



Existing Air Quality Ince Park Area

February 2013



Experts in air quality
management & assessment

Document Control

Client	Ince Park Community Forum	Principal Contact	Keith Butterick
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Report Prepared By:	Prof. Duncan Laxen and Caroline Murrell
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Air Quality Consultants Ltd
23 Coldharbour Road, Bristol BS6 7JT Tel: 0117 974 1086
12 Airedale Road, London SW12 8SF Tel: 0208 673 4313
aqc@aqconsultants.co.uk

Registered Office: 12 St Oswalds Road, Bristol, BS6 7HT
 Companies House Registration No: 2814570

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2005-201128

1 Executive Summary

- 1.1 Prof. Duncan Laxen of Air Quality Consultants Ltd has been commissioned by the Ince Park Community Forum to provide support to develop an air quality monitoring programme for the Ince Park development, with particular focus on the emissions from the Refuse Derived Fuel (RDF) facility.
- 1.2 This report provides information on existing air quality in the area around Ince Park, with the study area extending from Ellesmere Port to Frodsham. This information will help develop subsequent proposals for an air quality monitoring programme to be undertaken before and during operation of the RDF facility.
- 1.3 Information is provided on concentrations of 25 pollutants that may be of significance to human health. Where possible, results of monitoring within the study area have been used, but where there is no monitoring within the study area, results have been obtained from nearby sites in national monitoring networks that are considered to be reasonably representative of conditions in the study area. National maps of background concentrations have also been used to supplement the monitoring information.
- 1.4 The concentrations have been put in context by reference to a range of assessment levels that cover both short and long-term exposure.
- 1.5 Monitoring within the study area has been carried out by Cheshire West and Chester Council. This covers four pollutants: nitrogen dioxide, fine particulate matter (PM₁₀), sulphur dioxide and benzene. Information for the other 21 pollutants has been obtained from national network monitoring sites. Information on wind direction and speed has also been presented. The predominant winds are those blowing from the south-southeast through to north-northwest, with few winds blowing from the north through to east.
- 1.6 The existing baseline concentrations have been collated into four groups related to the assessment level: those considered to be *insignificant* (<1% of level), those of *marginal significance* (1-25% of level), of *some significance* (25-75% of level) and those considered to be *significant* (>75% of level).
- Insignificant:*** hydrogen chloride, hydrogen fluoride, chromium, copper, vanadium
- Marginal significance:*** carbon monoxide, ammonia, 1,3-butadiene, dioxins, arsenic, cadmium, lead, manganese, mercury, nickel;
- Some significance:*** sulphur dioxide, PM₁₀, PM_{2.5}, benzene;
- Significant:*** nitrogen dioxide, Benzo(a)pyrene, chromium VI
- 1.7 This information will be coupled with the predicted concentrations arising from the RDF and other facilities to determine those pollutants that should be monitored.

2 Introduction

2.1 Prof. Duncan Laxen of Air Quality Consultants Ltd has been commissioned to provide support to the Ince Park Community Forum in order to develop an air quality monitoring programme for the Ince Park development, with particular focus on the emissions from the Refuse Derived Fuel (RDF) facility.

2.2 The work will be carried out in stages:

- A review of existing air quality;
- Development of a baseline air quality monitoring programme;
- Implementation of the baseline air quality monitoring programme;
- Assessment of the findings of the baseline air quality monitoring programme;
- Continuation of air quality monitoring programme during operation; and
- On-going assessment of the findings of the operational air quality monitoring programme.

At all stages there will be regular reporting back to the Community Forum.

2.3 This report represents stage 1 - the review of existing air quality. A separate report will be provided setting out a proposal for the pollutants to be monitored.

3 Pollutants of Interest

3.1 The pollutants of interest are those identified as being released from the RDF plant and other operations within Ince Park that may have an effect on human health¹. These pollutants have been identified from the air quality assessments carried out for the planning application and the EA permitting. They are listed in Table 1, accompanied by their relevant assessment criteria.

Table 1: Potentially Relevant Pollutants and Assessment Criteria

Pollutant	Assessment Criteria		Status ^a
	Concentration	Measured as	
Nitrogen dioxide (NO ₂)	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	UK Objective and EU Limit Value
	40 µg/m ³	Annual mean	UK Objective and EU Limit Value
Sulphur dioxide (SO ₂)	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	UK Objective and EU Limit Value
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	UK Objective and EU Limit Value
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	UK Objective
Carbon monoxide (CO)	10 mg/m ³	Running 8-hour mean	UK Objective and EU Limit Value
Particulate Matter (PM ₁₀)	50 µg/m ³ , not to be exceeded more than 35 times a year	24-hour mean	UK Objective and EU Limit Value
	40 µg/m ³	Annual mean	UK Objective and EU Limit Value
Particulate Matter (PM _{2.5}) ^b	25 µg/m ³	Annual mean	UK Objective and EU Limit Value
Hydrogen chloride (HCl)	750 µg/m ³	1-hour mean	EA EAL
Hydrogen fluoride (HF)	160 µg/m ³	1-hour mean	EA EAL
	16 µg/m ³	1-month mean	EA EAL
Ammonia (NH ₃)	2,500 µg/m ³	1-hour mean	EA EAL
	180 µg/m ³	Annual mean	EA EAL
Benzo(a)pyrene	0.001 µg/m ³	Annual mean	EU Target

¹ There are pollutants that can affect ecosystems and vegetation, but they have been scoped out of this review.

Pollutant	Assessment Criteria		Status ^a
	Concentration	Measured as	
	0.00025 µg/m ³	Annual mean	UK Objective
Benzene	5 µg/m ³	Annual mean	UK Objective and EU Limit Value
1,3-butadiene	2.25 µg/m ³	Annual mean	UK Objective
Dioxins	0.0000003 µg/m ³	Annual mean ^c	WHO guideline
Antimony (Sb)	150 µg/m ³	1-hour mean	EA EAL
	5 µg/m ³	Annual mean	EA EAL
Arsenic (As)	0.006 µg/m ³	Annual mean	EU Target
	0.003 µg/m ³	Annual mean	EA EAL
Cadmium (Cd)	0.005 µg/m ³	Annual mean	EU Target
Chromium (Cr)	150 µg/m ³	1-hour mean	EA EAL
	5 µg/m ³	Annual mean	EA EAL
Chromium VI	0.0002 µg/m ³	Annual mean	EA EAL
Cobalt (Co)	n/a ^d	n/a	n/a
	n/a	n/a	n/a
Copper (Cu)	200 µg/m ³	1-hour mean	EA EAL
	10 µg/m ³	Annual mean	EA EAL
Lead (Pb)	0.5 µg/m ³	Annual mean	EU Limit Value
	0.25 µg/m ³	Annual mean	UK Objective
Manganese (Mn)	1,500 µg/m ³	1-hour mean	EA EAL
	0.15 µg/m ³	Annual mean	EA EAL
Mercury (Hg)	7.5 µg/m ³	1-hour mean	EA EAL
	0.25 µg/m ³	Annual mean	EA EAL
Nickel (Ni)	0.02 µg/m ³	Annual mean	EU Target
Thallium (T)	n/a	n/a	n/a
	n/a	n/a	n/a
Vanadium (V)	1 µg/m ³	1-hour mean	EA EAL
	5 µg/m ³	Annual mean	EA EAL

^a EU = European Union, WHO = World Health Organisation, EPAQS = Expert Panel on Air Quality Standards, EA EAL = Environment Agency Environmental Assessment Level.

^b There is an additional exposure-reduction requirement that is to be applied at urban background locations, for the UK as a whole.

^c This is the level above which the source should be identified and control measures taken. There is no clearly specified timescale, but it is taken to be annual.

^d n/a = none available.

4 Area of Interest

- 4.1 Pollutants from the processes located on the Ince Park site will be emitted, after abatement, mainly at height through chimney stacks. These are known as point source emissions. There will also be some fugitive emissions, which will arise closer to the ground. These are harder to quantify. Once emitted, the pollutants will be dispersed and diluted. The extent of this will depend very much on the wind and weather conditions, as will the direction of movement away from the point of emission. It is known that plumes from chimney stacks generally do not come down to the ground immediately. They tend to reach the ground after travelling several hundred or sometimes several thousand metres.
- 4.2 The area of interest around Ince Park is therefore defined as an area extending about 18 km east-west and 8 km north-south, as shown in Figure 1.



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Figure 1: Area of Interest around Ince Park.

5 Existing Air Quality

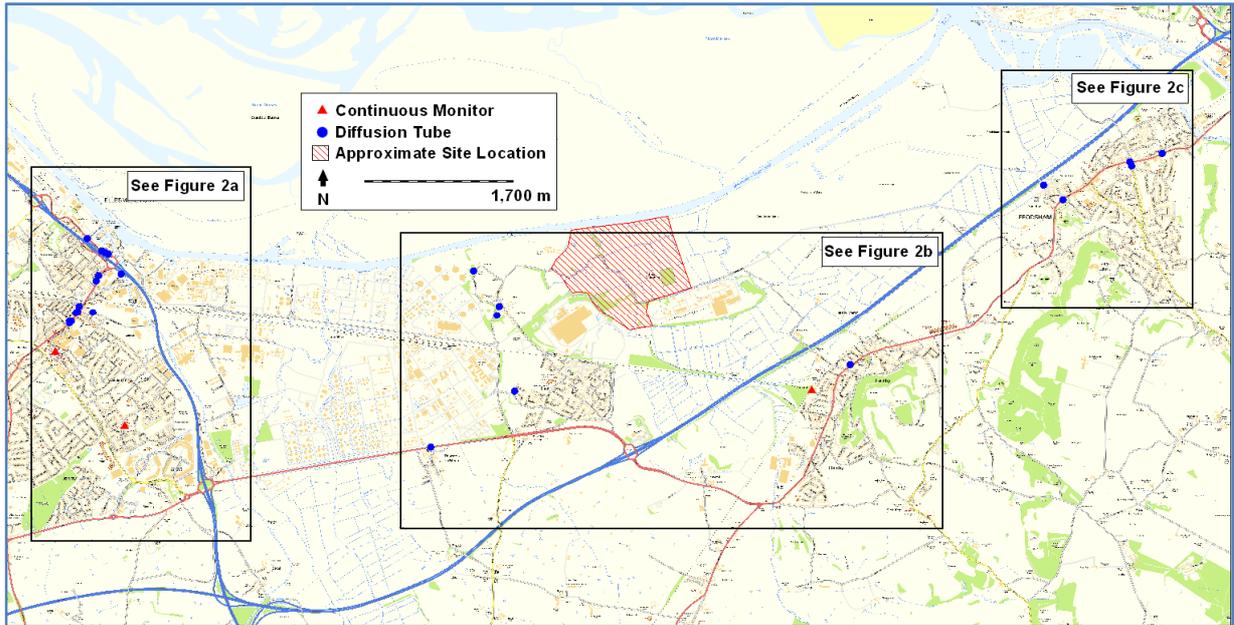
5.1 Information on existing baseline concentrations of the pollutants of interest has been gathered from a number of sources: monitoring carried out by Cheshire West and Chester Council; monitoring carried out on behalf of Defra, and modelled background pollutant maps for the UK. Windroses are also presented, as the wind direction and speeds play an important role in determining the areas most likely to be affected by the pollutant emissions. Where data from outside of the study area have been presented they are considered to be reasonably representative of conditions within the study area.

Cheshire West and Chester Council Monitoring

5.2 Cheshire West and Chester Council (CWCC) operates seven automatic monitoring stations within its area. The Council also operates a number of nitrogen dioxide and benzene monitoring sites using diffusion tubes. Table 2 provides a summary of the continuous monitoring undertaken within 8 km of the Ince Park site. The locations of both the continuous monitors and diffusion tubes are shown in Figure 2 (Figures 2a – 2c provide more detailed information about the monitoring locations).

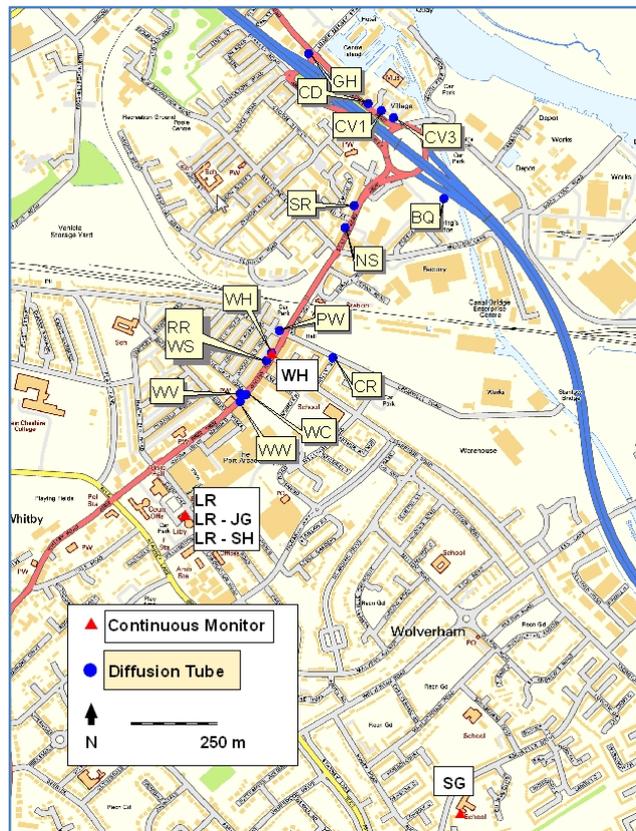
Table 2: Cheshire West and Chester Council Continuous Monitoring Sites

Site Id	Site Type	Site Location	Pollutants Monitored
WH	Roadside	Whitby Road	NO, NO ₂ , NO _x
SG	Urban Background	Stanney Grange	NO, NO ₂ , NO _x , SO ₂ , PM ₁₀
LR	Urban Background	Central Library	PM ₁₀
LR-JG	Urban Background	Opis Path 1 (DOAS) Central Library	NO ₂ , SO ₂
LR-SH	Urban Background	Opis Path 2 (DOAS) Central Library	NO ₂ , SO ₂
HE	Industrial	Helsby	NO, NO ₂ , NO _x , SO ₂ , PM ₁₀



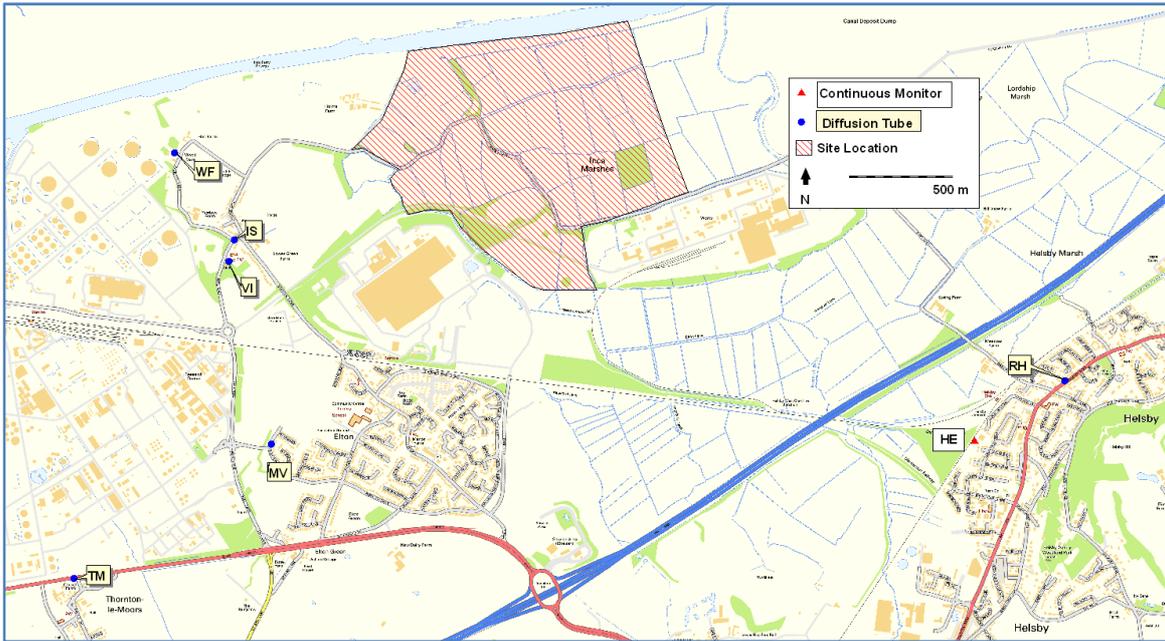
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Figure 2: Cheshire West and Chester Council Monitoring Sites.



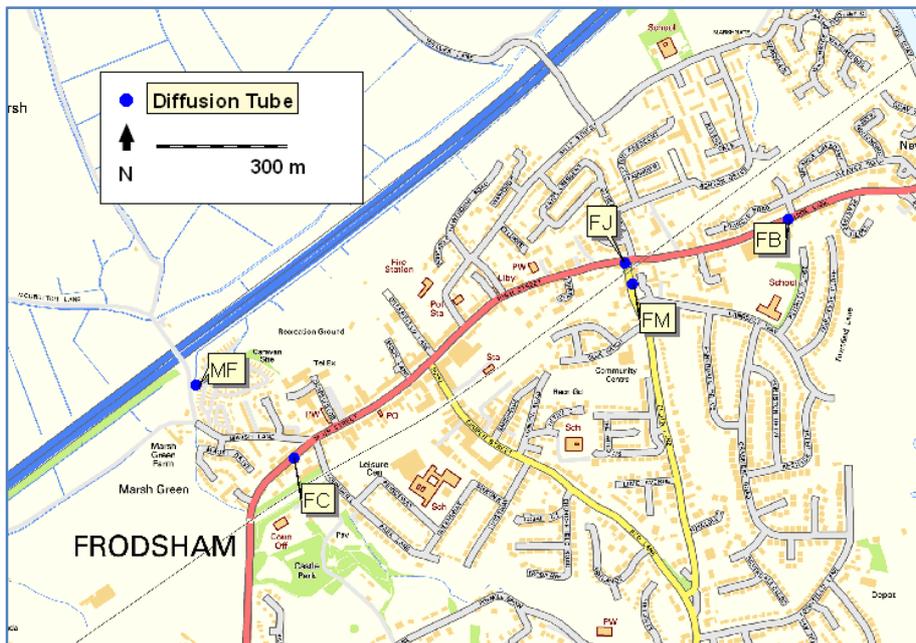
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Figure 2a: Monitoring Sites in Ellesmere Port



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Figure 2b: Monitoring Sites in Ince, Elton and Helsby



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Figure 2c: Monitoring Sites in Frodsham

Nitrogen Dioxide

5.3 The annual mean and 1-hour mean results from the continuous monitoring sites, for the years 2007 to 2011, are summarised in Table 3 and Table 4 respectively.

Table 3: Summary of Annual Mean Nitrogen Dioxide (NO₂) Monitoring (2007-2011)

Site Id	Site Type	Annual Mean Nitrogen Dioxide Concentrations (µg/m ³) ^{a, b}				
		2007	2008	2009	2010	2011
WH	R	44.3	41.2	36.7	38.2	41.0
SG	UB	18.6	20.1	14.2	22.1	20.0
LR-JG	UB	22.8	22.8	24.7	30.6	23.5
LR-SH	UB	25.9	28.2	24.7	33.3	25.5
HE	I	-	-	-	-	18.0
Objective and Limit Value		40				

^a 2007 data taken from the 2010 Progress Report (Cheshire West and Chester Council, 2010), 2008 – 2010 data taken from the 2011 Progress Report (Cheshire West and Chester Council, 2011), 2011 data taken from the 2012 USA (Cheshire West and Chester Council, 2012).

^b Exceedences are shown in bold.

Table 4: Number of Exceedences of 1-hour Mean Nitrogen Dioxide Objective (2007-2011)

Site Id	Site Type	Number of Exceedences of 1-hour mean (200 µg/m ³) ^a				
		2007	2008	2009	2010	2011
WH	R	0	1	0	0	0
SG	UB	0	0	0	0	0
LR-JG	UB	0	0	0	0	0
LR-SH	UB	0	0	0	0	0
HE	I	-	-	-	-	0
Objective and Limit Value		18				

^a 2007 data taken from the 2010 Progress Report (Cheshire West and Chester Council, 2010), 2008 – 2010 data taken from the 2011 Progress Report (Cheshire West and Chester Council, 2011), 2011 data taken from the 2012 USA (Cheshire West and Chester Council, 2012).

5.4 Annual mean results from the nitrogen dioxide diffusion tube monitoring sites, for the years 2007 to 2011, are shown in Table 5.

Table 5: Summary of Annual Mean Nitrogen Dioxide Diffusion Tube Monitoring (2007-2011)

Site Id	Site Location	Site Type	Annual Mean Nitrogen Dioxide Concentrations ($\mu\text{g}/\text{m}^3$) ^{a, b}				
			2007	2008	2009	2010	2011
BQ	BQ, Ellesmere Port	R	-	32.3	28.8	30.5	26.3
CD	Century House, Ellesmere Port	R	-	-	-	35.4	32.5
CR	Cromwell Road, Ellesmere Port	R	31.1	28.2	27.8	30.0	25.7
CV1	Canal Village (1), Ellesmere Port	R	-	35.2	35.9	34.0	30.7
CV3	Canal Village (3), Ellesmere Port	R	-	39.2	34.2	34.1	30.9
GH	Grosvenor Hotel, Ellesmere Port	R	-	-	35.5	36.5	33.1
IS	Ince Square, Ince	I	25.2	22.7	21.4	25.5	19.4
MV	18 Meadow View, Elton	I	-	-	24.0	21.6	18.9
NS	News Station Road, Ellesmere Port	R	41.8	38.8	36.1	40.5	36.4
PW	Princes Whitby, Ellesmere Port	R	33.3	32.1	28.7	33.1	28.3
RR	Richfield Recruitment, Ellesmere Port	R	52.5	48.4	42.9	46.1	36.2
SR	Station Road, Ellesmere Port	R	45.5	41.0	36.8	41.1	39.3
WC	Whitby (Cards), Ellesmere Port	R	38.0	37.4	32.9	35.6	32.1
WH	Whitby Road (triple), Ellesmere Port	R	44.8	41.5	40.5	42.5	39.4
WS	Whitby Salon, Ellesmere Port	R	43.5	41.0	36.7	41.7	34.8
WV	Whitby Victoria, Ellesmere Port	K	38.7	36.4	33.3	34.9	35.4
WW	Whitby Wetherspoons, Ellesmere Port	R	37.6	37.9	33.4	31.9	31.3
FB	Bridge Lane, Frodsham	K	-	25.5	29.7	35.9	31.4

Site Id	Site Location	Site Type	Annual Mean Nitrogen Dioxide Concentrations ($\mu\text{g}/\text{m}^3$) ^{a, b}				
			2007	2008	2009	2010	2011
FC	Chester Road (26), Frodsham	R	-	35.9	35.6	36.4	32.0
FJ	Fluin Junction, Frodsham	R	-	-	-	-	43.1
FM	Fluin Lane/Manor Farm, Frodsham	R	-	-	-	-	37.3
MF	Marsh Lane (M56), Frodsham	R	-	22.2	24.0	28.2	20.4
RH	Railway PH, Helsby	K	-	25.8	29.0	35.0	28.8
Objective and Limit Value			40				

^a 2007 data taken from the 2010 Progress Report (Cheshire West and Chester Council, 2010), 2008 – 2010 data taken from the 2011 Progress Report (Cheshire West and Chester Council, 2011), 2011 data taken from the 2012 USA (Cheshire West and Chester Council, 2012).

^b Exceedences are shown in bold.

- 5.5 Annual mean nitrogen dioxide concentrations at background sites (UB sites in Table 3) are typically in the range 20-30 $\mu\text{g}/\text{m}^3$, and are well below the objective and limit value of 40 $\mu\text{g}/\text{m}^3$. Concentrations are generally higher near to roads and in some cases exceed 40 $\mu\text{g}/\text{m}^3$. For those sites with relevant exposure this will represent an exceedence of the objective. There is no clear evidence of any trends in the annual mean concentrations over the 5 year period. Further information on annual mean nitrogen dioxide concentrations across the area of interest, is provided in the section on mapped background concentrations.
- 5.6 The measured 1-hour mean concentrations only exceeded 200 $\mu\text{g}/\text{m}^3$ for one hour, in one year, at one site (Table 4)². This illustrates that the annual mean objective and limit value is more stringent than the 1-hour mean objective and limit value, and thus more likely to be exceeded.

Particulate Matter (PM_{10})

- 5.7 Results from the continuous monitoring sites, for the years 2007 to 2011, are summarised in Table 6 and Table 7. The annual mean concentrations are generally between 15 and 20 $\mu\text{g}/\text{m}^3$, and are well below the objective of 40 $\mu\text{g}/\text{m}^3$. There have been a few days (up to 7) when the 24-hour mean concentrations have exceeded 50 $\mu\text{g}/\text{m}^3$. These do not represent exceedences of the objective and limit value, which allow 35 days a year above 50 $\mu\text{g}/\text{m}^3$. Further information on

² This does not represent an exceedence of the objective, which allows 18 hours in a year above 200 $\mu\text{g}/\text{m}^3$.

annual mean PM₁₀ concentrations across the area of interest, is provided in the section on mapped background concentrations.

Table 6: Summary of Annual Mean PM₁₀ Automatic Monitoring (2007-2011)

Site Id	Site Type	PM ₁₀ Concentrations (µg/m ³) ^a				
		2007	2008	2009	2010	2011
SG	UB	17.3	18.2	16.7	18.8	16.9
LR	UB	18.1	21.9	15.9	14.0	17.1
HE	I	-	-	-	-	16.0
Objective and Limit Value		40				

^a 2007 data taken from the 2010 Progress Report (Cheshire West and Chester Council, 2010), 2008 – 2010 data taken from the 2011 Progress Report (Cheshire West and Chester Council, 2011), 2011 data taken from the 2012 USA (Cheshire West and Chester Council, 2012).

Table 7: Number of exceedences of 24-hour mean PM₁₀ Objective (2007-2011)

Site Id	Site Type	Number of Exceedences of 24-hour Mean (50 µg/m ³) ^a				
		2007	2008	2009	2010	2011
SG	UB	6	4	0	0	5
LR	UB	4	7	0	0	6
HE	I	-	-	-	-	1
Objective and Limit Value		35				

^a 2007 data taken from the 2010 Progress Report (Cheshire West and Chester Council, 2010), 2008 – 2010 data taken from the 2011 Progress Report (Cheshire West and Chester Council, 2011), 2011 data taken from the 2012 USA (Cheshire West and Chester Council, 2012).

Sulphur Dioxide

- 5.8 The 15-minute mean results from the continuous monitoring sites, for the years 2007 to 2011, are summarised in Table 8. The 15-minute mean concentrations have only exceeded the objective level of 266 µg/m³ on three occasions and this was at one site, in one year. The objective allows 35 exceedences of 266 µg/m³ in a year, so the objective was not exceeded. The 99.9th percentiles of the 15-minute mean concentrations were all well below the objective level of 266 µg/m³, the values lying in the range 70-180 µg/m³.
- 5.9 The limit values for sulphur dioxide are 1-hour and 24-hour means, but these are less stringent in practice than the 15-minute mean objective.

Table 8: Summary of Sulphur Dioxide Monitoring (2007-2011)

Site Id	Site Type	Number of Exceedences of 15-minute Mean (266 µg/m ³) (99.9 th Percentile of 15-minute Means (µg/m ³) in Brackets ^a)				
		2007	2008	2009	2010	2011
SG	UB	0 (129)	0 (106)	3 (141)	0 (128)	0 (66)
LR-JG	UB	0 (105)	0 (180)	0 (71)	0 (87)	0 (76)
LR-SH	UB	0 (125)	0 (159)	0 (84)	0 (90)	0 (100)
HE	I	-	-	-	-	0 (170)
Objective		35 (266)				

^a Data taken from the 2012 USA (Cheshire West and Chester Council, 2012).

Benzene

- 5.10 Results from the continuous monitoring sites, for the years 2007 to 2011, are summarised in Table 9. Concentrations are below the 5 µg/m³ UK objective at all sites in all years.

Table 9: Summary of Annual Mean Benzene Monitoring (2007-2011)

Site Id	Site Location	Site Type	Benzene Concentrations (µg/m ³) ^a				
			2007	2008	2009	2010	2011
MV	18 Meadow View, Elton	I	-	-	1.4	1.0	2.3
TM	A5117, Thornton le Moors	I	-	-	2.2	2.4	2.2
VI	Village Hall, Ince	I	2.9	2.5	2.0	1.1	2.8
WF	Wood Farm, Ince	I	2.7	3.3	2.2	1.3	2.5
Objective and Limit Value		5					

^a Data taken from the 2012 USA (Cheshire West and Chester Council, 2012).

National Data on Other Pollutants

- 5.11 Defra carries out monitoring for PM_{2.5}, ammonia, carbon monoxide, hydrogen chloride, polycyclic aromatic hydrocarbons (PAHs), metals and dioxins. There are no monitoring sites within the study area. Information is therefore provided on concentrations measured at the nearest sites that form part of the national monitoring network. These concentrations are considered to be reasonably representative of concentrations that may occur across the Ince Park area of interest. It is important to note the different concentration scales for some of the pollutants, which are summarised in Table 10.

Table 10: Concentration Units

Units		Relative to $\mu\text{g}/\text{m}^3$
milligrammes per cubic metre	mg/m^3	1000
microgrammes per cubic metre	$\mu\text{g}/\text{m}^3$	1
nanogrammes per cubic metre	ng/m^3	0.001
picogrammes per cubic metre	pg/m^3	0.000001
femtogrammes per cubic metre	fg/m^3	0.000000001

Particulate Matter (PM_{2.5})

- 5.12 The nearest site is located at Liverpool Speke, which is around 7 km to the north of Ince Park. The annual mean concentration in 2011 was $12 \mu\text{g}/\text{m}^3$, which is well below the $25 \mu\text{g}/\text{m}^3$ UK objective and EU limit value.

Ammonia

- 5.13 The nearest site is located at Little Budworth Common SSSI, an area of restored lowland heath around 16 km to the southeast of Ince Park. Dairy farms are present in the area and slurry spraying takes place during the winter, both of which will contribute ammonia. The annual mean ammonia concentration in 2010 was $2.1 \mu\text{g}/\text{m}^3$. This is well below the assessment level of $180 \mu\text{g}/\text{m}^3$. Further information on annual mean ammonia concentrations, specific to the area of interest, is provided in the section on mapped background concentrations.

1,3-butadiene

- 5.14 The nearest site is located at Liverpool Speke, which is around 7 km to the north of Ince Park. The annual mean concentration in 2011 was $0.1 \mu\text{g}/\text{m}^3$, which is well below the $2.25 \mu\text{g}/\text{m}^3$ UK objective.

Carbon Monoxide

- 5.15 The nearest site is located at Liverpool Speke, which is around 7 km to the north of Ince Park. The maximum 8-hour running mean concentration in 2011 was $1.2 \text{mg}/\text{m}^3$, which is well below the objective and limit value of $10 \text{mg}/\text{m}^3$. The annual mean was $0.21 \text{mg}/\text{m}^3$.

Hydrogen Chloride

- 5.16 The nearest site is located at Plas Y Breni, around 80 km to the west near Snowdon. The annual mean was $0.25 \mu\text{g}/\text{m}^3$ in 2010. This is well below the environmental assessment level of $750 \mu\text{g}/\text{m}^3$.

Hydrogen Fluoride

- 5.17 There are no routine hydrogen fluoride measurements in the UK. Given that the reported monthly mean concentrations near to industrial facilities are between 0.03 to $2 \mu\text{g}/\text{m}^3$, and that these levels are well below the environmental assessment level of $16 \mu\text{g}/\text{m}^3$, it is reasonable to assume that the background levels will be less than 1% of the assessment level, i.e. $<0.16 \mu\text{g}/\text{m}^3$ (Expert Panel on Air Quality Standards, 2006).

PAHs (Benzo(a)pyrene)

- 5.18 Defra carries out monitoring for PAHs at a number of sites across the country. The nearest relevant site is Liverpool Speke, which is around 7 km to the north of Ince Park. A number of volatile and particulate PAH compounds are collected, but the focus is on benzo(a)pyrene, which is a PAH present in the particulate phase³ (Brown et al., 2011). Benzo(a)pyrene is used as an indicator compound for PAHs. The concentrations at Speke in the three years 2009, 2010 and 2011 were $0.17 \text{ ng}/\text{m}^3$, $0.29 \text{ ng}/\text{m}^3$ and $0.19 \text{ ng}/\text{m}^3$ respectively. These values are below the $0.25 \text{ ng}/\text{m}^3$ UK objective in two years and above in one. The EU target value of $1.0 \text{ ng}/\text{m}^3$ was not exceeded.

Metals

- 5.19 Defra carries out monitoring for a suite of 12 metals at a number of sites across the country. The nearest site is Weston Point, Runcorn. This is in a school near to an industrial area with a chlor-alkali plant and about 75 m from a busy road (A557). Table 11 summarises the results for the latest year, 2011, together with the national average for urban/industrial sites (Brown et al., 2012). The concentrations at Runcorn are similar to the national average, apart from mercury, for which the concentrations are the highest in the network. The mercury will be related to the chlor-alkali plant. All the concentrations are well below the assessment levels. There are no data for antimony or thallium and there is no assessment level for cobalt.

³ The benzo(a)pyrene is found associated with particulate matter in the air. Other PAHs are volatile at ambient temperatures and are present in the gas phase. Some can change from the particulate phase to the gas phase depending on ambient temperature – they are semi-volatile.

5.20 Trend data for the Runcorn site over the last 7 years (2005-2011) are shown graphically in Appendix A1. Manganese shows no clear trend over this period, while the pattern for the other metals is downward, especially for mercury, nickel and vanadium, and less so for copper, lead, chromium, arsenic and cadmium.

Table 11: Annual Mean Concentrations of Metals at Runcorn (2011), the National Average (2009) and the Assessment Level (ng/m³)

Pollutant	Runcorn 2011	National Average (2011)	Assessment Level
Arsenic	0.71	0.66	3
Cadmium	0.15	0.35	5
Chromium (total)	2.49	6.06	5,000
Chromium VI	(0.5) ^a	(0.4) ^a	0.2
Cobalt	0.16	0.21	n/a
Copper	7.3	18.2	10,000
Manganese	4.4	14.5	150
Nickel	1.29	3.98	20
Lead	9.25	14.9	250
Vanadium	1.55	1.62	5,000
Mercury (particulate)	0.512	0.040	250
Mercury (vapour)	21.1	4.04	

^a Taken to be 20% of total chromium, following Environment Agency advice on emissions (Environment Agency, 2012). There must be considerable uncertainty with this value, which is estimated and not measured.

^b Data for year May 2011 to April 2012. The 2012 data were provisional.

^c n/a = not available.

Dioxins and Furans

5.21 Defra carries out monitoring for dioxins and furans at six sites across the country, with a mix of rural and urban locations. The nearest sites are the semi-rural site at Hazelrigg, near to Lancaster, and the urban site at Manchester Piccadilly. A range of individual dioxin and furan compounds are measured with the results expressed as the sum of the toxic equivalent (TEQ) concentrations, which allows for the fact that different compounds have different toxicities.

5.22 The results for the five years 2006-2010 are summarised in Figure 3⁴. The mean concentration at Hazelrigg, 11.7 fg TEQ/m³, was about half that at Manchester, 23.8 fg TEQ/m³, although there was considerable year-to-year variation at each site, which may reflect the challenging nature of the sampling and analysis of low concentrations of dioxins and furans. These concentrations are well below the 300 fg TEQ/m³ guideline suggested by the WHO.

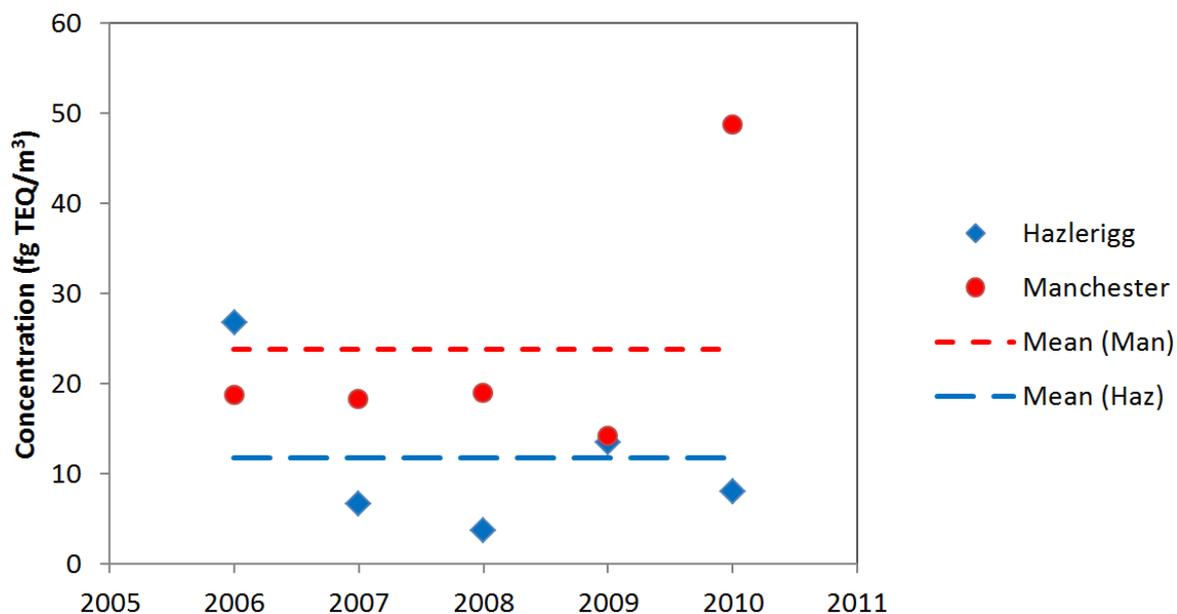


Figure 3: Annual Mean Dioxin and Furan Concentrations at 2 Sites, 2006-2010

Mapped Background Concentrations

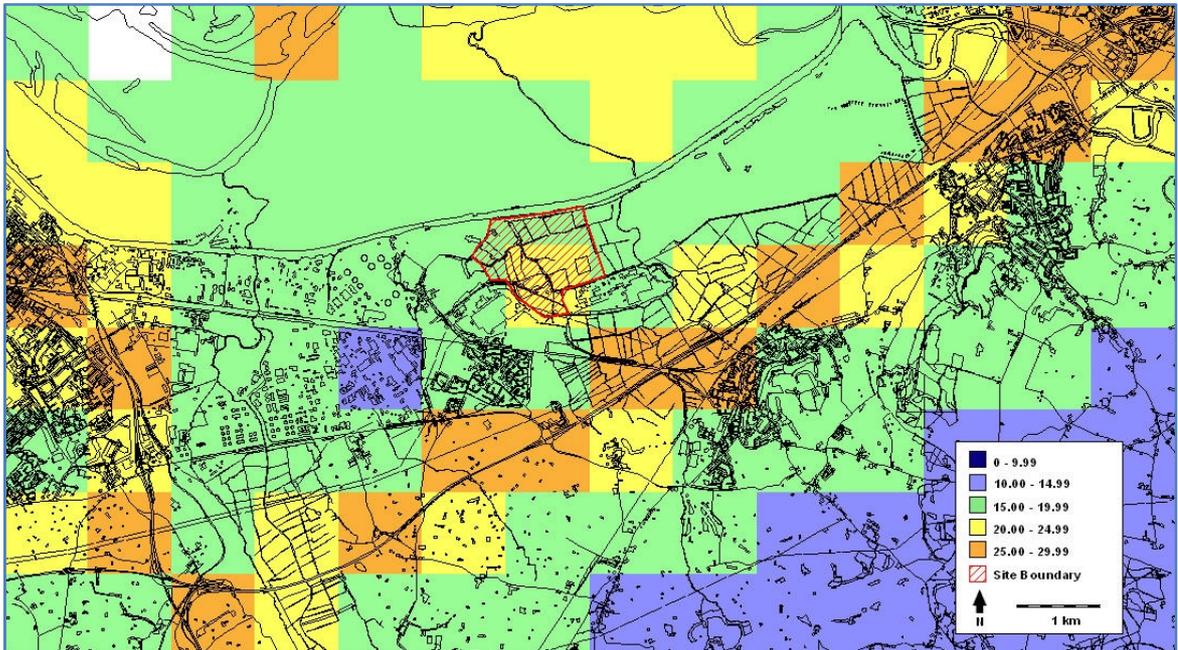
Nitrogen Dioxide, PM₁₀ and PM_{2.5}

5.23 In addition to the locally measured concentrations, background annual mean concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} across the area of interest are shown in Figure 4, Figure 5 and .. These have been prepared using the national maps produced for Defra. These national maps represent modelled concentrations calibrated against monitoring data. The latest maps have been calibrated against 2010 data. It is recognised by Defra that 2010 was a high pollution year due the meteorological conditions that prevailed during that year. As a consequence, more typical levels would be a little lower than those shown.

5.24 The background annual mean concentrations of nitrogen dioxide PM₁₀ and PM_{2.5} are all well below the objectives. The higher values follow the motorway corridor and other principal roads. The range of the concentrations is less for PM₁₀ and PM_{2.5} than for nitrogen dioxide. This is because

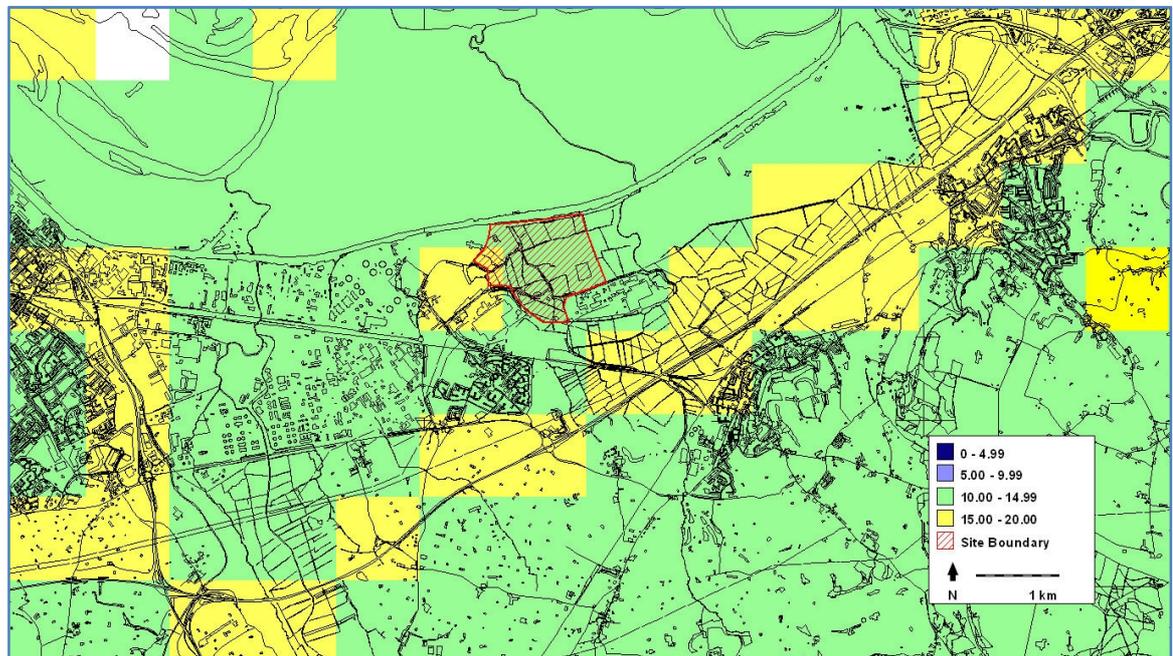
⁴ The data have been accessed from the UK-Air: Air Information Resource website (<http://uk-air.defra.gov.uk/data/tomps-data>)

sources elsewhere in the UK and Europe tend to dominate, with a smaller role played by local sources of PM.



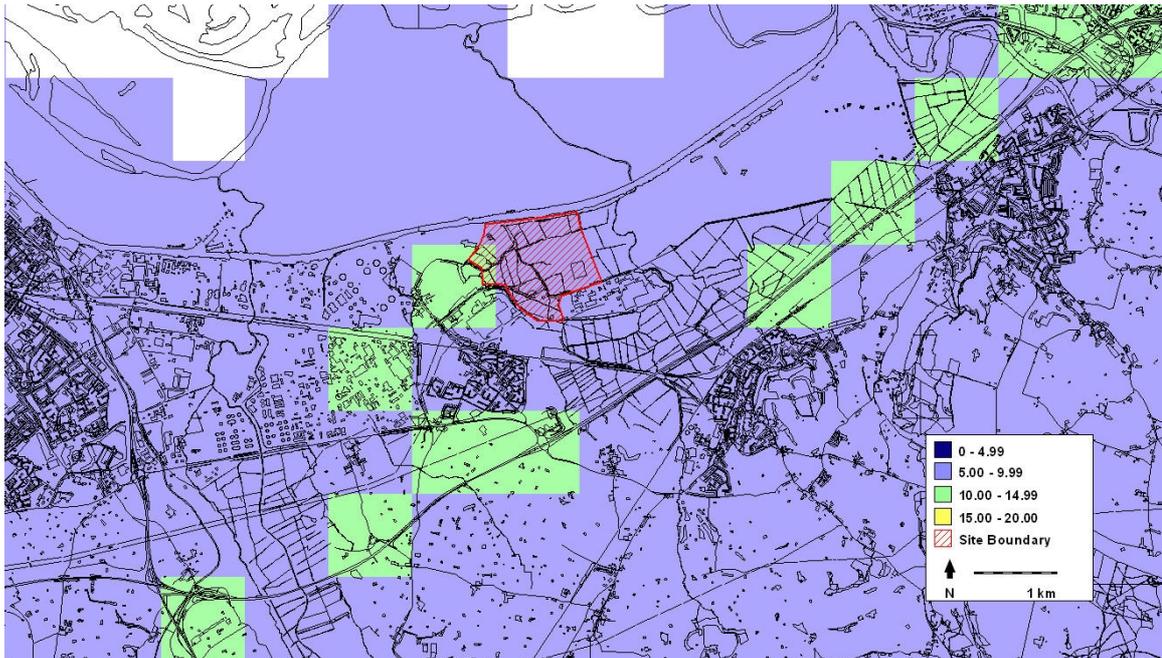
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Figure 4: Background Nitrogen Dioxide Concentrations in 2010



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Figure 5: Background PM₁₀ Concentrations in 2010



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Figure 6: Background PM_{2.5} Concentrations in 2010

Ammonia

- 5.25 Background annual mean concentrations of ammonia have been obtained from the national maps produced for Defra. These maps are at 5x5 km resolution. The concentrations range from around 1 $\mu\text{g}/\text{m}^3$ at Ellesmere Port, to around 2 $\mu\text{g}/\text{m}^3$ at Frodsham. These values are well below the assessment level of 180 $\mu\text{g}/\text{m}^3$.

Meteorological Data

- 5.26 Windroses for three locations within 20 km of the site are shown in Figure 7. Modelled wind data are shown for the national Automatic Urban and Rural Network (AURN) stations located at Speke Airport, Warrington and Wirral, and are for the year 2011. Measured data from the Speke Airport Site are for 2009. There is reasonable agreement between the modelled and measured wind speeds and directions across different years. The pattern is one of few winds blowing from the sector running from north-northwest through northeast round to southeast. There is also evidence of more frequent winds from the south-southeast and from the west-northwest.

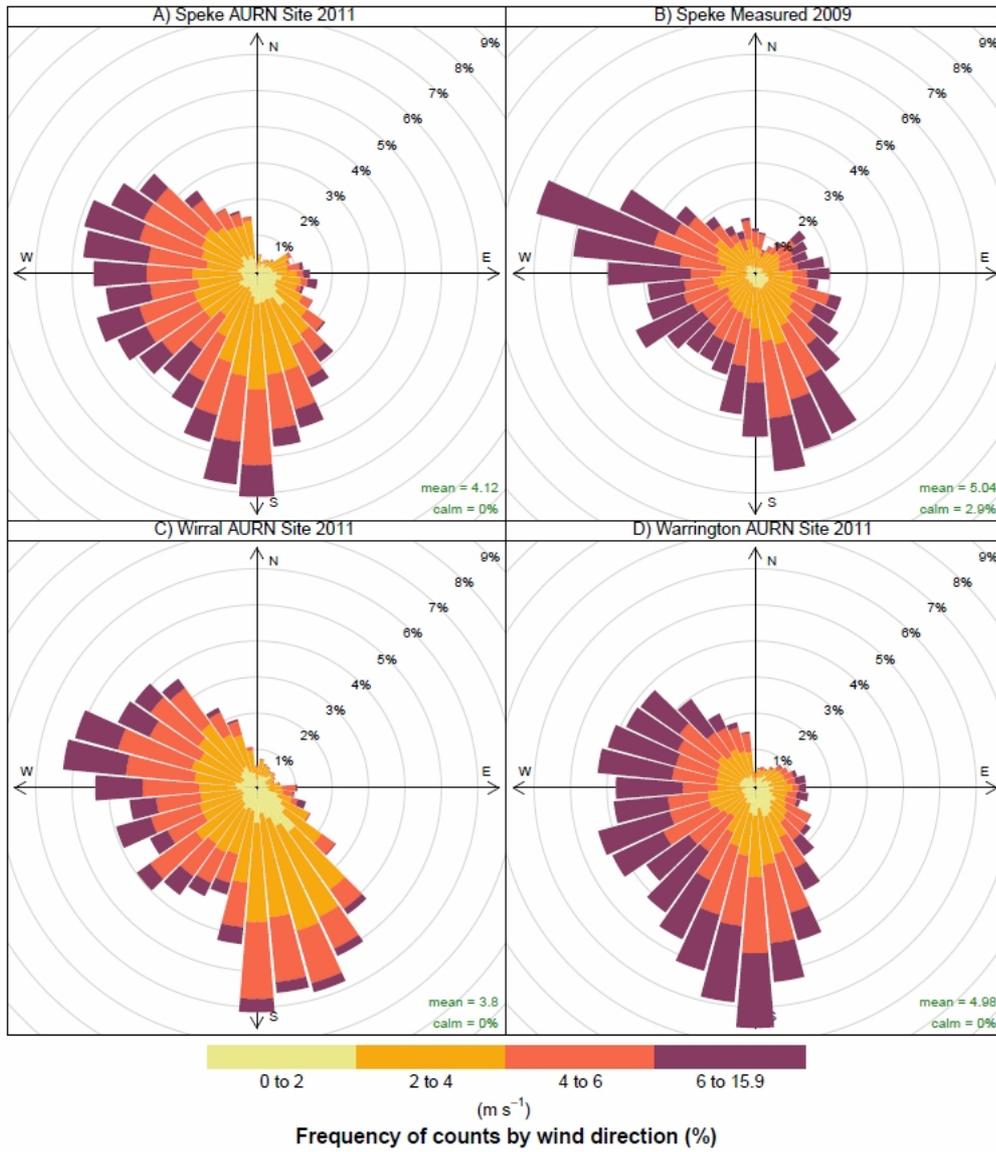


Figure 7: Windroses for Meteorological Stations in the Surrounding Area.

6 Discussion and Conclusions

- 6.1 The existing baseline air quality conditions in the area around Ince Park have been defined using available information from monitoring and modelling by the Cheshire West and Chester Council and Defra.
- 6.2 To provide an overall summary, the pollutants have been split into four groups to indicate their significance as baseline pollutants, as follows:
- those that are *insignificant*, in that they are present at less than 1% of the assessment level;
 - those that are of *marginal significance*, in that they are present at concentrations above the 1% assessment level but below 25% of the assessment level;
 - those that are of *some significance*, in that they are present at concentrations between 25% and 90% of the assessment level; and
 - those that are *significant*, in that they are just below or may exceed the assessment levels at some locations (>90% of the assessment level).
- 6.3 The allocation of the pollutants to each of these categories is set out in Table 12. This information should be taken into account when developing a monitoring programme.

Table 12: Significance of Baseline Concentrations

Insignificant	Marginal Significance	Some Significance	Significant
Hydrogen chloride	Carbon monoxide	Sulphur dioxide	Nitrogen dioxide
Hydrogen fluoride	Ammonia	Particles (PM ₁₀)	Benzo(a)pyrene
Chromium	1,3-butadiene	Particles (PM _{2.5})	Chromium VI
Copper	Dioxins	Benzene	
Vanadium	Arsenic		
	Cadmium		
	Lead		
(Cobalt) ^a	Manganese		
(Antimony) ^b	Mercury		
(Thallium) ^b	Nickel		

^a There is no assessment level for cobalt.

^b There are no measurements for these antimony and thallium.

7 References

Brown, A.S., Butterfield, D.M., Brown, R.J.C., Hughey, P., Whiteside, K.J., Goddard, S.L. and Williams, M. (2011) *Annual Report for 2010 on the UK PAH Monitoring and Analysis Network*, London: National Physical Laboratory.

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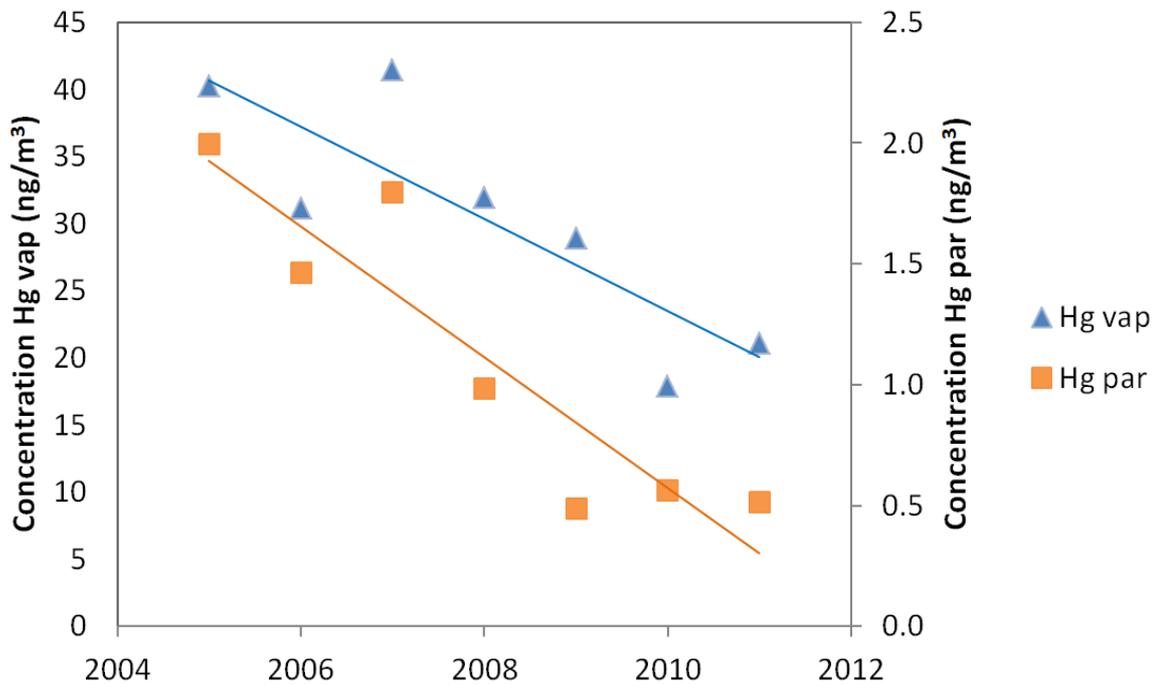
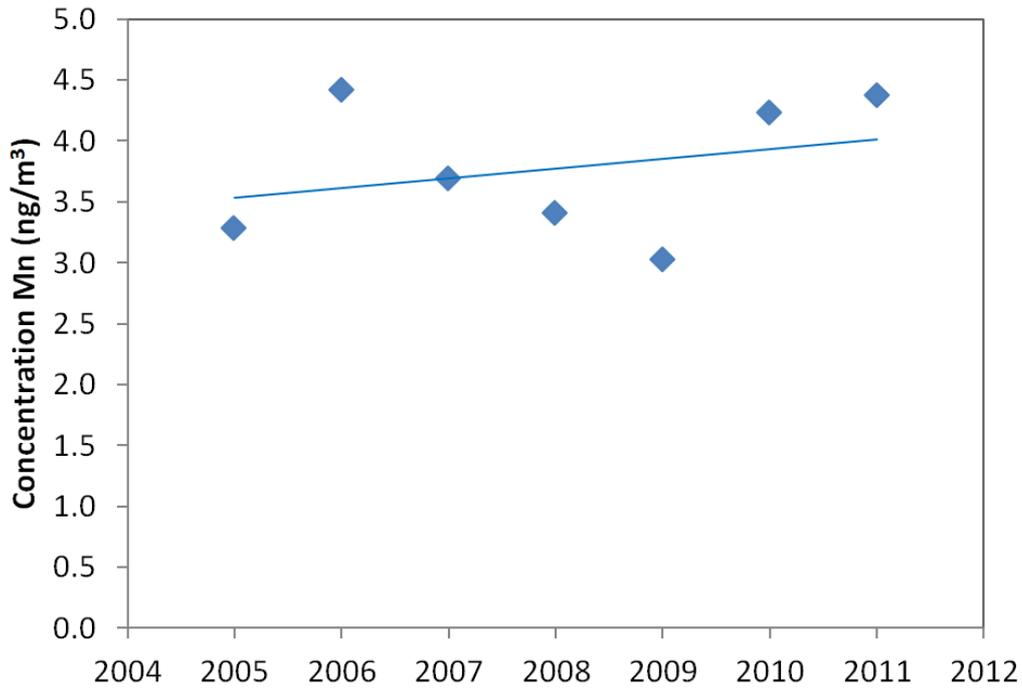
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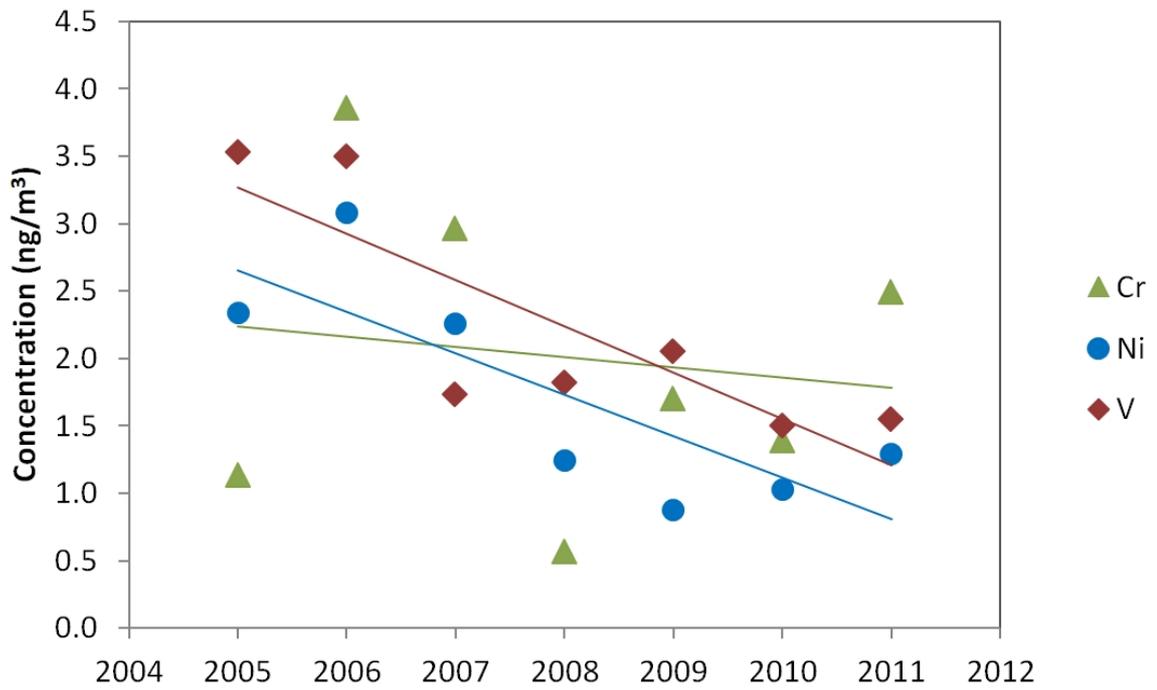
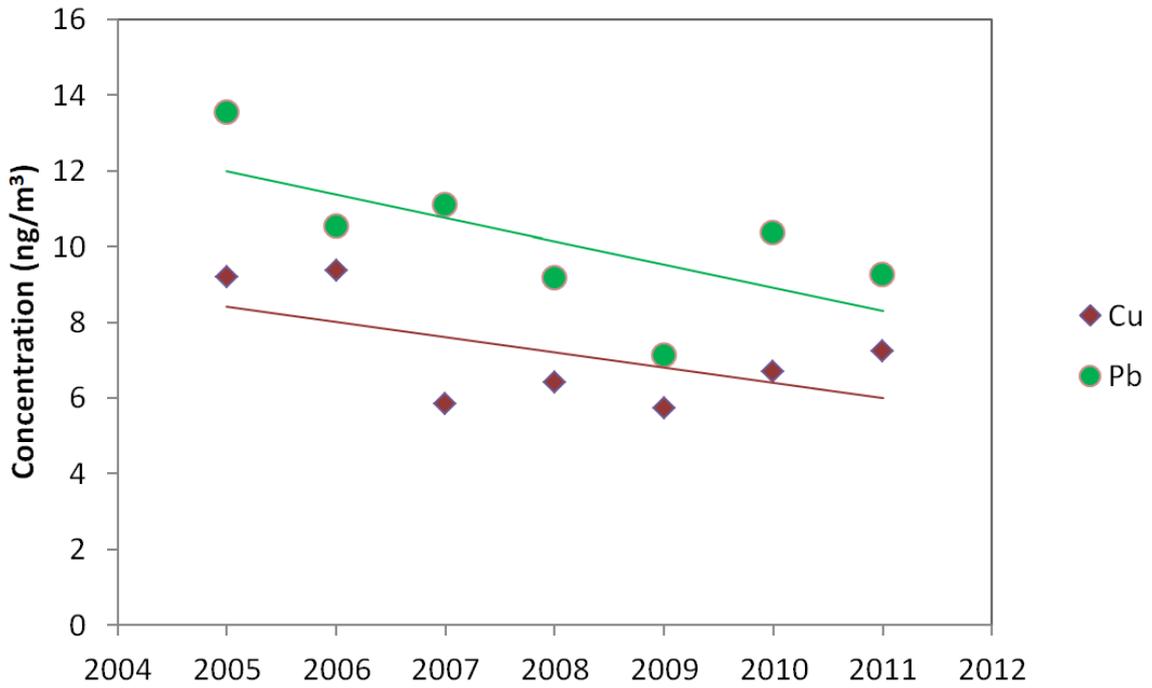
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8 Appendices

A1	Trends in Metal Concentrations at Runcorn.....	26
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A1 Trends in Metal Concentrations at Runcorn





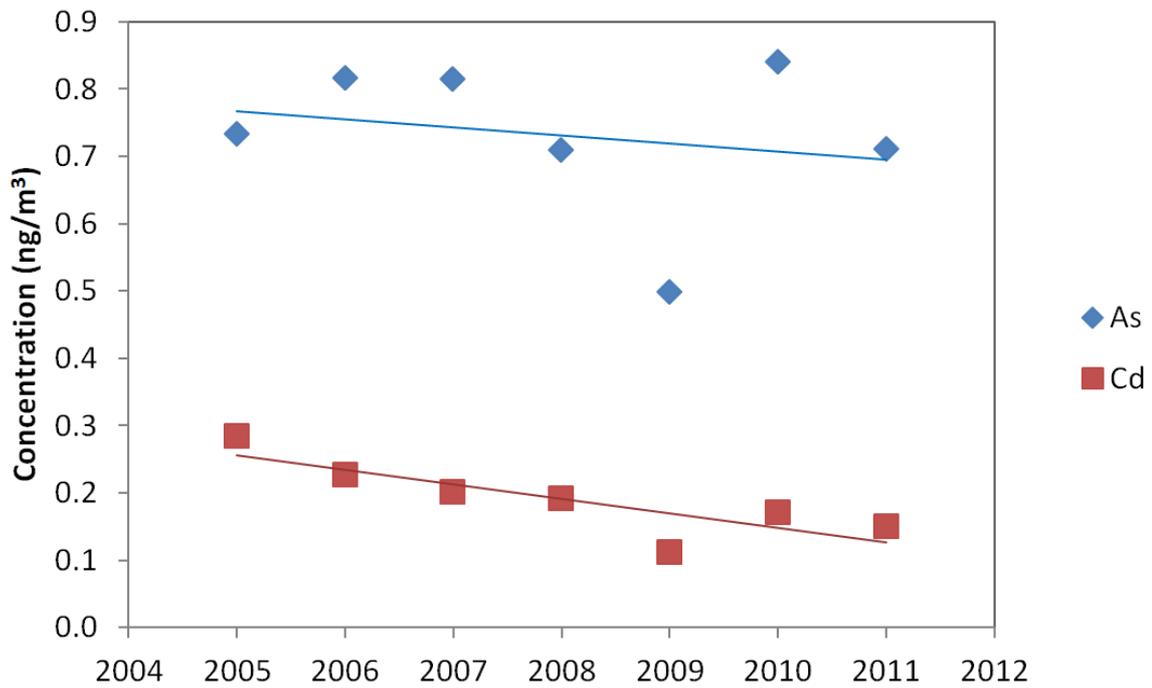


Figure A1.1: Annual Mean Concentrations at Measured at Runcorn (units ng/m³) 2005-2011.

Mn = manganese, Hg vap = mercury vapour, Hg par = mercury particulate, Cu = copper,
 Pb = lead, Cr = chromium, Ni = nickel, V = vanadium, As = arsenic, Cd = cadmium.

A1.1 The data set out in Figure A1.1 have been taken from the national network site at Runcorn Weston Point, downloaded from the UK-Air: Air Information Resource (see web page <http://uk-air.defra.gov.uk/data/metals-data>)