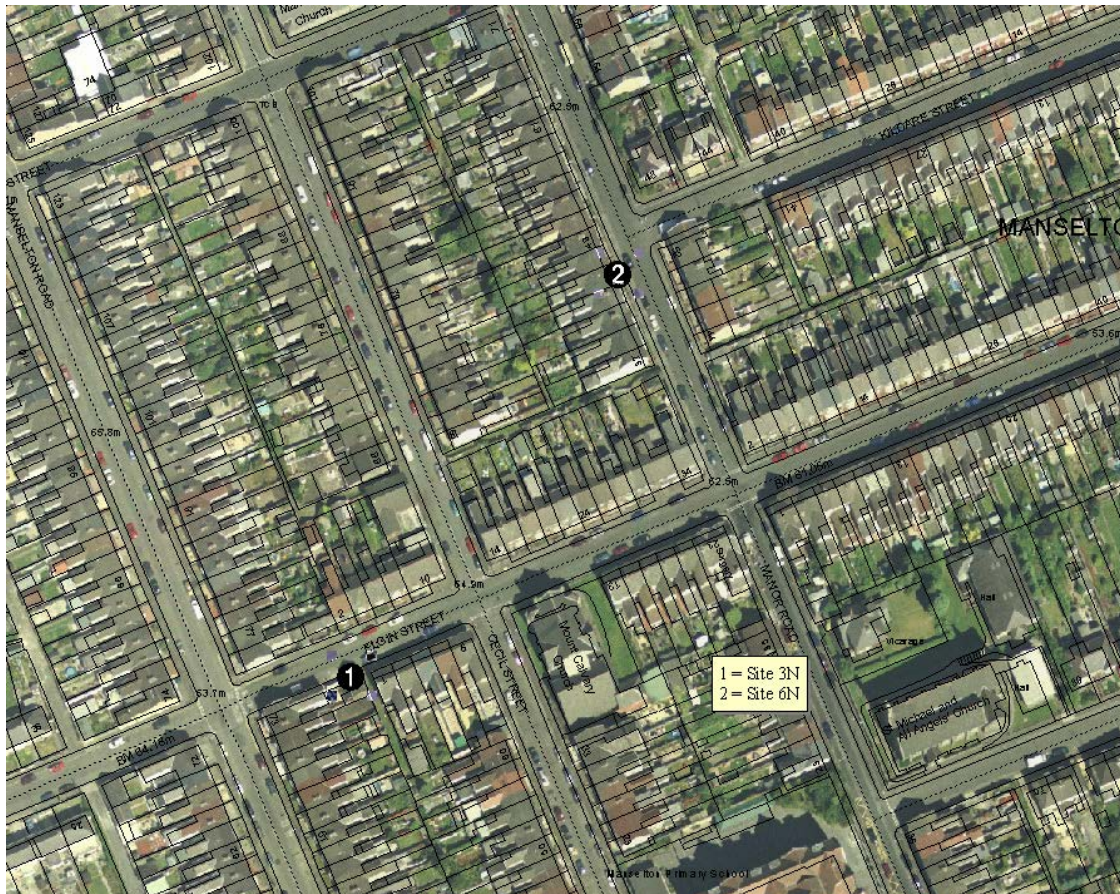
Measurements commenced at the relocated site along Manor Road, Manselton (site 6N) during October 2004. The site classification has remained as Urban Background (U4)<sup>2</sup> allowing direct comparison between the two locations. Map 11 shows the location of both sampling sites. The sites both lie outside of the existing Hafod Air Quality Management Area.

The demise of the UK Non Automatic Network has resulted in this site ceasing as a measurement site following completion of the December 2005 measurement period. The full dataset is presented here for sake of completeness.

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<sup>2</sup> Source LAQM.TG(03) Appendix A page A1-42





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Map 12 - Manselton Sites 3N and 6N - NO<sub>2</sub> sampling Locations

The bias factor that has been used is 0.78 from 1993 to 1999. From 2000, bias factors are available for Harwell Scientific Services at <http://www.uwe.ac.uk/aqm/review/diffusiontube300307.xls>. Therefore, the bias factors that have been used are the average of the co-location studies for the individual years 2000-2006 namely, 0.79 for 2000, 0.78 for 2001, 0.84 for 2002, 0.87 for 2003, 0.88 for 2004, and 0.88 for 2005.

Data capture for 2004 is 75% permitting the calculation of the annual mean. Annual mean data is shown below for Manselton sites 3N and 6N between 1993 and 2005 as table 41. These sites have consistently recorded levels below the annual mean objective standard as would be expected with the site classification.



No major trend is evident within the data, as levels have remained remarkably consistent over the period of measurement. One interesting observation is that the atypical meteorological conditions experienced during 2003 are clearly evident within the annual mean for that year. This effect was not so pronounced at the other UK Non automatic network sites operated by the authority.

Year	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias Corrected Annual mean 2000-2006 (0.83)	National bias factor from 61 studies (0.98) using 50% TEA in Acetone
1993	30.39	23.70	-	-
1994	32.53	25.37	-	-
1995	32.90	25.66	-	-
1996	33.42	26.07	-	-
1997	30.55	23.83	-	-
1998	26.19	20.43	-	-
1999	31.2	24.34	-	-
2000	29.36	23.19	24.37	28.77
2001	31.25	24.38	25.94	30.63
2002	28.77	24.17	23.88	28.19
2003	35.29	30.70	29.29	34.58
2004	29.17	25.67	24.21	28.59
2005	22.2	19.54	18.43	21.76

Table 41 Manselton Sites 3N and 6N NO<sub>2</sub> Monitoring 1993 - 2005

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls) ). Using 2005 as the base year a projection of 17.09µg/m<sup>3</sup> is obtained for 2010 which is below the EU objective of 40µg/m<sup>3</sup>.

## **4.1.5 Additional NO<sub>2</sub> Diffusion Tube Monitoring**

The authority has undertaken a previous 56 passive diffusion tube study between the period 2<sup>nd</sup> June 2004 and 1<sup>st</sup> June 2005. This data has been reported within the Updating and Screening Assessment dated April 2006 but is repeated here for completeness and updated with the latest bias factor available for Harwell Scientific Services. In addition, a new 61 tube survey commenced during October 2005 and remains active. Again, data for this survey now reflects the latest bias factor available for Harwell Scientific Services.

Twelve of the sites from the 56 tube survey have been continued into the new study. This latest diffusion tube study is intended to run for the foreseeable future in order to obtain some long term trend data. For ease of reference the studies are presented separately here.

### **4.1.5.1 Study period 2<sup>nd</sup> June 2004 to 2<sup>nd</sup> June 2005**

Fifty six sites were located around identified junctions together with additional monitoring within the existing Hafod Air Quality Management Area being undertaken.

Site classification was limited to Roadside (U2)<sup>3</sup>. Table 42 details the sites Ordnance Survey 6 digit grid co-ordinates and location. Map 13 indicates the areas where monitoring was undertaken and the extent of the existing Hafod AQMA.

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<sup>3</sup> Source LAQM.TG(03) Appendix A page A1-42

Site	Easting	Northing	Within AQMA	Location
1	258714	198713	-	40 Alexandra Road, Gorseinon
2	258910	198789	-	21 Pontardulais Road, Gorseinon
3	259192	198641	-	o/side 41 High Street Gorseinon
4	258921	198470	-	38 West Street, Gorseinon
5	259543	193648	-	310 Dunvant Road, Dunvant
6	260102	192798	-	470 Gower Road, Killay
7	261949	193075	-	173 Gower Road, Sketty
8	262225	192674	-	O/s 12 Sketty Park Drive, Sketty
9	262367	192699	-	O/s Dylan's 73 Dillwyn Road
10	262504	192862	-	22 Dillwyn Road, Sketty
11	262537	192945	-	112 Gower Road, Sketty
12	262633	193004	-	22 Vivian Road, Sketty
13	262707	192996	-	6 Frogmore Avenue, Sketty
14	262694	192852	-	15 Gower Road, Sketty,
15	262903	192772	-	34 Gower Road, Sketty
16	262762	193230	-	95 Vivian Road, Sketty
17	262855	193393	-	133 Vivian Road, Sketty
18	262903	193376	-	5 Broadway, Broadway
19	262899	194446	-	165 Cockett Road, Cockett
20	262920	194555	-	188 Cockett Road, Cockett
21	263033	195089	-	Cwmbach Road, Cockett
22	263141	195028	-	9 St Peters Terrace, Cockett
23	263175	195121	-	8 Station Road, Cockett
24	263243	195362	-	89 Station Road, Cockett
25	263280	195358	-	90 Station Road, Cockett
26	263217	195505	-	932 Carmarthen Road
27	263428	195286	-	838 Carmarthen Road, Fforestfach
28	263838	195047	-	694 Carmarthen Road, Fforestfach
29	263334	195465	-	12 Ravenhill Road, Fforestfach
30	262988	195820	-	1034 Carmarthen Road
31	263595	195948	-	129 Ravenhill Road, Fforestfach
32	263737	195941	-	547 Pentregethin Road, Gendros
33	263819	192896	-	11 Sketty Road, Sketty
34	263803	192935	-	rear of 2 Sketty Road, Sketty
35	264833	193059	-	Brunel Court, Uplands
36	265238	192745	-	37-44 West Way, Swansea
37	265354	192533	-	132 Oystermouth Road, Swansea
38	265457	192403	-	Trawler Road, Marina, Swansea
39	266682	193189	-	Port Tennant Road, Port Tennant

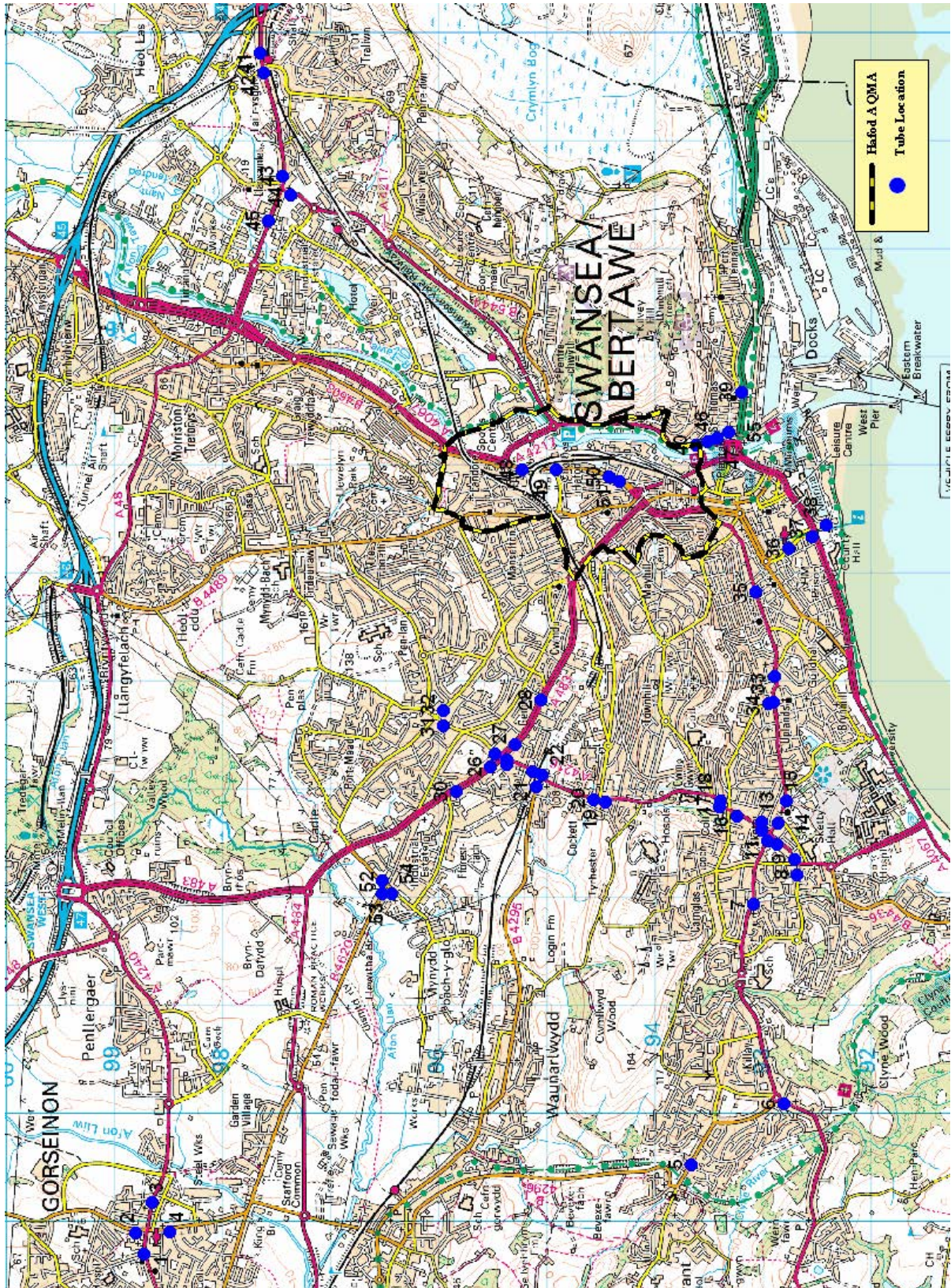
40	266201	193608	Yes	Pentreguinea Road, St Thomas
41	269822	197634	-	260 Peniel Green Road, Llansamlet
42	269641	197610	-	233 Peniel Green Road, Llansamlet
43	268687	197434	-	outside 9 Peniel Green Road, Llansamlet
44	268509	197356	-	26 Nantyffin Road, Llansamlet
45	268270	197563	-	66 Samlet Road, Llansamlet
46	266258	193408	-	Sheltered housing Pentreguinea Road, St Thomas
47	266229	193502	-	Jnc Pentreguinea Road and Benthall Place, St Thomas
48	265973	195220	Yes	5 Morfa Terrace, Hafod
49	265965	194900	Yes	120 Neath Road, Hafod
50	265904	194416	Yes	38 Neath Road, Hafod
51	265858	194315	Yes	16 Neath Road (Hafod Laundrette)
52	262161	196513	-	2 Ffordd Cynore, Fforestfach
53	262047	196420	-	12 Ystrad Road, Fforestfach
54	262048	196508	-	1344 Carmarthen Road, Fforestfach
55	266316	193300	-	50 Delhi Street, St Thomas
5N	264061	192886	-	Uplands Crescent, Uplands

Table 42 –NO<sub>2</sub> monitoring locations 2<sup>nd</sup> June 2004 – 2<sup>nd</sup> June 2005

Monthly exposure periods ran from June 2004 to June 2005. All passive diffusion tubes were exposed in accordance with the UK NO<sub>2</sub> survey Instruction Manual and were either fixed to the front façade of a receptor i.e. to a down pipe or where one was not available to the nearest lamppost. All lampposts used were within 5m of the façade of the dwellings – in majority of cases within 2.5m as the properties fronted directly onto the pavement.

All passive diffusion tubes were analysed using Harwell Scientifics Ltd standard operating procedure's AEAT/GW1/1015 issue 11. From 2000, bias factors are available for Harwell Scientific Services at <http://www.uwe.ac.uk/aqm/review/diffusiontube300307.xls>. Therefore, the bias factor that has been used is the average of the co-location studies for the individual years i.e.: 0.88 for 2004, and 0.88 for 2005 = 0.88 June 2004 – June 2005.





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Map 13 – NO<sub>2</sub> Diffusion Tube Survey June 2004 – June 2005 Monitoring Locations



## Monitoring Results

Monitoring was conducted between the 2<sup>nd</sup> June 2004 and the 1<sup>st</sup> June 2005. The calculations of the "annual mean" that are presented below within table 43 are for the period June 2004 - June 2005 representing a full year of measurement. The bias factor used to correct the measured tube data for 2004 /2005 is 0.88.

Site	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias (0.88) Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias (0.83) Corrected Annual mean 2000-2006	National bias factor from 61 studies (0.98) using 50% TEA in Acetone	Data loss
1	33.8	29.74	28.05	33.12	0
2	26.35	23.19	21.87	25.82	1
3	38	33.44	31.54	37.24	0
4	35.42	31.17	29.40	34.71	0
5	31.24	27.49	25.93	30.62	1
6	23.81	20.95	19.76	23.33	1
7	36.2	31.86	30.05	35.48	0
8	30.24	26.61	25.10	29.64	0
9	35.12	30.91	29.15	34.42	0
10	39.29	34.58	32.61	38.50	0
11	41.46	36.48	34.41	40.63	0
12	37.47	32.97	31.10	36.72	0
13	26.15	23.01	21.70	25.63	1
14	53.86	47.40	44.70	52.78	1
15	36.77	32.36	30.52	36.03	1
16	32.68	28.76	27.12	32.03	2
17	45.86	40.36	38.06	44.94	0
18	32.16	28.30	26.69	31.52	0
19	31.77	27.96	26.37	31.13	0
20	31.8	27.98	26.39	31.16	2
21	30.84	27.14	25.60	30.22	2
22	31.77	27.96	26.37	31.13	1
23	36.82	32.40	30.56	36.08	4
24	25.2 *	22.18	20.92	24.70	6
25	40.73	35.84	33.81	39.92	0

Site	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias (0.88) Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias (0.83) Corrected Annual mean 2000-2006	National bias factor from 61 studies (0.98) using 50% TEA in Acetone	Data loss
26	43.55	38.32	36.15	42.68	0
27	38.95	34.28	32.33	38.17	0
28	36.78	32.37	30.53	36.04	1
29	44.91	39.52	37.28	44.01	1
30	47.26	41.59	39.23	46.31	0
31	29.5	25.96	24.49	28.91	0
32	32.33	28.45	26.83	31.68	1
33	45.85	40.35	38.06	44.93	1
34	45.04	39.64	37.38	44.14	1
35	51.24	45.09	42.53	50.22	2
36	42.4	37.31	35.19	41.55	3
37	45.26	39.83	37.57	44.35	1
38	30.36	26.72	25.20	29.75	1
39	37.77	33.24	31.35	37.01	2
40	44.42	39.09	36.87	43.53	0
41	39.66	34.90	32.92	38.87	0
42	40.66	35.78	33.75	39.85	1
43	43.19	38.01	35.85	42.33	0
44	39.85	35.07	33.08	39.05	0
45	31.5	27.72	26.15	30.87	0
46	33.82	29.76	28.07	33.14	2
47	49.16	43.26	40.80	48.18	2
48	61.83	54.41	51.32	60.59	0
49	47.01	41.37	39.02	46.07	1
50	65.43	57.58	54.31	64.12	1
51	56.86	50.04	47.19	55.72	0
52	24.82	21.84	20.60	24.32	0
53	33.2	29.22	27.56	32.54	0
54	25.27	22.24	20.97	24.76	0
55	52.7	46.38	43.74	51.65	1
5N	43.11	37.94	35.78	42.25	2

Table 43 – NO<sub>2</sub> monitoring results June 2004 – June 2005

\* Site 24 Data capture less than 75%

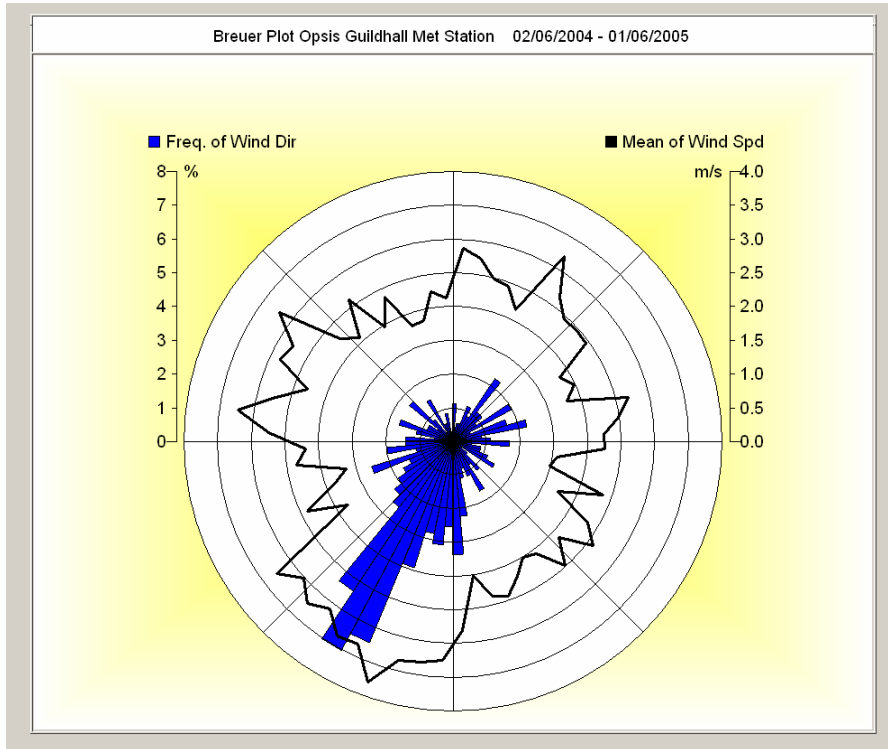
The monitoring undertaken has highlighted 11 sites where the corrected NO<sub>2</sub> annual mean is above the objective standard of 40µg/m<sup>-3</sup>. In addition, there are 6 sites where the bias corrected annual mean is between 38-40µg/m<sup>-3</sup> and these sites should also be considered at risk of breaching the annual mean objective. Of these 11 failing sites, 4 sites lie within the existing Hafod AQMA along Neath Road (sites 48, 49, 50 and 51) and represent additional monitoring within the existing Hafod Air Quality Management Area.

**What is clear from this survey are the widespread exceedences seen outside of the existing Hafod AQMA.** These widespread exceedences coupled with the sites within the 38-40µg/m<sup>-3</sup> range were unexpected given previous monitoring works. This maybe the effect of using Harwell Scientific Services average bias factor (0.88) for 2004/2005 as opposed to the 0.71 previously reported by Harwell Scientific Services for this period. **In light of this, no decision to proceed to Detailed Assessments will be made until the works currently underway to determine a Swansea bias factor are complete.** All data will be reassessed at this time. For sake of completeness, the available bias corrected data presented above is projected to 2010 within table 44 below.

Meteorological data has been examined for the period June 2004 – June 2005. A Breuer Plot representing the period of measurement is given below as Breuer plot 8 and shows a prevalence of south westerly winds. This probably typifies the expected meteorological conditions.

Previous passive diffusion tube surveys notably during 2003 have been found to have been heavily influenced under the prevalence of a south easterly wind.





*Breuer Plot 8 – Meteorological conditions June 2004 – June 2005*

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls)).

Using 2005 as the base year, projections for 2010 are shown below as table 44

Site	Bias Corrected Annual Mean $\mu\text{g}/\text{m}^{-3}$	Projected 2010	Site	Bias Corrected Annual Mean $\mu\text{g}/\text{m}^{-3}$	Projected 2010
1	29.74	25.02	29	39.52	33.24
2	23.19	19.51	30	41.59	34.98
3	33.44	28.13	31	25.96	21.84
4	31.17	26.22	32	28.45	23.93
5	27.49	23.12	33	40.35	33.94
6	20.95	17.62	34	39.64	33.34
7	31.86	26.8	35	45.09	37.93
8	26.61	22.38	36	37.31	31.38
9	30.91	26	37	39.83	33.5
10	34.58	29.09	38	26.72	22.48
11	36.48	30.69	39	33.24	27.96
12	32.97	27.73	40	39.09	32.88
13	23.01	19.35	41	34.90	29.36
14	47.40	39.87	42	35.78	30.1
15	32.36	27.22	43	38.01	31.97
16	28.76	24.19	44	35.07	29.5
17	40.36	33.95	45	27.72	23.32
18	28.30	23.8	46	29.76	25.03
19	27.96	23.52	47	43.26	36.39
20	27.98	23.54	48	54.41	45.77
21	27.14	22.83	49	41.37	34.8
22	27.96	23.52	50	57.58	48.43
23	32.40	27.25	51	50.04	42.09
24	22.18	18.66	52	21.84	18.37
25	35.84	30.15	53	29.22	24.58
26	38.32	32.23	54	22.24	18.71
27	34.28	28.83	55	46.38	39.01
28	32.37	27.23	5N	37.94	31.91

Table44 –NO<sub>2</sub> Survey June 2004 – June 2005 Projected Annual Means 2010

Only 3 sites (sites 48, 50 and 51) all of which are contained within the existing Hafod Air Quality Management Area, and which represent additional monitoring within the AQMA are projected to exceed the objective standard in

2010. These sites are in addition to the Hafod Post Office site mentioned above in 4.1.1.

In addition to the predicted failures within the existing Hafod AQMA in 2010, there are two sites which lie outside of the area that are very close to the 2010 objective limit (sites 14 and 55) and should be considered highly likely to exceed the EU objective in 2010.

It is proposed to continue NO<sub>2</sub> monitoring at these and several other sites to build up a long term dataset to establish continued compliance with the EU objective during 2010. The first year of data from this new study is reported below within section 4.1.5.2.

LAQM.TG(03) indicates that where there are monitoring data for the identified junctions, then these results should be used in preference to the DMRB screening model to reach a decision, assuming the data has been quality assured.<sup>4</sup>

#### **4.1.5.2 Study period commencing 4th October 2005.**

The authority commenced a new 61 site diffusion tube survey on the 5<sup>th</sup> October 2005. This survey followed on from the previous work undertaken outlined above. Based on the original analysis using the previously notified bias factor, some sites within 4.1.5.1 were discontinued and new sites established. However, twelve sites were continued into this survey and were assigned new site numbers. Both the new site numbering and previous site numbering are included below within table 45 where appropriate for ease of reference. Map 14 below

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<sup>4</sup> LAQM.TG(03) box 6.2 page 6-18 and section 6.58 page 6-29

indicates the areas where monitoring was undertaken and the extent of the existing Hafod AQMA. All exposure periods operate on a monthly basis.

Site	Easting	Northing	Prev. Ref	Within AQMA	Location
1	262046	196420	53	-	12 Ystrad Road, Fforestfach
2	262095	196500	-	-	1332 Carmarthen Road, Fforestfach
3	262161	196513	52	-	2 Ffordd Cynore, Fforestfach
4	262497	192857	10	-	26 Dillwyn road, Sketty
5	262548	192943	11	-	108 Gower Road, Sketty
6	262612	192995	12	-	21 Vivian road, Sketty
7	262691	192852	14	-	15 Gower Road, Sketty
8	262990	195820	30	-	1034 Carmarthen Road, Fforestfach
9	263190	195205	-	-	41 Station Road, Fforestfach
10	263219	195513	26	-	932 Carmarthen Road, Fforestfach
11	263344	195474	-	-	18 Ravenhill Road, Fforestfach
12	263680	195103	-	-	747 Carmarthen Road, Gendros
13	264830	193066	35	-	Brunel Court, Walter Road
14	265285	192696	-	-	14 Clarence Street
15	265334	192608	-	-	56 Westway
16	265339	192534	-	-	136 Osytersmouth Road
17	265496	192408	-	-	1-7 Arethusa Quay, Marina
18	265526	195807	-	Yes	6 Cwm Level Road, Landore
19	265597	194061	-	Yes	49 Dyfatty Street, Dyfatty
20	265594	194175	-	Yes	30 Carmarthen Road, Dyfatty
21	265634	195316	-	Yes	33 Plough Road, Landore
22	265682	195374	-	Yes	114 Pentreharne Road
23	265728	195494	-	Yes	15 Mysydd Road, Landore
24	265760	192420	-	-	126-149 Trawler Road, Marina
25	265845	195547	-	Yes	53 Mysydd Road, Landore
26	265876	194318	-	Yes	1399 Neath Road, Landore
27	265922	194428	-	Yes	1379 Neath Road, Landore
28	265949	194891	-	Yes	119 Neath Road, Landore
29	265973	195222	48	Yes	5 Morfa Terrace, Landore
30	266080	192516	-	-	34-41 Trawler Road, Marina
31	266153	196003	-	-	289 Neath Road, Landore
32	266209	193867	-	Yes	6 Pentreguinea Road, St. Thomas
33	266236	193488	-	-	69 Pentreguinea Road, St. Thomas
34	266272	196168	-	-	1184 Neath Road, Landore
35	266314	193298	55	-	50 Delhi Street, St. Thomas

Site	Easting	Northing	Prev. Ref	Within AQMA	Location
36	266455	193300	-	-	24 Delhi Street, St.Thomas
37	266515	193213	-	-	2 Sebastopol Street, St.Thomas
38	266662	193181	-	-	5 Port Tennant Road, Port Tennant
39	266905	193271	-	-	69 Port Tennant Road, Port Tennant
40	266951	198278	-	-	19 Pentrepoeth Road, Morriston
41	266953	198085	-	-	Fountain Inn, Woodfield Road
42	267084	198274	-	-	32 Sway Road, Morriston
43	267093	198063	-	-	17 Clase Road, Morriston
44	267639	199543	-	-	4 Ian's Walk, Ynysforgan
45	267661	199451	-	-	52 Glyncollen Drive, Ynysforgan
46	267752	193218	-	-	63 Wern fawr Road, Port Tennant
47	267908	199773	-	-	505 Clydach Road, Ynysforgan
48	268011	193101	-	-	5 Bevans Row, Port Tennant
49	268501	197329	-	-	34 Nantyffin Road, Llansamlet
50	268530	197419	-	-	6 Nantyffin Road, Llansamlet
51	268593	197434	-	-	138 Samlet Road, Llansamlet
52	268643	197245	-	-	87 Midland Place, Llansamlet
53	268652	197508	-	-	16 Church Road, Llansamlet
54	268693	197416	-	-	12 Peniel Green Road, Llansamlet
55	268789	197420	-	-	38 Peniel Green Road, Llansamlet
56	269306	198661	-	-	Ynysallan Road, Birchgrove
57	269395	199042	-	-	18 Coed Fedwen, Birchgrove
58	264000	192800	5N	-	16 Uplands Crescent, Uplands
59	265900	194500	1N	Yes	Hafod Post Office
60	265036	192931	-	-	10 St.Helens Road
61	264959	192878	-	-	Pacos St.Helens Road

Table 45 NO<sub>2</sub> Diffusion tube survey 5<sup>th</sup> October 2005 onwards

Monthly exposure periods commenced 5<sup>th</sup> October 2005. All passive diffusion tubes were exposed in accordance with the UK NO<sub>2</sub> survey Instruction Manual and were fixed to the front façade of a receptor location i.e. to a down pipe. The exception to this is at sites 56 and 58 where lampposts were used. See section 4.1.2 (site 58) for details on siting. At site 56, the lamppost used is close to the entrance to a new housing development along Ynysallen Road (see site 57 for monitoring within this development) and is within 25m of the eastbound carriageways of the M4.

The intention at these locations is to assess and determine the drop off from a major source as there is a possibility of a Planning Application being received for residential development in which it is proposed to have facades within 20m of the M4 motorway close to these locations.

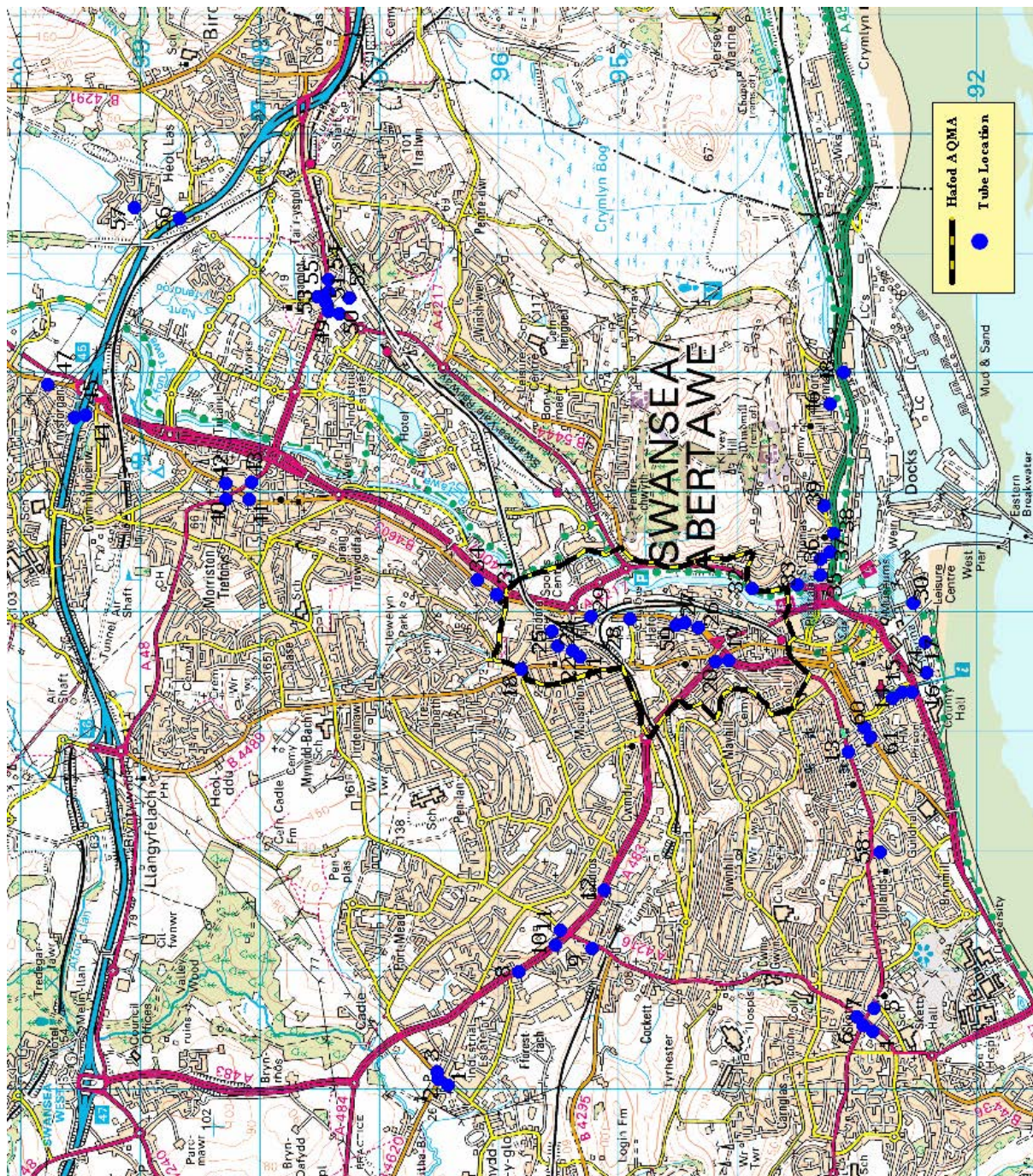
Similarly, sites 44 (Ian's Walk) and 45 (Glyncollen Crescent) are located at existing residential properties situated alongside the M4 motorway. The siting of site 45 can be seen at <http://test.swansea.airqualitydata.com/cgi-bin/dustsites.cgi> where indicative PM<sub>10</sub> monitoring is also underway. This location overlooks the westbound carriageways and westbound slip road at junction 45 of the M4.

All passive diffusion tubes were analysed using Harwell Scientifics Ltd standard operating procedure's AEAT/GW1/1015 issue 11.

From 2000, bias factors are available for Harwell Scientific Services at <http://www.uwe.ac.uk/aqm/review/diffusiontube300307.xls>. Therefore, the bias factor that has been used is the average of the co-location studies for year under consideration – in this study the first full year of measurements is from 2006. The Harwell Scientific services mean co-located studies bias for 2006 is 0.78.

It should be noted that the bias advice given within the above spreadsheet link shows a marked difference within the Harwell Scientific Services bias factors for 2005 and 2006. Harwell Scientifics Services 2005 overall bias factor (using 14 studies) is 0.88 whilst the overall bias factor for 2006 (using 12 studies) is 0.78. As an indication of the resulting possibilities, both sets of bias correction have been undertaken within table 46 below.





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Map 14 – NO<sub>2</sub> Diffusion Tube Survey October 2005 onwards Monitoring Locations

Data presented below within table 46 represents the first full calendar year of measurement from this survey i.e. January 2006 – December 2006. Data from October 2005 – December 2005 has been held back from any analysis for sake of simplicity of presentation (except site 59 Hafod Post Office see below).



Site	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias 2006 (0.78) Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias 2005 (0.88) Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias (0.83) Corrected Annual mean 2000-2006	National bias factor from 61 studies (0.98) using 50% TEA in Acetone
1	29.55	23.05	26.00	24.53	28.96
2	20.23	15.78	17.80	16.79	19.82
3	24.53	19.14	21.59	20.36	24.04
4	38.71	30.19	34.06	32.13	37.93
5	39.06	30.47	34.37	32.42	38.28
6	36.70	28.63	32.30	30.46	35.97
7	58.77	<b>45.84</b>	<b>51.72</b>	<b>48.78</b>	<b>57.59</b>
8	48.50	37.83	<b>42.68</b>	<b>40.26</b>	<b>47.53</b>
9	34.41	26.84	30.28	28.56	33.72
10	29.46	22.98	25.92	24.45	28.87
11	46.85	36.55	<b>41.23</b>	38.89	<b>45.92</b>
12	48.03	37.46	<b>42.26</b>	39.86	<b>47.06</b>
13	34.28	26.74	30.17	28.46	33.60
14	28.98	22.61	25.51	24.06	28.40
15	29.52	23.02	25.97	24.50	28.93
16	35.39	27.61	31.14	29.38	34.68
17	25.73	20.07	22.65	21.36	25.22
18	49.56	38.66	<b>43.62</b>	<b>41.14</b>	<b>48.57</b>
19	51.57	<b>40.22</b>	<b>45.38</b>	<b>42.80</b>	<b>50.54</b>
20	46.83	36.53	<b>41.21</b>	38.87	<b>45.90</b>
21	37.25	29.06	32.78	30.92	36.51
22	42.11	32.84	37.06	34.95	<b>41.27</b>
23	37.48	29.24	32.99	31.11	36.73
24	24.90	19.42	21.91	20.67	24.40
25	34.01	26.53	29.93	28.23	33.33
26	50.27	39.21	<b>44.23</b>	<b>41.72</b>	<b>49.26</b>
27	50.05	39.04	<b>44.04</b>	<b>41.54</b>	<b>49.05</b>
28	32.76	25.55	28.83	27.19	32.10
29	67.09	<b>52.33</b>	<b>59.04</b>	<b>55.69</b>	<b>65.75</b>
30	25.64	20.00	22.56	21.28	25.13
31	38.99	30.41	34.31	32.36	38.21
32	37.52	29.26	33.01	31.14	36.77
33	37.23	29.04	32.76	30.90	36.48
34	40.39	31.51	35.54	33.53	39.58



Site	Measured NO <sub>2</sub> Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias 2006 (0.78) Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias 2005 (0.88) Corrected Annual Mean µg/m <sup>-3</sup>	Harwell Scientific Services bias (0.83) Corrected Annual mean 2000-2006	National bias factor from 61 studies (0.98) using 50% TEA in Acetone
35	44.80	34.94	39.42	37.18	43.90
36	37.98	29.62	33.42	31.52	37.22
37	29.95	23.36	26.36	24.86	29.35
38	38.74	30.22	34.09	32.16	37.97
39	31.44	24.52	27.67	26.10	30.81
40	32.29	25.19	28.42	26.80	31.65
41	45.58	35.56	40.11	37.83	44.67
42	32.70	25.51	28.78	27.14	32.05
43	41.13	32.08	36.20	34.14	40.31
44	34.35	26.79	30.23	28.51	33.66
45	39.77	31.02	34.99	33.01	38.97
46	19.59	15.28	17.24	16.26	19.20
47	28.00	21.84	24.64	23.24	27.44
48	28.45	22.19	25.04	23.61	27.88
49	33.01	25.75	29.05	27.40	32.35
50	45.33	35.36	39.89	37.63	44.43
51	37.12	28.95	32.66	30.81	36.37
52	31.39	24.49	27.62	26.06	30.76
53	27.28	21.28	24.01	22.65	26.74
54	44.32	34.57	39.00	36.78	43.43
55	42.69	33.30	37.57	35.43	41.84
56	45.26	35.30	39.83	37.56	44.35
57	18.69	14.58	16.45	15.51	18.32
58	47.52	37.06	41.81	39.44	46.57
59	65.31**	50.94	57.48	54.21	64.01
60	42.93*	33.49	37.78	35.63	42.07
61	44.00*	34.32	38.72	36.52	43.12

Table 46 NO<sub>2</sub> Monitoring 2006

\* Data Capture 75% for 2006

\*\* Data capture 66% for 2006

Data capture during 2006 for site 59 (Hafod Post Office) falls below the 75% required to form a valid annual mean (being 66%) due to area renewal renovation works underway to the Post Office and adjacent terraced dwellings between August and December 2006. If data from October 2005 to December

2005 is included within the analysis, data capture rises to 91.6% and the measured annual mean is  $68.9\mu\text{g}/\text{m}^{-3}$  with the bias corrected annual mean  $53.7\mu\text{g}/\text{m}^{-3}$  (using a bias correction of 0.78). The signal is so strong at this site that it is thought prudent to include these details for sake of completeness.

Data capture at sites 60 and 61 commenced in April 2006 and 75% data capture overall was achieved for 2006.

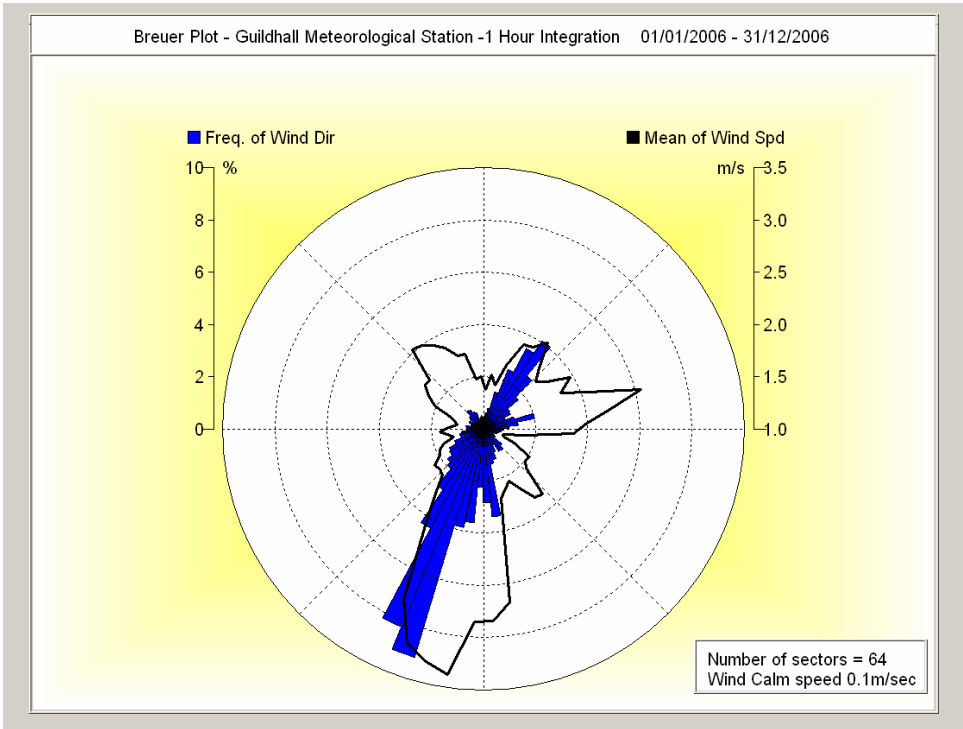
The monitoring undertaken has highlighted 4 sites where the corrected  $\text{NO}_2$  annual mean (Harwell Scientifics 2006 bias correction) is above the objective standard of  $40\mu\text{g}/\text{m}^{-3}$ . In addition, there are 3 sites where the bias corrected annual mean is between  $38\text{-}40\mu\text{g}/\text{m}^{-3}$  and these sites should also be considered at risk of breaching the annual mean objective. Of these 7 failing sites, 6 sites lie within the existing Hafod AQMA and represent additional monitoring within the existing Hafod Air Quality Management Area. The only site outside of the Hafod AQMA that breaches the objective level is site 7 Gower Road.

Should the bias correction factor for Harwell Scientific Services during 2005 be used (0.88) then a different picture is obtained with 14 sites breaching the objective level with a further 4 sites being within the  $38\text{-}40\mu\text{g}/\text{m}^{-3}$ . These sites should be considered likely to breach the annual mean objective.

A conservative estimate may be obtained by using the Harwell Scientific Services bias correction mean of 0.83 for the period 2000-2006. Using this factor, 14 sites are above the  $40\mu\text{g}/\text{m}^{-3}$  objective level with a further 4 sites within the  $38\text{-}40\mu\text{g}/\text{m}^{-3}$  range. Of these 18 failing sites 7 sites lie within the Hafod AQMA with 11 sites falling outside of the existing AQMA boundary.

The above range of possibilities and resultant outcomes merely reinforces the definite requirement for Swansea to obtain its own local bias factor. As already stated, this work is well advanced.

Meteorological data has been examined for the period January 2006- December 2006. A Breuer Plot representing the period of measurement is given below as Breuer Plot 9 and shows a prevalence of south westerly winds. This probably typifies the expected meteorological conditions.



Breuer Plot 9 – Guildhall Meteorological Conditions 2006

The January 2006 update of LAQM.TG(03) indicates that the correction factors provided within the original LAQM.TG(03) guidance (box 6.7 and 6.8 page 6-29) to estimate annual mean concentrations in future years should no longer be used. The revised guidance indicates use of the Year Adjustment Calculator v2.2a (from [http://www.airquality.co.uk/archive/laqm/tools/Year\\_Adjustment\\_Calculator22a.xls](http://www.airquality.co.uk/archive/laqm/tools/Year_Adjustment_Calculator22a.xls)).

Using 2006 as the base year, the range of possible projections for 2010 are shown below as table 47.

Site	2006 bias corrected (0.78) annual mean	Projected 2010	2006 bias corrected (0.88) annual mean	Projected 2010	2006 bias corrected (0.83) annual mean	Projected 2010
1	23.05	19.96	26.00	22.51	24.53	21.24
2	15.78	13.66	17.80	15.41	16.79	14.54
3	19.14	16.57	21.59	18.69	20.36	17.63
4	30.19	26.14	34.06	29.49	32.13	27.82
5	30.47	26.38	34.37	29.76	32.42	28.07
6	28.63	24.79	32.30	27.96	30.46	26.37
7	45.84	36.69	51.72	44.78	48.78	42.23
8	37.83	32.75	42.68	36.95	40.26	34.86
9	26.84	23.24	30.28	26.22	28.56	24.73
10	22.98	19.90	25.92	22.44	24.45	21.17
11	36.55	31.64	41.23	35.70	38.89	33.67
12	37.46	32.43	42.26	36.59	39.86	34.51
13	26.74	23.15	30.17	26.12	28.46	24.64
14	22.61	19.58	25.51	22.09	24.06	20.83
15	23.02	19.93	25.97	22.48	24.50	21.21
16	27.61	23.90	31.14	26.96	29.38	25.44
17	20.07	17.38	22.65	19.61	21.36	18.49
18	38.66	33.47	43.62	37.77	41.14	35.62
19	40.22	34.82	45.38	39.29	42.80	37.06
20	36.53	31.63	41.21	35.68	38.87	33.65
21	29.06	25.16	32.78	28.38	30.92	26.77
22	32.84	28.43	37.06	32.09	34.95	30.26
23	29.24	25.32	32.99	28.56	31.11	26.93
24	19.42	16.81	21.91	18.97	20.67	17.90
25	26.53	22.97	29.93	25.91	28.23	26.44
26	39.21	33.95	44.23	38.29	41.72	36.12
27	39.04	33.80	44.04	38.13	41.54	35.96
28	25.55	22.12	28.83	24.96	27.19	23.54
29	52.33	45.31	59.04	51.12	55.69	48.22
30	20.00	17.32	22.56	19.53	21.28	18.42
31	30.41	26.33	34.31	29.70	32.36	28.02
32	29.26	25.33	33.01	28.58	31.14	26.96
33	29.04	25.14	32.76	28.36	30.90	26.75
34	31.51	27.28	35.54	30.77	33.53	29.03

Site	2006 bias corrected (0.78) annual mean	Projected 2010	2006 bias corrected (0.88) annual mean	Projected 2010	2006 bias corrected (0.83) annual mean	Projected 2010
35	34.94	30.25	39.42	34.13	37.18	32.19
36	29.62	25.64	33.42	28.93	31.52	27.29
37	23.36	20.22	26.36	22.82	24.86	21.52
38	30.22	26.16	34.09	29.51	32.16	27.84
39	24.52	21.23	27.67	23.96	26.10	22.60
40	25.19	21.81	28.42	24.61	26.80	23.20
41	35.56	30.79	40.11	34.73	37.83	32.75
42	25.51	22.09	28.78	24.92	27.14	23.50
43	32.08	27.77	36.20	31.34	34.14	29.56
44	26.79	23.19	30.23	26.17	28.51	24.68
45	31.02	26.86	34.99	30.29	33.01	28.58
46	15.28	13.23	17.24	14.93	16.26	14.08
47	21.84	18.91	24.64	21.33	23.24	20.12
48	22.19	19.21	25.04	21.68	23.61	20.44
49	25.75	22.29	29.05	25.15	27.40	23.72
50	35.36	30.61	39.89	34.54	37.63	32.58
51	28.95	25.06	32.66	28.28	30.81	26.67
52	24.49	21.20	27.62	23.91	26.06	22.56
53	21.28	18.42	24.01	20.79	22.65	19.61
54	34.57	29.93	39.00	33.77	36.78	31.84
55	33.30	28.83	37.57	32.53	35.43	30.67
56	35.30	30.56	39.83	34.48	37.56	32.52
57	14.58	12.62	16.45	14.24	15.51	13.43
58	37.06	32.09	41.81	36.20	39.44	34.15
59	50.94	44.10	57.48	49.77	54.21	46.93
60	33.49	28.99	37.78	32.71	35.63	30.85
61	34.32	29.71	38.72	33.52	36.52	31.62

Table 47 – NO<sub>2</sub> projections to 2010 from 2006 Monitoring

As has already been stated, the authority is undertaking tri location co-exposure of passive diffusion tubes on the sample intakes of chemiluminescent NO<sub>x</sub> analysers at the Swansea AURN, Morfa Groundhog and Morryston Groundhog air quality stations. Once the survey has a full year of data then works to ratify the NO<sub>x</sub> measurements at the Morfa and Morryston sites will commence.

Ratified NO<sub>x</sub> data for the Swansea AURN will be downloaded from the Air

Quality Archive once it's available. All ratified datasets will be used in the compilation of the local bias factor. It is both envisaged and anticipated that the tri co-location study will continue and each year a new bias adjustment factor for locally exposed diffusion tubes obtained.

No decision to proceed to Detailed Assessments at the sites breaching/predicted to exceed the EU objective will be made until a full review of the existing diffusion tube data can be made when the local bias factor known. As can be seen from the analysis above, different scenarios are possible dependant upon the bias correction factor used.

## **5 Other Monitoring Works**

### **5.1 Heavy Metals Monitoring**

The Department of the Environment, Transport and the Regions (DETR) is funding a monitoring study to determine ambient concentrations of lead, cadmium, arsenic, mercury and nickel in the vicinity of a wide-variety of industrial processes.

The City and County of Swansea were requested to participate in this study from its inception during 1999/2000 due to the nickel refinery at INCO Europe being located within the authorities area at Clydach.

On the 16<sup>th</sup> July 2003 the European Commission adopted a proposal for a Directive relating to arsenic, cadmium, nickel, mercury and polycyclic hydrocarbons (PAH) in ambient air<sup>1</sup>. The target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of Best Available Technique (BAT). There are therefore, as yet, no binding obligations to reduce these pollutants. Ambient air concentrations of these substances only have to be monitored once emissions have passed a critical threshold.

Annexe 1 of the Directive details the target values for arsenic, cadmium, nickel and benzo(a)pyrene and these are reproduced below as table 48.

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<sup>1</sup> COM 2003 (423)

Pollutant	Target value ng/m <sup>-3</sup>
Arsenic	6
Cadmium	5
Nickel	20
Benzo(a)pyrene	1

Table 48- Target Values 4<sup>th</sup> Daughter Directive - Heavy Metals Monitoring

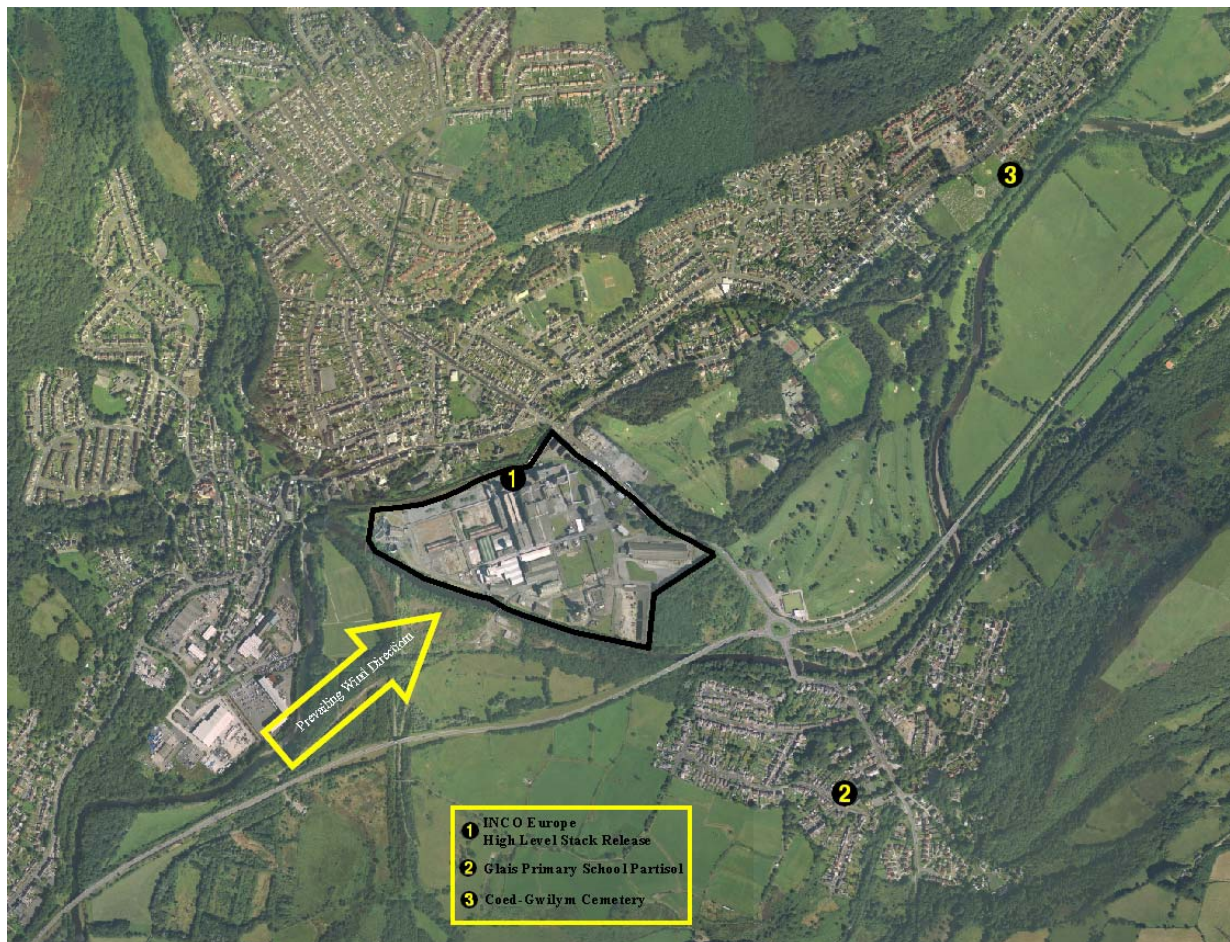
Glais Primary School, School Road, was chosen as the initial monitoring location due to its proximity to the refinery and for additional security issues with the equipment at the time. A Rupprecht & Patashnick Co., Inc. Partisol 2000 sampling unit, fitted with a PM<sub>10</sub> sampling inlet with a flow rate of 16.7 l/min, has been installed on a flat roof at Glais School.

During July 2006, two additional monitoring locations were added: one at Coed-Gwilym Cemetery upwind of the high level stack release and one at the Morriston Groundhog some 4.1 kilometres downwind of the stack release point (see section 3.3.1 for site location of the Morriston Groundhog). Both additional units are Partisol 2025 units with automatic filter cartridge exchange and are fitted with PM<sub>10</sub> sampling inlets with flow rates of 16.7 l/min. Four filters are housed in the main exchange drum and the unit automatically regulates weekly exposure of each filter. Neither of these two new units is officially part of the UK Heavy Metals Monitoring Network but the data that is collected is analysed and ratified by the network contractor (NPL) in exactly the same way as the network sites. These additional monitoring points have been established to try and obtain an upwind and downwind correlation in order to undertake further analysis.

It is envisaged that one if not both of these new monitoring locations will be absorbed into the UK Heavy Metals Monitoring Network during late 2007 or early 2008. Should this prove to be the case then the units will be replaced with Partisol 2000 sampling units.



The location of INCO Europe and the sampling locations can be seen within map 15.



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Map 15 - Heavy Metals Monitoring -Glais Partisol and Coed-Gwilym Cemetery

Filters are exposed on a weekly basis and sent to the National Physics Laboratory (NPL) for analysis. The analysed parameters are: Arsenic (As), Cadmium(Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Magnesium (Mn), Nickel(Ni), Lead(Pb), Platinum (Pt), Vanadium (V), Zinc (Zn) and Mercury(Hg). Analysis for particulate-phase metals took place at NPL using a PerkinElmer Elan DRC II ICP-MS, following NPL's UKAS accredited procedure, which is fully compliant with the requirements of EN 14902:2005.

Upon arrival at NPL, the filters were cut accurately in half, and each portion digested at temperatures up to 220°C using a CEM Mars X microwave. The digestion mixtures used were:

- Hg & Pt: 5 ml of nitric acid and 5 ml hydrochloric acid.
- All other metals: 8 ml of nitric acid and 2 ml hydrogen peroxide.

ICP-MS analysis of the digested solutions took place using at least four gravimetrically-prepared calibration solutions. A QA standard was repeatedly analysed (after every two solutions), and the change in response of the QA standard was mathematically modelled to correct for the long-term drift of the instrument. The short-term drift of the ICP-MS was corrected for by use of an internal standards mixture (containing Y, In, Bi, Sc, Ga & Rh) continuously added to the all samples via a mixing block. Each sample is analysed in triplicate, each analysis consisting of five replicates.

The amount of each metal in solution (and its uncertainty) was then determined by a method of generalised least squares using XGenline (an NPL-developed program) to construct a calibration curve<sup>2</sup>.

The uncertainty weighted mean for a series of  $N$  measurements, where the  $i^{\text{th}}$  measurement produces a value,  $x_i$ , with a measurement uncertainty,  $u_i$ , the uncertainty-weighted mean of the measurement,  $\bar{x}_u$ , would be given by:

$$\bar{x}_u = \frac{\sum_{i=1}^{i=N} \left( \frac{x_i}{u_i^2} \right)}{\sum_{i=1}^{i=N} \left( \frac{1}{u_i^2} \right)}$$

---

<sup>2</sup> 2006 NPL Report DQL-AS 036 Annual Report for 2006 on the UK Heavy Metals Monitoring Network

Nickel results are presented as annual means from 2002-2006 with presentation of monthly means (along with the other metals monitored) and the resulting annual means for 2005-2006 for the Glais Primary School monitoring.

Table 49 details the annual means and table 50 the monthly means (2005-2006) for the Glais primary School site. All results are expressed in  $\text{ng/m}^{-3}$

Year	Annual Mean $\text{ng/m}^{-3}$	% of target Value (100% = Target Value)
2002	28.91	145
2003	18.14	91
2004	33.83	169
2005	19.62	98
2006	26.13	131

*Table 49 Nickel Annual Means Glais Primary School*

<b>2005</b>	<b>As</b>	<b>Cd</b>	<b>Cr</b>	<b>Cu</b>	<b>Fe</b>	<b>Mn</b>	<b>Ni</b>	<b>Pb</b>	<b>Pt</b>	<b>V</b>	<b>Zn</b>	<b>Hg</b>
Jan	0.60	0.25	6.90	4.84	73	1.84	<b>18.82</b>	22.5	0.08	48.40	16.7	0.05
Feb	4.17	2.23	9.92	24.18	84	9.23	<b>26.76</b>	98.2	0.00	2.88	34.9	0.16
Mar	0.78	0.19	1.16	3.20	113	3.08	<b>18.02</b>	7.6	0.00	2.68	14.2	0.08
April	0.69	0.25	5.33	2.60	121	3.75	<b>20.24</b>	7.1	0.00	31.67	13.1	0.09
May	2.35	0.10	8.75	1.83	92	3.53	<b>7.11</b>	5.3	0.00	84.79	7.4	0.88
June	0.44	0.11	1.21	3.50	98	3.25	<b>9.52</b>	6.0	0.00	2.78	26.8	0.09
July	0.52	0.23	1.71	4.19	171	3.87	<b>33.38</b>	8.2	0.02	1.65	18.0	0.21
Aug	0.50	0.15	5.88	3.99	154	4.37	<b>23.17</b>	6.4	0.02	23.99	7.0	0.26
Sept	0.58	0.28	3.81	5.11	151	5.32	<b>16.65</b>	12.6	0.00	2.80	27.4	0.07
Oct	0.85	0.29	1.84	4.10	162	3.87	<b>11.81</b>	10.2	0.00	1.86	16.5	2.64
Nov	1.38	0.23	2.25	10.63	162	3.44	<b>21.46</b>	17.3	0.02	0.43	15.5	0.69
Dec	1.30	0.21	1.28	6.20	215	3.38	<b>28.48</b>	13.4	0.04	2.93	16.5	0.28
<b>Ann Av.</b>	<b>1.18</b>	<b>0.38</b>	<b>4.17</b>	<b>6.20</b>	<b>133</b>	<b>4.08</b>	<b>19.62</b>	<b>17.9</b>	<b>0.01</b>	<b>17.24</b>	<b>17.8</b>	<b>0.46</b>
<b>2006</b>	<b>As</b>	<b>Cd</b>	<b>Cr</b>	<b>Cu</b>	<b>Fe</b>	<b>Mn</b>	<b>Ni</b>	<b>Pb</b>	<b>Pt</b>	<b>V</b>	<b>Zn</b>	<b>Hg</b>
Jan	1.14	0.29	0.62	7.43	234	4.79	<b>30.86</b>	16.9	0.02	1.65	21.4	2.29
Feb	1.44	0.33	6.90	22.54	668	9.37	<b>15.76</b>	21.6	0.00	3.77	37.2	0.23
Mar	0.52	0.19	5.20	2.96	107	2.82	<b>24.35</b>	6.2	0.15	2.40	11.3	0.64
April	0.41	0.11	2.98	3.49	82	2.18	<b>26.86</b>	5.4	0.01	1.66	13.9	0.25
May	0.72	0.14	3.28	4.62	196	4.69	<b>18.68</b>	7.6	0.01	3.00	16.9	0.26
June	0.38	0.20	1.91	5.15	229	6.50	<b>20.04</b>	9.3	0.10	2.12	16.6	0.52
July	0.71	0.24	2.12	5.02	274	6.91	<b>18.98</b>	12.5	0.00	3.52	16.3	0.17
Aug	0.36	0.14	1.51	3.42	91	2.90	<b>27.42</b>	7.5	0.00	0.78	9.0	0.24
Sept	0.39	0.21	6.22	4.43	183	6.22	<b>18.19</b>	8.6	0.01	1.13	20.2	0.68
Oct	0.84	0.15	1.97	3.94	100	3.35	<b>32.60</b>	9.4	0.00	1.73	15.1	0.63
Nov	2.73	0.34	5.84	10.41	168	3.83	<b>27.72</b>	34.5	0.00	0.85	24.8	0.18
Dec	1.39	0.24	3.45	5.34	124	2.61	<b>52.09</b>	18.5	0.00	1.51	18.5	0.12
<b>Ann Av.</b>	<b>0.92</b>	<b>0.21</b>	<b>3.50</b>	<b>6.56</b>	<b>205</b>	<b>4.68</b>	<b>26.13</b>	<b>13.2</b>	<b>0.03</b>	<b>2.01</b>	<b>18.4</b>	<b>0.52</b>

Table 50 Monthly Heavy Metals Data Glais Primary School 2005-2006

Tables 51 and 52 detail the monthly means that are available for the Coed-Gwilym Cemetery and Morryston Groundhog sites. All results are expressed in  $\text{ng/m}^{-3}$ .

<b>Coed-Gwilym Cemetery</b>												
<b>2006</b>	<b>As</b>	<b>Cd</b>	<b>Cr</b>	<b>Cu</b>	<b>Fe</b>	<b>Mn</b>	<b>Ni</b>	<b>Pb</b>	<b>Pt</b>	<b>V</b>	<b>Zn</b>	<b>Hg</b>
Aug	0.25	0.09	1.96	3.1	55	2.32	31.1	6.6	<0.01	0.61	16.0	0.30
Sept	0.45	0.21	5.57	5.9	203	5.65	66.6	9.5	<0.01	2.05	23.6	0.40
Oct	0.89	0.22	9.14	4.2	127	4.66	76.3	12.5	<0.01	1.51	18.7	0.62
Nov	1.89	0.28	5.95	9.5	118	3.46	49.2	26.8	<0.01	0.56	20.5	0.29
Dec	3.68	1.13	6.46	14.5	173	4.19	141.0	31.0	<0.01	2.98	36.9	0.07

Table 51 Heavy Metals Monitoring Coed-Gwilym Cemetery 2006

<b>Morrison Groundhog</b>												
<b>2006</b>	<b>As</b>	<b>Cd</b>	<b>Cr</b>	<b>Cu</b>	<b>Fe</b>	<b>Mn</b>	<b>Ni</b>	<b>Pb</b>	<b>Pt</b>	<b>V</b>	<b>Zn</b>	<b>Hg</b>
Aug	0.26	0.15	1.03	17.6	338	5.76	15.3	12.4	<0.01	0.56	24.3	0.43
Sept	0.57	0.24	4.45	29.0	582	11.96	24.6	27.0	<0.01	2.57	48.5	0.60
Oct	0.91	0.26	36.6	29.6	563	10.07	74.0	20.0	<0.01	1.79	28.8	0.44
Nov	2.90	0.61	7.59	46.2	574	9.68	39.8	51.8	<0.01	0.70	39.5	0.16
Dec	3.81	1.23	4.88	35.2	657	9.77	88.1	36.7	<0.01	2.92	57.8	0.09

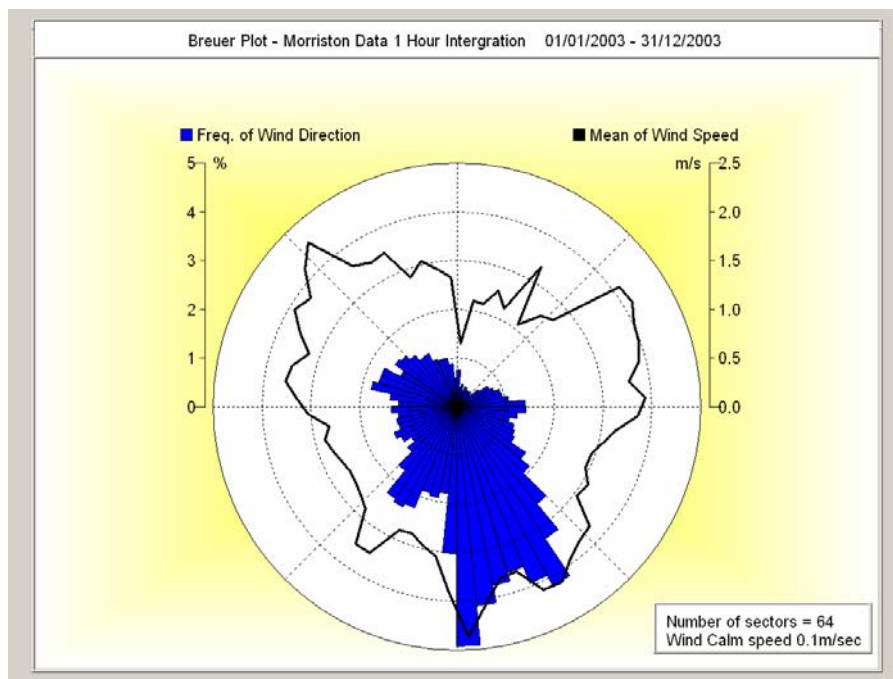
Table 52 Heavy Metals Monitoring Morrison Groundhog 2006

Whilst there is little data at present from the Coed-Gwilym Cemetery and Morrison Groundhog sites, it is clear that there is greater variability and higher mean weekly concentrations recorded within the monthly means (August – December 2006) compared to the Glais Primary School site. This can only be attributed to the additional monitoring stations being sited upwind and downwind of the prevailing wind direction in relation to the high level stack release source, providing a more accurate distribution of ground level concentrations. The Glais Primary School site is located to the east of the stack release where higher concentrations are normally seen under the influence of a north westerly wind direction.

From the annual mean data presented within table 49 it is evident that the Glais Primary School site recorded nickel concentrations during the period 2002 – 2006 that either marginally fall below the Forth Daughter Directive Target Value ( $20\text{ng/m}^{-3}$ ) or exceed this Target Value. However you look at the data, the signal is strong suggesting a dominant consistent local source.

Meteorological data for all Breuer Plots below (Breuer Plots 10 - 13) is taken from the Morriston Groundhog station which is located within the lower Swansea Valley area, approximately 4 kilometres south of Glais and forms the nearest local data source.

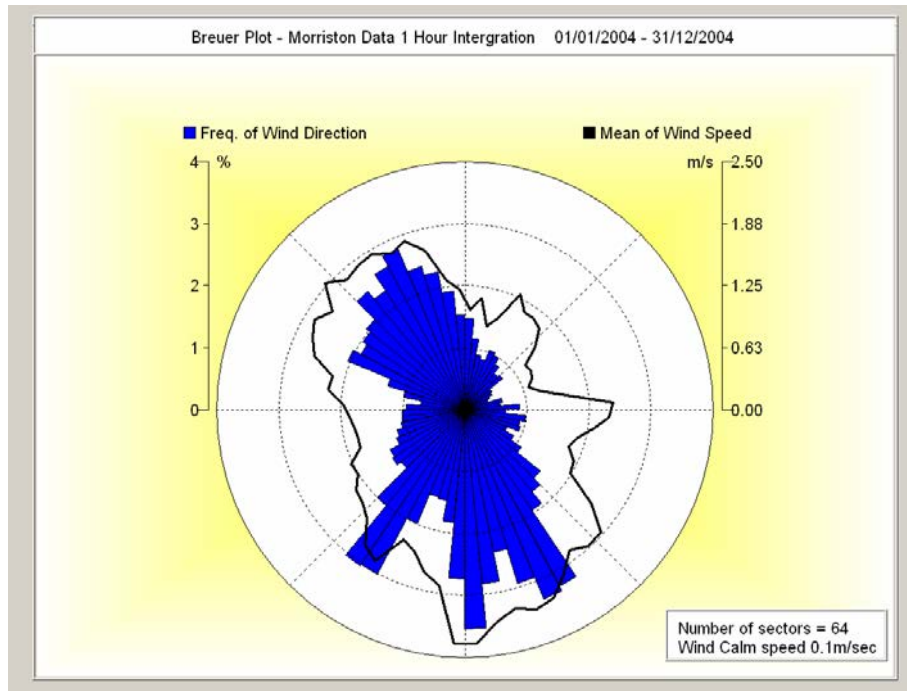
Breuer Plot 10 below for 2003, shows what is known to be an atypical meteorology year with a prevalence of easterly/ south easterly winds (taking the air mass over the monitoring station before the high level stack release point). This may explain why concentrations fell marginally below the Target Value during 2003.



Breuer Plot 10 – Meteorological conditions 2003

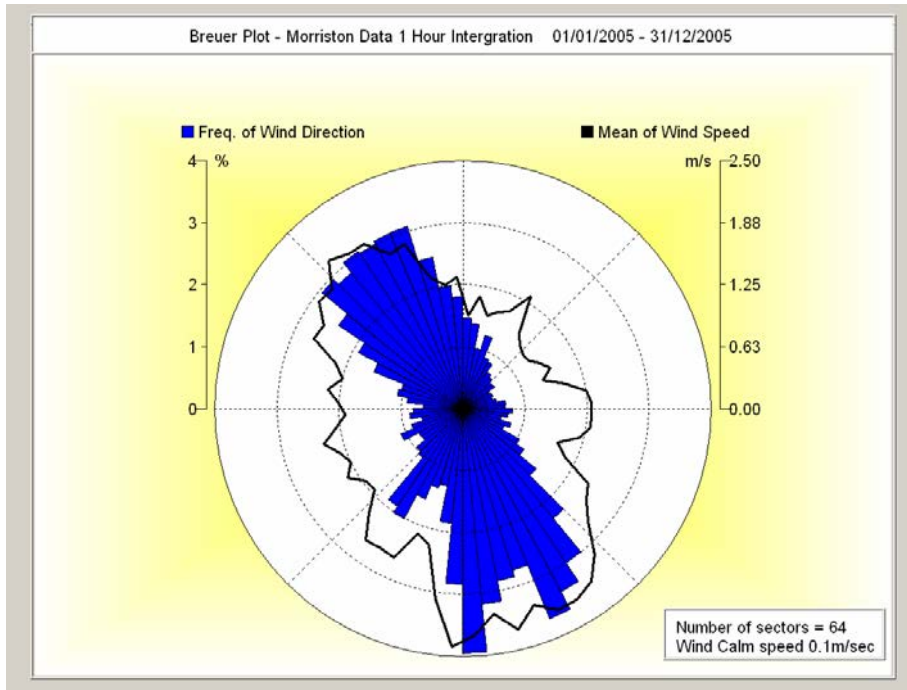


Breuer plot 11 below for 2004 shows a prevalence of south easterly and north westerly winds along with the expected prevailing south westerly wind - the north westerly winds would influence nickel concentrations at the Glais Primary site and this can be seen in the annual mean nickel concentration for 2004.



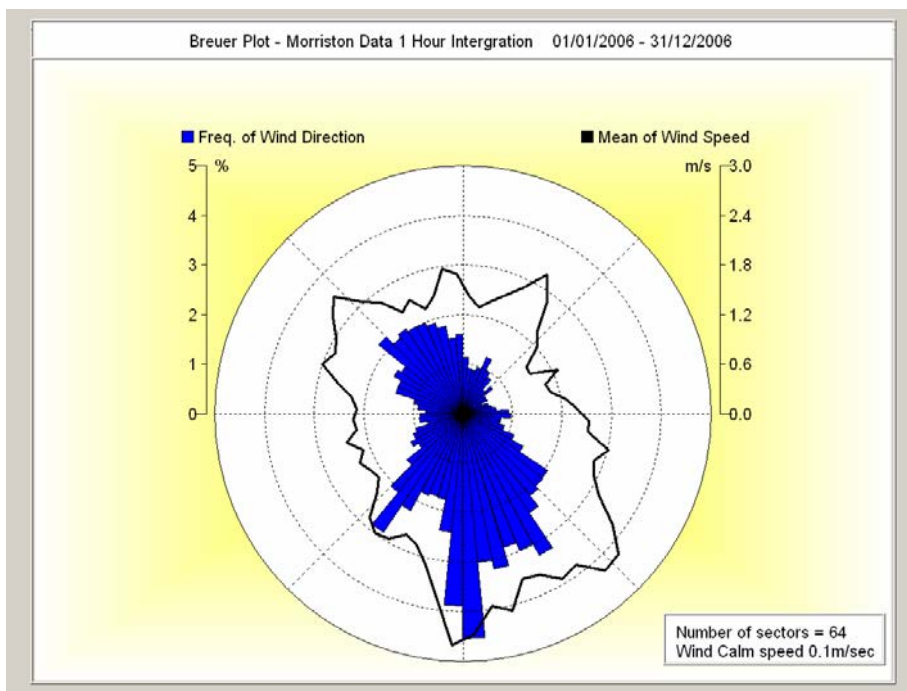
*Breuer Plot 11 – Meteorological conditions 2004*

Breuer plot 12 below for 2005 shows a prevalence of south easterly winds and more importantly for the resulting annual mean, a prevalence of north westerly winds that would influence nickel concentrations at the Glais Primary site, with unusually, very little influence from the prevailing south westerlies.



Breuer Plot 12 – Meteorological conditions 2005

Breuer plot 13 below for 2006 shows a prevalence of southerly/south easterly winds. North westerly winds are again noticeable, with again unusually, very little influence from the prevailing south westerlies.



Breuer Plot 13 – Meteorological conditions 2006



Information to hand would indicate that low-level fugitive emissions are minimal and that the vast majority of release is via the high-level discharge stack. It is anticipated that the monitoring location at Coed-Gwilym Cemetery will be within the footprint of the stack plume. Additional monitoring locations are also being investigated (in addition to the existing 3 sites) as it is not clear whether the stack emissions could generate these data, or, what the contribution from re-suspended historical deposition might be. In order to try and gain an understanding of the historical deposition versus active release debate, the analysis undertaken from the Morryston and Coed-Gwilym Cemetery sites also includes scandium to determine if any significant nickel-scandium relationship exists which would possibly indicate historical deposition being re-suspended. To date, and from the limited data available, no such relationship can be seen within the data.

From table 50 it is clear that annual mean concentrations at the Glais Primary School site fall well below the 4<sup>th</sup> Daughter Directive Target Values for both arsenic and cadmium.

## **6 New Local Developments**

During the last two to three years, Swansea has seen a substantial amount of interest in development of both green field sites and brown field sites. The catalyst for this upsurge in development has undoubtedly been the DIEN (Department of Innovation Enterprise and Networking – formally the Welsh Development Agency) led redevelopment of the old docklands within Swansea Port that has become known as the SA1 development. This major investment site has seen developers submitting Planning Applications both within the SA1 area and more lately outside of that area but to the main within the influence zone of the SA1 development.

Details of all major projects known of are summarised below as some developments have the potential to impact upon air quality. In the main, these impacts have largely been resolved through the planning process. Some development sites have been completed while others remain either in the early stages of construction or planning processes. These details have been reported within the Updating and Screening assessment submitted in April 2006 but are repeated and updated here where appropriate for the sake of completeness.

### **6.1 New Retail Developments**

#### **6.1.1 Morfa Retail Park**

Construction of the Morfa Retail Park commenced during 2003 alongside the construction of a new sports stadium to be used by both Swansea City Football Club and for the new regional rugby team the Ospreys. Swansea City Football

Club will play all of its home games at the stadium whilst the Ospreys will play some of their home fixtures at the venue - the remainder being hosted at The Gnoll, Neath. The sports stadium development has been named during 2006 as The Liberty Stadium and is located within the boundary of the Hafod Air Quality Management Area (AQMA). The Morfa Retail Park development lies just outside of the Hafod AQMA and map 16 below indicates the extent and location of the development within the lower Swansea Valley.

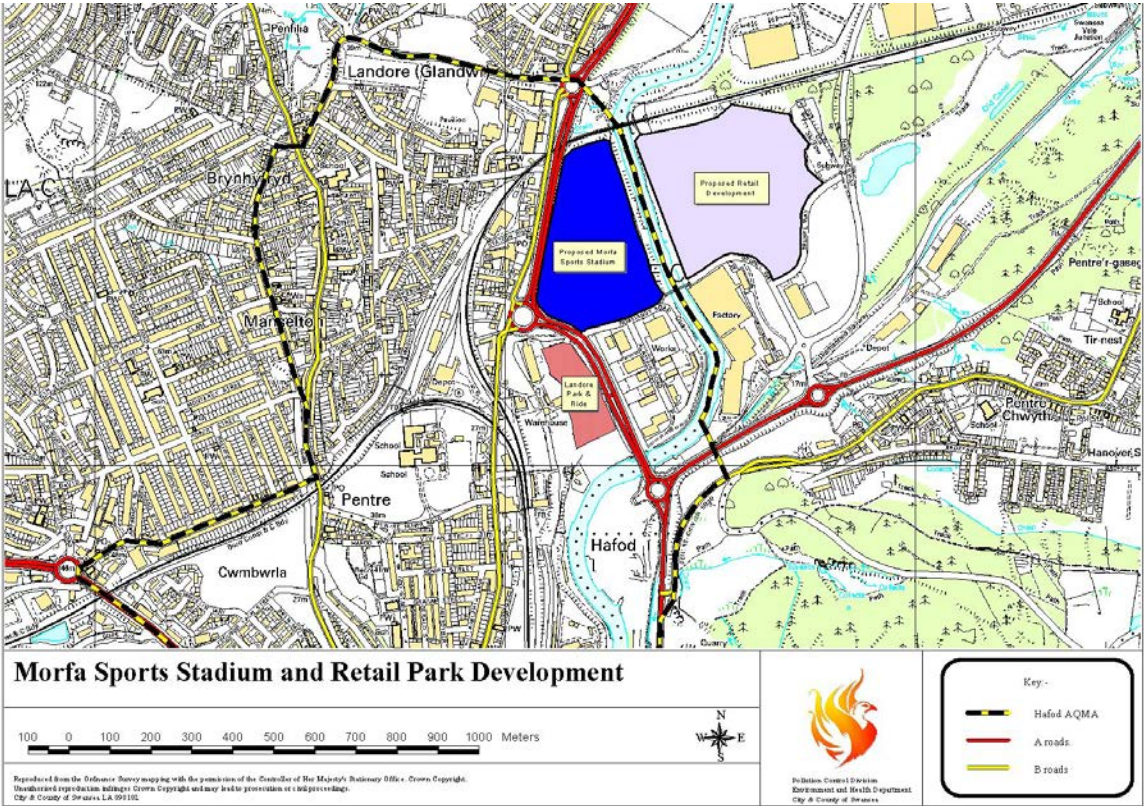
The Morfa Groundhog (see 3.1.1 above) air quality monitoring station is located at Normandy roundabout, adjacent to the development site. This site will provide the data to enable an assessment of any impact upon the lower valley area from the development and the road transport infrastructure of the lower valley area.

The Retail Park opened during late 2004/early 2005 and has seen major UK operators establish premises within the retail park. These operators include a major DIY chain, numerous cloths and sports goods outlets and a major UK food retailer. The vast majority of the remainder of the retail units were occupied during 2005 but whilst one or two remain vacant during the early part of 2007 additional units were under construction.

The sports stadium was completed during June 2005 and hosted its first football game during July 2005 prior to the commencement of the football and rugby season for 2005/2006. The stadium will be in use for the majority of weekends as well as certain weekday evening fixtures for both sport uses.

There are plans to stage major pop concerts and other “outdoor events” at this venue. The first of these events occurred during June 2007 when “The Who”

performed at the Liberty Stadium. In addition, the Retail Park will be open for business until late evening for the majority of the time.



Map 16 - Sports Stadium and Morfa Retail Park Developments

Vehicle by vehicle automatic classification and counting is now ongoing throughout the lower Swansea Valley via a network of GPRS Automatic Traffic Counters. This will provide in time, the data to enable a clearer picture to be obtained of the influence of the road transport network to the lower valley area.

### 6.1.2 Parc Fforestfach & Pontardulais Road Retail Park

Parc Fforestfach has been constructed over the last couple of years following the reconstruction of a major UK food retailer store and the aquisition of adjoining derelict retail units. The complex now can be considered to straddle two sites - one either side of the busy A483 Pontardulais Road. The complex as a whole

comprises of major UK food retailers, clothing retailers and electrical retailers together with a fast food outlet and other mixed retail units consisting of, amongst other things, a bookstore and chemists.

It has become established as a major "out-of-town" retail attraction for both Swansea residents and further afield. Access to the complex is off the A483 and also via the traffic signal controlled junction at the intersection of the A483 with Ffordd Cynore and Pentregethin Road. Junction 47 of the M4 is approximately one mile to the north of the site. Swansea City centre is located approximately 3 miles to the south of the complex.

Traffic congestion at peak times - particularly over the weekends is becoming a concern for local residents. Passive nitrogen dioxide monitoring tubes have been established to the facade of terraced dwellings along Ffordd Cynore (site 3 in section 4.1.5.2 along with site 52 in earlier survey), Ystrad Road (site 1 in section 4.1.5.2 along with site 53 in earlier survey) and the A483 Carmarthen Road (site 2 in section 4.1.5.2) as well as 1344 Carmarthen Road (site 54 in previous study 4.1.5.1) – The location and monitoring results from 2004 - 2006 for these sites can be seen within tables 43-47 above. In view of the noticeable congestion within the area at certain periods, the results are surprisingly low. This is not to say that there have been or will be breaches of the NO<sub>2</sub> 1-hour objective standard but this is unlikely given the annual mean values from 2004 being lower than 60µg/m<sup>-3</sup><sup>1</sup>. The location of the developments can be seen below as map 17.

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<sup>1</sup> *Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites - Laxen et al July 2003*





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*Map 17 - Parc Fforestfach and Pontardulais Road Retail Parks*

PM<sub>10</sub> will be monitored along Ffordd Cynore in the vicinity of the Retail Park as soon as the monitoring station that has been ordered has been re-commissioned following an upgrade to the flow pump. Difficulties have been experienced with its location and electricity supply etc but the site was finally established during the summer of 2006 when the flow pump issue was first noticed. It is intended to use the laser light-scattering device initially as a screening tool to assess any likely breach of the as yet provisional PM<sub>10</sub> standards for 2010. These measurements will continue for the foreseeable future along with the passive NO<sub>2</sub> diffusion tube work. These measurements have taken on greater significance due to the housing development commencing opposite the Retail Park during 2004 and early 2005 with continued expansive development

extending into 2007. This housing development accessed off Ffordd Cynore is outlined below within 6.3.1. Additionally the proposed mixed-use development off Ffordd Cynore (see 6.2.4 below) is adjacent to these developments

### **6.1.3 Proposed Asda Store, Gorseinon**

The application site consists of a vacant parcel of land (2.63 hectares / 6.5 acres) and incorporates the two existing residential properties of 12 and 13 Mill Street and forms part of the Melyn Mynach development site adjacent to the north-east of the Gorseinon District Shopping Centre and Somerfield retail store. The site was previously part of the Mountain Colliery and Gorseinon Tin Plate Works, which was reclaimed in the late 1970's. The site is bounded by the residential development of Cae Glas and Cwrt Rhian to the north; Ty'r Felin doctors surgery and the residential properties in Cecil Road to the west; the Somerfield store to the south and Heol Mynydd to the east. An outline of the proposed site can be seen within map 18 below.

The application seeks full planning permission for the development of a Class A1 retail store with a gross floor space of 5,341 sq m (57,500 sq ft) together with associated car parking (471 spaces) and service delivery area. The net sales area of the store will be 2705 sq m, of which it is proposed that up to 40% (1082 sq m) would be used for the sale of comparison goods and the remainder, convenience goods. The proposal involves the demolition of the residential properties at 12 and 13 Mill Street. It is proposed to construct a new vehicular access incorporating a roundabout on Heol-y-Mynydd at the eastern end of the site with a separate service yard access at the western end of the site along the existing Somerfield store access. The existing vehicular connection to Cecil Road will remain open. Pedestrian access and crossing points are indicated







the proposed store would employ 300 people as a result of the proposed development.

The planning application is accompanied by a Retail Assessment, Transport Assessment, Design Statement, Landscaping Appraisal, Air Quality Assessment, Phase 2 Geo-environmental Investigation and an Environmental Noise Survey Report.

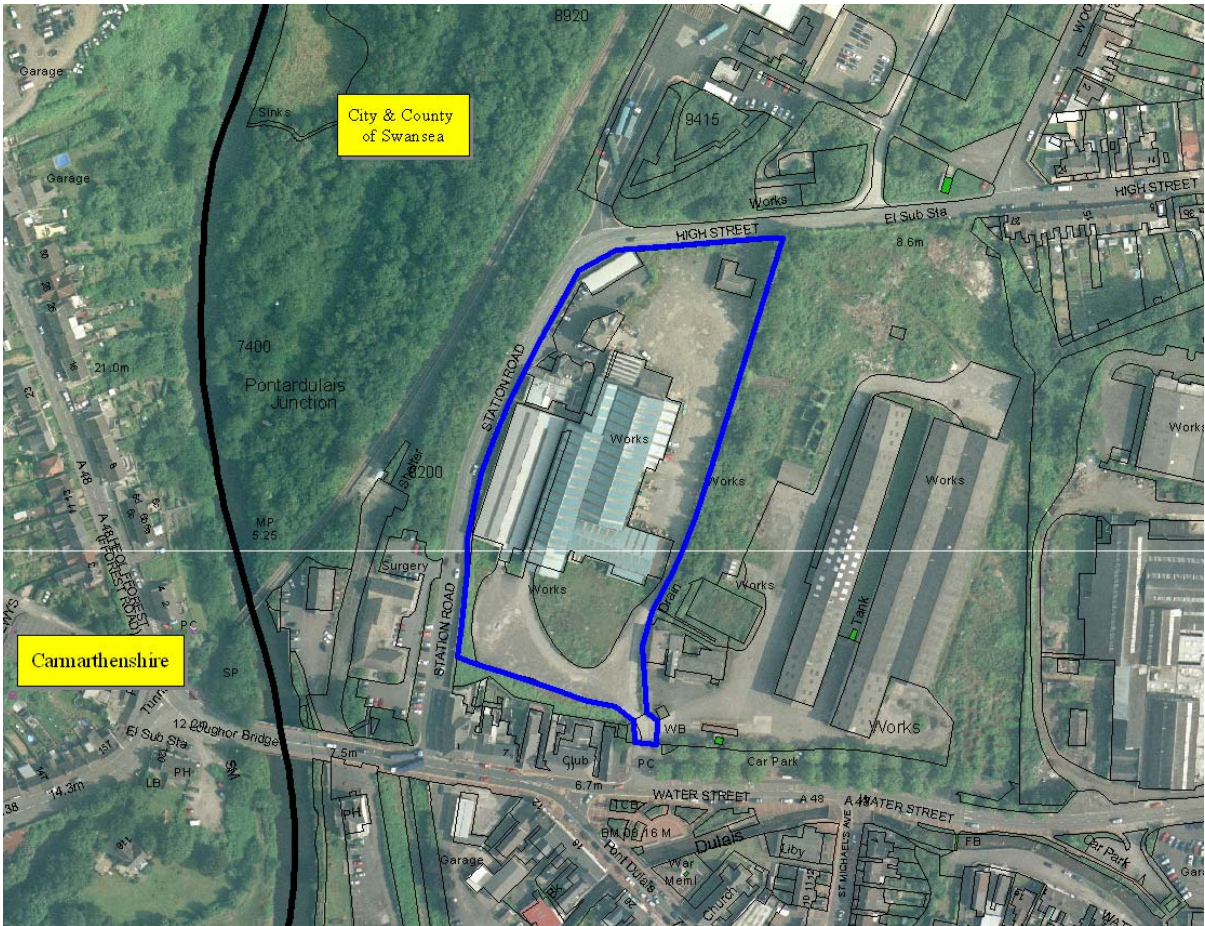
The proposal was subject to a screening opinion under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 prior to the submission of the planning application to assess the requirement for an Environmental Impact Assessment (E.I.A.) to accompany the application. It was concluded that the proposed development would be unlikely to raise any significant environmental issues of more than of local importance, and that the scale of the store would not exceed the tolerances within the E.I.A. Circular (02/99) which indicates that an EIA is more likely to be required for proposals to redevelop land on a greater scale if the site is greater than 5 hectares or would involve more than 10,000m<sup>2</sup> of new commercial floor space. It was therefore considered that an Environmental Impact Assessment was not required.

**A recommendation to refuse the application for the following reason is to be made** “The application fails to adequately demonstrate the need for the size and type of store proposed at this location and that the development would not have an unacceptable adverse impact upon the Gorseinon Shopping Centre as a whole and the potential for enhanced shopping facilities within the broader catchment area.” As such the development fails to accord with Structure Plan Policies S2 and S4, Southern Lliw Valley Local Plan Policies S1, S3 and S9, Draft Swansea Unitary Plan Policies SP6, EC4 and EC5 and the adopted Parc Melin Mynach

Development Brief. Further updates will be provided dependant upon the applicant submitting an appeal within subsequent reporting.

### 6.1.4 Proposed Tesco Store, Pontardulais

The proposed development involves the demolition of the existing buildings on the Former Clayton Works Site, Station Road, Pontardulais, and the construction of a Tesco Retail Store which would provide a total floor space of 4,517 sq. metres (48,622 sq.ft.) with associated parking (325 spaces) and the formation of a new vehicular access off Station Road with deliveries from High Street. Map 19 below outlines the development site.



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Map 19 Tesco Development Site, Pontardulais

The application site is currently occupied by David Mathews Ltd. who operate an aluminium works on the site. The aluminium works operations have been scaled down over the last few years and there is limited production on the site. The site is bounded to the west by Station Road, with High Street forming the northern boundary. The eastern boundary of the site was formerly occupied by the industrial buildings of Morgan Rees and Teddington Bellows, however, both sites are currently being redeveloped for residential development by Persimmon Homes (see 6.3.7 below). The site is within walking distance of the town centre and also is well located in relation to the town's railway station and there are also bus stop facilities located along Water Street. The site is therefore a relatively accessible, brownfield edge of centre location.

The planning application is accompanied by a Retail Assessment, Transport Assessment, Landscape Supporting Statement, Design Statement, Ecological Assessment and Flood Risk Assessment. The Retail Assessment has been updated following the retail audit by CgMs Consultants requesting that the assessment was conducted on a "goods" rather than a "business" basis. It also re-examines the relevant issues in the context of national and local policy guidance and assesses the potential trading consequences and benefits associated with the proposed store. A Consultant's desktop study report in relation to noise from the proposed development was submitted during the processing of the application.

The Retail Assessment (RA) states that the proposal is to provide a modern main (bulk) food store designed to meet the existing and growing needs of Pontardulais and its surrounding catchment area. The RA indicates that the proposed store will provide a broad range of convenience products accounting to 1,554 sq. m (16,729 sq.ft.) or 62.2% of the retail sales area. The store will also

provide a range of comparison goods accounting to 886 sq. m (9,539 sq.ft.) or 37.8%, typically including health and beauty products, pet foods, videos/CDs and small items of homeware. However, the RA does confirm that the proposed Tesco store will not include a cafeteria; pharmacy; opticians; post office; or dry cleaners. It is submitted that the absence of the above services within the proposed store coupled with the provision of a pedestrian link will encourage Tesco shoppers to undertake linked shopping trips to Pontardulais town centre. It is argued that the linked shopping trips would deliver spin-off economic benefits for existing town centre businesses, encouraging the revitalization of the town centre and ensuring the scheme's physical and economic integration with the town centre. In order to better integrate the proposed store to the town centre, and to improve the existing town centre, Tesco have offered a Unilateral Undertaking to pay £70,000 and £250,000 to fund a pedestrian link and town centre improvement works respectively.

It is indicated that the store's 325 space car park will provide additional short term public parking in close proximity to the town centre and additionally, would serve the doctor's surgery on Station Road, where parking frequently spills on to the road. A car park Management Strategy document has been submitted, which includes a two hour waiting limit, in order to control usage of the store car park by customers. The existing boundary wall along Station Road will be largely retained, but may need to be rebuilt using stone.

It is also indicated that the construction of the proposed store would allow the relocation of the existing industrial occupier of the site, David Mathews Ltd., to more suitable premises, thereby enabling them to operate in purpose built premises and secure the future of their business. The existing buildings on the site are in poor condition and the demolition of the existing buildings would present an opportunity to improve the visual appearance of the area. The

proposal would therefore safeguard the existing employment of the current occupier, whilst it is stated that the proposed Tesco store will provide an opportunity of delivering up to 280 jobs.

The proposal was subject to a screening opinion under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 prior to the submission of the planning application to assess the requirement for an Environmental Impact Assessment (E.I.A.) to accompany the application. It was concluded that the proposed development would be unlikely to raise any significant environmental issues more than of local importance, and that the scale of the store would not exceed the tolerances within the E.I.A. Circular (02/99) which indicates that an EIA is more likely to be required for proposals to redevelop land on a greater scale if the site is greater than 5 hectares or would involve more than 10,000 m<sup>2</sup> of new commercial floor space. It was therefore considered that an Environmental Impact Assessment was not required.

A recommendation to refuse the application has been made, for the following reason: “The application fails to adequately demonstrate the need for the size and type of store proposed at this location and that the development would not have an unacceptable adverse impact upon the Pontardulais Shopping Centre as a whole and the potential for enhanced shopping facilities within the broader catchment area, and that a sequentially preferable site is not available. As such the development fails to accord with Structure Plan Policies S2 and S4, Southern Lliw Valley Local Plan Policies S1, S3 and S9, Draft Swansea Unitary Plan Policies SP6, EC4 and EC5”. Further updates will be provided dependant upon the applicant submitting an appeal within subsequent reporting

## **6.2 Mixed Use Developments**

### **6.2.1 SA1 Development**

The SA1 Development is located alongside the River Tawe and the Prince of Wales Dock and covers an area of approximately 40 acres. The proposed development lies approximately 450 metres south of, and outside of, the Hafod AQMA. The site extends from the eastern bank of the River Tawe 1.2 Km eastwards. The A483-Fabian way forms its northern boundary. The A483 is one of the principal routes into and out of Swansea and connects to junction 42 of the M4. The eastern boundary of the site extends to the Port Tennant district of Swansea.

To the south and east the site is surrounded by the existing dock's complex. The Swansea-Cork Ferry operates from a berth to the south of this development. The River Tawe Barrage is also located close to this development and the Maritime Quarter is located to the west of the development.

Existing businesses that are traditionally associated with docks i.e. sand dredging and building supplies will be relocated to existing derelict plots elsewhere within the docks complex.

The SA1 Development is proposed as a mixed-use development combining residential and commercial development. The development will extend the waterfront along both banks of the River Tawe. Development works have been divided into zones A-F and will be undertaken in four phases running from 2002 to 2017. Phase 1 began during late 2002 with extensive redevelopment works

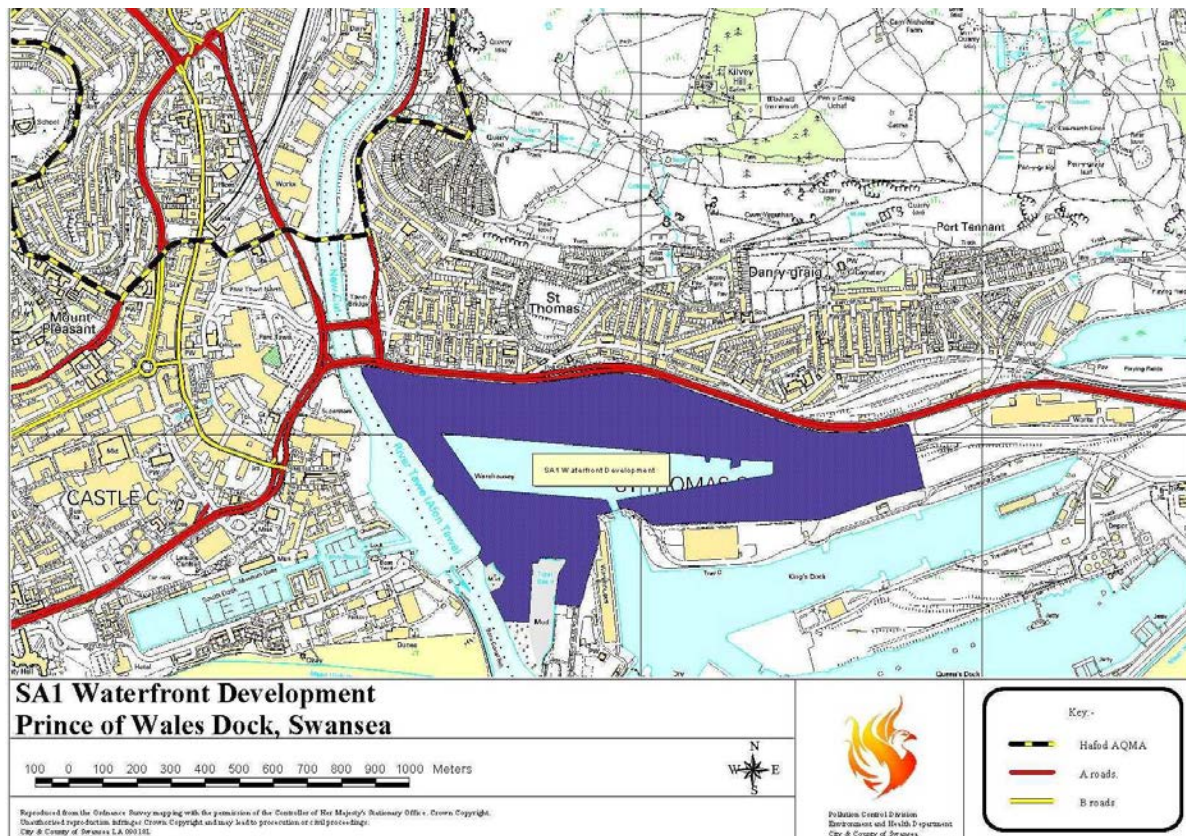
taking place during 2005-2006. Some elements of the scheme were available for occupation during the late summer of 2005.

The Environmental Statement submitted concludes that the results of the Design Manual for roads and Bridges (DMRB) screening assessment indicate that no exceedences of air quality standards at sensitive sites closest to the A483 and the Quay Parade bridges are predicted. Assessments undertaken for future traffic flows (2005-2017) and traffic directly associated with the development indicate that both nearby and existing residents along with new residents are unlikely to experience a significant deterioration in air quality with all objectives being met in both 2005 and 2017. The Environmental Statement states that whilst traffic flows are not disputed to show an increase as a result of the development, any effect from this increase in traffic flows and resultant emissions will be mitigated by technological improvements in emissions management. However, recent EIA submissions based on detailed modelling for the most recently released phases within the development are starting to contradict this view. Modelling projected to 2010 is indicating that the whole of the SA1 development and surrounding existing residential areas will fail the as yet provisional PM<sub>10</sub> annual mean standard.

A new traffic signal controlled access road into the development site was completed during March/April of 2006 at the junction of the main A483 Fabian Way and Port Tennant Road. The development site will also be capable of being accessed by the existing "docks entrance" at Quay Parade Bridges.

The location and extent of the development is indicated within map 20 below.





Map 20 - SAI Development Site

## 6.2.2 Tawe Vale Development Site

The Tawe Vale development lies to the north-east of Swansea, approximately 5 miles from the City Centre and approximately 2 miles from the northern most boundary of the Hafod AQMA. The site as a whole covers 190 hectares of what was originally urban fringe land, of mixed use ranging from improved agricultural land to derelict “brown field” sites. An Environmental Statement was submitted in May 1993.

The overall proposal is for a mixture of housing, business, industry and leisure uses. Proposals have been made to provide for up to 1800 new homes on approximately 132 acres of the site. The housing is intended to provide clusters of villages separated by landscaped areas. A range of housing types will be



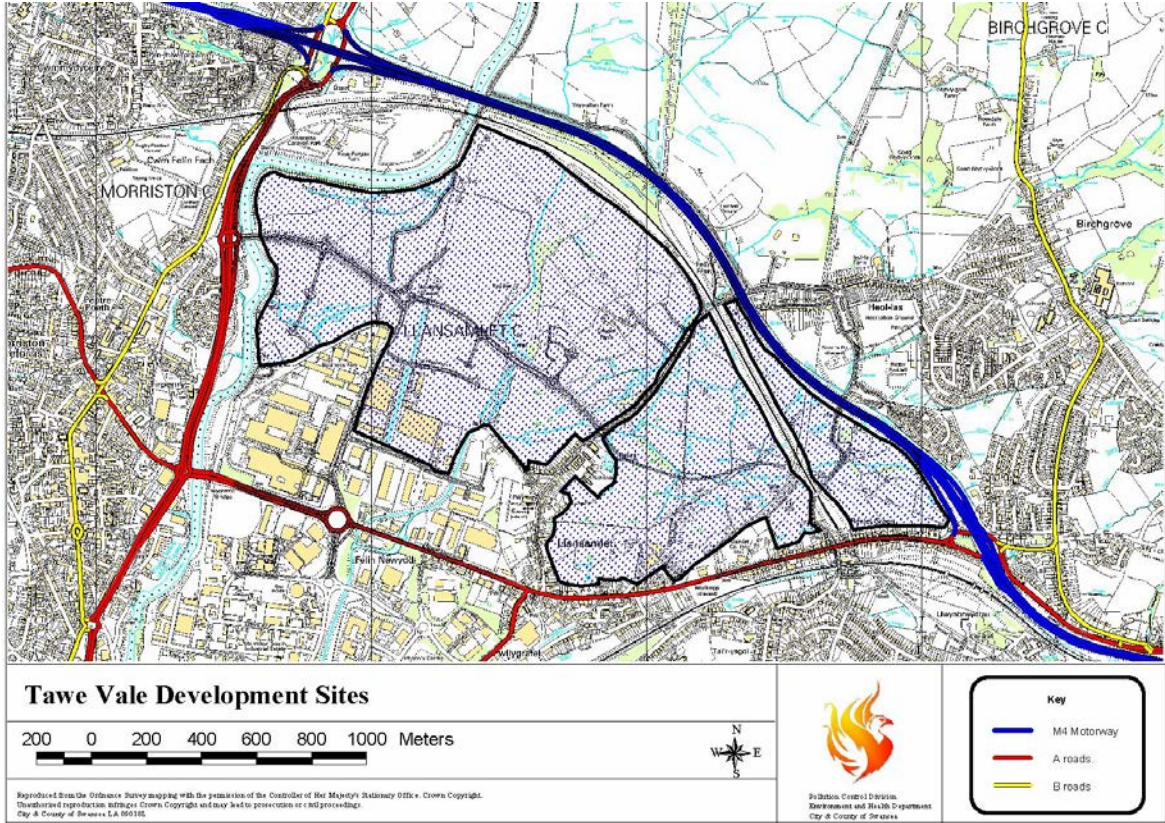
provided but as yet the precise mix and distribution of private and social housing has yet to be finalised. Residential land parcels are to be sold to interested developers and, given the large-scale provision of housing land at this site the development of the overall housing provision will take place in a phased manner over a long term. Construction of one “village” commenced in late 2001/2002 with the homes being occupied during early 2003. Further extensive housing developments were undertaken during 2003 and 2004 with the majority of these dwellings, also now fully occupied.

Employment provision is made for at approximately 100 acres. As with the housing proposals, the employment sites have been divided into discrete parcels, each of which is proposed to be situated within a landscaped setting. A mix of employment uses is envisaged, within a high quality business park.

The main leisure provision is via a golf course and recreational use of the designed open spaces will be encouraged through the extension of the footpath and cycle networks along the River Tawe. The golf course development has yet to commence.

The Environmental Statement identified problems with the overall road network that existed with heavy congestion on the A4067 and A48 at peak times. Works have been undertaken during the last several years to improve the A4067 with the construction of an underpass at the Wychtree roundabout intersection with improvements to the A48 also being made. The development has seen the provision of a new dual-carriageway access from the A4067 and a single lane access from Church Road, Llansamlet. The M4 motorway runs from east to west around the eastern and northern boundaries of the site. Access can be gained indirectly from junctions 44 and 45 of the M4.

The development site overall will see the continued development of all the provisions that make up the overall scheme over the next several years. The extent of the development site as a whole can be seen in map 21.



Map 21 - Tawe Vale Development

### 6.2.3 Seagate and Ferrara Quay, Trawler Road, Maritime Quarter.

This mixed use application was granted full planning on the 10<sup>th</sup> March 2005 and comprises:

## Ferrara Quay

- A twenty nine storey tower with retail/leisure use (Class A1/D2) at ground floor, restaurant (Class A3) on the top floor and 124 residential uses throughout the interim levels (Ferrara Tower);
- One six storey block with ground floor commercial uses (retail Class A1/A3, leisure use Class D2 and Office Class B1) and 20 residential units above (Ferrara Block A);
- One part six storey/part ten storey block with ground floor commercial (retail Class A1/A3, leisure Class D2 and office Class B1) and 41 residential units above (Ferrara Block B);

## Seagate

- One six storey block with 47 residential units with ground floor commercial unit (office Class B1) (Seagate Block A);
- One part seven/part nine storey block with 41 residential units (Seagate Block B);
- Two nine storey towers providing 18 residential units (Seagate Tower 1 and 2);

## Plus

- Two hundred and thirty four undercroft car parking spaces (78 spaces at Ferrara Quay and 156 spaces at Seagate);
- Refurbishment of existing Camona Drive multi-storey car park to provide 67 allocated;

- Associated areas of open space, landscaping, pedestrian routes and infrastructure.

The application site in the main comprises two distinct areas separated by Trawler Road in the Swansea Maritime Quarter. The seafront area (Seagate) measures approximately 0.35 hectares and has a southern frontage boundary onto the established seafront promenade and a northern boundary to Trawler Road. The site is currently vacant and predominantly level and grassed. The land is approximately 2m above Trawler Road level and slightly elevated above the promenade. The dockside area (Ferrara Quay) measures approximately 0.27 hectares and has an extensive northern frontage to the dockside walkway. The ground is level and the southern boundary adjoins Trawler Road. Ferrara Quay is currently in use as a pay and display surface car park.

A further element of the site is the Camona Drive multi-storey car park, which is an existing 120 space facility of four mezzanine floors located on the southern side of Trawler Road, to the east of the Seagate site. The upper two floors comprise 38 public car parking spaces and 15 spaces allocated to local residents. The remaining 67 lower car parking spaces are currently cordoned off and are unused. It is proposed as part of the scheme to introduce lighting, CCTV and generally upgrade the lower floors. The number of car parking spaces will not change; however, 59 of the unused spaces would be used by occupants of Seagate and Ferrara Quay, with the remaining 8 spaces used by the commercial units.

The main element of the proposal involves the introduction of high density mixed use development on the Seagate and Ferrara Quay sites. This is predominately residential, adding a further 291 apartments to the existing complement of living accommodation at the Maritime Quarter. This is made up

from 138 two-bedroom apartments, 11 three-bedroom apartments, 12 three-bedroom penthouse apartments, 124 one-bedroom apartments and 6 one-bedroom penthouse apartments. Added to this are commercial uses totalling 2,500 square metres, positioned at key locations on the ground floor as well as in the top two levels of the tower. The majority of the car parking (234 spaces) would be accommodated within the basement and semi-basement levels beneath both halves of the site.

The strategy for the development is based upon the use of three distinct architectural forms: -

- The most significant of these is the high-rise tower of 29 storeys at the western end of the Ferrara Quay site, which would measure 90m in height by 40.5m in width. Its elliptical plan derived from the sweep of Trawler Road is carried through its full height resulting in a blade-like form. The tower is positioned so that its curved form 'hugs' the side of the road. It is oriented with its narrow ends facing due east and west and its broadsides facing due south and north. Particular attention has been paid to the design of the uppermost storeys that would accommodate a restaurant. The roof of the tower is raised above two storeys of glass and inclined towards the east. Otherwise, the materials employed on the elevations are intended to reinforce the tower's smooth curved planes. The composition is based on a series of bold verticals such as the multiple stacked balconies and slender rendered panels designed to disguise the tower's apparent width.
- In addition to the main tower, four smaller towers are proposed; three nine storey towers measuring 28m in height and 11m in width aligned alongside the promenade on the Seagate site and one ten storey tower, measuring 31m in height and 11m in width, at the north east corner of the Ferrara Quay site

at the end of the six storey Ferrara Block B. The Seagate towers would enclose semi private gardens at regular spacing thereby permitting views into and out of the development through the gaps. These towers are slender in proportion and intended to provide a distinctive, albeit less imposing frontage to the promenade.

- The remainder of proposed development comprises predominantly 6 storey blocks known as Ferrara Blocks A and B and Seagate Blocks A and B. These are intended to be the 'background' architecture that unify the development and create an urban structure that provides enclosure and continuity to the Trawler Road and dockside frontages. The blocks would also frame two new public spaces: Ferrara Square next to Trawler Road and Ferrara Quayside, next to the dock. Additionally the design of these blocks are intended to establish an aesthetic rapport with the warehouse inspired render and brick architecture of the existing Maritime Quarter which are of similar scale and materials.

Turning to the treatment of the public realm around the buildings, it is proposed that the promenade would be integrated with the site where it would border the development by the introduction of a broad raised plinth designed to bring pedestrians closer to the level of the semi-private 'Seagate Gardens'. A series of interweaving ramps and steps are proposed to link the western end of the promenade to Trawler Road, whilst a link between the promenade and Trawler Road and the dock edge is proposed along the western side of Camona Drive. On the opposite side of Trawler Road, Ferrara Square is intended to act as the hub at the centre of the development with further routes linking to the dock edge. Because of the semi-basement car park, the level of the two linked squares at this location is raised above Trawler Road and the dock edge, consequently a

number of ramps and steps are proposed. The dock edge walk would be linked to the development at four separate locations.

In view of the scale of the proposed development, it has been necessary to analyse the potential changes it may cause to wind speeds, especially at pavement level. The results have identified the need for the positioning of additional artificial and natural screening at strategic locations throughout the development to mitigate the effects of worse case scenario wind speeds.

Although the precise design of the wind mitigation measures are not yet finalised, it is likely they would include trees and sail-like screens within both squares on the Ferrara Quay site, transparent screens positioned at both ends of the north-south link between Ferrara Blocks A and B and Camona Drive with canopies around the base of Ferrara Tower and Ferrara Block A.

It is proposed that the development be constructed on a phased basis as follows:

- Phase 1: Seagate Block B
- Phase 2: Seagate Block A
- Phase 3: Seagate Tower 1
- Phase 4: Seagate Tower 2
- Phase 5: Ferrara Block A
- Phase 6: Ferrara Block B
- Phase 7: Ferrara Tower
- Phase 8: External Works

Phases 1 - 7 would commence construction at the same time although it is envisaged that occupation of these phases will occur in the order listed above.



Phase 8, external works, would be developed as an integral part of each development phase.

The Seagae element of the development site is commenced construction works during June 2006

Map 22 below indicates the extent and location of the development.



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Map 22 - Seagate and Ferrara Quay Development, Trawler Road, Maritime Quarter

## 6.2.4 Ffordd Cynore Development, Fforestfach

A formal Planning Application has not been received as yet for the proposed mixed use development on the site outlined within map 23 below. However, it is anticipated that any application will seek to include residential dwellings, along with a hotel/pub/restaurant. This section should be read in conjunction with sections 6.1.2 (Parc Fforestfach) and section 6.3.1 (Ffordd Cynore Development) which are located adjacent to the proposed site.



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Map 23 - Ffordd Cynore Mixed Use Development, Fforestfach

## **6.2.5 Swansea Point (Spontex Site), Marina**

This development is taking place on a brown field site formally occupied by sponge manufacturers Spontex. Planning approval was given in 2004 for a mixed-use housing and commercial development and works are in progress.

The proposal is for a dense urban development that would reflect the character of the adjacent area and the aspirations of the City and County of Swansea's Development Brief. The buildings would define the edge of the streets, which would in turn create a series of spaces that connects the residents and visitors into the pedestrian network of Swansea Marina and across the River Tawe into the new Swansea Waterfront development. To meet the demands of providing an active public frontage on the street and private residential areas, the design concept illustrates how the buildings set along the street frontages, would create private courtyard areas for amenity and vehicular access. In this way all the residential car parking would be provided within the courtyards with public car parking provided along the promenade and next to the mixed use area.

The focal point of the development would be The Point, a 10 storey landmark building on Harbour View Square next to the River Tawe and harbour entrance. The proposed location of The Point is at the termination of the seafront promenade and Trawler Road; it would be the natural destination for the main pedestrian routes and a significant landmark on the Swansea skyline.

The proposed Atlantic Square would provide a new public place, focused on the attractive barrage area and the new pedestrian link across the river. Within the Square would be provided a wide range of A3/leisure and support activities to enliven the public realm for all those living and working in the area.

The continuation of the seafront promenade is an integral part of Swansea Point. The promenade will extend along the whole southern frontage of the site, next to the dunes and around the eastern side next to River Tawe before joining the public area next to the barrage. It would also provide access to the two main pedestrian routes across the site, which connects into Swansea Marina.

The proposed land uses illustrates in indicative form the proposed layout of the development. The majority of the site has been identified as being appropriate for residential development in the form of townhouses and apartments. It is proposed that the site has the capacity to accommodate some 600 units in total. These would be laid out along the street frontages with private spaces located within the residential courtyards. Dual access is promoted for all properties onto the street and courtyard.

The mixed-use component of the scheme would be predominantly sited on the northeast of the site next to the River Tawe and Maritime Quarter. Atlantic Square forms the focal point of the mixed use development with 440m<sup>2</sup> of A3/leisure use on the north side of Atlantic Square, 480m<sup>2</sup> of A3/leisure use on the south side of Atlantic Square and a further 480m<sup>2</sup> of A3/leisure use on the ground floor of the hotel building next to Atlantic Square. In addition, 300 m<sup>2</sup> of commercial use is located on the ground floor of the block overlooking the Maritime Quarter. This will be used to provide accommodation for the Sea Scouts, who would need new accommodation when their existing building on Pilot Wharf Quay is demolished to make way for Atlantic Square to connect onto the barrage area.

A 3 star 60-bed hotel is proposed, that would cover 2,400m<sup>2</sup> on 6 floors above the ground floor A3/leisure use. 1,440m<sup>2</sup> of work units are also provided above the ground floor leisure facility on the south of Atlantic Square.



The car park to serve the leisure development in Atlantic Square and the public parking required for these uses would be provided in the multi-level car park adjacent to the new development. A waterfront A3/leisure use would also be located next to the public car park on Harbour View Square. This would provide 700m<sup>2</sup> of space on 2 storeys and 25 car-parking spaces dedicated to the leisure use. A 500m<sup>2</sup> play area is proposed next to the leisure use.

In addition three new public places are proposed, comprising:

- Crescent Park – a 0.3 ha green amenity area in the centre of the development and the crossroads for many of the pedestrian routes;
- Atlantic Square –the heart of the mixed use development with the building frontages providing a dynamic shape to the square opening out onto the river and barrage; and
- Harbour View Square –the termination of the seafront and riverfront promenades. The square would accommodate a number of different functions including a turning area for buses, public car parking, leisure use with car park and 500m<sup>2</sup> play area, together with car parking to serve the adjacent Point 10-storey residential development.

The proposed spaces would accommodate the pedestrian, cycle and vehicle movements into and through the site. Trawler Road would continue on a new alignment through the scheme to terminate at a new roundabout next to the promenade and new public car park at Harbour View Square. Trawler Road would also provide access to the multi-level public car park next to Atlantic Square. Further public car parking is proposed to be located on the west of the site at the end of Slipway Road.

The network of pedestrian routes in Swansea Marina, are continued through the development to connect to each other and onto the promenade. The seafront promenade would be designed to accommodate the train/people carrier that the City & County of Swansea will be providing at a later date. A new bus turning area would be provided in Harbour View Square at the termination of Trawler Road and a series of bus stops provided along the highway. It is also proposed that the main pedestrian/cycle routes within Swansea Point would form strategic connections to other parts of the city centre. There is also scope for the development to include offsite improvements next to the Boat yard, to open up the pedestrian link across Trawler Road and the provision of a pedestrian bridge across the lock of Swansea Marina.

Access and egress from this development will be via Trawler Road which itself is accessed from the A4067 Oystermouth Road located to the west of the development. The southern boundary of the Hafod AQMA is approximately 1000 metres north of the development. Immediately to the east of the development and across the River Tawe is the SA1 development site.



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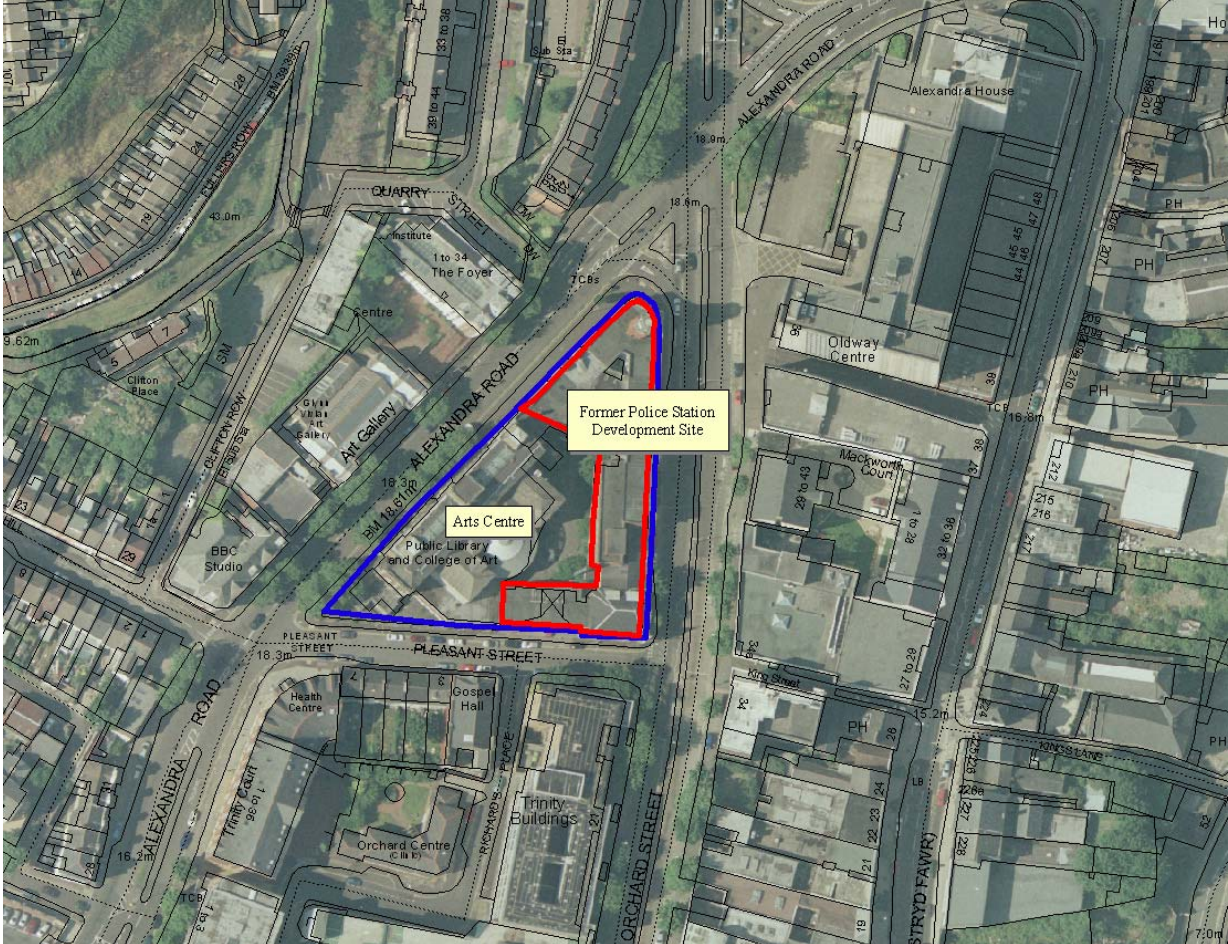
Map 24 - Swansea Point Development

## 6.2.6 Former Swansea Central Police Station, Alexandra Road / Arts centre/ Restaurant

The former Swansea Central Police Station now lies within the revamped one way traffic system introduced as part of the Swansea Metro scheme (see 6.7.4 below). The site lies at the junction of 3 traffic signal controlled junctions and at peak times traffic can be seen queuing down the new one-way system along Orchard Street and Alexandra Road. Traffic can join Orchard Street to the southern boundary of the development again by way of a traffic signal controlled junction. Queuing traffic can at peak times surround the development site on all three sides. The impact of this in terms of air quality has yet to be



assessed as monitoring is impossible at the moment due to the constraints imposed by the construction activities. An outline of the whole development site can be seen shown in blue within map 25 below with the former Police Station outlined in red.



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Map 25 Former Swansea Central Police Station Development

The application seeks planning permission for the construction of 4th storey roof extension to Orchard Street and Alexandra Road elevations, construction of 3rd storey roof extension to Pleasant Street elevations, erection of courtyard sub-station, addition of solar panels to roof of former cell block, landscaping to internal courtyard area and change of use of former police station to restaurant (Class A3), offices (Class B1) and arts studio/workshop (Class D1) at ground floor level; arts studio/hall (Class D1) and offices/board room (Class B1) and 27

student accommodation units with associated kitchen diner facilities at first floor level; arts studio/offices (Class D1/B1) and 29 student accommodation units with associated kitchen diner facilities at second floor level and 24 student accommodation units with kitchen/diner facilities at 3rd floor level.

Internally on the ground floor the proposed redevelopment seeks to provide an Arts Centre of studio and exhibition space for artists with its principal entrance being from Alexandra Road, opposite the Glynn Vivian Art Gallery along with a restaurant with aspects to Orchard Street and the new internal public courtyard. Ancillary office space is also proposed at the ground floor. The mix of uses and configuration of entrances and access to the courtyard is intended to reflect the aspirations for revitalising the block as a cultural centre to the city, generating necessary level of street life to animate the site and benefit/compliment the activities of the surrounding locality. The student accommodation is proposed on three floors above ground floor with the principal entrance on Alexandra Road.

No suitable on-street parking facilities are available for residential use and there is no proposal to introduce such facilities. No parking permits will be made available for residents.

### **6.3 Housing Developments**

There are a number of developments that are either underway, have just gained Planning approval or are within the initial stages of the Planning Approval process. The major developments are listed below.

### **6.3.1 Ffordd Cynore Development, Fforestfach**

The application for the construction of 230 dwellings on the former Brynau-Duon Farm on behalf of 3 developers was originally refused planning permission on the 16<sup>th</sup> January 2003. The reason for refusal was: "The development by virtue of traffic generation would exacerbate existing traffic congestion in the vicinity of Parc Fforestfach to the detriment of the safe and free flow of traffic in the area". However, the applicants appealed against the authorities decision and approval for the development was given upon appeal.

Construction works commenced during the early summer months of 2004 and a limited number of dwellings were occupied during the early months of 2005. Additional works are now complete and the vast majority of completed dwellings are now occupied. Construction of additional dwellings remains in progress. The extent of the development can be seen within map 26 below.

Access and egress to the development site is via a junction on Ffordd Cynore. This junction is within approximately 170 meters of the main traffic signal controlled junction leading into Parc Fforestfach and within 330 meters of the signal controlled junction of Ffordd Cynore with the A483 Pontardulais Road. To the west of the site access and within approximately 130 meters is the signal-controlled junction with Ystrad Road and Carmarthen Road.





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*Map 26 -Ffordd Cynore Development, Fforestfach*

## **6.3.2 St.Thomas Riverside Development**

Outline planning consent was approved on the 14<sup>th</sup> July 2003 for a hotel and residential development. The residential development comprises of 50 combination three/four storey townhouses, 169 apartments in 6, 5.5 storey pavilions, 1 4.5 storey pavilion and 1 block rising from 4 storeys to 7.5 along with associated car parking. Landscaping and infrastructure requirements will also be undertaken.

The majority of the site is located on a former railway station yard that has been contaminated through its former use.



The site itself lies part within the Hafod AQMA, with the majority of the site lying just outside the boundary of the Hafod AQMA. Pentreguinea Road is subject to heavy congestion during peak times and will be affected by any re routing of traffic through the lower valley routes and more importantly by the existing Quay Parade bridges. Attention will be given to the access and egress from this site and whether this will compound the existing congestion.

An application for formal planning consent was received during 2005 but was rejected due to the intensity of the development. A modified scheme will be resubmitted shortly to include an element of social housing as a result of the appeal process. The WAG Planning Panel are yet to issue its formal decision.



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Map 27 - St Thomas Riverside Development (Former Station Yard Site)

### **6.3.3 Bryngwyn Steelworks Site**

The 13 hectare (about 32 acres) Corus Plant at Bryngwyn closed in June, 2001 and an outline application for the comprehensive redevelopment of this "brown field" site has been received. The former industrial site is bordered to the west by the residential properties of West Street and Libanus Road together with the Gorseinon Business Park, with more housing to the north along Lime Street. The eastern boundary is bordered by the Afon Lliw with the Mardy Industrial Estate on the eastern banks of the river. The centre of Gorseinon lies approx. 500 metres to the north west of the site.

Outline planning permission was approved on the 9<sup>th</sup> December 2003.

The outline application was for a mixed use redevelopment comprising residential development, a community enterprise centre and economic development. The application was accompanied by an illustrative land use plan, which provides a draft allocation of 21 acres of residential land, 6.4 acres of economic development and 4.5 acres for the community development facilities. The applicants (Corus) are seeking a valid planning permission to dispose of the site to a developer, who will carry out the demolition of the buildings and the site remediation and preparation, in advance of the site's redevelopment.

A reserved matter approval for the construction of residential development of 376 units (reserved matters approval pursuant to outline planning permission 2003/1241 granted 9th December 2003) was approved during August 2004. A further reserved matters application for the construction of residential development of 359 units was approved during November 2004.



Works are now well in advance with the vast majority of the dwellings now complete and occupied.



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Map 28 - Former Bryngwyn Steelworks Development Site

### 6.3.4 Former Marcroft Engineering Site, Port Tennant

The 4.6 hectare site at the former Marcroft Engineering Works, Port Tennant has been derelict for some time and an outline application has been made for the comprehensive redevelopment of this "brown field" site. The former industrial



site is bordered to the west by the residential properties of Wern Terrace, and to the east, by the Crymlyn Bog Site of Special Scientific Interest (SSSI). The south-eastern boundary of the site is bounded by the main access road to the Tir John landfill site located approx. 250 metres to the east. The former Marcroft Engineering Works buildings consist of two large disused workshops, a series of temporary 'portacabins' and associated peripheral facilities such as outbuildings, areas of hard standings, cranes, as well as fuel and chemical storage tanks. Whilst the application is submitted for outline consent it is indicated that access would be obtained to the north of the site from Danygraig Road/Tir John North Road. However, it is indicated that site access for construction traffic, particularly HGV's, could be obtained from the Tir John landfill site access to the south, which would reduce the impacts to local residents located along Danygraig Road.

The applicants have submitted a detailed application for the residential development of the site, which is currently being assessed. However, in the meantime, the applicants are seeking a valid outline planning permission to establish the principal of the redevelopment of the site for residential purposes. This would then justify the demolition of the buildings and ancillary structures on the site and to commence the site remediation and preparation, in advance of the site's redevelopment.

This outline approval was given, subject to a Section 106 on the 18th July 2005.



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Map 29 - Former Marcroft Engineering Development Site

### 6.3.5 Pearl Building City Centre

Pearl Assurance House overlooks the Kingsway and the new one way system within the city centre introduced as part of the Swansea Metro scheme (see 6.7.4 below) and consists of a three storey building with retail units at ground floor. The application was accompanied by a Design Statement. Planning permission has been given for the conversion of the first and second floor levels from office and retail storage space together with the construction of a three storey rear extension and the addition of a third floor to provide 42 self contained flats (Class C3), and other external alterations. Map 30 below outlines the development site. Please note that the roundabout has been removed as part of the Metro scheme and one way system introduced during 2006.





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Map 30 Pearl Building Development Site, Kingsway, Swansea.

The development site overlooks the former location of the Swansea AURN air quality station on Princess Way which can be seen within map 30. This station was itself relocated during late 2006 due to the demolition and redevelopment of the David Evans buildings complex to the east of the station. Traffic flows have radically altered since the introduction of the one way system and the façade of this building will in all likelihood form part of the diffusion tube network operated by the authority once the development is completed.

Policy H5 of the Swansea Local Plan Review No.1 presumes in favour of the conversion of vacant or underused upper floor space above commercial properties for residential purposes subject to satisfactory access and parking arrangements (where appropriate), detailed design considerations and the

relationship with and impact upon adjacent uses. The proposed change of use of the upper floors will result in the reuse of a large area of redundant floor space. Its conversion to a residential use will make a valuable contribution to the city's housing stock as well as securing a diversity of uses. It is therefore considered that the change of use of the upper floors of this building complies with policy H5 of the Swansea Local Plan Review No.1.

It is proposed to retain the existing ground floor entrance on The Kingsway and to enhance the internal lobby area by providing an internal level access and the provision of a lift. The retention of the existing entrance is important for aesthetic reasons but also from a Community Safety perspective. The entrance will serve the whole of the development, providing secure access and lead to a stair and lift serving all floors. The basic layout of the first, second and third floors apartments would consist of a single aspect either looking over The Kingsway or the rear elevation and are situated either side of a central circulation spine.

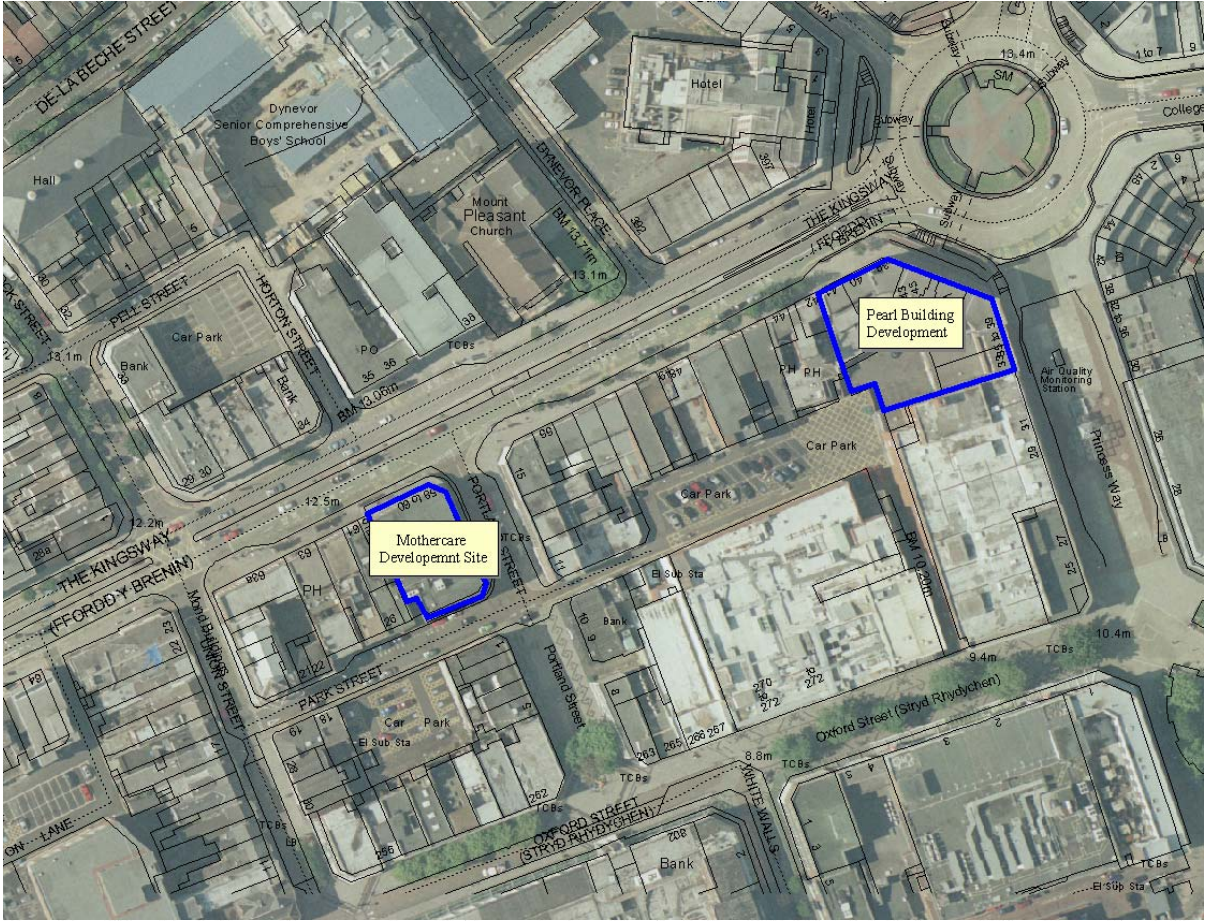
There are currently 10 parking spaces provided within the rear service yard and it is proposed that this provision will be reduced to 8 spaces. The loss of spaces is due to the creation of a new electrical sub-station and a refuse area. However, the application property is located within the City Centre core area where off street parking facilities are not required for residential development.

Additionally, a bicycle store (14 spaces) is indicated in the basement. The Head of Engineering and Transportation raised no objection to the proposal but recommends that a Travel Plan is implemented prior to the occupation of the residential units, having regard to the nature of the development in terms of its restricted parking facilities.



### 6.3.6 Former Mothercare Building, Portland Street

The Mothercare building occupies a prominent location at the junction of Portland Street with The Kingsway and consists of a four storey building with a basement area. Mothercare previously retailed from the ground and first floor levels but is now vacant. Planning permission has been given for the conversion of the first, second and third floor levels from retail and retail storage space to provide 39 self contained one bedroomed flats (Class C3), together with various external alterations. Map 31 outlines the development site.



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Map 31 Former Mothercare Building Development, Portland Street

The development site overlooks the new city centre one way system and Metro scheme (see 6.7.4 below) along the Kingsway. Traffic flows have altered since

the introduction of the one way system but are not at present, thought to present any concerns in respect of air quality at this location.

Policy H5 of the Swansea Local Plan Review No.1 presumes in favour of the conversion of vacant or underused upper floor space above commercial properties for residential purposes subject to satisfactory access and parking arrangements (where appropriate), detailed design considerations and the relationship with and impact upon adjacent uses. The proposed change of use of the upper floors will result in the reuse of a large area of existing vacant floor space. Its conversion to a residential use will make a valuable contribution to the city's housing stock as well as securing a diversity of uses. It is therefore considered that the change of use of the upper floors of this building complies with policy H5 of the Swansea Local Plan Review No.1.

The building is unable to provide any off-street car parking space. However, the application property is located within the City Centre core area where off street parking facilities are not required for residential development. Additionally, a bicycle store is indicated in the basement. The Head of Engineering and Transportation raised no objection to the proposal but recommended that cycle storage stands facilities together with wheeling ramps are installed.

### **6.3.7 Persimmon Homes Development, Pontardulais**

The application sought reserved matters approval for the comprehensive residential redevelopment of the "brownfield" site of the former Clayton and Teilo Works which were granted outline planning permission on 15<sup>th</sup> June, 2005 and 5<sup>th</sup> December, respectively. The former industrial site is adjacent to the residential properties in Water Street and Tyn-y Bonau Road and abuts the



David Matthews industrial site to the west, which is subject to a current application for the redevelopment of a Tesco retail store (see 6.1.4 above). The centre of Pontardulais lies approx. 150 metres to the south west of the site. Map 32 outlines the development site.



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Map 32 Persimmon Homes Development, Pontardulais

Previous outline and reserved matters applications have been the subject of screening opinions under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 to assess the requirement for an Environmental Impact Assessment (EIA) to accompany the applications. Whilst it was concluded that the potential impact from the development would be significant on the environment by way of its size and location, in terms of the nature of the development the proposal would remove



an industrial use from the residential area. The site is not considered to be located within an environmentally sensitive area and the redevelopment proposal will not breach the threshold figure of 5 hectares or 1000 dwellings contained in Annex A of DETR Circular 02/99. Having regard to the nature and scale of the proposed development, the proposal is unlikely to raise any significant environmental issues of more than local importance and therefore an Environmental Impact Assessment was not required for the proposed development.

This current application seeks the joint residential redevelopment of both Clayton and Teilo Works sites with a residential layout comprising a total of 220 residential units, consisting of 121 dwellings and 99 residential apartments. The dwellings would consist predominantly of two storey three and four bedroomed detached, semi-detached and terraced properties with a proportion (28) of three storey and two and a half storey (18) townhouses. The residential apartments would be accommodated within 8 three storey blocks within the development with a small proportion (6) of flats situated above garage blocks. The vehicular access would be obtained from Water Street and High Street allowing for a linked access through the site with a 'Village Green' area in the centre of the layout which would provide a focal point for the development.

The new development aims to create an attractive and interesting 'people friendly' environment where cars are not allowed to dominate the street scene, whilst integrating the layout with the surrounding area and community. The principles that drive the proposal are: -

- a comprehensive approach to both former industrial sites;
- a public open space within development linked to surrounding areas;
- the incorporation of a pedestrian/cycle movement framework within and linking beyond the development; and

- a landscape strategy that supports the concept and utilises existing natural features.

The layout is based upon a loose grid of streets that connect with the existing street pattern at two locations: to the north from High Street and to the south from Water Street, where vehicular accesses to the site are proposed. In addition to this there are pedestrian/cycle connections with Ty'n y Bonnau Road to the east and Water Street at the southwest corner of the site. There is an area of public open space at the heart of the development, which consists of a 40m x 32m 'village green' laid out in a formal rectangular pattern partially surrounded by trees, and overlooked on four sides by residential frontages. At the centre of the development the green provides an obvious focus for the development.

Vehicular access will be obtained from a new junction off Water Street and a further new access is proposed off High Street. Visibility at both access points is acceptable and within the recommended guidelines. The site layout plan in the main indicates a conventional estate road layout with standard carriageway width and footways on both sides. Standard methodology was used to assess the traffic generation of the development and the affect of this additional traffic on the surrounding highway network, and this was covered in detail under the Transport Assessment submitted with the outline consent. The affect of development traffic on 8 local junctions was previously assessed. This encompassed all junctions on the one-way system through that part of Pontardulais. All junctions tested indicated that there will be no adverse affect on the ability of the junctions to accommodate the additional traffic movements and all junctions in the test should operate satisfactorily.

The application site is suitably located for access by all modes. There are bus stops within a short distance of the site to an adequate bus service and footways

are present for pedestrian access. In addition to the vehicular accesses there are two pedestrian/cycle accesses shown, one to the east and one to the west, the vehicle accesses are to the north and south of the site.

Whilst the bus frequency in the locality is acceptable, improvements to facilities at and on the approach to the adjacent bus terminus are required. The improvements will become more crucial as a result of this proposal if the travel mode of future occupiers is to be influenced. This residential development will strengthen the need for improvements to be implemented before the development is fully occupied and to that end will require the applicant to pay a sum of money in order that these improvements can be implemented. The monies have been secured to the sum of £35,000 under a section 106 agreement drafted under the outline consent.

Parking facilities have been provided through the site, in a mixture of parking courts, driveways and garages and would be provided in accordance with Council's adopted parking guidelines. Parking is predominately contained to the side or rear of the properties to reduce the visual impact. Cycle stores have also been provided for the residents within the proposed apartment blocks.

The internal road layout has been designed in accordance with the Highway Authority guidelines with the grid pattern of the road network reflecting the urban character of the site and provides access to a series of private drives and courtyards. The main road network is characterised by properties fronting directly onto the street. Served off the main network are a series of home-zones and private drives. The development proposal has been agreed in principle at outline stage and the Head of Transportation & Engineering accepted the conclusions of the TIA which accompanied the Outline Planning Permission which indicated that the proposed development would not have a detrimental

impact upon the operation of the existing highway network and will not adversely effect local highway safety conditions and therefore raises no highway objection.

Broadly speaking the proposed layout is a logical approach to the site which will help to create a sense of place and community. The network of alternative routes within the site and beyond for vehicles, cyclists and pedestrians will encourage walking and maximise pedestrian activity and community interaction on the street. The layout based on perimeter blocks ensures public fronts and private backs where streetscenes are mainly addressed by attractive active frontages. This is also inherently more secure as there are higher levels of natural surveillance and in most cases a clear definition between public and private ownership. The layout incorporates a combination of railings and dwarf wall/railings for the front boundary treatments which will provide appropriate public/private definition by utilising an architectural device that is widely seen in the established parts of Pontardulais.

Approval has now been given and demolition/construction works commenced late 2006 and are now well advanced.

## **6.4 The Tawe Riverside Development Corridor**

Proposals for the Tawe Riverside Development span a large area of former derelict industrial land and currently occupied commercial sites from Quay Parade Bridges up to, and beyond the new Liberty Stadium and Morfa Retail Park area of the lower Swansea Valley. The proposals include some housing development sites as well as mixed use sites. All details relating to this development corridor are identified and discussed here as to split the

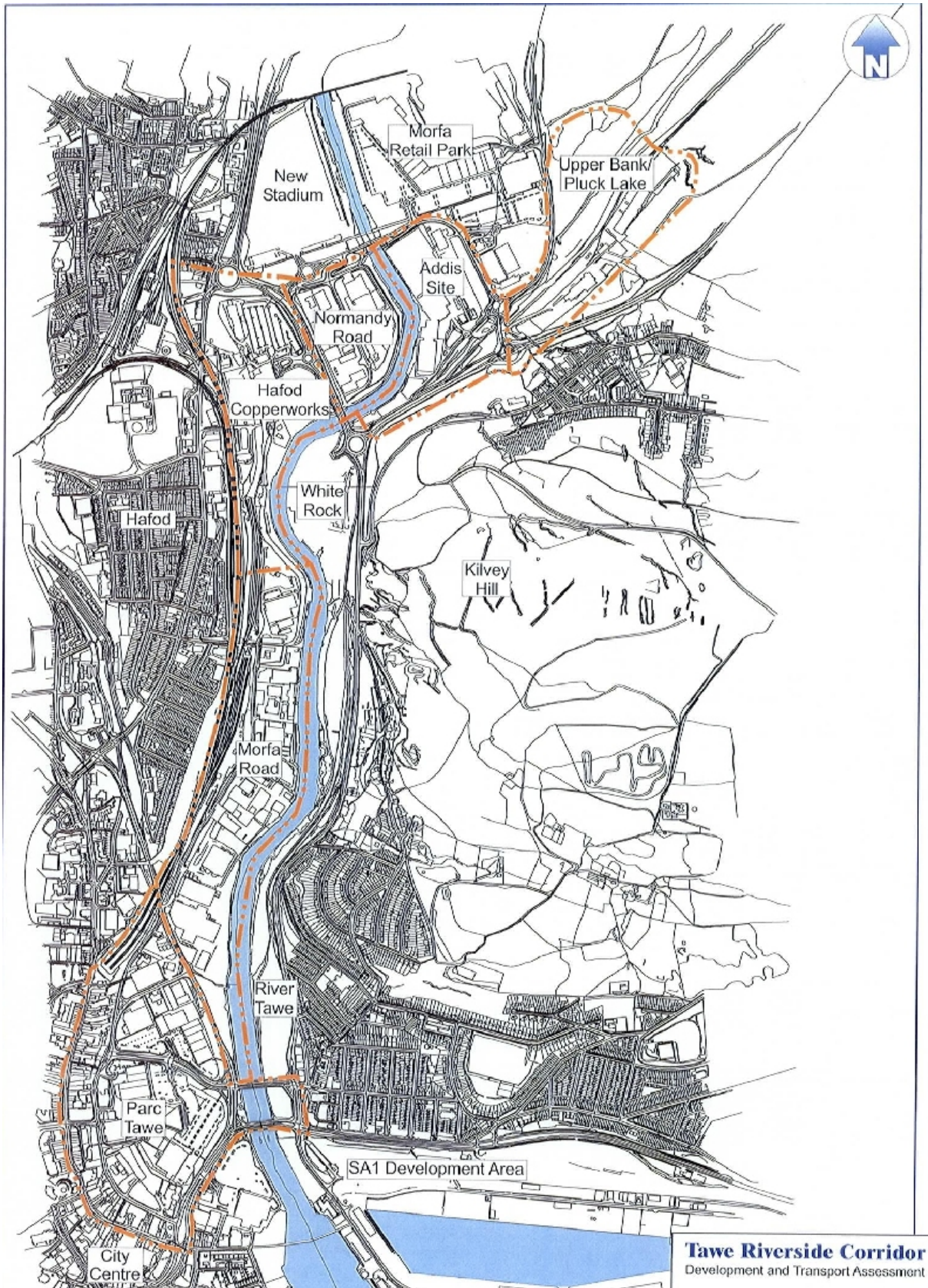
developments as is the case in 6.1 - 6.3 above may detract from the overall scale of the proposals and significance that the authority is placing on the regeneration of the lower Swansea Valley/Tawe Riverside area. The development area can be seen within map 33 below<sup>2</sup>. The Morfa Road and Hafod Copperworks proposals fall within the existing Hafod Air Quality Management Area.

The River Tawe Corridor provides a series of distinct locations linked by the river and its rich industrial past. The Tawe forms part of the Swansea Waterfront concept, which is of national importance. The concept seeks to integrate the City Centre, Maritime Quarter, SA1 and the River Tawe corridor to allow the creation of a high density, mixed use, modern core for the City. The riverside corridor area provides the next significant opportunity to create a new place in the City for living, working and visiting, capitalising on the heritage importance of the area, which is a key theme linking the development of the area, and the potential of the river for visual interest, leisure and recreation. The Tawe Corridor provides a new sector of the city between the Waterfront and City Centre and links the modern developments at Morfa to the City Centre.

These proposals have the potential to impact significantly on air quality both within the existing Hafod Air Quality Management Area and outside. An internal working group has been established in order that discussions can take place on how the air quality issues raised can be addressed as air quality objections have already been tabled in respect to certain parts of the masterplan.

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<sup>2</sup> Tawe Riverside Corridor Study Development and Transport Assessment Final Report June 2006  
Hyder Consulting



Map 33 Tawe Riverside Development Corridor



The Corridor is of immense importance in terms of its industrial past. The development area comprises the western edge of the former Hafod and Morfa Copperworks, which merged in 1924 and were acquired by Yorkshire Imperial Metals in 1957, and are therefore widely known as the YIM site. It lies on the west bank of the River Tawe, bounded to the west by the Swansea Canal, which was established in 1794-8 to open up the coal trade from the head of the Swansea Valley. Its presence encouraged the establishment of other industries, such as Hafod and Morfa Copperworks. No longer profitable by 1902, it became disused and finally closed in 1931. It was infilled, both naturally and deliberately, and was complete by the 1970s. Sections higher up the valley, at Clydach and Pontardawe, were still “wet” in 1988. In 2002, a study was undertaken by Atkins Consultants on the restoration of the Swansea and Neath-Tenant Canals. This developed a range of proposals for restoration, although it was not proposed to restore the canal within the development area to a working waterway given that significant sections are no longer in place.

Hafod Copperworks was established in 1810, the adjoining Morfa Works dating from 1828. At its peak in the mid 19th century, Hafod was the largest copperworks in the world, with the greatest output. Morfa’s output followed closely behind and between them, the 13 copperworks in the Lower Swansea Valley accounted for 90% of the world’s copper production.

The two works merged in 1924 and were acquired as Yorkshire Imperial Metals in 1957. Copper working ceased in 1980 and the site was acquired by (then) Swansea City Council. Much of it was cleared. The A4067/A4217 Cross Valley Link Road was carried through the centre of the site in the early 1990s, and light industrial units established in the eastern half. In the 2000s, part of the site was occupied by the Landore Park-and-ride scheme.

To the south of these copperworks, between Morfa Road and the River Tawe, were a number of other industries. These were largely established in the 19th century although the Cambria Pottery, at the south end of the development area, dates from 1720. It was disused by 1868 and has now gone. This area lay between the Swansea Canal and the River Tawe and was a natural site for a series of coal wharves, and wet- and dry-docks. Other industries developed in this area during the 19th century including a foundry, a nickel-cobalt works and a phosphate works. Many of them had closed by the earlier 20th century. The canal, wharves and docks were progressively disused and infilled during the 20th century, and much redevelopment took place, mainly comprising light industrial units. An area to the south, between Morfa Road and the River Tawe, during the 19th century, was the site of a number of subsidiary industries including two large and important potteries, in addition to the coal wharves and dry docks that served the port of Swansea.

The area is of crucial importance to the later history and development of Swansea. The Hafod and Morfa Works, two 19th century copperworks were, during the mid 19th century, the largest in the world, with the greatest output. Hundreds were employed in these industries, and housed in purpose-built densely packed back-to-back terraced housing - notably, the Hafod area.

The area is also an important feature of the urban landscape. It is one of the very few assemblages of 18th-19th century industrial buildings that survive in Swansea. There are 11 listed buildings within the development area, and two Scheduled Ancient Monuments, alongside the incomplete remains of a large number of other structures and features.

The structural remains within the development area are not limited to listed buildings and Scheduled Ancient Monuments. There are the remains of further

former structures, and former surfaces, which together increase the Group Value of the site. The extensive use of local building stone (Pennant sandstone), and indigenous copper slag blocks, are an important contribution to the ‘sense of place’. The geometry of the area and its relationship with the Swansea Canal and the river, is also important, and is still well preserved.

The protection of the surviving remains is seen as “the last chance” to preserve and interpret the industrial copper heritage of Swansea.

## **6.4.1 Summary of Area Strategies**

The strategies for the development and regeneration of the parts of the development area are in summary:

### **Morfa Distributor Road**

- The introduction of a new road between the A4067 (Hafod Site) to the Strand and New Cut Road (Morfa Road site) to have a “distributor route” function to serve development in the area, enabling maximum development opportunities with minimum environmental impact, particularly on industrial heritage;

### **Morfa Road Area**

- Altering the balance of uses in the Morfa Road area from light and heavy industry and dereliction, which ignores the river frontage, to a high quality mixed area of residential, commercial and light industrial uses. The development would thus capitalise

on the superb riverside setting, the proximity of the area to the City Centre and waterfront and also celebrate and interpret the heritage of the area.

### **Hafod Copperworks Area**

- An integrated, mixed use development of Hafod Copperworks, which:
- preserves heritage structures, interprets industrial history and finds new uses for heritage buildings, to ensure the heritage importance of the area is fully celebrated;
- capitalises on the stunning waterfront location and strategic proximity to the stadium by the introduction of a hotel and restaurant/ bar/ café uses, bringing economic vitality back to the river frontage by day and evening;
- provides for water transport links and recreation, in particular a ferry stop to enable the site to be linked to the Swansea Waterfront and the National Museum;
- provides for park and ride links to the City Centre; and
- provides a high quality living environment with strengthened links to the existing Hafod community.

### **Normandy Road Industrial Estate**

- The retention of Normandy Road Industrial Estate as a location for employment and industry, whilst visually enhancing the site, reducing the visual impact on adjacent land uses and investing in improvements to properties to raise the quality of the estate.

## **Addis Site**

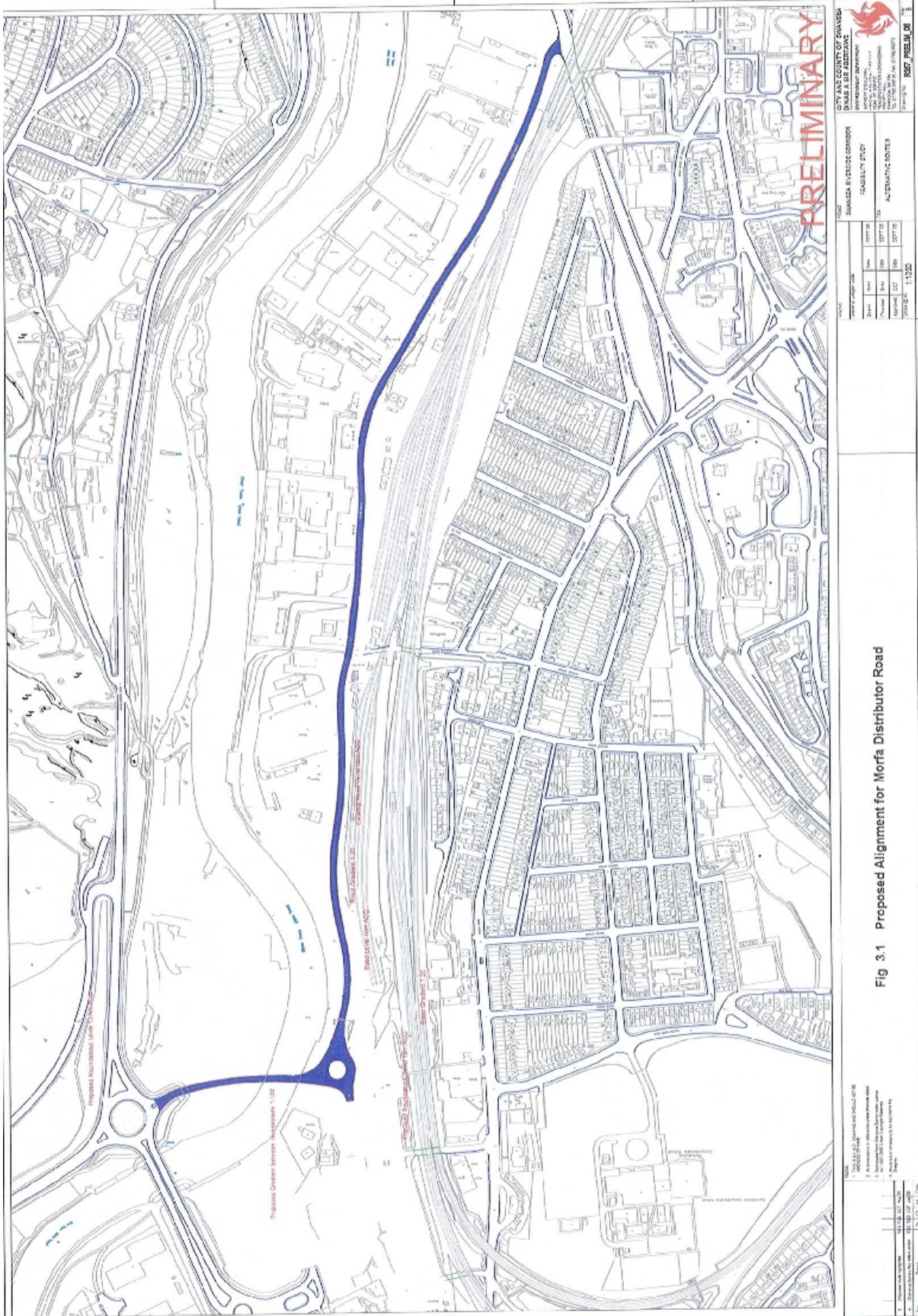
- The redevelopment of the Addis site for residential uses as the next stage in forming a truly mixed use and high quality part of the riverside – with leisure, retail, industrial and residential uses, whilst respecting the heritage importance of the site.  
Development of this site commenced during 2006 with the former factory units being demolished and the site remediated.  
Construction works commenced late 2006/early 2007

## **Upper Bank/ Pluck Lake**

- Encouraging a compatible mix of land uses to regenerate the Upper Bank site, removing the current areas of dereliction and contributing to the regeneration of the wider area;
- Accommodating the objectives and future plans of the Swansea Vale Railway Company and recognising the heritage value of the site; and
- Recognising the amenity importance of Pluck Lake and Kilvey Woodland, whilst bringing selective development into the area to improve the attractiveness of the site.

## **6.4.2 Morfa Distributor Road**

The City and County of Swansea is proposing to introduce a new road from the vicinity of the existing junction between the B4603 and A4067 (Hafod Site) to the Strand and New Cut Road (Morfa Road site). It is intended that the road would have a “distributor route” function aiming to serve development in the area. Map 34 below shows the Distributor Road preliminary proposals.



Map 34 Morfa Distributor Road Preliminary Alignment Proposals



An alignment for a route directly southwards through the Hafod Copperworks Site has been included and protected within the Swansea development plans as far back as 1992. The route is shown in the Deposit Draft Unitary Development Plan (October 2006).

Alternatives to this route have been investigated by the Highway Authority as part of the development proposals. This is to ensure that the route chosen enables maximum development opportunities in the Hafod/ Morfa Road area with minimum environmental impact, particularly on industrial heritage, as well as providing the distributor road.

A new option of a crossing of the river from White Rock is now proposed. This preliminary route is considered to have less impact on the heritage of the Hafod Copperworks Site and enable more coherent development of the Hafod Site. The two options of the protected route and a White Rock alignment have been presented to CADW, who have expressed the preliminary view (in a letter dated 31 March 2006) that: *“Of the two options being considered, CADW would support Option 2 (White Rock), which goes some way towards respecting the integrity of the Hafod-Morfa site and its relationship with the Swansea Canal and associated features”*.

The preliminary alignment for a route is illustrated in map 28 above. The route would cross from the western arm of the White Rock roundabout in a westerly direction. There would be a roundabout junction north of the Locomotive Shed and south of the Engine Houses on the west bank of the river and the route would then pass southwards along the route of the former Swansea Canal. As with the protected alignment, it would involve an upgraded link based on the

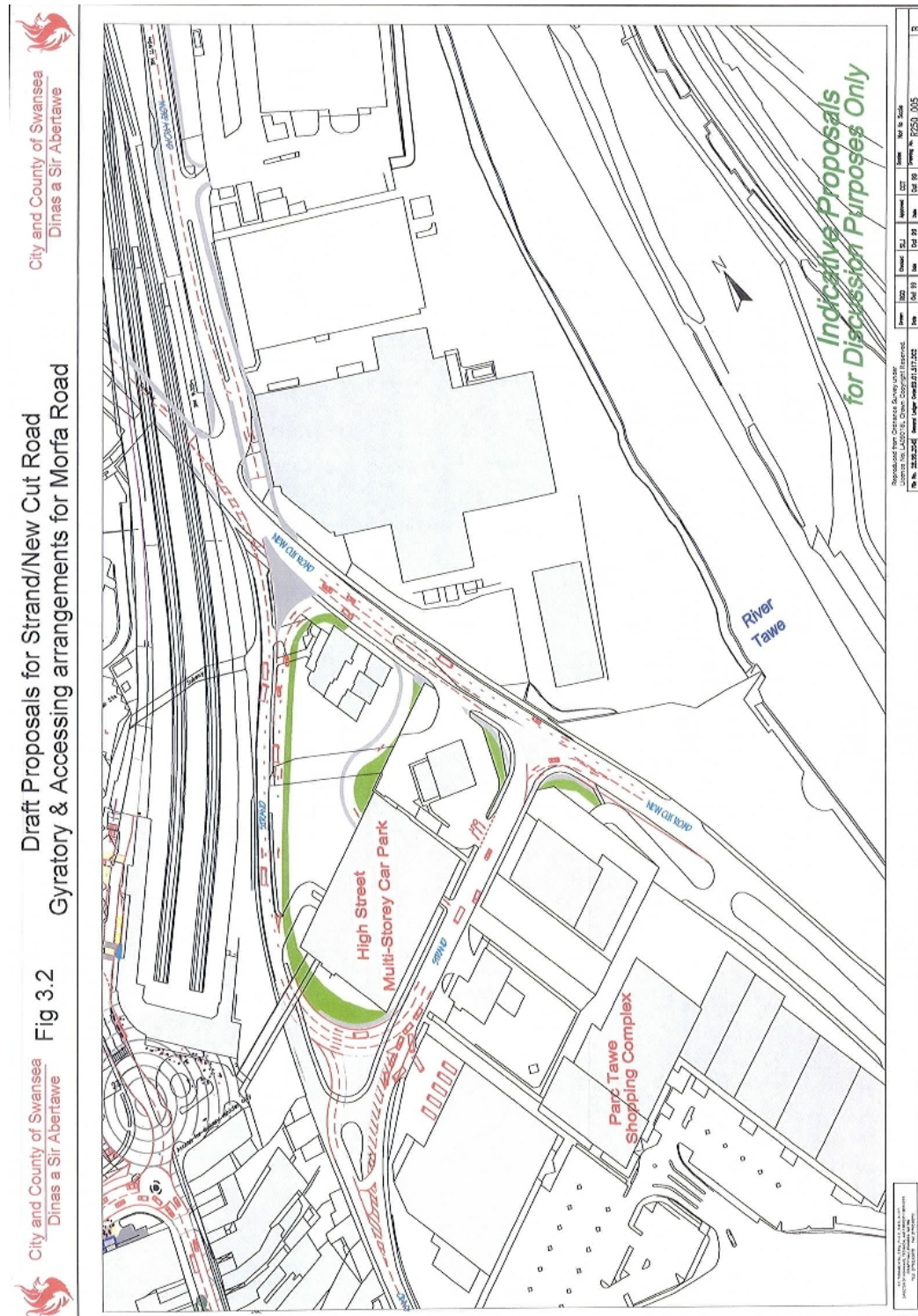
alignment of Morfa Road from the Hastie Site southwards. The route can be described in two sections:

1. A 'Rural' type design, low-density development section between the Hastie Site and the connection with the A4217, which would be subject to a speed limit of 40mph. Due to the limited access required on this section it is considered that a standard single carriageway road (7.3m plus 1m hard strips) would be suitable. The river crossing would have a pedestrian/cycle route adjacent to the carriageway.
2. An Urban high-density development section between New Cut Road and the Hastie Site, which would be subject to a speed limit of 30mph. From analysis of the traffic flows, it is considered that a 10m carriageway should be provided. This road would allow a single lane for through traffic in each direction together with a standard ghost island right turning lane to cater for all turning movements. There would be an adjacent pedestrian route along Morfa Road separated by a verge. It is proposed that two roundabouts be included to serve the larger sites on Morfa Road, as shown in map 28.

It is anticipated that the Distributor Road could accommodate bus services, subject to the provision of a new service along the route.

It is envisaged that the link under the railway from Maliphant Street would become for pedestrian and cyclists only, and be enhanced. This could include painting or cladding of the underside of the bridge in a light colour, a shared surface for cyclists and pedestrians which also allows emergency access, new signing and lighting.

At the southern end of the proposed Distributor Road, works are also proposed on New Cut Road and The Strand. These works would involve the provision of a gyratory carriageway layout (as previously proposed in Transport Grant Applications). The draft gyratory layout is illustrated below in map 35.



Map 35 Draft New Cut Gyratory Layout

In summary, it involves a gyratory whereby traffic from the Distributor Road would only be able to travel left onto New Cut Road and would enter Morfa Distributor Road only from The Strand. The intention is to minimise traffic queuing and delays at the southern end of the route and also thereby manage levels of air pollution.

### **6.4.3 Morfa Road Area**

Morfa Road presents a significant opportunity for redevelopment, capitalising on the riverside setting, the proximity of the area to the City Centre and waterfront and also to celebrate and interpret the heritage of the area.

The strategy for the regeneration of the area is to alter the balance of uses from light and heavy industry and dereliction, which ignores the river frontage, to a high quality mixed area of residential, commercial and light industrial uses.

While the land uses provide the framework for development, it is envisaged that the City and County of Swansea will take a flexible view of the use of each site, taking into account any changes in the market situation and the aspirations of land owners. Thus in the longer term, should market conditions change, the majority of the sites in the area may be redeveloped for housing and this is also considered to be acceptable.

The strategy is to be achieved through the provision of a master plan that sets the framework for investment by the private and public sector in the area and is shown within map 36 below.



**Morfa Road Masterplan**  
**Figure 4.1**



The overall design concept is for:

- a mixed use development of individual sites according to land ownerships;
- the prime focus of each development site being orientated towards the river;
- a network of routes for pedestrians focussed on the riverside walkway/ cycleway with links through the sites at key locations to Morfa Road;
- a secondary focus to development sites to the centre of each site, giving a more intimate scale to the living environment. The central parts of site would be the location for any community facilities and local open space;
- traffic access from Morfa Distributor Road into each site. Within the sites, residential development in accordance with the 'Home Zone' principle of shared pedestrian and vehicular surface, designed for a speed of 10 mph.

The master plan incorporates the following elements:

- An upgraded Morfa Road to a distributor road standard, linking from the north between the Hastie Site and the railway. The road link is proposed to have a limited number of junctions, the locations for which have been chosen to enable phased development in accordance with the various land ownerships.
- A riverside walkway and cycle route of minimum width of 6 metres. This would provide continuous access from Parc Tawe through to the Hafod Site. A footpath is in place for the majority of the route at present, with the exception of the Swansea



Industrial Components site. Moreover it is currently impassable in places due to overgrowth and there is no barrier to protect users along the river edge.

- The provision of a new pedestrian and cycle bridge across the Tawe between the areas of open space south of the Unit Superheaters site, across to the St Thomas Station Site. This, together with a similar facility shown for the Hafod Site, would enable use of both sides of the river bank, connecting to the National Cycle Route on the east bank and link the Morfa Road area to the St Thomas community;
- Mixed-use development of the sites including approximately 360 homes, enhancement and some new development of light industrial uses and trade counter uses; retention of the Dragon Arts Centre facility and approximately 23,000 m<sup>2</sup> of office space. Specifically:
  - Residential development of the Unit Superheaters, Swansea City Highways Depot and Hastie site (7.3 ha, approximately 360 dwellings at a density of 50/ha);
  - Light industrial uses or trading counter uses on the Bevan and Gladeborough sites, involving a mix of enhancement of existing buildings and new development (2.7 ha, approximately 13,500 m<sup>2</sup> of industrial/ trading space);
  - Office development of the former dairy site, average of three storeys (1.55 ha, approximately 23,250 m<sup>2</sup> gross floor area);
  - Retention of the Dragon Arts Centre facility;

- Light industrial uses on the Swansea Industrial Components site, possibly comprising a single large factory unit of 5,500 m<sup>2</sup>/ 60,000 sq ft; and
- Retention of light industrial units on the GLT Exports site.

The master plan also illustrates the potential for an element of local needs convenience shopping, open space, and a public house/ café making up part of the overall development as illustrated.

#### **6.4.4 Hafod Copperworks Site**

The Hafod Copperworks Site or Yorkshire Imperial Metals (Y.I.M.) Site is a site of international importance in industrial history and has the potential to help tell the story of Swansea's development over the past three hundred years, provide a place for public enjoyment of the riverside, and a new place for living and working.

The site has lain largely vacant for several decades however, the industrial monuments are deteriorating and certain buildings are at serious risk of loss. The site is the last opportunity to preserve and interpret the City's industrial history.

The strategy for Hafod Copperworks is for an integrated, mixed use development which:

- preserves heritage structures, interprets industrial history and finds new uses for heritage buildings;

- capitalises on the waterfront location and strategic proximity to the stadium by the introduction of a hotel and restaurant/ bar/ café uses, bringing economic vitality back to the river frontage by day and evening;
- provides for water transport links and recreation, in particular a ferry stop to enable the site to be linked to the Swansea Waterfront and the National Museum;
- provides for park and ride links to the City Centre; and
- provide a high quality living environment with strengthened links to the existing Hafod community.

The strategy is to be achieved through the master plan that sets the framework for development of the site. The overall design concept for the Hafod Copperworks site aims to:

- create a stimulating contrast between the dispersed historic buildings and structures and contemporary architecture and activities, all set in a consistent landscape theme;
- exploit the riverfront and differences in level to create memorable views and a sense of drama;
- establish a pattern of mixed uses which will help create vitality, day and evening, particularly on the waterfront;
- organise linkages into and through the site which will be convenient, safe and secure;
- maximise the development potential of the key riverside site; and
- minimise the potential impact of the railway.



The main elements are:

- a new river crossing for traffic with an alongside pedestrian and cycle route, from White Rock to a roundabout junction south of the Musgrove Engine House;
- an extension to the existing park and ride scheme (300 additional spaces);
- Mixed use waterfront development – a mixed development of apartments, hotel and public house/ restaurant;
- High density housing on two sites either side of the former canal route (approximately 100 units);
- Restoration of the canal as a landscape and heritage feature with a walk along the route;
- Creation of a public space on the river front, giving setting to the Engine Houses and a location for a river ferry stop;
- Continuous walking and cycling route from the footbridge south along the riverfront;
- The consolidation and re-use of the listed buildings and Scheduled Monument within the site:
  - Further development of the Museum Stores for public access, with car parking and pedestrian routes from Neath Road;
  - Consolidation and refurbishment of the Laboratory and Canteen Buildings for commercial use, such as eating and drinking;

- Consolidation and interpretation of the Musgrove Engine House for public access; and
- Commercial uses in the Vivian Engine House.

The master plan sets out the potential form of development, but within the framework there is some flexibility to respond to demands for other uses. In particular, there may be potential demand for alternative uses, such as:

- Student and potential key worker accommodation;
- A residential care home;
- Social low cost and specialist housing, including older person accommodation, family accommodation and special needs bungalows;
- A new doctor's surgery/medical centre to replace one surgery potentially requiring relocation in the Hafod.

## **6.4.5 Normandy Road Industrial Estate**

Normandy Road is an industrial estate lying to the east of the Hafod Site and the south of the Liberty Stadium and Morfa Retail Park. It is almost fully developed and bounded by the river on the eastern boundary, the A4217 to the west and stadium to the north. The estate is occupied predominately by industrial premises, with the exception of the Territorial Army premises and a three-storey office block. The estate is visually prominent in an area, which has seen considerable recent development.



It is considered that the industrial estate serves an important function in providing premises close to the city centre, and it would neither be desirable or easily achievable (given the large number of occupiers and leases with the local authority) to comprehensively redevelop the estate. The buildings are however relatively dated and the estate could benefit from selective redevelopment and refurbishment. The location of the industrial estate is shown below as map 38.



Map38 Normandy Road Industrial Estate

The site is not proposed for comprehensive redevelopment and therefore the proposals involve a package of environmental improvements rather than a master plan for the site. The strategy for the future of Normandy Road is therefore to:

- Retain the site as a location for employment and industry;
- Visually enhance the site and reduce the visual impact on adjacent land uses;

## **6.4.6 Addis Development Site**

The Addis site occupies a strategic location adjacent to the Morfa Retail Park. The site was formally occupied by the Addis factory, which produced plastic household goods. It was been acquired by PMG Developments Ltd who sought planning permission for the redevelopment of the site for residential uses. The redevelopment of the site for residential will be the next stage in forming a truly mixed use and high quality part of the riverside – with leisure, retail, industrial and residential uses, whilst respecting the heritage importance of the site (notably the listed industrial building and Bascule bridge)

A planning application was submitted in January 2006 by Holder Matthias Architects for the redevelopment of the site with construction of 564 residential units including:

- 8 no five storey blocks of 296 residential apartments along the riverside;
- 146 apartments in 2 and 3 storey blocks;

- 122 terraced 2 and 3 storey dwellings; and
- retention of the listed building in the centre of the waterfront area, with future uses to be determined.

The application includes for access, car parking (including undercroft), landscaping, open space and infrastructure works including a new riverside cycle path/ walkway.

The overall design concept is to develop a strong river frontage with blocks of apartments and a new riverside walkway and cycleway, graduating eastwards to lower rise two and three storey town houses and terraces. The development uses the principles of a home zone, with access within the site as shared surface between pedestrians and vehicles. The housing design has the majority of properties fronting directly onto the street with gardens to the rear in courtyards/ enclosed spaces. Images of what the development may look like are included as Figures 1 and 2.<sup>3</sup> The Master plan for the site produced for the application is included as map 39. Works commenced during late 2006/early 2007.



Figure 1



Figure 2

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<sup>3</sup> Images courtesy of Hyder Consulting Final Report Tawe Riverside Corridor June 2006





Map 39 Addis Development Site

## **6.4.7 Upper Bank/Pluck Lake**

Upper Bank represents one of the few predominantly underused sites in the area occupying a key location overlooking the redeveloped area of Liberty Stadium and Morfa Retail Park. The opportunity now exists to regenerate the site, connecting to the key development land and transport links in the area, whilst promoting a mix of different land uses.

The last remaining section of the Swansea Vale Railway runs through the centre of the site and is occupied by the Swansea Vale Railway Society. The Society has a vision to create a Railway Heritage Centre. The majority of the Upper Bank site is however in a state of considerable dereliction. The adjacent Pluck Lake area is an important amenity area and ecological resource.

The strategy for the future development of the site is to:

- encourage a compatible mix of land uses to regenerate the site, removing the current areas of dereliction and contributing to the regeneration of the wider area;
- accommodate the objectives and future plans of the Swansea Vale Railway Company and recognise the heritage value of the site;
- recognise the amenity importance of Pluck Lake and Kilvey Woodland, whilst bringing selective development into the area to improve the attractiveness of the site;

The overall design concept for the Upper Bank/ Pluck Lake site aims to:

- maximise the commercial development potential of the site;
- exploit the differences in level to provide attractive views out from the site to the west;
- establish a pattern of viable mixed uses which will create an attractive living environment and complement the regeneration of the wider area;
- enhance the role of the site in telling the story of Swansea's industrial heritage;
- improve linkages to the Pentrechwyth community and the Kilvey Community Woodland.

The master plan for the site is illustrated in map 40 below and includes:

- A new access westwards from a proposed roundabout junction on Nantong Way;
- A mix of affordable and general housing, totalling approximately 125 units;
- A roundabout junction providing access into the housing areas and railway heritage area;
- Relocation of the Railway Society operations with provision to enable future phases of development of a heritage centre; and
- Potential development site for a hotel south of Pluck Lake



The master plan as proposed would release a significant parcel of brownfield land for housing development. The area of housing land identified on the plan would amount to 3.19 hectares.

The site is proposed to include a small food store (approximately 10,000 sq ft) and associated parking, serving the immediate local area and offering a different product to the Morrison’s superstore within the retail park.

The site would be sensitively integrated with the adjacent rail land and the amenity of the future occupiers will be safeguarded from any of the potential impacts of the rail activity by close attention to a green buffer between the two.



Map 40 Upper Bank/Pluck Lake Development Site

The master plan includes the provision of an area to safeguard the future operations and expansion of the Railway Society site. The proposal includes the recommendation that the site redevelopment includes for implementation of Phase 1 works (by negotiation between the Railway Society and City and County of Swansea) to enable the Railway Society to continue their current operations of upgrading the remaining section of the Swansea Vale Railway and restoring the locomotives and rolling stock within a covered modern industrial unit. The proposals would also enable the Society to fully explore the feasibility of establishing a shuttle service between the two terminals at Upper Bank. This will require basic facilities at either terminal, but will help to establish a revenue stream for the Society and the impetus to progress subsequent phases.

#### **6.4.8 Proposed New Leisure Facility incorporating Snow Ski Facility, Water Park and Hotels.**

The site extends to approx. 27 hectares in total and comprises of two main parcels sub-divided by Nantong Way with approx. 7 hectares located at the former dry ski slope site to the west of Nantong Way and approx. 20 hectares comprising Pluck Lake and the associated woodland area located to the east of Nantong Way. The majority of the proposals for the site east of Nantong Way are outlined above within 6.4.7 and can be seen within map 40. It is indicated that the submitted site area is indicative at this stage and may be refined prior to the submission of a planning application. The site is bounded to the north by the main Swansea / Paddington railway line and Llansamlet Industrial Estate, and the former dry ski slope is situated to the rear of the Morfa Retail Park, with the Swansea Vale Railway Line (Upper Bank) located to the south – east. An indicative map of the development (west of Nantong Way) is given below as map 41.

The proposal is to develop a comprehensive new leisure resort focussed around the existing redundant dry ski slope. The project would involve the following:

West of Nantong Way:

- the redevelopment of the existing ski-slope into an Indoor Snow Centre / Ski Facility
- Fitness / Health Facility
- Skateboard / BMX Park
- Bike Hire and Associated Bike Trails

East of Nantong Way:

- 120 bed Budget Hotel and associated Restaurant
- 3 / 4 Star 150 bed Family Hotel and Conference Centre
- 37 No. Lakeside Chalets
- Extension of Pluck Lake to be used for Rowing / Fishing / Boating Activities
- Boating and Fishing Club



Map 41 Indicative outline of proposed Ski Centre development site

It is indicated that the proposed development is intended to create a multi leisure attraction including the indoor real snow and ski facility, fitness / health club, skateboard / bike facility and boating / fishing activities, which will promote a sustainable tourism / leisure facility.

## **6.5 New Landfill Developments**

There have been no new landfill development sites within the authority. Indeed, as the Environment Agency had refused to issue a Permit for the operations carried out at Tir John Landfill Site, Port Tennant, the operations undertaken had ceased. The Local Authority Waste Disposal Company (Swansea Waste Disposal Company) appealed this decision and the Permit was granted. The amount of HGV traffic using the access and haul roads has therefore been minimal from April 2004.

Both the Civic Amenity site and the landfill site may well reopen during 2008 for major re-engineering works.

## **6.6 New Mineral Extraction Developments**

There have been no new operations or applications for mineral extraction within the authorities' area during 2005 or 2006.

## **6.7 New Road Schemes**

### **6.7.1 Fabian Way**

Fabian Way has seen the construction of a junction to serve the new SA1 development access road around the Port Tennant Road junction with the A483 Fabian Way. This junction is controlled via traffic signals and is approximately 450 meters from the existing traffic signal controlled junction to the old dock entrance and Quay Parade Bridges. To the east of the new SA1 junction and



approximately 1100 meters away, is the traffic signal controlled junction that regulates access at the new main docks entrance and the Fabian way Park and Ride site.

There are also proposals to construct a new dedicated express bus route into the city centre from the Fabian Way Park and Ride site. Phase 1 of the express bus route will cross over the A483 Fabian Way at the site of an old railway bridge, which has now been removed. This crossing is to be replaced with a "sail-bridge" during 2007. The express bus route will then run parallel at ground level, adjacent to and parallel with the inbound carriageway of the A483 to Quay Parade Bridges. Further phases of the Fabian Way Express Bus Route will see it extended into the city centre.

## **6.7.2 Landore Park & Ride Express Bus Route**

Phase 1 of the Landore Park & Ride Express Bus Route was completed along a section of Neath Road, Hafod late 2004 / early 2005. The existing provision has seen a link provided from the Park & Ride site at Landore through a parcel of derelict land up to a traffic control point ① on the B4603 Neath Road at the commencement of the bus lane itself - see Map 42. This traffic control point is traffic signal controlled and activated when a Park & Ride bus approaches. Initially, a cycle time of 140 seconds in the am peak and 115 seconds in the pm peak was proposed that would allow three phases of green for southbound Neath Road traffic, but just one phase of green for the Park & Ride site. This cycle time would result in an amber/red phase lasting about 20-30 seconds followed by a green phase lasting 20-25 seconds. Northbound traffic would be halted once every cycle for about 16 seconds, to allow traffic from the Park & Ride site



to exit (provision has to be made for access into and from the Landore Social Club off this link road). The consultants employed, modelled the effects of these cycles and it was found that significant queues would be formed equivalent to around 85-110 seconds per vehicle in the am and pm peaks respectively.

If the above were accepted, this would require modifications to the junction of Pentremawr Road and Neath Road to prevent long queues forming due to traffic turning right at this junction. It was decided therefore to remove the existing mini-roundabout and make Neath Road the priority route with a dedicated right turn lane.

Discussions remain ongoing over the exact method of operation of this traffic control point from an air quality perspective. Local knowledge indicates that queues will quickly form towards Normandy roundabout and Morfa Terrace. What is in doubt is the actual extent of these queues and the knock-on effect in the real world. One avenue being explored is allowing the lights to remain on green phase except when activated by the express bus route, thus minimising delays and stationary traffic. Southbound traffic may well be discouraged from using Neath Road as a southbound route anyway by the proposed road-narrowing ③ of lower sections of Neath Road as recommended by the Hafod Integrated Transport Study and included as part of the Action Plan.



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Map 42 - Landore Park & Ride Express Bus Route Phase 1

As a long term goal, it may be desirable to actively use this point as a delaying tactic during periods where pollution is forecast to be high along Neath Road, to intentionally make Neath Road less attractive as a through route. The outcome achieved would however be a fine balancing act between improving conditions within the Neath Road corridor and possibly worsening conditions along Morfa Terrace and Normandy roundabout.

From this control point, the express bus route has been constructed parallel to the existing B4603 Neath Road. Neath Road from this point effectively becomes 3 lanes with the main carriageway being reduced to 6meters width. Phase 1 of the express bus route has stopped outside junction of Neath Road with Bowen

Street. At present, buses merge onto the existing Neath Road again via a traffic signal controlled junction. Phase 2 (was expected to commence September 2005 but is still subject to extensive delays) of the express bus route ② will see the route extended behind terraced housing along Neath Road to High Street Railway station. Buses using the route southwards into the city centre will not travel inbound along the more congested section of Neath Road. Buses making the return journey to Landore Park & Ride site will access Neath Road at the priority junction at Bowen Street. Buses will use the existing carriageway up to the access junction to the Park & Ride site mentioned above where they will activate the traffic signals to receive a priority right turn.

### **6.7.3 Morfa Distributor Road**

This proposal is outlined in detail as part of the Tawe Riverside Development Corridor above. Details can be found within section 6.4.2 above.

### **6.7.4 Swansea Metro Scheme**

This project aims to transform public transport in Swansea by introducing the new concept StreetCar vehicle, on a route with priority at key sections, between Morriston Hospital and Singleton Hospital, via the City Centre.

It will run on-street from Morriston Hospital to Singleton Hospital via the City Centre and Oystermouth Road stopping at many key destinations, including:

- Morriston Hospital,
- Woodfield Street, Morriston
- High Street Station,

- Kingsway,
- the new Quadrant Interchange ( see Action Point 5 in section 7 below)
- County Hall,
- University and Singleton hospital.

Priority will be provided at key locations, including:

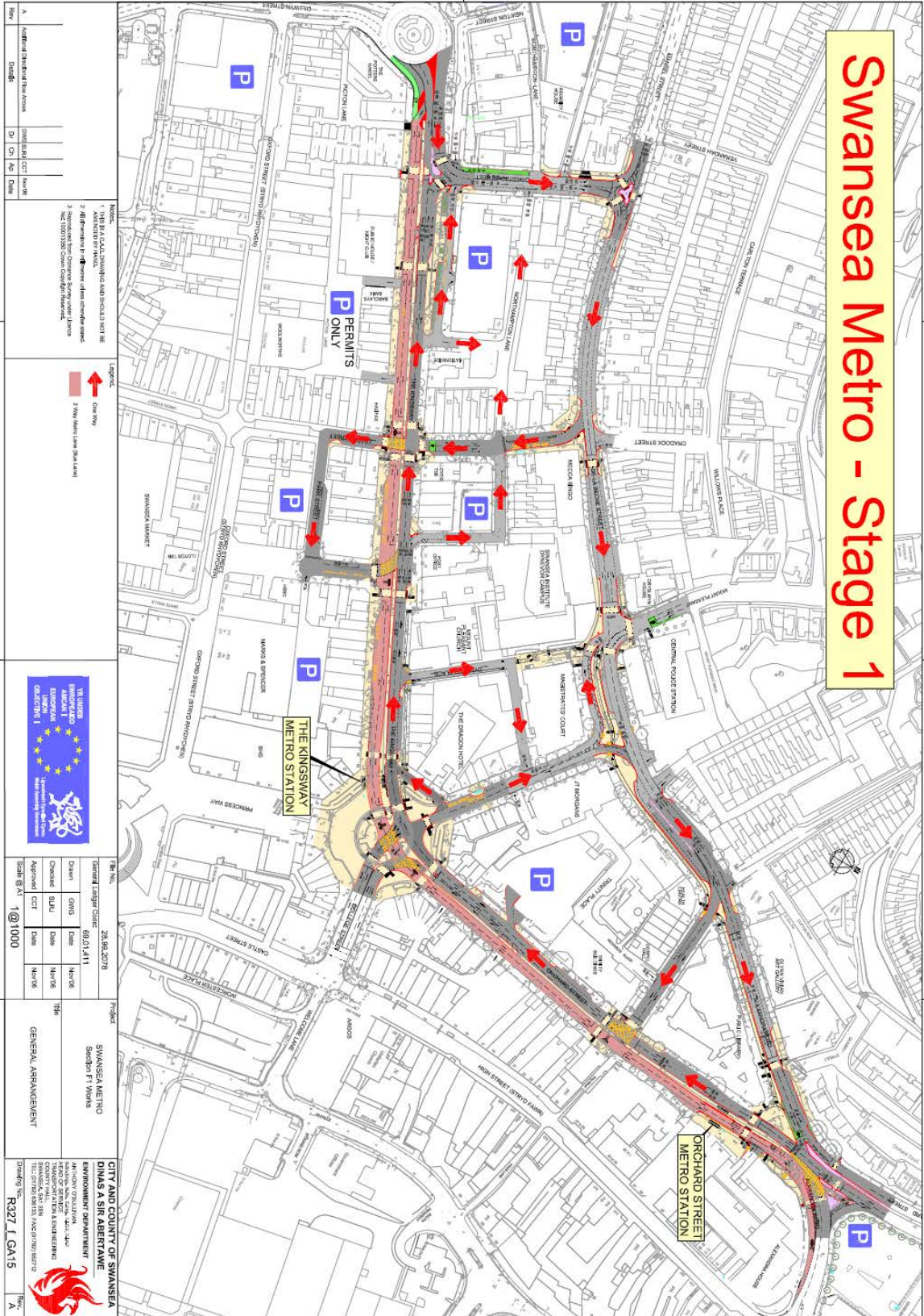
- Martin Street roundabout,
- Cwm Level roundabout,
- Normandy Road roundabout,
- the proposed Landore Express Route
- and in the City Centre, with the detailed design being carried out in-house

In order to enable the Swansea Metro to run, considerable works to the existing road network are required. Some of these works required at Cwm level and Normandy Road roundabouts lie within the existing Hafod Air Quality Management Area. Details at these key interchanges are still to be finalised and will be included in subsequent reporting.

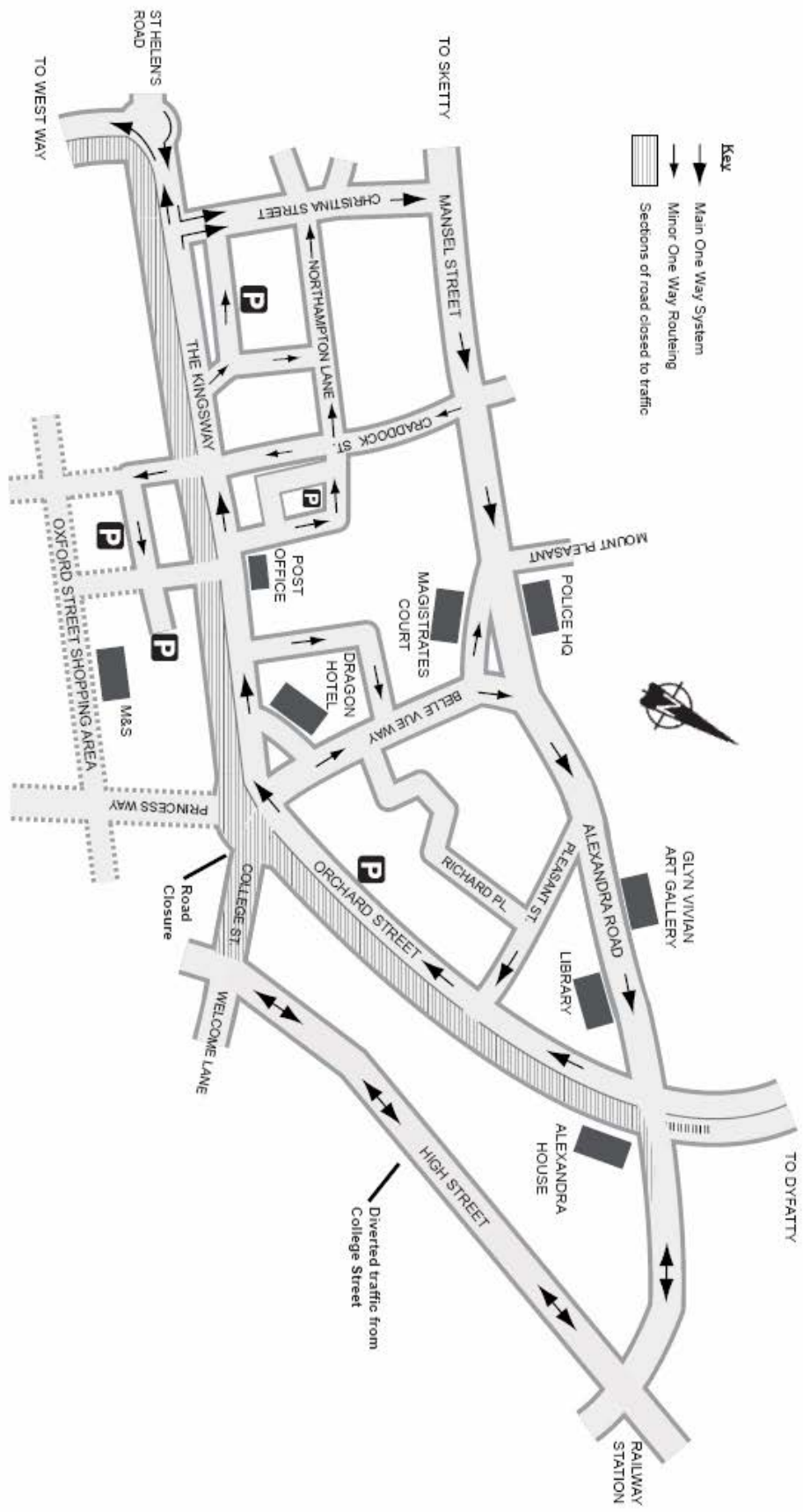
The first phase of these works started within the Kingsway area of the city centre during the summer months of 2006. Plans of the works completed as part of phase 1 can be seen below as maps 43 and 44.



# Swansea Metro - Stage 1



Map 43 – Swansea Metro Phase 1



Map 44 Swansea Metro Phase 1







## 6.8 New Permitted Processes [IPPC and LAPC]

There has been one new A2 processes established within the boundary of the authority during 2005-6 with an application being received in October 2006

The site is situated in the north east of Swansea on the Winch Wen Industrial Estate and is operated by Ethnic Cuisine Ltd. Its location can be seen within Map 46.



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*Map 46 Location of Ethnic Cuisine Ltd*

The nearest receptors are commercial premises to the west of the site and residential dwellings east of the site. The main features of the installation are as follows:

The proposed food waste treatment system is designed to treat all food wastes and other suitable wastes produced on site as described in the application. The treatment process converts the waste into bio-fuel, which is thermally treated in a bio-mass burner, with the heat generated being fed to a boiler to produce steam for use in the factory. The system is modular with the main components consisting of the bio-fuel converter, a bio-fuel silo, the bio-mass burner, a boiler to recover heat from the hot flue gases and a cyclone. The main environmental issues arising from the installation are emissions of combustion gases, the control of odour from the bio-mass converter, the discharge of liquid effluent and the disposal of residual solid waste.

The Waste Incineration (England and Wales) Regulations 2002 (SI 2002 No. 2980) (The WI Regulations) and the [Pollution Prevention and Control (Waste Incineration Directive) (England and Wales) Direction 2002] [The Environmental Protection (Waste Incineration Directive) (Wales) Direction 2002] together implement the requirements of the Waste Incineration Directive (Directive EC 2000/76/EC) on the Incineration of Waste.

The installation regulated under this Permit contains a new Waste Incineration Installation (as defined in the WI Regulations) in which the incineration of waste in a co-incineration plant is carried out. Conditions delivering the corresponding requirements of the relevant articles of the Waste Incineration Directive have been incorporated into the Permit.

## 7 Action Plan Progress

The authority submitted its Action plan in relation to the Hafod Air Quality Management Area in December 2004. Delays were incurred in the formulation of the plan due to the extensive planning and consultation works that were thought vital to delivering a workable plan.

The Action Plan detailed 10 action points to be taken forward by the authority. Progress against each of these action points are briefly discussed below:

- **Action Point 1 - Traffic Management measures on Neath Road**

The majority of measures identified for this action point depend upon funding being made available to undertake the recommendations of the Integrated Hafod Transport Study. Some identified action points have been completed and have been undertaken as part of phase 1 works in relation to the Landore Park & Ride Express Bus Route scheme. Items completed as part of this scheme include:

- Provision of some bus stops and shelters
- Gateway treatment to entrance to Neath Road from the Normandy Road roundabout
- Creation of traffic control point

All other identified action points within the Action Plan remain outstanding at present. The recommendations of the Hafod Integrated Transport Study are to be phased in after the renewals program being undertaken along Neath Road as part of the Hafod Renewals Program. This program is undertaking

complete renovation of both domestic and commercial properties within the Hafod. At present, major works by the renewals program are scheduled for two sections of Neath Road. As these works entail extensive building works taking over part of the footway/highway with scaffolding, skips etc. it has been decided to undertake the Hafod Integrated Transport Study works after the renovation works are complete, as to do so earlier would result in the damage of any finished surfaces.

Renewal works are to be undertaken in two phases on two separate blocks of properties along Neath Road. The first phase has undertaken works at 1364 - 1391 Neath Road, and between 15 - 52 Neath Road. Further properties are due to commence renovation works during late 2007 to the block of terraced dwellings that house the Opsis DOAS Receiver open path measurements. This unfortunately will result in another break in the dataset for this station.

It may be a further 2-3 years before the Transport Study recommendations are complete. The Action Plan initially indicated a target of December 2005.

- **Action Point 2 - Park and Ride provision**

Provision of Park & Ride is seen as a fundamental element of Swansea's Transportation Strategy. Significant progress has been made in respect to this action point:

- Landore and Port Tennant Park and Ride sites are now fully operational.
- Fforestfach Park & Ride was opened during November/December 2006 and works are now nearing completion. Map 47 below shows the location on the A483 Carmarthen Road.





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Map 47 Location of Fforestfach Park and Ride Site

Patronage statistics for 2005 and 2006 show yet another increase in usage of the park and ride provisions provided by the authority.

Table 53 shows patronage figures for all 3 sites during 2005-2006.

Site	Total Spaces	2005	2006
Landore	550	122,105	138,692
Fabian Way	550	86,407	111,878
Fforestfach	226 (temp) 449 (perm)		4,982

Table 53 Park & Ride Patronage Figures 2005-2006



- Phase 1 of the dedicated express route serving the Landore Park and Ride site has been completed. Phase 2 was due to commence during September 2005 but is still subject to delays.
- A Planning Application has been submitted in respect of the dedicated express bus route from the Port Tennant Park & Ride site. Some preparatory works on the ground have already been undertaken and include the removal of an old railway bridge crossing which it is proposed to replace with a new bus/cycle bridge during 2007 to carry the express bus route across the A483

All other identified action points within the Action Plan remain outstanding and were not complete by the indicated target of December 2005.

- **Action Point 3 - Improved Bus Provision**

The action points contained within the Action Plan were to the main being achieved upon submission of the Action Plan. However, in order to continue to achieve these aims, the authority continues to:

- Use its revenue budget to ensure that most areas have at least a minimum level of service.
- Make use of the National Assembly's Bus Subsidy Grant to ensure breaks in service are kept to a minimum
- Promote bus priority routes
- Fund a local concessionary bus fares scheme for certain categories of people
- Provide free unlimited bus travel within the authorities area for elderly people

The identified action points within the Action Plan are being achieved now but ongoing provision remains desirable.

- **Action Point 4 - Bus Corridor Enhancements**

Progress made to date includes:

- Transport Grant funded improvements to A48 Bus priority Demonstration Corridor completed during early 2005
- Bus priority proposals for Neath Road being reviewed. Works have commenced for a new concept Metro service linking Morriston Hospital with the city centre and Singleton Hospital (see 6.7.4 above) . The aim is to provide advantages of modern tram at modest costs. Envisaged that the service will use the Landore express bus route, thereby avoiding much of Neath Road and that bus priority will be introduced at key junctions along the route.
- Variable Message displays installed along a number of routes to improve dissemination of travel information to passengers.
- Accessibility to bus services for residents who are disabled or who suffer from limited mobility increased, following Transport Grant funding to raise kerb levels along with the provision of road markings and bus clearway orders at bus stops.
- Bus shelters upgraded on a number of routes

The identified action points within the Action Plan are being achieved now but ongoing provision and enhancements remain desirable.

- **Action Point 5 - Enhancements of Bus and Rail Stations**

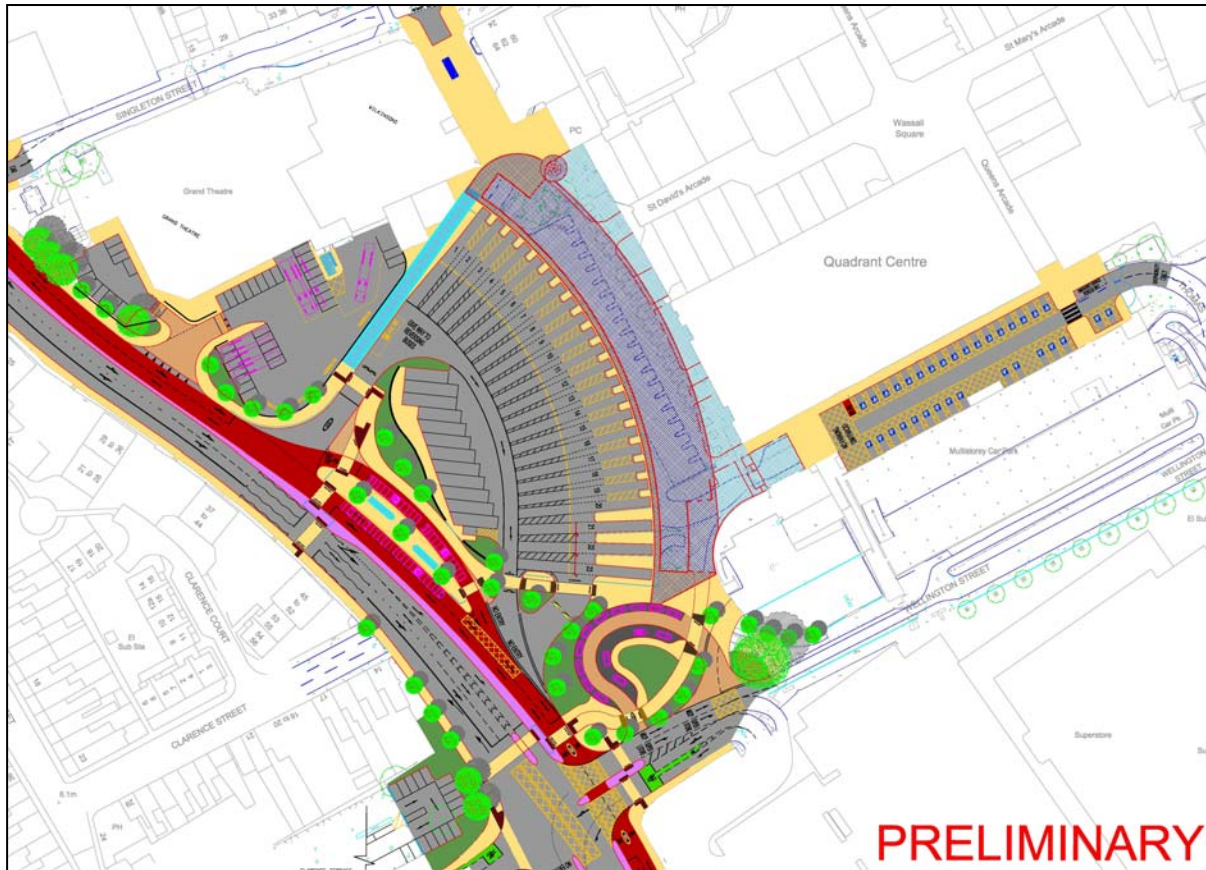
Progress made to date include:

- Swansea High Street Transport Interchange was completed during March 2004. Funded through a combination of Transport Grant and Objective 1 funding, this scheme has provided improved access to the railway station by bus, taxi, and on foot, together with a new public realm, improved security and improved parking facilities.
- Discussion ongoing with network rail and Arriva Trains Wales on how to improve passenger facilities at the station itself.

### **Quadrant Transport Interchange**

The City and County of Swansea has prepared a scheme to replace the existing Quadrant bus station with a modern Transport Interchange to cater for both buses and coaches, including Swansea Metro vehicles, on a larger footprint. The Quadrant Interchange scheme has been accepted for Transport Grant funding by the Welsh Assembly Government. The current bus station is outdated in terms of passenger convenience, comfort and security. The Council's aspiration is for a modern transport interchange with high standards of cleanliness and security. The refurbishment of the Quadrant bus station was identified as a high priority in the Swansea Local Transport Plan 2000 – 2005. However the bus pad was in private ownership.

Map 48 indicates the provisional scheme with artists impressions of the façade given below.



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*Map 48 Provisional Quadrant Transport Interchange off Westway, Sswansea.*





## Outline of scheme

The main components of the scheme comprised the following elements:

- 20 bus bays,
- 3 coach stands
- 2 Swansea Metro “stations” on Westway.
- 12 lay-over spaces
- Modern coach station facility to serve the long distance services,
- Enhanced passenger concourse with support facilities.
- Safe access to and from West Way
- New staff and office facilities
- Travel Shop (Information/ticket sales area.)
- Shopmobility Facility. In the Garden Street tunnel area
- Associated Retail Units.
- Enhanced links into the Quadrant shopping area.
- Improved access to the Grand Theatre and Wilkinson’s service areas

- Taxi rank for 9 vehicles
- Short stay parking for 5 cars (Passenger pick-up) adjacent to the coach area
- Passenger drop-off area

## **Programme**

The authority had hoped to start construction of the Quadrant Interchange scheme in early 2007-08. However the Transport Grant allocation for the current year falls short of the bid. Moreover the Welsh Assembly Government has indicated that there should be a 20% private sector contribution. Meetings have taken place with Welsh Assembly Government officials and First Group to explain the scheme in detail and explore funding opportunities. First Group has indicated that they may be able to make a contribution.

The authority has written to the Welsh Assembly Government suggesting that the scheme could start in late 2007-08 and be spread over three financial years. A response to this letter is awaited.

### **• Action Point 6 - Safe Routes to School**

Safe Routes to School has been delivered in Swansea for the last 6 years with numerous schemes undertaken.

- Currently, Safe Routes to school schemes have been developed at:
  - Clydach,
  - Brynhyfryd,
  - Pennard,



- Birchgrove.
- Gowerton Comprehensive and its Primary feeder schools
- Penllergaer
- Whitestone Primary

Schemes are currently underway at:

- Oystermouth Primary
- Newton Primary

The aim again, is to encourage more pupils to walk and cycle to school through improved facilities, the introduction of traffic calming measures, together with complementary educational work and road safety training.

The focus of this work with schools is now based on the development of school travel plans. These have previously been prepared for YGG Bryniago (Pontardulais), Penllergaer Primary, Penyrheol Primary (Gorseinon), Whitestone Primary (West Cross), Oystermouth Primary and Newton Primary. In addition, travel plans are in the process of development for Manselton Primary, Plasmarl Primary, Crws Primary, Cwmbwrla Primary, Hafod Primary, Pentrepoeth Juniors, Bishopston Primary, Knelston Primary, Mayals Primary, Sketty Primary. These travel plans will provide the basis for both infrastructure and educational work over the next two years

- **Action Point 7 - Vehicle Emissions Testing**

No additional progress has been made with respect to this action point.

However, the equipment is being kept serviced and calibrated. The primary reasons for the lack of progress are:

- No funding for Policing costs
- Lack of staff resources due to the labour intensive nature of the work.
- The Welsh Assembly Government fund for this purpose was not offered to the City & County of Swansea.

- **Action Point 8 Quay Parade Bridges Improvements**

- Feasibility studies remain ongoing as to how total capacity at the bridges can be increased. The initial intention of providing a signal controlled gyratory scheme has now been discounted due to the assessment that it would have a significant and unacceptable negative impact on local traffic and some bus services. The feasibility works are currently looking at the recalibration of the traffic signals at the bridges together with those along Quay Parade/Victoria Road/Oystermouth Road. The aim however remains the same - to make more effective use of the existing highway network. Parallel options for extending bus priority across Quay Parade to Oystermouth Road are still being investigated.

- An air quality monitoring station along Pentreguinea Road has been established with measurements commencing during September 2005. The system measures the pollutants nitrogen dioxide, sulphur dioxide, ozone, benzene, toluene and xylene along a 280-meter open path. The system comprises of a transmitter and a receiver. The transmitter shines a xenon lamp along the path length to the receiver module where the light is focused and transmitted down a fibre optic cable and into a spectra analyser where the measurements take place. The system is now providing spatial data over the 280-meter path length.



*Photo 1 - St Thomas DOAS Transmitter*



*Photo 2 - St Thomas DOAS Receiver Station*

- **Action Point 9 - City & County of Swansea Vehicle Fleet**

Improvements are ongoing within the fleet of vehicles operated by the authority. With 40% of the potential green fleet vehicles converted to L.P.G., other bespoke solutions have been implemented to assist in managing down the environmental impact of a 750 vehicle fleet operation within the Council's area. These include,

- A robust time based maintenance and inspection regime that specifies oil and filter changes twice a year
- A rolling 5 year programme of vehicle renewals to consolidate technological advancements within the fleet

- Detailed consultation with users on specifications to ensure maximised utility for the supplied vehicle
- A replacement component strategy that “ builds in “ disposal and recycling requirements for tyres, oils, batteries, cleaning products, asbestos free linings etc
- Active use of Energy Savings Trust grants for dual fuel vehicle provision that totals in excess of £120,000 to date
- Establishing a refuelling site within our primary operational depot for L.P.G. vehicles, in partnership with Flogas, and extending the use of this facility to other dual fuel users such as the D.V.L.A., taxi associations, local businesses and private individuals.
- Specifying Eminox Continuous Regenerating Particle traps ( CRTs ) and Euro 3 compliant engines on new heavy commercial vehicles
- Retrospectively fitting CRTs to existing ordered vehicles and applying for the Wales Assembly Government grants in support of this
- Introduction of Low Sulphur diesel to the Council’s fuel stocks

The authority actively enforces a “good neighbour “approach in terms of the Council’s driver conduct, vehicle operations and parking arrangements.

- **Action Point 10: Traffic Management Systems with Air Quality Monitoring Feedback.**

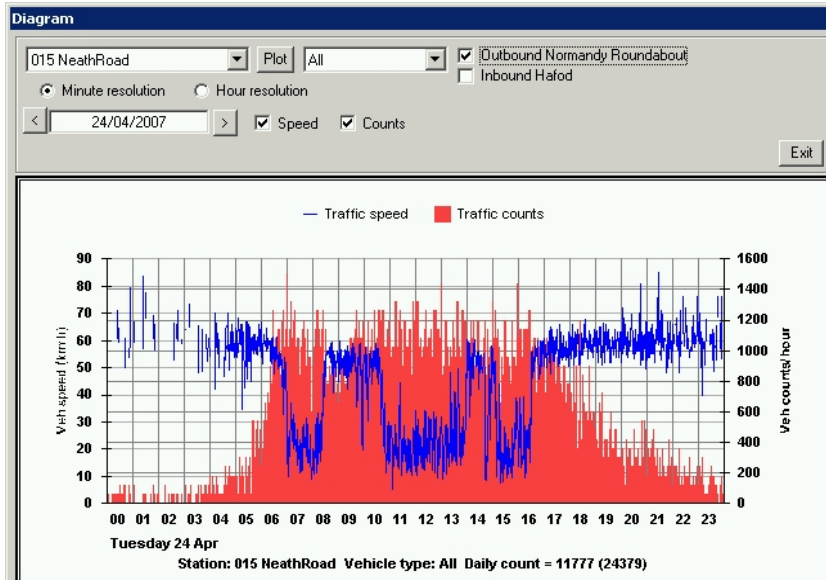
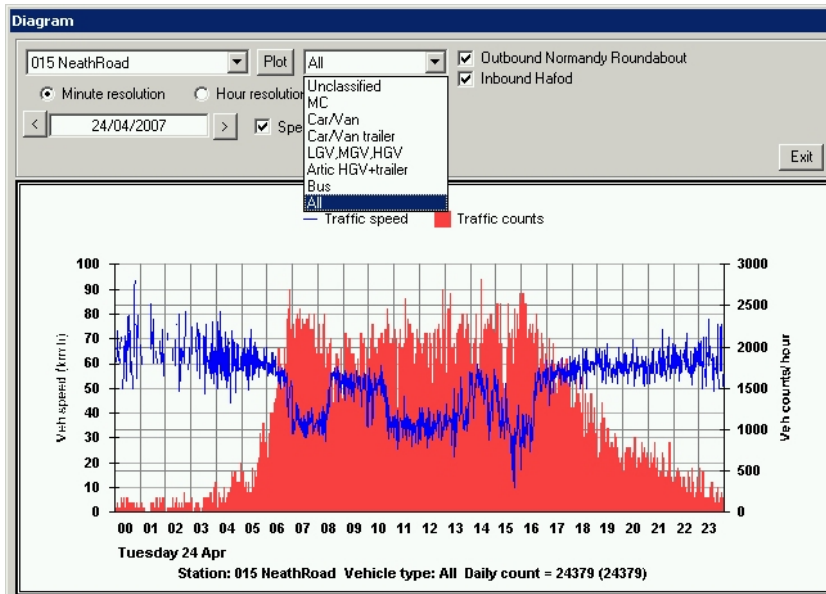
Considerable efforts are being made to ensure that all data feeds into the system under development operate reliably. The major data feeds are:

- ◆ Vehicle by Vehicle Traffic flow
- ◆ Ambient Air Quality Monitoring data
- ◆ Meteorological forecast

A total of 43 GPRS vehicle by vehicle (VbV) automatic traffic counters have been installed and commissioned and data quality is being assessed - see map 49 below for the location of the existing 43 GPRS traffic counters. Additional temporary surveys are underway within “local streets” for a period of one week to establish basic flow information.

The GPRS automatic traffic counters transmit data to an FTP server every 5 minutes. The vehicle by vehicle data is compiled into 1 minute integration and stored within databases linked to the emissions database (EDB). An example of the information that is now available to both the models and for dissemination to local radio media traffic bulletins (i.e. detection of congestion forming) is given below.

All vehicles are classified into the EUR6 classification scheme at point of detection as well as the speed of the vehicle. This information has again been provided for use within the modelling under development. Examples of the detailed flow information now available are given within annexe 3.

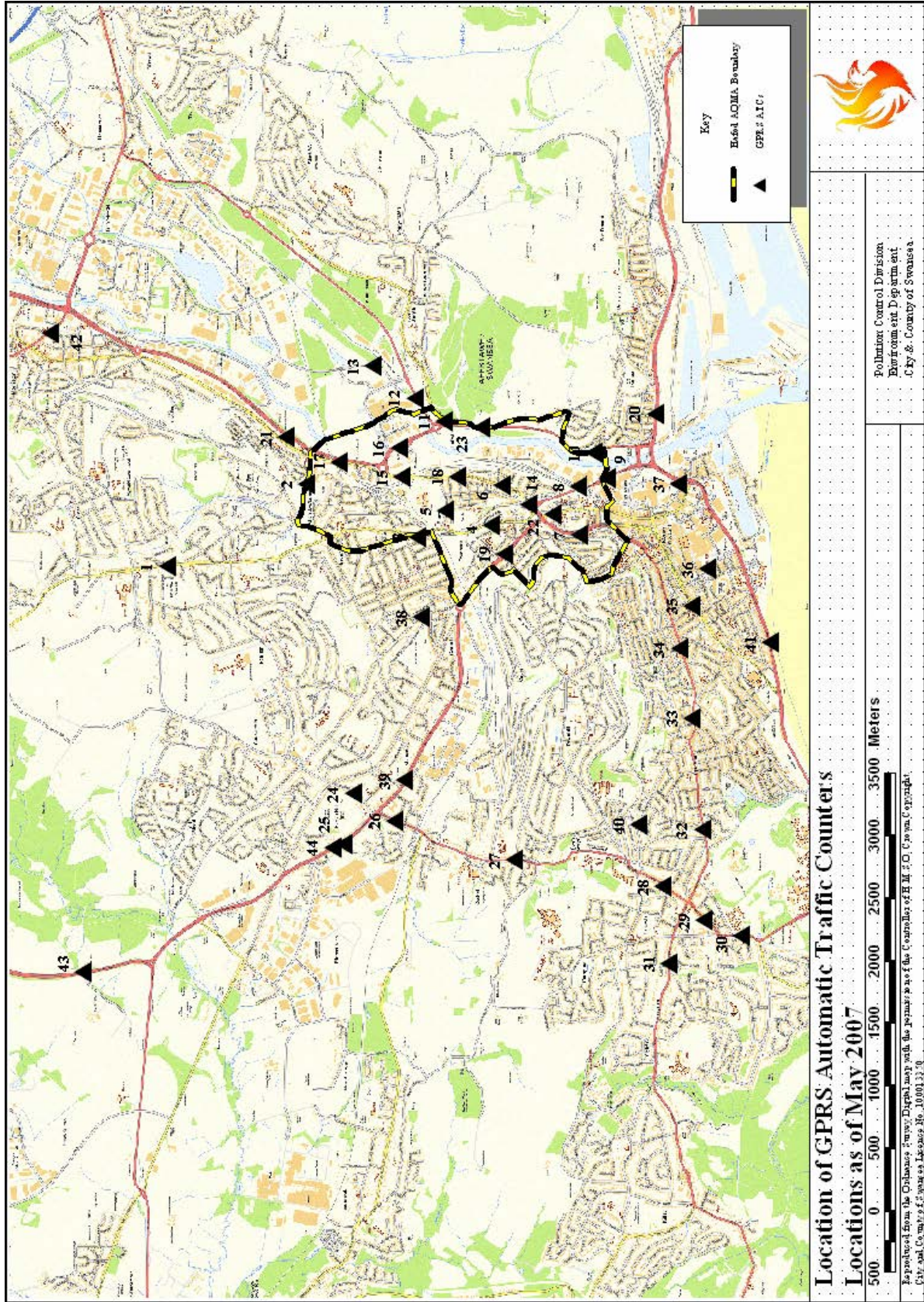


ATC 15 Neath Road is located opposite Morfa Terrace (see sec 4.1.5.2 site 29 for NO<sub>2</sub> tube data) on the B4603. The ADT for 2006 is 22032 with the AWDT being 23520. 1 minute resolution traffic flow data enables detection of congestion in almost “real-time”.

The direction of formation of congestion can be established by separation of the directions. Here the congestion can be seen within the outbound lane. Notice the 3 significant periods of slow moving vehicles during the AM, midday and PM periods.

This 1 hour data integration view does not enable easy detection of these significant congestion periods

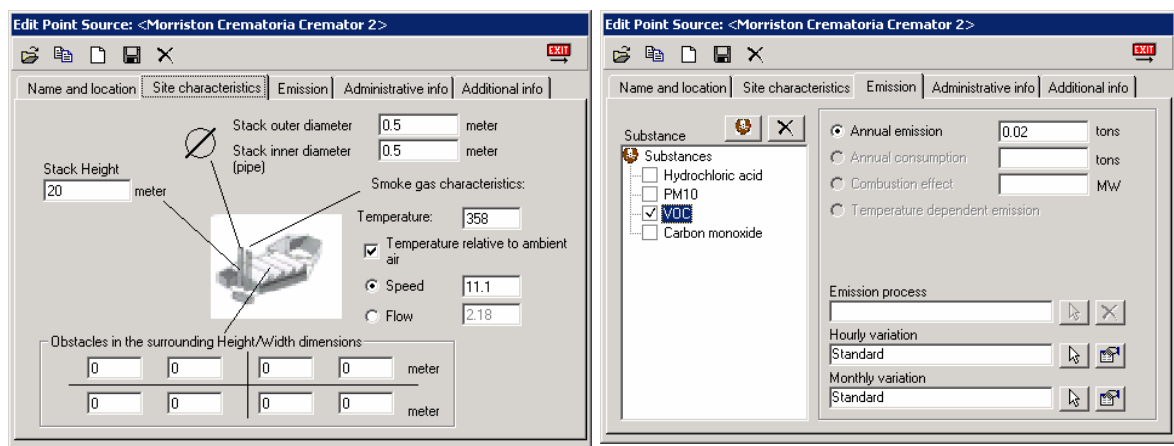




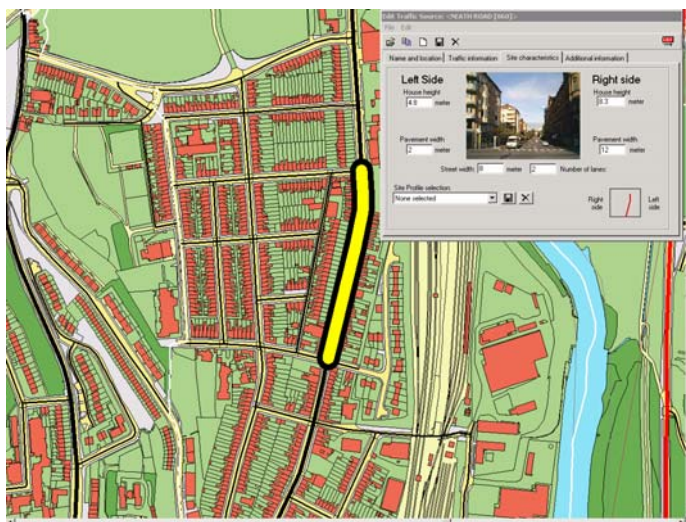
Map 49 - Location of GPRS Automatic Traffic Counters



- Discussions have commenced to develop an interface to manage the dissemination of information to local media i.e. traffic bulletins and roadside signage. This system will receive output predictions from Nowcaster and will take logical decisions upon what messages are disseminated to the local news media as well as the variable message signs located initially within the lower Swansea valley. Discussions are ongoing with regard to the specification of the variable message signs.
- Emissions data is being collated and inputted into an emissions database (EDB) which will be central to the system. The information required is extensive and includes all point source /area/grid emissions sources.



Every road link is in process of being classified and the details inputted into



the EDB in order that the model understands the local conditions influencing dispersion in that road link. Width of road/pavement and building heights are being provided as parameters into the emissions database.

- Installation of a dedicated 30m meteorological mast at Cwm Level Park within the lower Swansea Valley to provide high quality temperature and wind profiles data in the lowest atmospheric layer in the valley into the models.



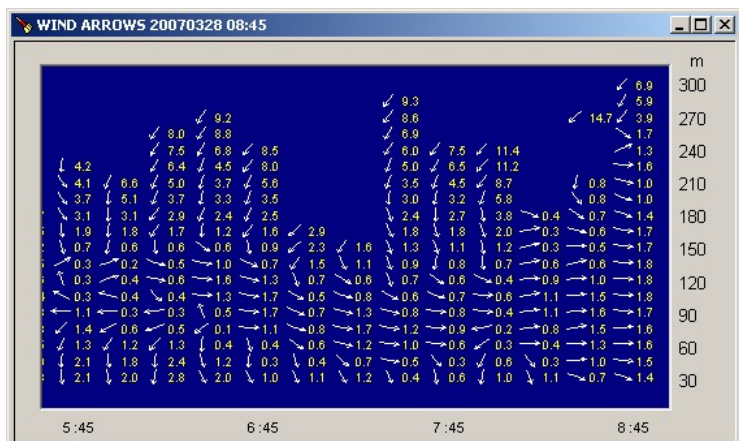
### Meteorological parameters measured

- Wind Speed at 30m
- Wind Direction at 30m
- Global Radiation at 30m
- Wind Speed at 10m
- Wind Direction at 10m
- 22m Differential Temperature
- 8m Differential Temperature
- 2m Absolute Temperature
- 2m Relative Humidity
- Rainfall

- Installation of an AQ500 “Wind Profiler” within the lower Swansea Valley.



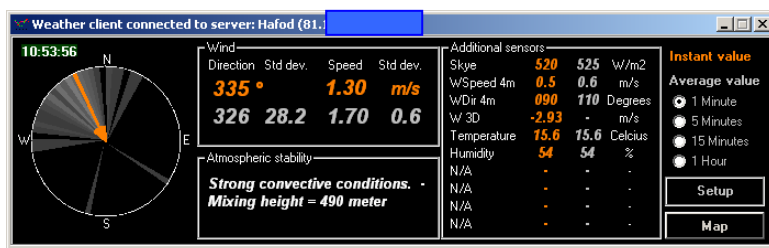
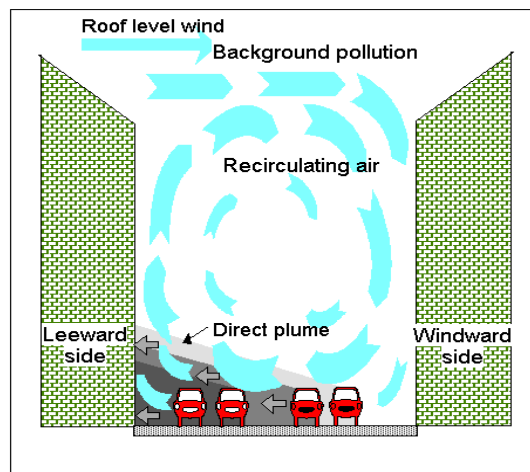
This equipment measures the wind speed and wind direction in 15m “layers” up to its maximum height range of 300m.



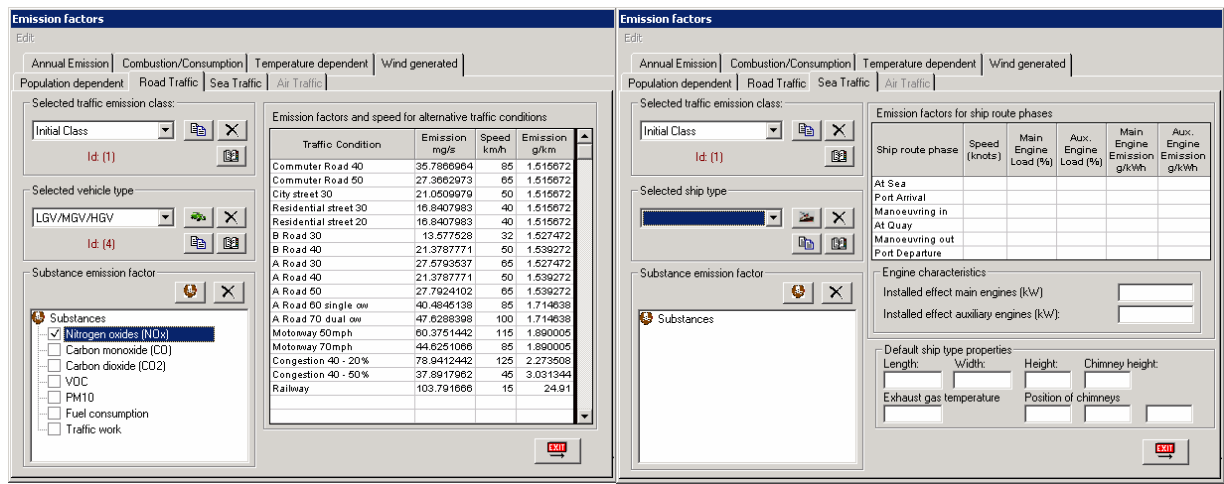
- Establishment of a street canyon meteorological station within Neath Road. This station has been fixed to the front elevation of the Hafod Post Office opposite the open path air quality measurements being undertaken by the Hafod DOAS. This station will supply the meteorological information to validate Nowcaster and other modelling output/predictions/forecasts.

### Meteorological parameters measured

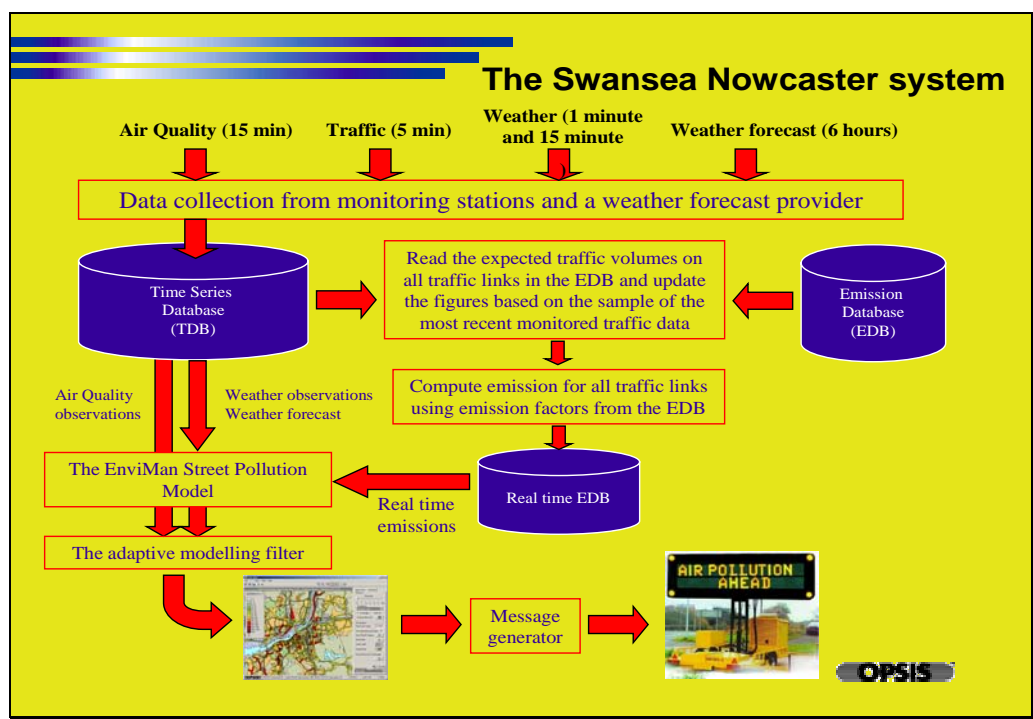
- Global Radiation
- Wind Speed 5m above roof ridge level
- Wind Direction 5m above roof ridge level
- Horizontal Wind Speed at first floor level
- Horizontal Wind Direction at first floor level
- Vertical Wind Speed at first floor level
- Air Temperature at first floor level
- Relative Humidity at first floor level



- Development of emission factors for all modes of transportation.



- A schematic of the system under development is shown below



Schematic 1 - Swansea Nowcaster Traffic Management System

- Additional air quality monitoring stations have been installed within St. Thomas (see action point 8 above) and an additional 10 laser light scattering PM<sub>10</sub> analysers are to be installed during 2007.

- The Nowcaster model interface with the system under development is still undergoing customisation to allow unattended import of all required datasets and automatic operation and output of predictions. This is taking longer than anticipated.

As a result of the considerable testing and development works now ongoing it is envisaged that the system will be proven by December 2007. **However, further expansion and development of the system will be severely restricted by the budgetary constraints that the authority is now working to. There is no Capital allocation for 2007/2008 or subsequent years for this project and there is also a reduction in the Pollution Control Revenue budget for the financial year 2007/2008.** This is also relevant to the hard physical works on the ground planned within the Hafod Air Quality Management Area.

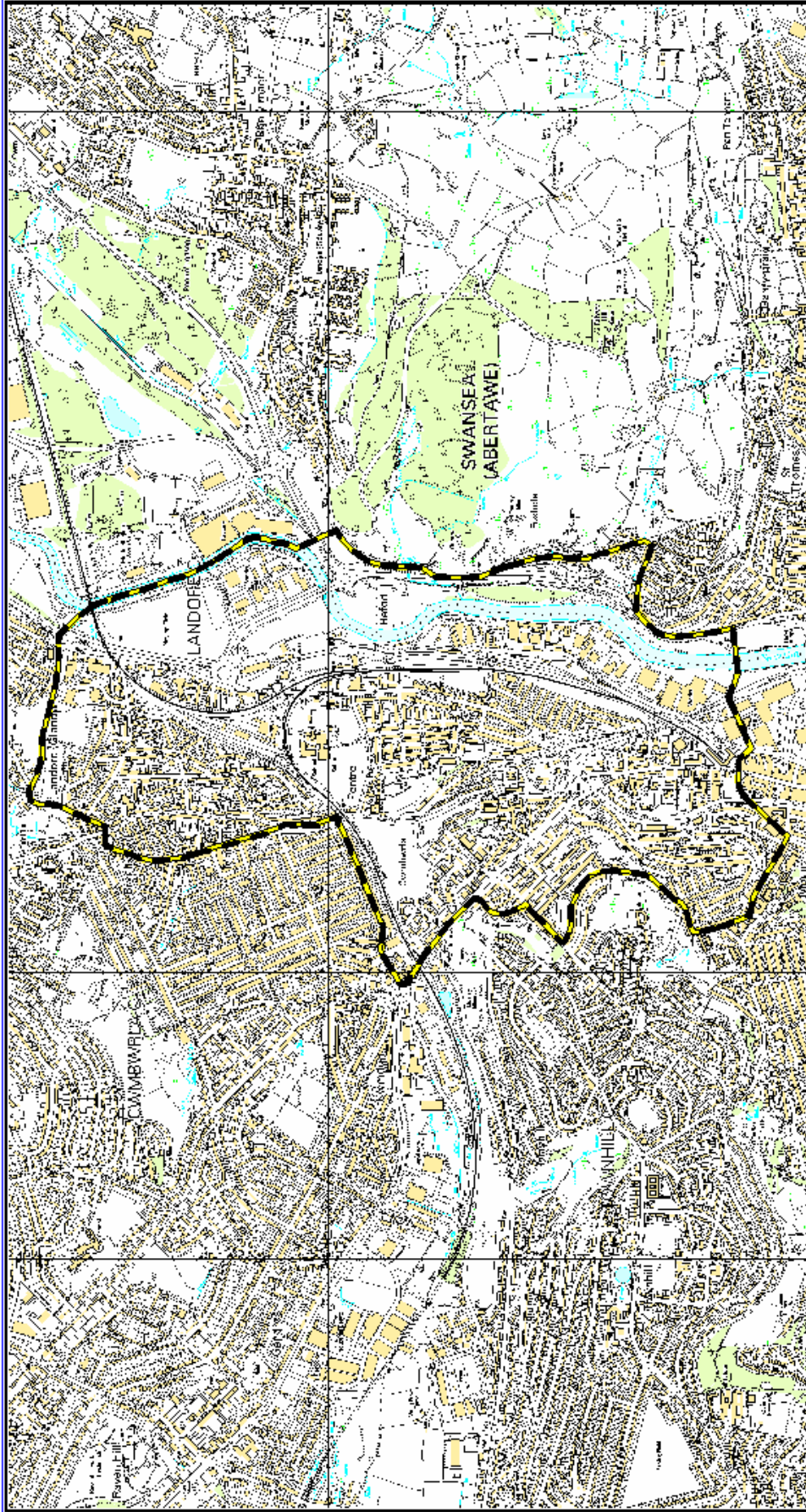


## 8 Planning Policies

Policy EV40 has been inserted within the authorities draft Unitary Development Plan. In particular, sub policies within policy EV40 seek to clarify the authorities position with regard to air quality considerations.

- 1.8.8 Pollution may cause significant damage to human health, quality of life, residential amenity, and the natural and historic environment. This policy seeks to ensure that developments that would result in unacceptable high levels of noise, light or air pollution are appropriately located away from residential areas, other sensitive developments and areas of landscape, natural environment and heritage importance. The policy also seeks to ensure that incompatible development and land uses are not located close to existing sources of potential pollution.*
- 1.8.9 The adverse effects of pollution are an important consideration when determining planning applications. When assessing new development proposals the Council will seek to minimise the impact of pollution of all kinds, and where possible planning conditions will be used to minimise environmental harm. The Council will look to the statutory environmental agencies to use their anti pollution legislative powers to monitor and enforce against discharges, noise, etc.*
- 1.8.10 Planning permission will not be granted for development that would be harmful to air quality by virtue of emissions from the development itself or the additional new traffic movements it would generate. Neither will permission be granted where a development is proposed that would increase the number of exposed individuals in an area likely to fail UK air quality objectives (proposed or in Regulations). This may be a declared Air Quality Management Area (AQMA), or an area that might become an AQMA if the application were to be granted.*

# Annexe 1



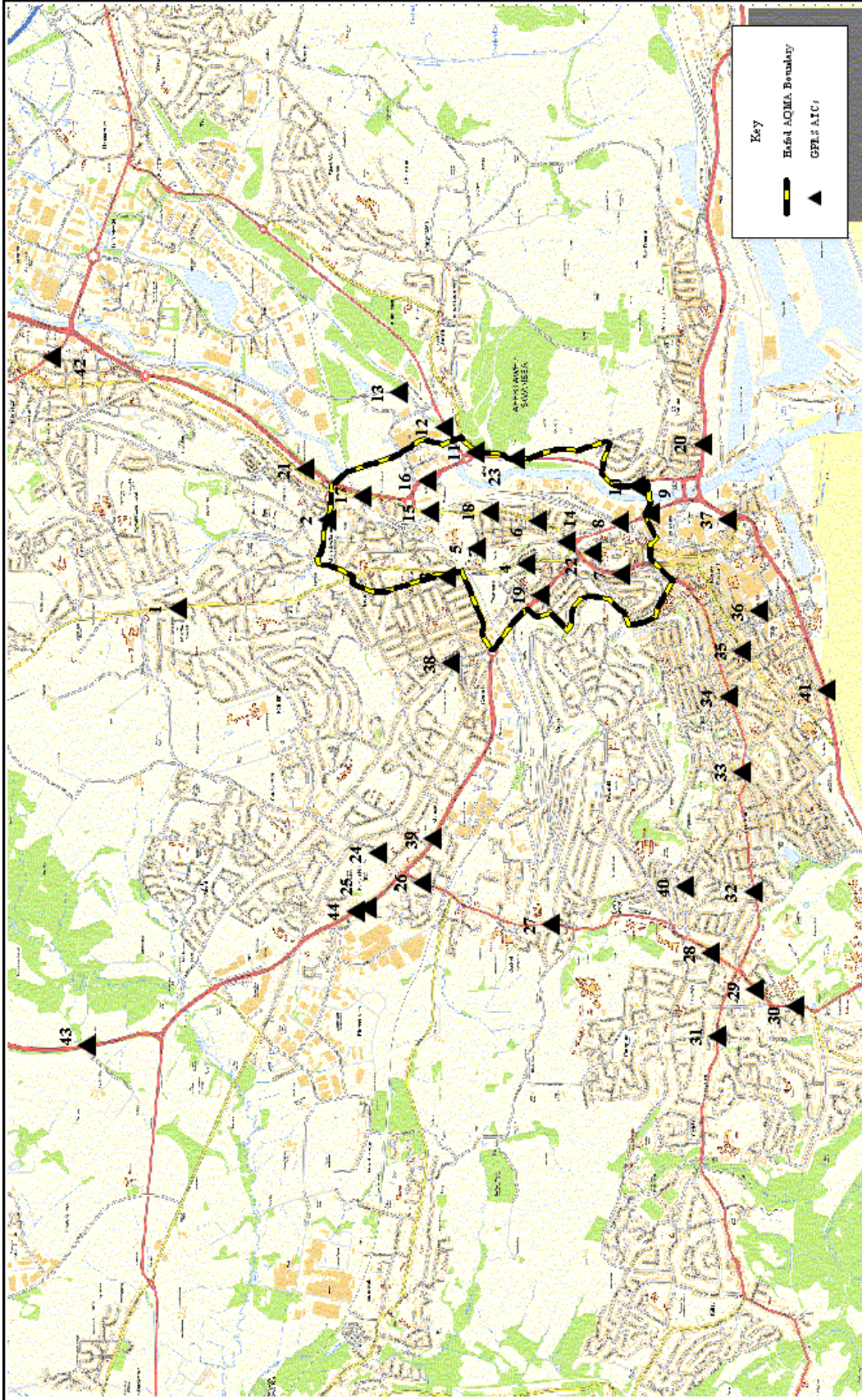
**The Hafod Air Quality Management Area (N02)  
City & County of Swansea (Hafod Air Quality Management Area (NO2)) Order 2001**



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 Scale 1:12 000

## Annexe 2





**Location of GPRS Automatic Traffic Counters  
Locations as of May 2007**

500 0 500 1000 1500 2000 2500 3000 3500 Meters

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Pollution Control Division  
Environment Department  
City & County of Swasea

**Key**

- Rabat AQMA Boundary
- ▲ GPRS ATC



## Annexe 3



As these files are large spreadsheets, designed to print landscape at A3 please contact:

Pollution Control Division,  
Environment Department,  
City & County of Swansea,  
Room 401,  
The Guildhall,  
Swansea. SA1 4PE

Tel +44 (0)1792 635600

or by email

[pollution@swansea.gov.uk](mailto:pollution@swansea.gov.uk)

and they will be sent via the postal system to you.