



Devonport Air Quality Monitoring

TRL installed an air quality monitoring station on behalf of MVV Umwelt GmbH at Devonport Docks, Plymouth, to continuously measure Oxides of Nitrogen (NO, NO₂ and NO_x), Sulphur Dioxide (SO₂) and particulate concentrations (PM₁₀), and to undertake monthly measurements of PAH, PCBs, Dioxins, Furans, and Heavy Metals.

This report covers data collected between 17th August 2010 and 3rd March 2011.

UK Air Quality Objectives

Air quality standards and objectives are set out in the Air Quality (England) Regulations 2000 (as amended 2002) and the Air Quality Strategy (AQS). The limits contained within the AQS are based upon concentrations over a given period of time that are considered to be acceptable, in terms of the effects of each pollutant on human health. Table 1 outlines the Air Quality objectives for NO₂, SO₂, PM₁₀ and PAH as set out in the UK AQS published in July 2007.

Table 1. Air Quality Strategy Objectives

Objective	Compliance date
UK objectives for NO₂ set in regulations	
Hourly average concentration of 200 µg/m ³ not to be exceeded more than 18 times a year	31 December 2005
Annual mean of 40 µg/m ³	31 December 2005
UK objectives for NO_x not set in regulations (vegetation based directives; targets met)	
Annual average concentration of 30 µg/m ³	31 December 2000
UK objectives for SO₂ set in regulations	
Hourly average concentration of 350 µg/m ³ not to be exceeded more than 24 times a year	31 December 2004
UK objectives for PAH set in regulations	
Annual average concentration of 0.25 ng/m ³	31 December 2010
UK objectives for Particles (PM₁₀) set in regulations	
24 hour running mean of 50 µg/m ³ not to be exceeded more than 35 times a year	31 December 2004
Annual mean concentration of 40 µg/m ³	31 December 2004

Results for hourly ratified NO_x and SO₂ data at Devonport (17/08/2010 to 03/03/2011)

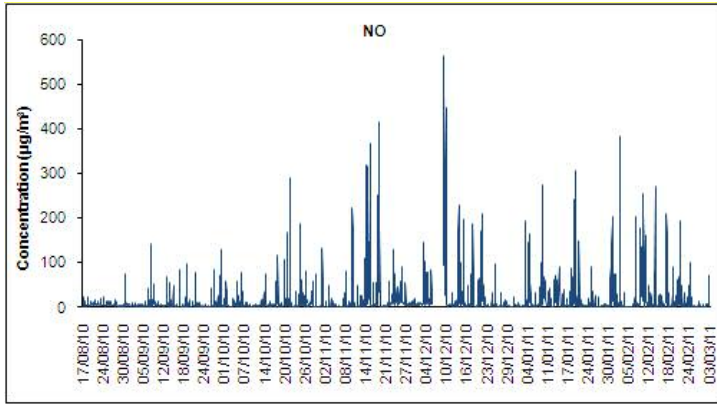


Figure 1: NO hourly data

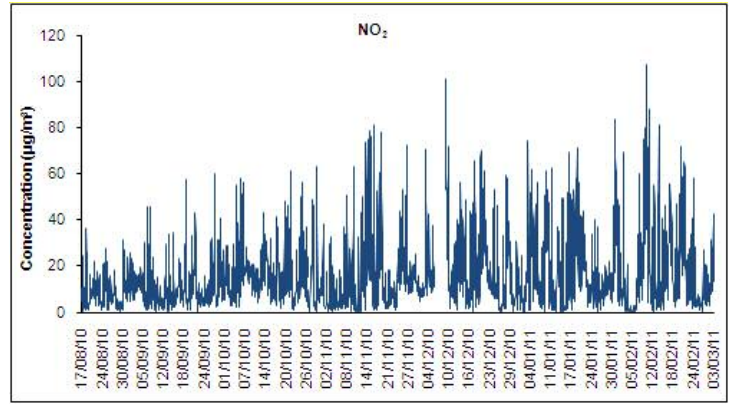


Figure 2: NO₂ hourly data

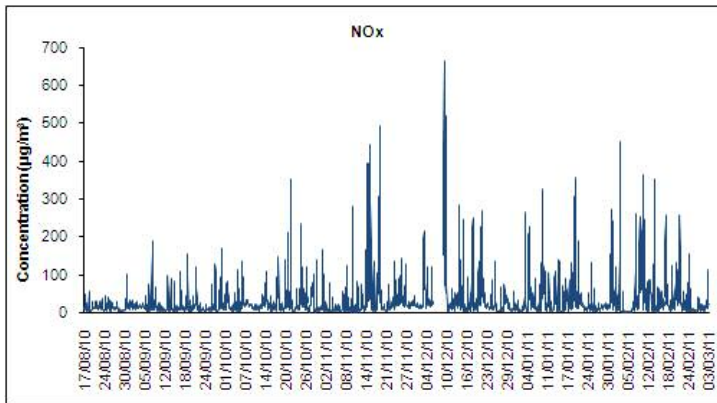


Figure 3: NO_x hourly data

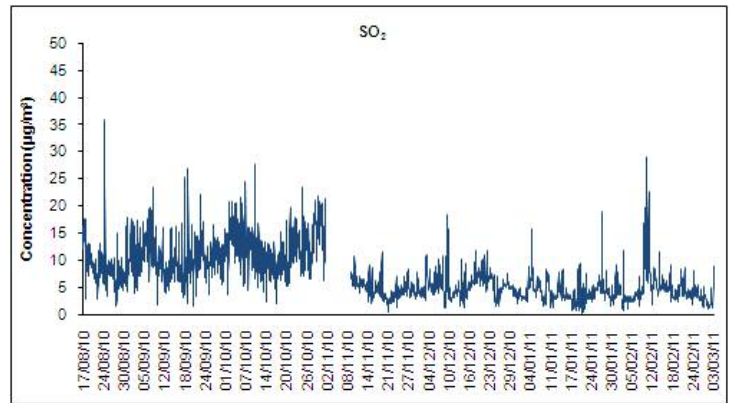


Figure 4: SO₂ hourly data

Table 2. Statistics for oxides of nitrogen and sulphur dioxide at Devonport (hourly average)

	NO	NO _x	NO ₂	SO ₂
NO ₂ 1 hour mean objective (200 µg/m ³ , 18 exceedences/year)	-	-	0	-
SO ₂ 1 hour mean objective (350 µg/m ³ , 24 exceedences/year)	-	-	-	0
Minimum (µg/m ³)	0.0	0.9	0.2	0.2
Average (µg/m ³)	14.7	30.1	15.3	7.1
Standard deviation (µg/m ³)	36.7	48.1	14.6	4.2
Median (µg/m ³)	3.7	15.6	10.9	5.8
Maximum (µg/m ³)	563.0	664.3	107.2	36.0
Data capture (%)	97.8	97.8	97.8	95.1

Results for PM₁₀ data at Devonport (18/08/2010 to 03/03/2011)

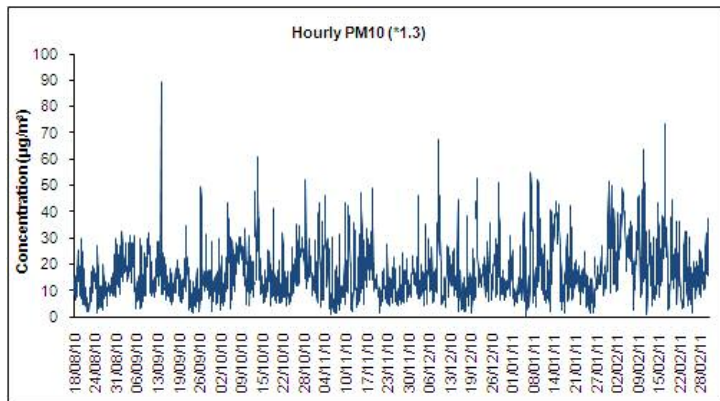


Figure 5: Adjusted PM₁₀ hourly data

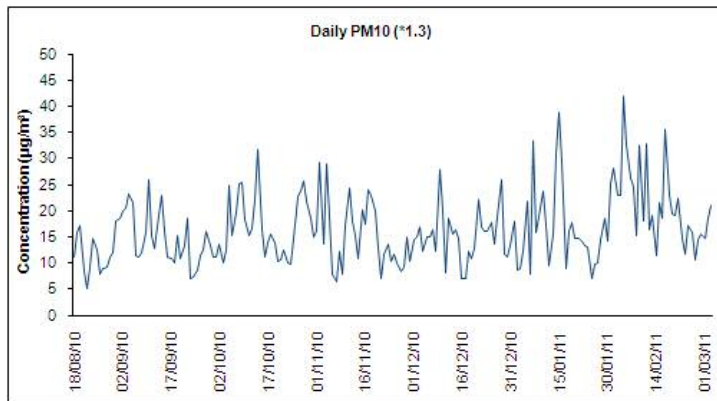


Figure 6: Adjusted PM₁₀ 24 hour average data

Table 3. Statistics for PM₁₀ at Devonport (24 hour average)

	Adjusted PM ₁₀	VCM Corrected PM ₁₀
PM₁₀ 24 hour mean objective (50 µg/m³, 35 exceedences/year)	0	0
Minimum (µg/m ³)	5.0	3.8
Average (µg/m ³)	16.3	13.3
Standard deviation (µg/m ³)	6.6	6.7
Median (µg/m ³)	15.2	11.8
Maximum (µg/m ³)	42.0	33.4
Data capture (%)	100.0	96.0

Results for average WID concentrations (ng/m³) at Devonport

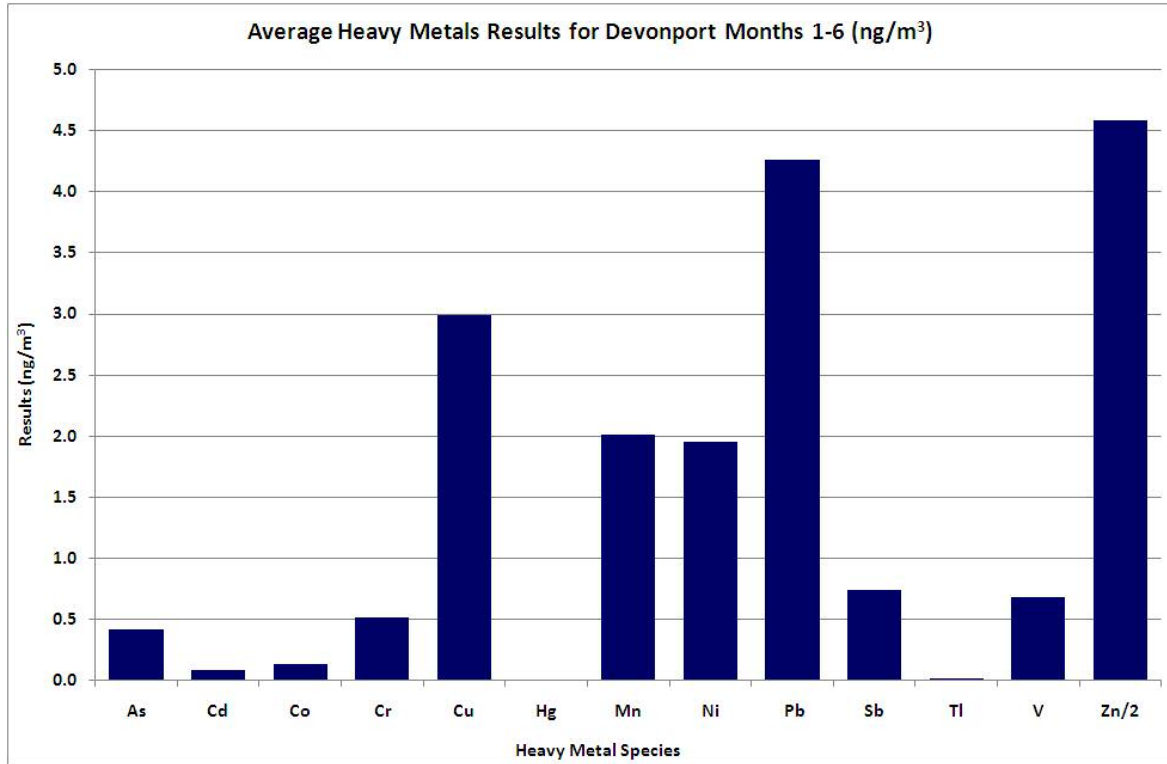


Figure 7: Average Heavy Metal Results

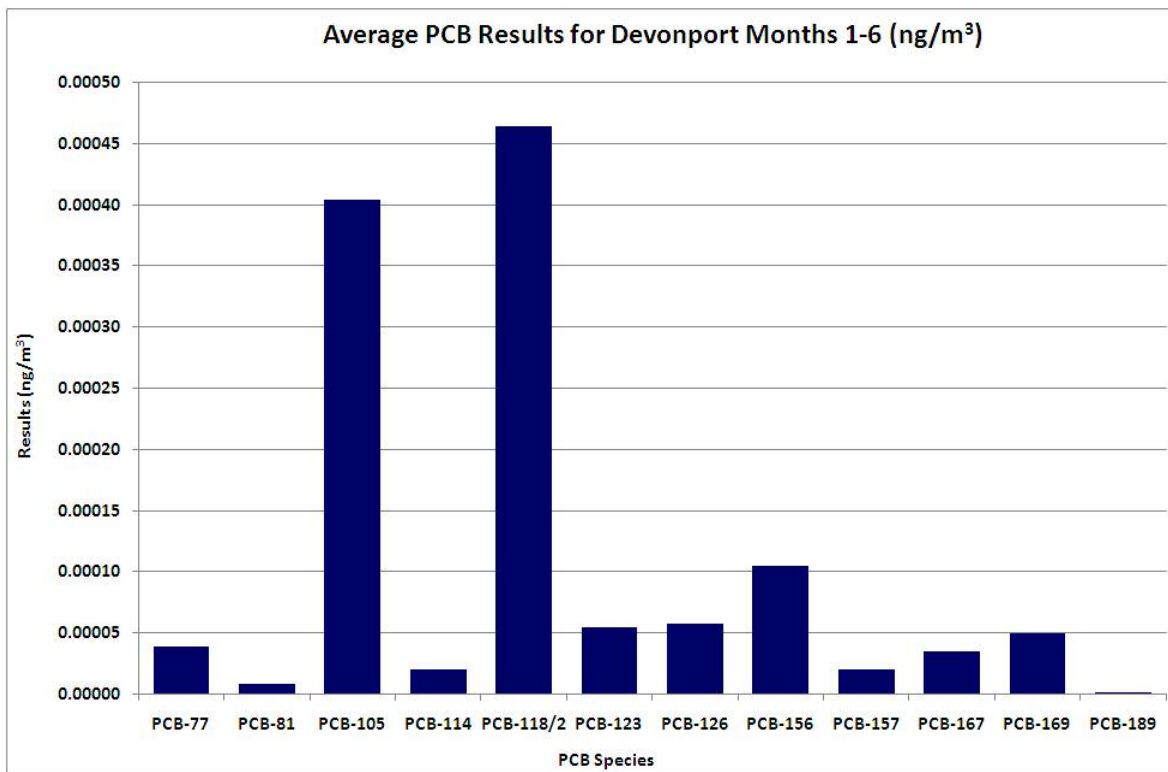


Figure 8: Average PCB Results

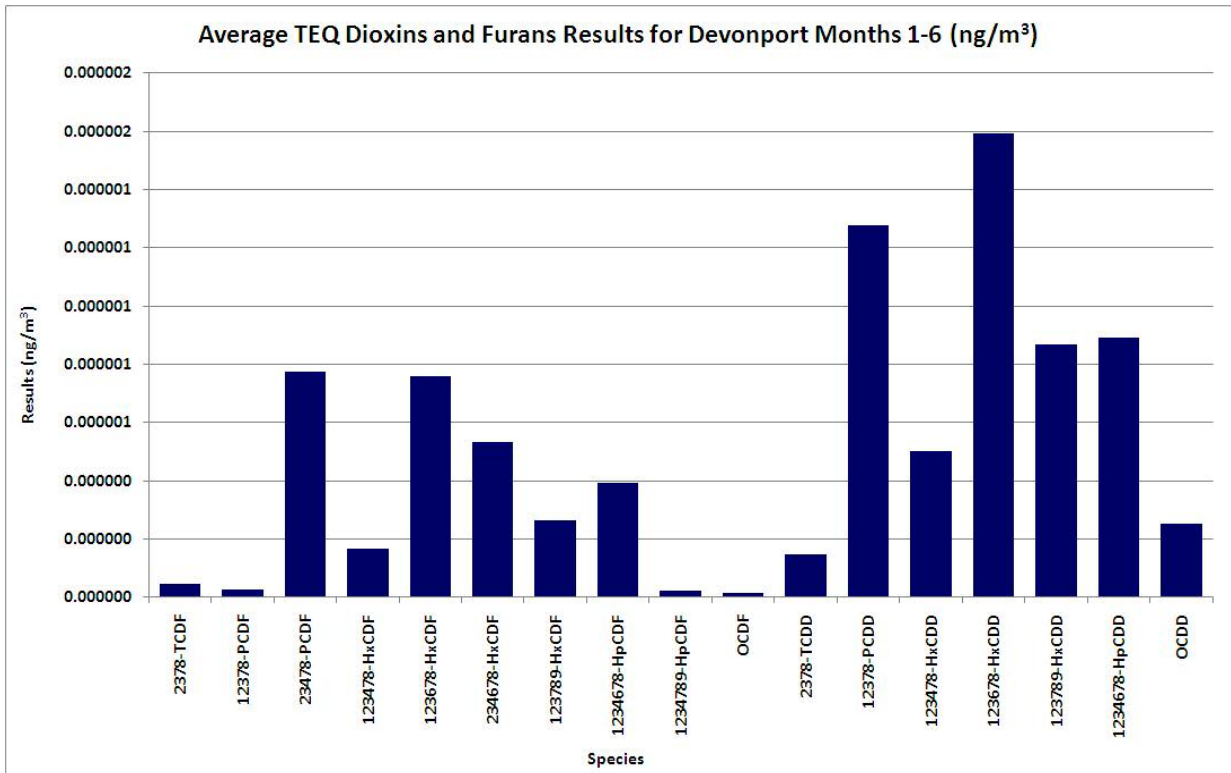


Figure 9: Average Dioxin and Furan Results

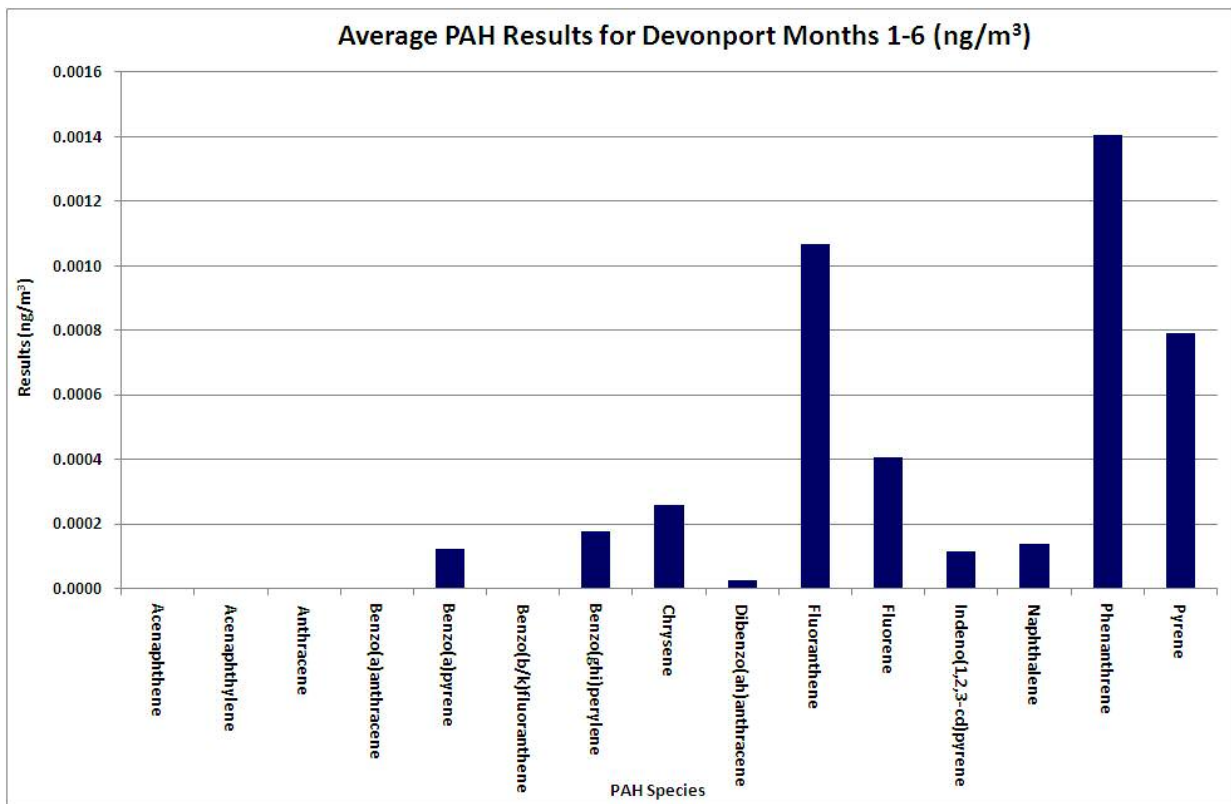


Figure 10: Average PAH Results

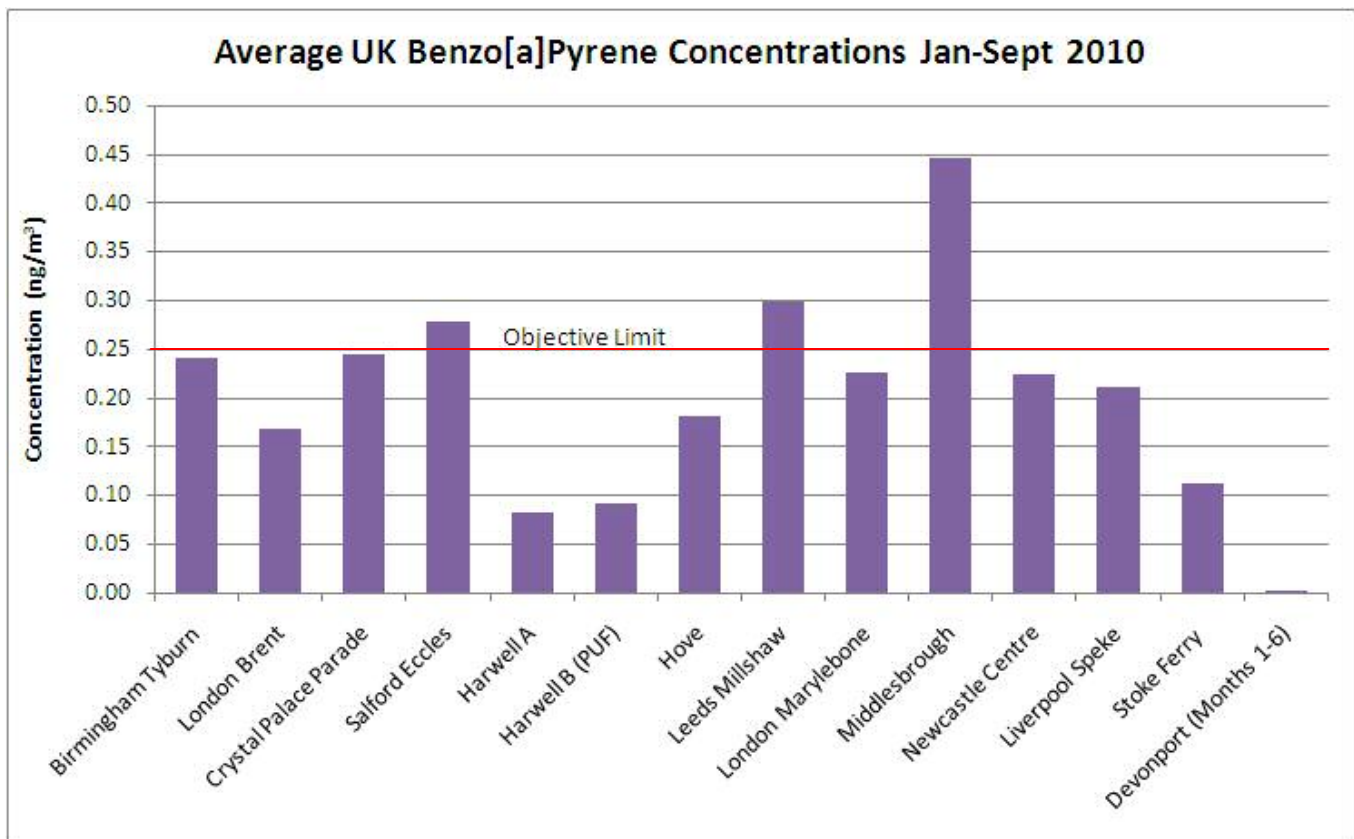


Figure 11: Comparison of average B[a]P concentrations for Devonport against other UK sites.

Table 4. Comparison of Heavy Metals Data at Devonport with limit values for heavy metals in the PM10 particulate fraction of ambient air from Fourth Daughter Directive (2004/107/EC)

Heavy Metal Species	Devonport Average (ng/m3)	Limit Value (ng/m3)
As	0.41	6
Cd	0.09	5
Co	0.14	-
Cr	0.52	-
Cu	2.99	-
Hg	0.01	-
Mn	2.01	-
Ni	1.96	20
Pb	4.26	500
Sb	0.74	-
Tl	0.02	-
V	0.68	-
Zn	9.17	-



Discussion

Air quality monitoring began at the Devonport Docks site in August 2010. This report presents the data collected from 17th August 2010 to 3rd March 2011. In addition, the provisional calibrated and ratified data, on which the statistics in this report are based, have also been provided to URS/Scott Wilson.

The data capture rates have been excellent over the monitoring period, with rates of 97.8% for NO_x, 95.1% for SO₂ and 100% for PM₁₀ being achieved.

Over the monitoring period presented in this report, there have been no exceedances of the hourly NO₂ objective of 200 µg/m³, as shown in Table 2. The mean NO₂ concentration of 15.3 µg/m³ is well below the annual mean objective limit of 40 µg/m³, however this can only be used as an indicative mean as the objective applies to a full annual data set.

Figure 2 shows hourly values for NO₂ at the Devonport site, the peaks and troughs experienced here compare well with the AURN monitoring site in Plymouth, an urban centre site to the east of Devonport.

Table 3 shows that there have been no exceedances of the PM₁₀ 24 hour mean objective of 50 µg/m³ over the monitoring period, and the average adjusted PM₁₀ concentration of 16.3 µg/m³ at this site is lower than the annual mean objective of 40 µg/m³. Many of the peaks in PM₁₀ concentrations shown in Figures 5 and 6 were also experienced at the Plymouth Centre monitoring site.

Quarterly measurements of PAH, PCBs, Dioxins, Furans, and Heavy Metals were also carried out; average data charts (Figures 7 to 10) are included in this report and show that levels were generally low and concentrations comply with objective limits, which is not unexpected due to the prevailing south westerly winds often bringing in clean maritime air. Table 4 shows that the average heavy metals results from Devonport comply with the limit values as set out in the EC Fourth Daughter Directive.

Figure 11 compares average Benzo[a]Pyrene concentrations for the monitoring period at Devonport with average concentrations at sites in the UK during the period Jan-Sept 2010, and shows that the concentrations at the Devonport site are substantially lower than concentrations from other sites. The chart also shows that the average concentration of B[a]P at Devonport is well below the annual mean objective limit of 0.25 ng/m³, however the objective does apply to a full annual data and so this can only be used as an indicative mean.