

**The Highland Council**  
**Local Air Quality Progress Report 2005**

**TEC Services**  
**June, 2005**

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## **1 Background**

The UK Government published its strategic policy framework for air quality management in 1995 establishing national strategies and policies on air quality which culminated in the Environment Act 1995. The Air Quality Strategy provides a framework for air quality control through air quality standards and air quality management. These air quality standards and their objectives have been enacted through the Air Quality Regulations in 1997, 2000 and 2002. The Environment Act 1995 requires Local Authorities to undertake air quality reviews. In areas where an air quality objective is not anticipated to be met, Local Authorities are required to establish Air Quality Management Areas and implement action plans to improve air quality.

## 1.1 Air Quality Objectives

Objectives included in the Air Quality (Scotland) Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management are outlined in Figure 1

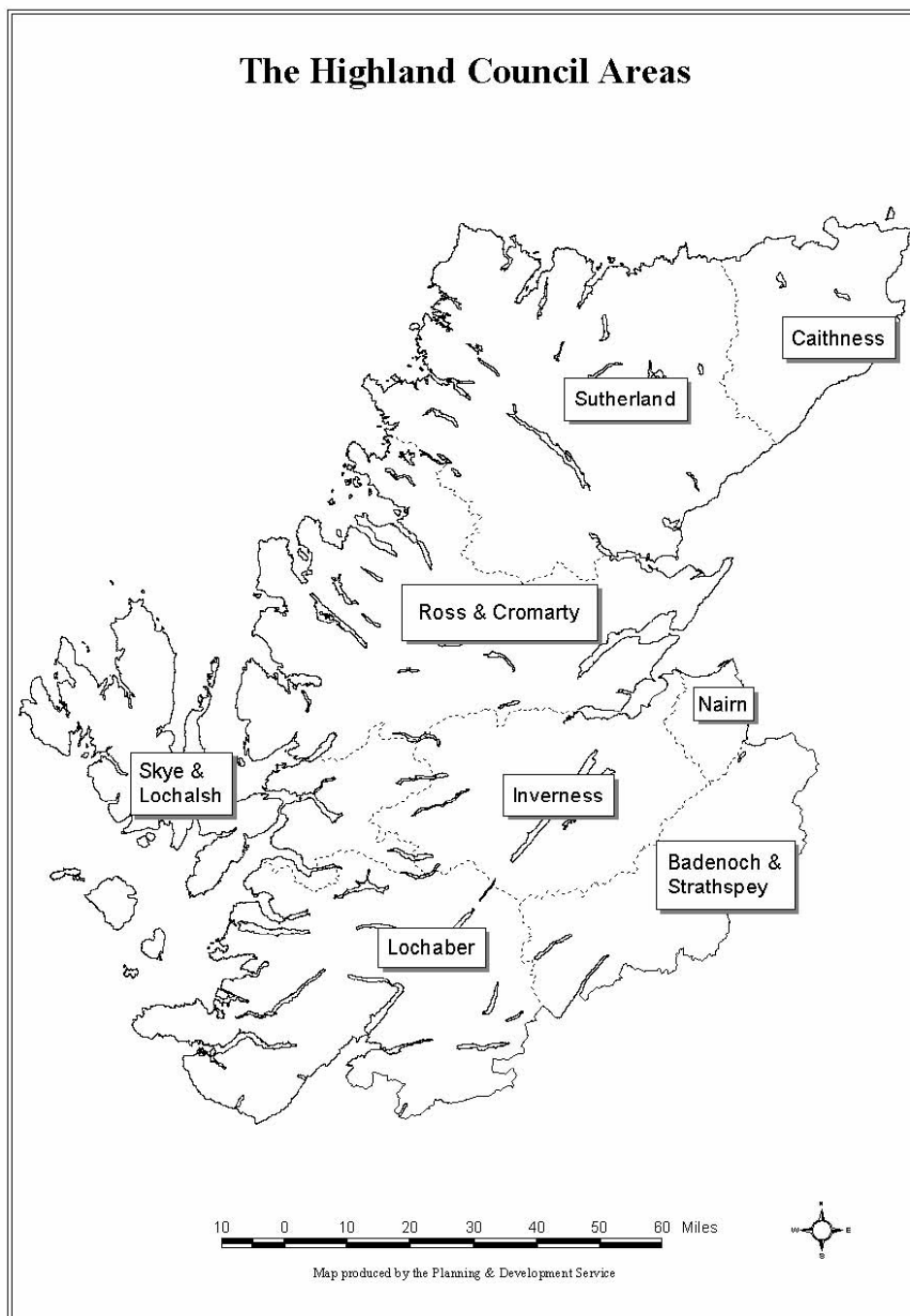
Figure 1 Air Quality Objectives

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
<b>Benzene</b>			
All authorities	16.25 $\mu\text{g}/\text{m}^3$	running annual mean	31.12.2003
Authorities in England and Wales only	5.00 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2010
Authorities in Scotland and Northern Ireland only	3.25 $\mu\text{g}/\text{m}^3$	running annual mean	31.12.2010
<b>1,3-Butadiene</b>	2.25 $\mu\text{g}/\text{m}^3$	running annual mean	31.12.2003
<b>Carbon monoxide</b>			
Authorities in England, Wales and Northern Ireland only	10.0 $\text{mg}/\text{m}^3$	maximum daily running 8-hour mean	31.12.2003
Authorities in Scotland only	10.0 $\text{mg}/\text{m}^3$	running 8-hour mean	31.12.2003
<b>Lead</b>			
	0.5 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2008
<b>Nitrogen dioxide</b>			
	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1 hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2005
<b>Particles (PM<sub>10</sub>) (gravimetric)</b>			
All authorities	50 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 35 times a year	24 hour mean	31.12.2004
	40 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2004
Authorities in Scotland only			
	50 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 7 times a year	24 hour mean	31.12.2010
	18 $\mu\text{g}/\text{m}^3$	annual mean	31.12.2010
<b>Sulphur dioxide</b>			
	350 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 24 times a year	1 hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 3 times a year	24 hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 35 times a year	15 minute mean	31.12.2005

1.2 The Highland Council Areas

Figure 2 shows the administrative areas in the Highland Council. Dingwall is located in the Ross and Cromarty Area

Figure 2 The Highland Council Areas



### **1.3 Progress Reports**

Highland Council published an Updating and Screening Assessment in June, 2003. The conclusions of this assessment indicated that the authority was should proceed to undertake detailed assessments for Sulphur dioxide at Fort William and Castletown and Benzene at Inverness and Nigg. On the advice of the Scottish Executive and the Scottish Environment Protection Agency, it was agreed that a detailed assessment would also be undertaken for Nitrogen dioxide at the Inverness City centre.

Annual Air Quality Progress Reports between subsequent rounds of review and assessments require to be produced thereby ensuring continuity in the Local Air Quality Management (LAQM) process. This is Highland Council's first Progress report and focuses on developments in 2004.

This Progress Report has regard to the requirements and recommendations of the Scottish Executives document LAQM.PRG(03) – Progress Report Guidance

The aims of Progress Reports are to:

- report progress on implementing local air quality management; and
- report progress in maintaining concentrations below the air quality objectives.

This Progress Report provides information regarding:

- new monitoring results; and
- new local developments that might affect local air quality

## 2 New Monitoring Results

### 2.1 New Monitoring Locations – Nitrogen dioxide

Nitrogen dioxide (NO<sub>2</sub>) is monitored on a monthly basis at a number of locations in Dingwall and Inverness using diffusion tube samplers. The four monitoring sites in Dingwall are included in the UK national survey.

During 2004, additional diffusion tubes were exposed at:-

- Telford Street at the automatic monitoring site, for the purpose of obtaining bias adjustment data.. Tubes IV4A, IV4B and IV4C
- Queensgate - In order to assess the validity of the results from site IV3A in Queensgate, tubes IV3B and IV3C were exposed away from the kerbside but within 1 to 5 metres of the kerb
- Academy Street – At the site of the proposed site of a second automatic monitoring station a second tube, IV2 B was exposed.

The locations of all diffusion tube sites are shown in the maps in Appendix A.

### 2.3 Details of Diffusion Tube Sampling Method and Analysis

Nitrogen Dioxide	
Sampling Method	Sampling is carried out following the guidance contained within the UK Nitrogen Dioxide Diffusion Tube network Instruction Manual
Analytical Laboratory	Gradko International Ltd
Accreditation	Diffusion tubes are tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. The Laboratory analytical method is accredited by UKAS.
Participation in inter laboratory round-robin exercises	Gradko International Ltd. Participated in the NO <sub>2</sub> Network Field Intercomparison 2004. The laboratory met the minimum participation criteria and the performance criteria in this comparison.
Type of Tube	Palmes
Absorbent/Tube preparation method	20% TEA/WATER
Limit of detection	0.01 µg NO <sub>2</sub>

### 2.4 Nitrogen Dioxide Monitoring Results (Diffusion Tubes) 2004

The diffusion tubes are prepared and analysed by Gradko. The tubes are prepared using 20% TEA in water. All quality controls are in place. Gradko participate in the NO<sub>2</sub> Network Field Intercomparison. In 2004, the bias adjustment factor for the Gradko 20% TEA in water diffusion tubes was 0.82 +/- 0.10.

It is a fact of life that, on occasion, diffusion tubes are removed or vandalised. Figure 3 shows the number of months data that was captured for each site

**Figure 3 Number of months for which data was collected in 2004**

IV1	IV2A	IV2B	IV3A	IV3B	IV3C	IV4A	IV4B	IV4C	IV5	RC1	RC2	RC3	RC4
9	12	9	12	10	8	12	12	12	12	12	12	10	12

Figure 4 shows the annual mean measurement values for nitrogen dioxide in 2004 at each of the monitoring locations. The fifth and sixth columns of Figure 4 show the bias corrected annual mean values for nitrogen dioxide.

In column 5, a bias adjustment factor of 0.94 was obtained from <http://www.uwe.ac.uk/aqm/review/diffusiontube100505.xls> published by Air Quality Consultants Ltd on behalf of Defra, the Welsh Assembly Government, the Scottish Executive and the Department of the Environment Northern Ireland. This factor is the overall factor derived from 10 collocation studies undertaken by Gradko in 2004 at sites where the diffusion tube medium was 20% TEA in water.

In column 6, a bias adjustment factor of 0.97 was calculated from the collocation study undertaken at the automatic monitoring site at Telford Street, Inverness in 2004 in accordance with the guidance available at Review And Assessment Help Desk Website (Operated by Air Quality Consultants Ltd. and the AQM Resource Centre, UWE) <http://www.uwe.ac.uk/aqm/review/no2dtbiasexplain.pdf>

Having regard to the guidance at:-

- <http://www.uwe.ac.uk/aqm/review/mfaqroad.html#ROAD6>; and
- [http://www.airquality.co.uk/archive/kb.php?action=showpost&question\\_id=332](http://www.airquality.co.uk/archive/kb.php?action=showpost&question_id=332)

the Gradko bias adjustment factor was used for all sites other than Telford Street where the Telford Street bias adjustment factor was used to obtain the bias correction.



Figure 4 Nitrogen dioxide diffusion tube annual means with bias corrections

Site	Town	Street	Annual mean	Bias corrected (by Gradko factor of 0.94) $\mu\text{g}/\text{m}^3$	Bias corrected (by Telford Street collocation factor of 0.97) $\mu\text{g}/\text{m}^3$
IV1	Inverness	Union Street	39.2	<b>36.8</b>	<del>38.2</del>
IV2A	Inverness	Academy St.	36.5	<b>34.3</b>	35.6
IV2B	Inverness	Academy St.	26.4	<b>23.1</b>	24
IV3A	Inverness	Queensgate	43.2	<b>40.6</b>	<del>42.2</del>
IV3B	Inverness	Queensgate	29.9	<b>28.1</b>	<del>29.2</del>
IV3C	Inverness	Queensgate	39.6	<b>37.2</b>	38.6
IV4A	Inverness	Telford Street	23.6	<del>22.1</del>	<b>23</b>
IV4B	Inverness	Telford Street	23.2	<del>20.8</del>	<b>22.7</b>
IV4C	Inverness	Telford Street	22.6	<del>21.3</del>	<b>22.1</b>
IV5	Inverness	Kenneth Street	26.1	<b>24.5</b>	<del>25.4</del>
RC1	Dingwall	Station Road	21.3	<b>20</b>	<del>20.8</del>
RC2	Dingwall	Wyvis Terrace	28.3	<b>26.6</b>	<del>27.6</del>
RC3	Dingwall	Burns Crescent	10	<b>9.4</b>	<del>9.7</del>
RC4	Dingwall	Kinnairdie Ave.	9.9	<b>9.3</b>	<del>9.7</del>

## 2.5 Estimated Nitrogen Dioxide Annual Means for 2005

Estimates of annual average NO<sub>2</sub> concentrations in 2005 from measured data at diffusion tube monitoring sites in 2004 were calculated using correction factors published in Technical Guidance LAQM.TG(03).

<http://www.defra.gov.uk/environment/airquality/laqm/guidance/pdf/laqm-tg03.pdf>

This information is contained within column 5 of Figure 5.

The predicted annual mean NO<sub>2</sub> concentrations for 2005 are below the annual mean objective of 40µg/m<sup>3</sup>.

**Figure 5 Estimated Nitrogen dioxide annual means 2005**

Site	Town	Street	Measured annual mean 2004 µg/m <sup>3</sup>	Estimated annual mean 2005 µg/m <sup>3</sup>
IV1	Inverness	Union Street	36.8	35.9
IV2A	Inverness	Academy Street	34.3	33.5
IV2B	Inverness	Academy Street	23.1	22.6
IV3A	Inverness	Queensgate	40.6	39.6
IV3B	Inverness	Queensgate	28.1	27.4
IV3C	Inverness	Queensgate	37.2	36.3
IV4A	Inverness	Telford Street	23	22.4
IV4B	Inverness	Telford Street	22.7	22.1
IV4C	Inverness	Telford Street	22.1	21.5
IV5	Inverness	Kenneth Street	24.5	23.9
RC1	Dingwall	Station Road	20	19.5
RC2	Dingwall	Wyvis Terrace	26.6	26
RC3	Dingwall	Burns Crescent	9.4	9.1
RC4	Dingwall	Kinnairdie Avenue	9.3	9.1

The highest annual mean was in Queensgate at the kerbside.

The highest 2004 bias adjusted annual mean, IV3A at 40.6 µg/m<sup>3</sup>, was at the kerb on the south side of Queensgate. Levels were lower at the two new façade sites– 37.2 µg/m<sup>3</sup> at IV3C (south side) and 28.1 µg/m<sup>3</sup> at IV3B (north side). It is suggested that these two sites are more representative of nitrogen dioxide levels in Queensgate.

The estimated annual means for nitrogen dioxide in 2005 are all below the air quality objective of 40 µg/m<sup>3</sup>.

## 2.6 Automatic Monitoring Station – Telford Street, Inverness

Site Address: Telford Street IV3 5LE

OS Grid Reference: NH 657 456

Site Type: Roadside

StartDate:17/07/01

The site is adjacent to a pathway connecting Telford Street (A862) and Cameron Square Inverness. It is 4 metres from the A862. It is a predominantly residential area with a retail business park 250 metres away.

Nitrogen dioxide, carbon monoxide and particulate matter have been monitored at this site since July 2001. Nitrogen dioxide and carbon monoxide are monitored continuously whereas PM10 is measured gravimetrically by a Partisol, with filters being changed daily.

The results for the three complete years, 2002 to 2004 are shown in Figures 6a to 6c. All data has been ratified.

Figure 6a Nitrogen dioxide levels monitored at Telford Street, Inverness

<b>Nitrogen Dioxide</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>Air quality Objective</b>
% Data Captured	97.8	98.3	98.1	-
Annual mean $\mu\text{g}/\text{m}^3$	21.85	23.1	22.6	The air quality objective annual mean to be achieved by 31.12.2005 is <b><math>40\mu\text{g}/\text{m}^3</math></b>
Maximum hourly mean $\mu\text{g}/\text{m}^3$	117	130	157	The air quality objective hourly mean to be achieved by 31.12.2005 is that an hourly mean of <b><math>200\mu\text{g}/\text{m}^3</math></b> is not to be exceeded more than <b>18 times a year</b>

Figure 6b PM<sub>10</sub> levels monitored at Telford Street, Inverness

Particulate matter (PM <sub>10</sub> )	2002	2003	2004	Air quality Objective
% Data Captured	65.8	93.4	95.3	
Annual mean µg/m <sup>3</sup> Gravimetric	17.3	17.3	15	18 µg/m <sup>3</sup> to be achieved by 31.12.2010
Maximum 24 hour mean µg/m <sup>3</sup> Gravimetric	51	68	54	
Number of Exceedences (>50 µg/m <sup>3</sup> )	1 on 31/12/2002	10 between 07/01/03 and 21/04/03	1 on 10/11/04	The air quality objective to be achieved by 31.12.2010 is <b>50 µg/m<sup>3</sup> is not to be exceeded more than 7 times a year</b>

There is no obvious reason for the ten exceedences of the 50 µg/m<sup>3</sup> limit in the spring of 2003.

Figure 6c Carbon monoxide levels monitored at Telford Street, Inverness

Carbon monoxide	2002	2003	2004	Air quality Objective
% Data Captured	65.8	93.5	95.3	-
Annual mean mg/m <sup>3</sup>	0.43	0.45	0.43	
Maximum hourly mean mg/m <sup>3</sup>	4.1	3.9	3.8	
Number of running 8-hour means exceeding 10mg/m <sup>3</sup>	0	0	0	The air quality objective is that <b>the running 8-hour mean must not exceed 10 mg/m<sup>3</sup></b>

With the exception of PM<sub>10</sub> in 2003, current and future air quality objectives are being met.

## 2.7 New Monitoring Locations – Benzene

The 2003 report concluded that a detailed assessment of benzene emissions was required in the vicinity of the petrol terminals at Inverness harbour and the Talisman Energy (UK) Ltd petroleum refining process at Nigg in Easter Ross.

Monitoring by passive diffusion tube was undertaken at Lotland Street, Inverness and at Nigg. The location of the diffusion tubes are shown in the maps in Appendix A. The monitoring commenced in March 2004 and the diffusion tubes were exposed on a monthly basis. Figure 7 details the results obtained over a 12 month period from March 2004 to February 2005.

**Figure 7 Benzene diffusion tube monthly results 2004 -2005**

Exposure Month	Nigg	Lotland Street
2004-Mar	0.28	0.49
2004-Apr	0.40	0.51
2004-May	0.37	0.48
2004-Jun		0.36
2004-Jul	0.12	0.34
2004-Aug	0.17	0.29
2004-Sep	0.1	0.3
2004-Oct	0.16	0.68
2004-Nov	0.21	0.71
2004-Dec	0.13	0.39
2005-Jan	0.14	0.56
2005-Feb	0.22	0.52
<b>12 Month Mean Concentration</b>	<b>0.21</b>	<b>0.47</b>

Although the annual mean thus obtained cannot be compared directly with the air quality objective of  $16.25 \mu\text{g}/\text{m}^3$  measured continuously as a running annual mean, the diffusion tube levels are low enough to conclude that the air quality objective is being met.

## 2.8 Details of Diffusion Tube Sampling Method and Analysis

Benzene	
Sampling Method	Sampling is carried out following the guidance contained with the Instruction manual for exposure and location of Passive Diffusion Air Monitors supplied by Gradko International Ltd.
Analytical Laboratory	Gradko International Ltd
Accreditation	Diffusion tubes are tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. The Laboratory analytical method is accredited by UKAS.
Type of Tube	Chromasorb 106
Absorbent/Tube preparation method	Chromasorb
Limit of Detection	2.80 ng
Uptake Rate	1.28 ng.ppm <sup>-1</sup> min <sup>-1</sup>

A field (transport) blank benzene diffusion tube was submitted with each tube exposed at the Nigg site. All results for RC5 – Nigg have therefore been blank subtracted. The results for Lotland Place are not blank subtracted.

### **3 Local Developments**

#### **3.1 Traffic in Inverness City centre**

The level of pollutants from traffic in the City centre has given rise to concern. The City centre is heavily trafficked by buses.

During the year, observations were made on how long buses were left to idle while waiting in Queensgate and Union Street. Meetings were held with bus companies who were supportive in requiring their drivers to switch off their engines in line with the Scottish Executive's guidelines. Highland Council has delegated to the Director of TEC Services, the authority to implement the "Local Authority Powers To Require Drivers To Switch Off Engines When Parked" So far, it has not been necessary to implement these measures.

A package of measures is currently being put together which, when realised in 2006 will reduce the traffic in the City centre. The proposals are to create more pedestrian friendly streets rather than full pedestrianisation, as access is still required for buses, taxis, disabled vehicles, delivery vehicles and cycles/motorcycles.

The reduction in traffic overall should permit more freedom of movement for the vehicles using the streets and cause less pollution from traffic waiting in queues at junctions. This, in turn, will help to keep nitrogen dioxide levels below the air quality objective limits.

#### **3.2 Local Transport Strategy for the Highlands**

The Council's Local Transport Strategy (LTS) document was approved in October 2000. It is available at [http://www.highland.gov.uk/rt/service\\_information/transport\\_strategy/lts.htm](http://www.highland.gov.uk/rt/service_information/transport_strategy/lts.htm) The next review of the Local Transport Strategy is now due. The Council has received guidance from the Scottish Executive regarding air quality issues and will embrace this guidance in it the course of the review.

#### **3.3 Industrial Processes**

The Scottish Environment Protection Agency (SEPA) has provided updated information on industrial processes in the Highland Council area. Three new processes commenced operation in 2004.

- Killara Chickens, Mains of Killravock, Croy, Inverness-shire, IV2 7PJ, s6.8 Part A, Poultry Meat production;
- Marine Harvest (Scotland) Ltd, Mallaig Harvest Station, Mallaig, PH41 4QB, s6.8 Part A, fish processing; and
- Edward Mackay Ltd, Rosslyn Yard, Brora, Sutherland KW9 6NY, s3.1 Part B, mobile concrete batching plant.

In addition there has been an extension to the Mid-Lairgs Quarry at Daviot.

None of these developments are likely to result in a significant impact on air quality.

Hunters Woollen Mill in Brora, Sutherland has closed down and this will result in a reduction of pollutants from combustion in the oil fired boiler.

#### **4 Progress with Detailed Assessment.**

The Council is proceeding to a detailed assessment for three pollutants – benzene, nitrogen dioxide and sulphur dioxide.

The investigation of benzene levels by diffusion tube commenced in March 2004 and is continuing. Details are contained in this report.

Funding has been received from the Scottish Ministers through the Local Air Quality Management 2004/05 Capital Grant Scheme to assist in the undertaking of a detailed assessment.

Highland Council has engaged Netcen, an operational division of AEA Technology to provide, maintain and operate continuous monitoring stations in order to provide 6 months of ratified data at three locations

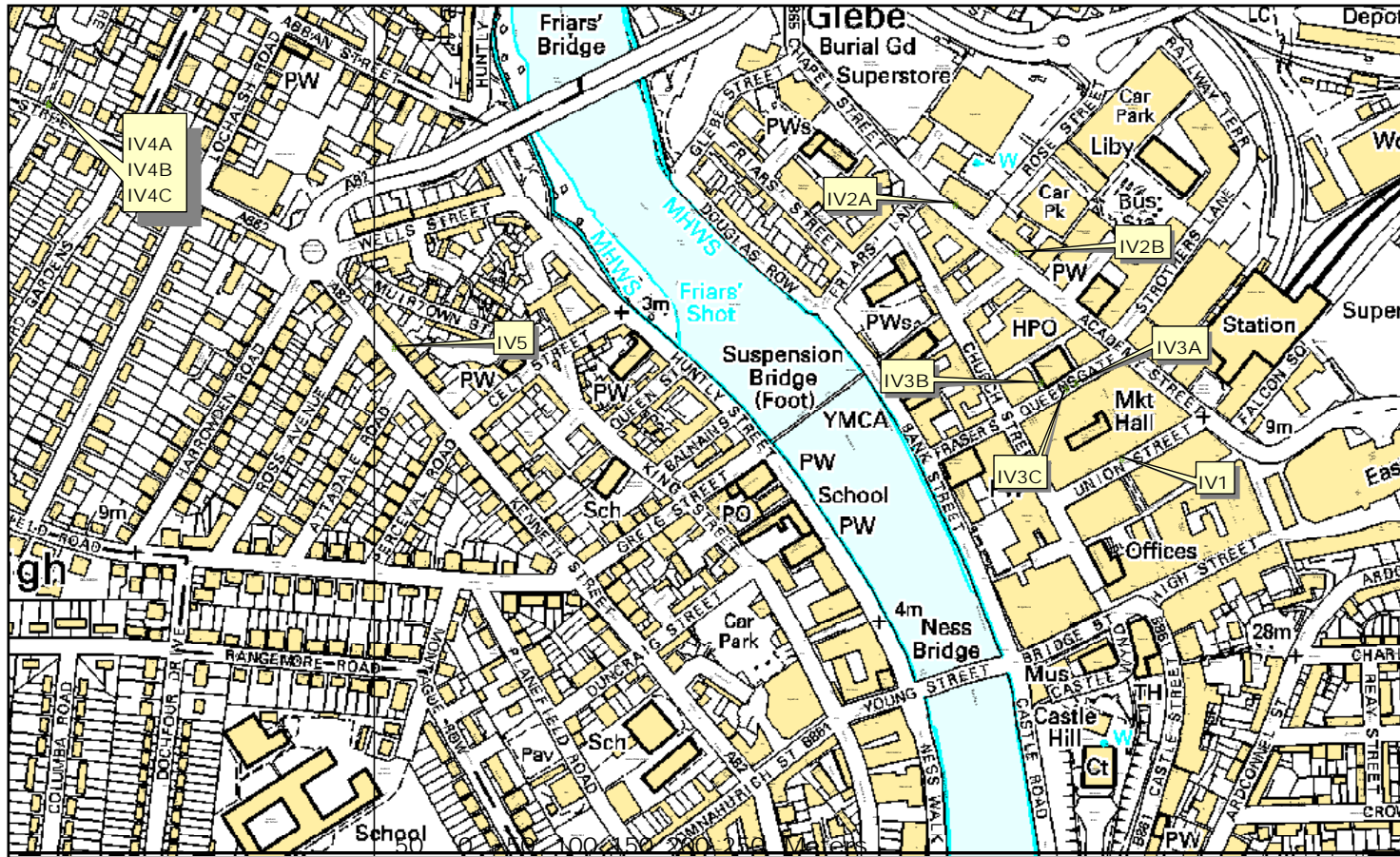
- Inverness City Centre - Nitrogen dioxide- traffic source. The continuous monitoring station has been sited in Academy Street, Inverness
- Castletown, Caithness – Sulphur dioxide – emissions from domestic solid fuel burning
- Fort William - Sulphur dioxide – emissions from an aluminium smelter and domestic solid fuel burning

The continuous monitoring commenced in December 2004 and is scheduled for completion in July, 2005. A Detailed Assessment Report will then be prepared.



**Appendix A – Maps**

- **Nitrogen dioxide diffusion tube locations – Inverness**
- **Nitrogen dioxide diffusion tube locations – Dingwall**
- **Benzene diffusion tube location – Inverness**
- **Benzene diffusion tube location – Nigg**



The Highland Council  
 16th June 2005

**Diffusion Tube Monitoring Locations**

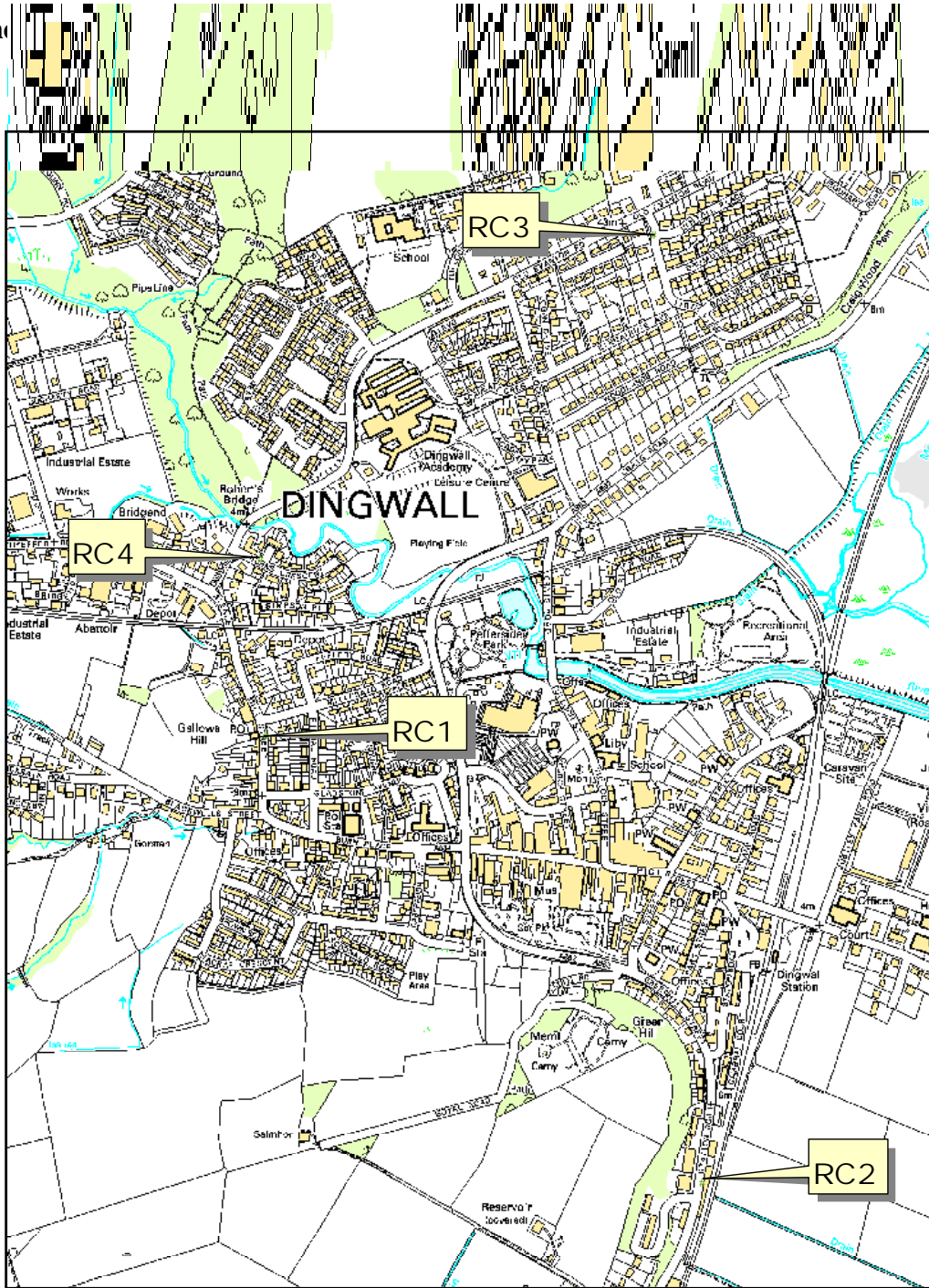
*Inverness*



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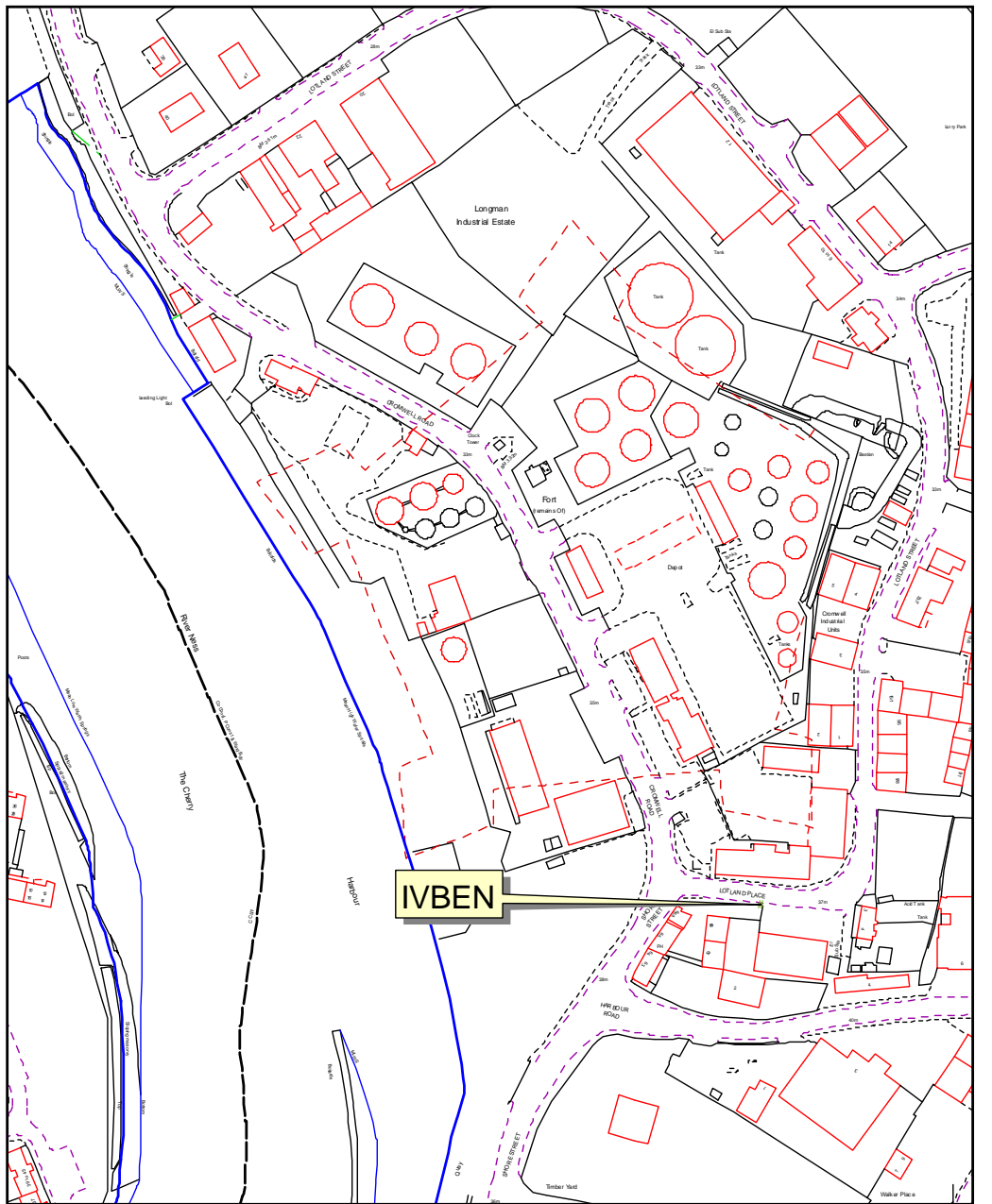
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Scale  
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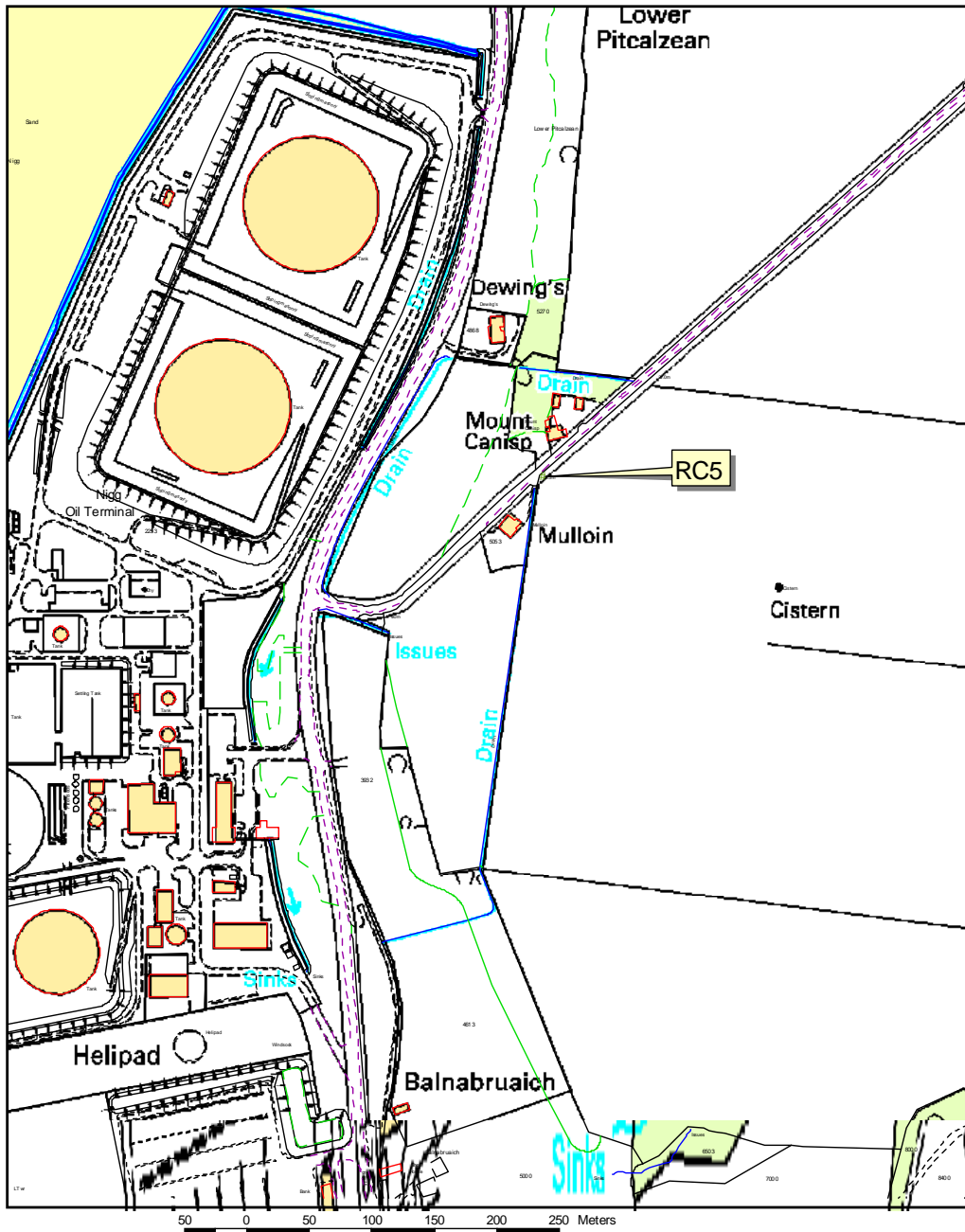
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 <p>The Highland Council Comhairle na Gàidhealtachd 2022/23 The Highland Council</p>	<h3>Diffusion Tube Monitoring Locations</h3>	 Scale <b>1:8500</b>
16th June 2005	<b>Dingwall</b>	
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 <p>The Highland Council Comhairle na Gàidhealtachd 2005/06 - The Highland Council</p>	<p><b>Benzene Monitoring Location</b> <i>Lotland Place</i></p>	 <p>Scale 1:2000</p>
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 <p>The Highland Council Comhairle na Gàidhealtachd 2005-2009 The Highland Council</p>	<p><b>Benzene Monitoring Location</b> <b>Nigg Oil Terminal</b></p>	 <p>Scale 1:4000</p>
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