



Final Report on the monitoring of Nitrogen Dioxide

Falmouth

July – December 2007

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Commissioned by Jodie Cleave, Transport Policy Officer, Cornwall County Council.

1.0 Introduction

A 6-month nitrogen dioxide (NO₂) monitoring programme in Falmouth was commissioned by the Planning, Transport and Estate department of Cornwall County Council as a response to local concerns regarding traffic volumes and resulting public health issues. A previous 12-month monitoring programme to 31st May 2006 highlighted an exceedance of the NAQS annual mean objective at Site 7 (Figure 1); other studies dating back to 2001 also recorded concentrations >40 µg m⁻³ at the Dracaena Avenue/Grenville Road junction. NETCEN have estimated a background concentration for 2005 in the Falmouth area of ~9 µg m⁻³ (http://www.airquality.co.uk/archive/laqm/tools/49_2004.csv).

1.1 National Air Quality Objectives for NO₂

NO₂ is not only a health damaging pollutant but it's also an excellent proxy measure for other traffic related pollutants. The Government's National Air Quality Strategy (NAQS) objectives for NO₂ are given in Table 1.

Table 1. NAQS objectives for nitrogen dioxide

Nitrogen dioxide (NO ₂)	Measured as	Concentration
	Annual mean	40 µg m ⁻³
	1 hour mean, 18 exceedances permitted	200 µg m ⁻³

1.2 Falmouth

Falmouth, a popular tourist destination and thriving student town, is characteristic of many Cornish towns in that the town centre layout predates the high volumes of traffic associated with modern urban centres. The resulting congestion can lead to high concentrations of traffic-related pollution compounded by adjacent tall buildings creating a canyon street effect.

Eight diffusion tubes are located around Falmouth in locations where previous monitoring has indicated high concentrations of traffic-related pollution. Site 1 is located in a background site near St Mary's Primary School approximately 1.5km from the town centre; sites 2-5 and 8 are located in the town centre; and sites 6-7 are situated on Dracaena Avenue, a primary route into Falmouth.

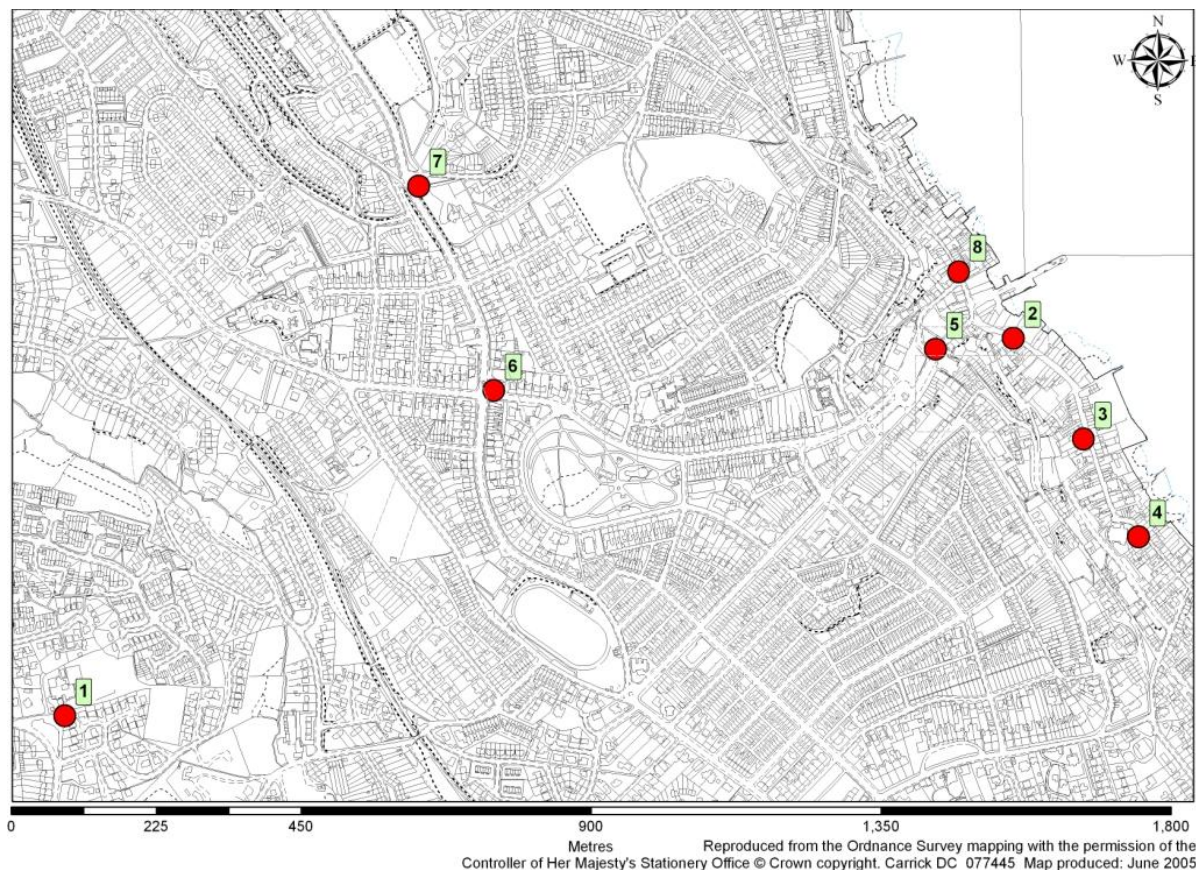


Figure 1. Falmouth town centre with the monitoring locations highlighted.

1.3 Diffusion tubes

Diffusion tubes are a relatively cheap method of monitoring NO₂ which provide monthly means for NO₂ concentrations for the immediate area in which they are deployed.

Tubes are supplied by Gradko International and the preparation method is 20% TEA (triethanolamine) in water. Tubes are exposed for one-month periods and are deployed at the beginning of each month.

In field inter-comparison exercises and QC testing undertaken by the Workplace Analysis Scheme for Proficiency (WASP) programme for NO₂ diffusion tube analysis (operated by the Health and Safety Laboratory), tubes supplied by Gradko International (Type 1, 20% triethanolamine (TEA) in water) performed well and had a Relative Standard Deviation (RSD) of standardised results for 2003 of 7%; significantly below the median of 12% for all participating laboratories. Gradko International was also given a Performance Score of “Good” for QC solution analysis for 2003 (Loader *et al*, 2005).

As the survey was 6-months DEFRA state a method for extrapolating an estimated calendar year mean (LAQM.TG(03) Box 6.5). The method calculates a correction factor allowing for seasonality in which continuous monitoring data from within a 50 mile radius is utilised. Using data from the Penryn Street, Redruth and Tregolls Road, Truro continuous monitors (chosen for their relative independence of very local factors) a correction factor of 0.99 was calculated. The DEFRA manufacturer bias adjustment factor of 0.98 was then applied to the seasonally adjusted values (<http://www.uwe.ac.uk/aqm/revie w/diffusiontube300307.xls>).

2.0 Results

2.1 Diffusion tube monitoring

As illustrated in Figure 2, Site 7 situated on Dracaena Avenue, was the only location where a monitoring programme mean $>40 \mu\text{g m}^{-3}$ recorded and therefore would exceed the NAQS annual objective. Site 2 recorded a mean concentration within 10% of the NAQS annual objective.

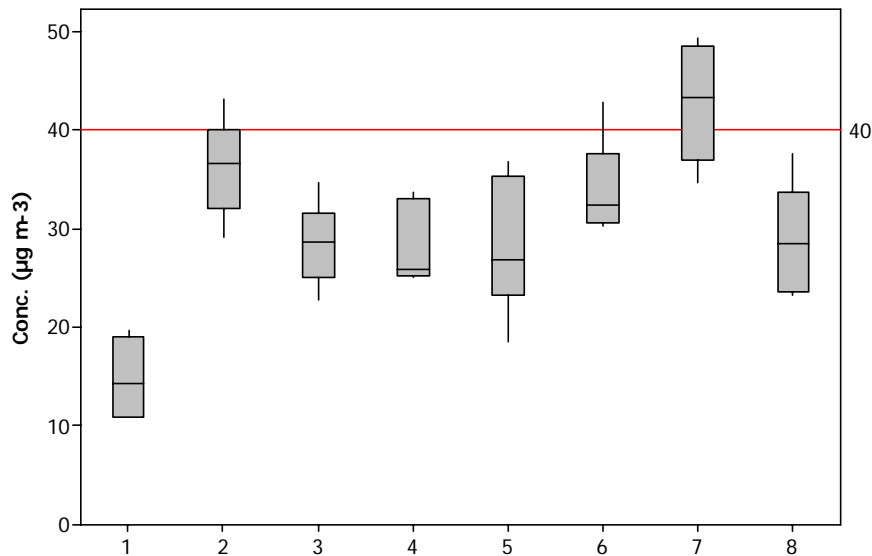


Figure 2. NO₂ concentration boxplot for the eight Falmouth diffusion tubes.

2.2 Collocated tube

A paired t-test statistical analysis concludes there is no statistical difference between the two collocated tubes located at Site 5 ($p = 0.704$); Figure 3 illustrates the range of means for the collocated pair.

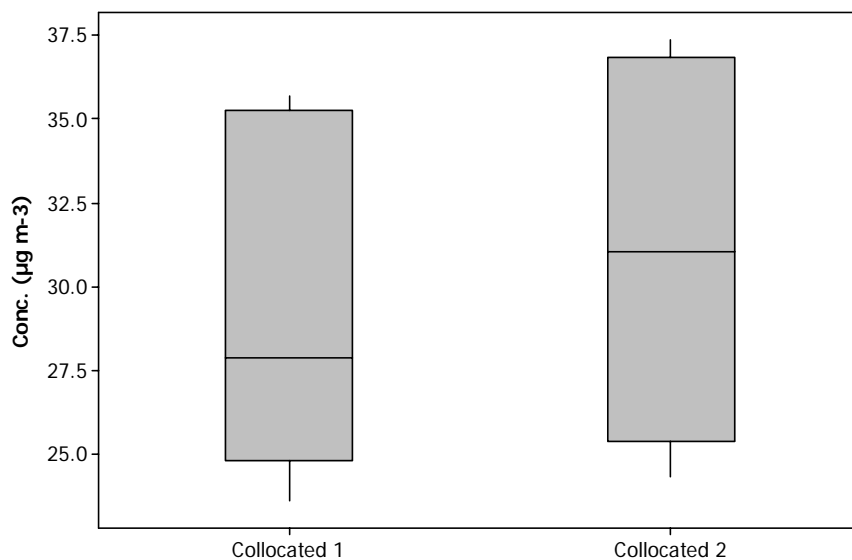


Figure 3. NO₂ concentration boxplot for the pair of collocated tubes at Site 5.

3.0 Discussion

3.1 Exceedance

One potential exceedance of the NAQS annual mean objective (calculated over a calendar year using the DEFRA annual mean correction calculation) was recorded at Site 7 on the Dracaena Avenue/Grenville Road junction with a monitoring programme mean of $42.4 \mu\text{g m}^{-3}$. Site 7 is situated on a steep incline at the beginning of a cut-out, next to a pedestrian crossing and it is suggested a combination of these factors would provide ideal conditions for traffic-related pollutants to accumulate. However, as Site 7 is not located near any residential properties and no properties are directly adjacent to the road, there would be no public health concern with regard to local air quality management.

All other tubes recorded mean concentrations below the NAQS annual objective concentration of $40 \mu\text{g m}^{-3}$ and as stated in DEFRA's LAQM.TG(03) this study is sufficient in demonstrating the negligible risk of exceeding NAQS objectives.

Located at a background location, Site 1 recorded a concentration of $14.7 \mu\text{g m}^{-3}$ approximately $5 \mu\text{g m}^{-3}$ greater than the NETCEN estimated background concentration. It is suggested the small disparity between the two values is as a result of the NETCEN value being an estimation and the recorded value is a true representation of background concentration.

3.2 Data capture

All tubes recorded 100% data capture for the monitoring period, except Site 6 where the tube for October 2007 was stolen.

3.3 Collocation analysis

The statistically significant agreement in collocated tube mean values implies that concentrations recorded at the other monitoring sites in this survey are comparable.

3.4 Comparison to previous monitoring data

A comparison of the current data to the 2005/6 12-month monitoring programme reveals no statistically significant difference between the mean concentrations at each site (p-values between 0.125 - 0.906). This suggests any developments that have occurred since 2005 have not altered air quality.

4.0 Conclusion

- There was one exceedance of the NAQS annual mean objective value recorded at Site7 at the Dracaena Avenue/Grenville Road junction. However, as there are no receptors at or near Site7 the NAQS objectives do not apply.
- All other sites recorded mean concentrations that would not exceed the NAQS annual mean objective.
- Data capture for the survey was 100% for all sites except Site 6.
- A collocation study reveals a good correlation in tube means.

Confidentiality

All sampling results from the monitoring sites in Carrick District will be the property of Carrick District Council, and will be subject to strict confidentiality and not disclosed any third party without prior formal permission from Carrick District Council.

Disclaimer

Cornwall College cannot accept any responsibility for the use to which the information is put nor for decisions, inferences or conclusions that are made on the basis on the information provided. No responsibility is taken for the accuracy of the sampling unless this is done under our own supervision.