

Avenue Remediation Project

Air Quality and Odour Monitoring Programme

Summary of Results: November 2009

1. Overview

1.1 Summary of Monthly Air Quality Monitoring Results

Table 1 provides an overview of the air quality measurement data for November 2009 (6 November to 3rd December¹) and the evaluation of significance of the measured values in the context of target levels for each pollutant. Further details concerning the measured levels of each of the pollutants are reported in subsequent sections of this summary report.

Table 1 – Summary of Air Quality Monitoring Results Compared to Air Quality Objectives and Guideline Values for Key Pollutants

Pollutant	Averaging Period	The Avenue Target Value	The Avenue Measured Values	Evaluation (Low, Med, High)
Nitrogen Dioxide (NO ₂)	Monthly Mean	40 µg m ⁻³	13.71 – 27.31	Low
Fine Particulate Matter (PM ₁₀)	Monthly Mean	40 µg m ⁻³	7.24 – 17.40	Low
Fine Particulate Matter (PM ₁₀)	24-hr Mean	50 µg m ⁻³	2.10 – 55.70	Medium
Fine Particulate Matter (PM _{2.5})	Monthly Mean	25 µg m ⁻³	4.93-6.04	Low
Sulphur Dioxide (SO ₂)	2-week Mean	125 µg m ⁻³	8.19 max	Low
Metals - Lead	Monthly Mean	0.25 µg m ⁻³	0.06 max	Low
Cyanide	2-week Mean	50 µg m ⁻³	0.3 max	Low
PAHs - Coal Tar Pitch Volatiles	2-week Mean	0.48 µg m ⁻³	0.133 max	Low
PAHs - Naphthalene	2-week Mean	126 µg m ⁻³	<0.2 max	Low
Phenols – Phenol	2-week Mean	48 µg m ⁻³	<0.2	Low
Phenols – Cresols	2-week Mean	220 µg m ⁻³	<0.2	Low
VOCs - Benzene	2-week Mean	5 µg m ⁻³	<2.1	Low
Dust Deposition - Directional Gauge	Monthly Mean	200 mg m ⁻² day ⁻¹	51 – 162	Low
Odours	n/a	n/a	Low-medium	Low

Notes:

Where the averaging period of the target value is for a 2-week mean, the measured value presented in the table is the maximum value measured during the month.

¹ Monitoring reporting periods are 4 or 5 weeks in duration and may not correspond directly to a calendar month.

In summary:

There were no air quality related complaints recorded during the month.

In terms of the monitoring results, the only exceedences of target levels of air pollutants were related to PM₁₀ for the 24 hour averaging period at Site 1 on 8th November 2009. These elevated concentrations are likely to be due to the activities surrounding Bonfire Night at this time of year.

Concentrations of particulate matter (PM₁₀ and PM_{2.5}) also appear to be higher than the previous month, but were still comfortably inside the relevant air quality targets.

1.2 Work Activity

The site remediation operations (known as Stage 3 of the Avenue project) officially commenced on 9 September 2009. Although, there was only limited operational activity during the month, some site-based works, with the potential to affect air quality have taken place. The earthworks included the following activities:

- Week 45 (2 – 8 November):
 - Vegetation stripping and stockpiling in Zone 2 (Low Level Stocking Area);
 - Breaking out of concrete in Zone 3a (High Level Stocking Area);
 - Stockpiling of slab from the High Level Stocking Area in Zone 5; and
 - Preparation of Holding Pond 1 in Zone 2.
- Week 46 (9 – 15 November):
 - Stockpiling in Zone 2;
 - Preparation of Holding Pond 1 in Zone 2;
 - Stockpile crushing in Zone 5; and
 - Borrow-pit excavation in Zone 2.
- Week 47 (16 - 22 November):
 - Preparation of Holding Pond 1 in Zone 2;
 - Stockpile crushing in Zone 5;
 - Borrow-pit excavation in Zone 2;
 - Removal of concrete in Zone 3a (High Level Stocking Area) to Zone 5; and
 - Installation of boreholes in accordance with Deployment Form/Water Management Plan.
- Week 48 (23 – 29 November):
 - Stockpile crushing in Zone 5;
 - Borrow-pit excavation in Zone 2;
 - Waste-tip treatment pad works in Zone 3a (High Level Stocking Area); and
 - Excavation of material from coke oven basements in Zone 4.
- Week 49 (30 November – 6 December)
 - Excavation of material from coke oven basements in Zone 4;
 - Borrow-pit excavation in Zone 2;
 - Stockpile crushing in Zone 5; and

- Waste-tip treatment pad works in Zone 3a (High Level Stocking Area).

1.3 Alterations, Downtime and Technical Difficulties

A summary of alternations to the monitoring programme, alongside downtime and technical issues during the month are summarised in Table 2.

Table 2 – Summary of Alternations, Downtime and Technical Difficulties

Location	Dates	Technical Issue
<i>Alternations to Monitoring Programme:</i>		
None	n/a	n/a
<i>Downtime and Technical Difficulties:</i>		
Site 4	18 th November to 3 rd December	The PAH and phenol sampling equipment broke down during the period and was replaced on 3 December 2009. No data is presented for these pollutants at this site for 18 th November to 3 rd December.
Site B and C	1 st to 3 rd December	The power supply to Sites B and C failed on 1 December 2009 and it was not restored until the 3 rd December. Some data was lost as a result at the APM950s located at these two stations. The power loss believed to be associated with groundworks nearby.
Site C	6 November – 10 November	The interruption to the power supply reported last month continued until 10 November 2009 and resulted in a loss of further APM950 data at Site C this month.
Site C	6 th to 18 th November	No analysis of the tenax tubes for VOCs due to excessive moisture on these tubes.

2. Detailed Air Quality Monitoring Results

2.1 Routine Air Quality Monitoring

This section provides an overview of the measurement data for the fixed monitoring sites.

2.1.1 PM₁₀ Concentrations

Table 3 presents monthly average concentrations of PM₁₀ at the fixed monitoring sites. The highest average concentration of 17.4 µg m⁻³ at the control site at Site 1 (Press Lane Farm), which is located ~3.5 km to the southwest of the site, is less than 50% of the 40 µg m⁻³ annual mean air quality objective. The second highest monthly average of 12.8 µg m⁻³ was recorded at Site 7 (Nursery at Stretton), which is also remote from the site, whilst the stations within and close to the Avenue recorded levels in the 7.2-11.3µg m⁻³ range.

Table 3 – Monthly Average Concentrations of PM₁₀ Particulate Matter (µg m⁻³)

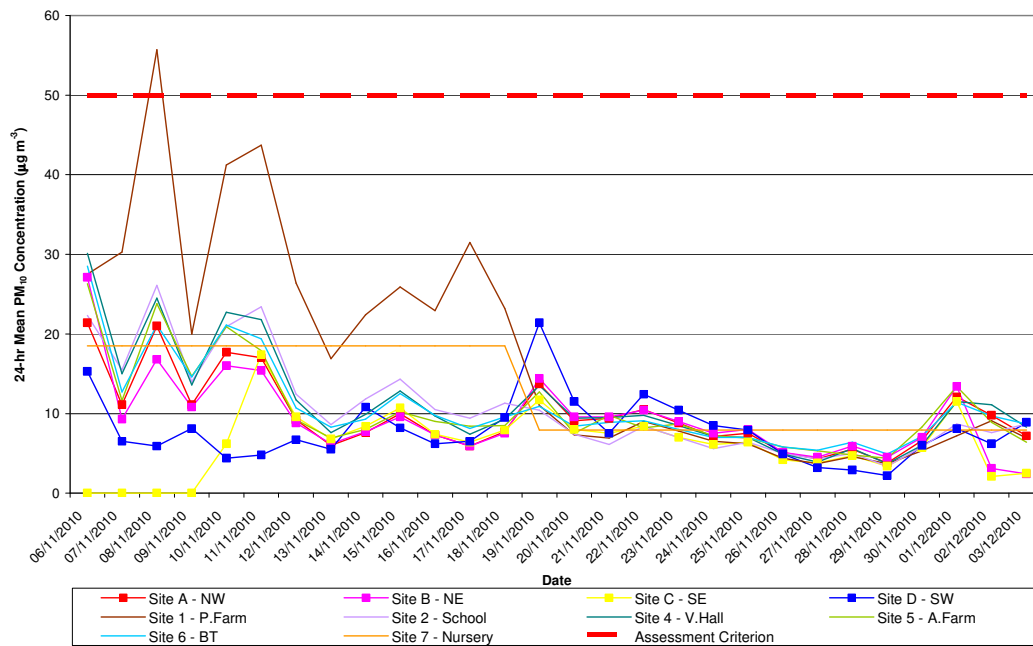
Monitoring Site	PM ₁₀ Monthly Average Concentration (µg m ⁻³)
Site A: Avenue (NW)	9.8
Site B: Avenue (NE)	9.4
Site C: Avenue (SE)	7.2
Site D: Avenue (SW)	7.9
Site 1: Press Lane Farm, Old Tupton	17.4
Site 2: Hunloke Primary School	10.7
Site 4: Village Hall, Hasland	11.3
Site 5: Avenue Farm	10.5
Site 6: BT Offices (Pioneer House) Mill Lane	10.9
Site 7: Nursery at Stretton*	12.8

Notes:

* Concentration measured at Site 7 using Mini-Vol sampler. All other measurements using APM950 instrumentation

Figure 1 presents 24-hour average concentrations of PM₁₀ at the fixed monitoring sites; measured concentrations in the November monitoring period are generally lower than those measured during October. The maximum measured concentration of 55.7 µg m⁻³ was recorded at Site 1 (Press Lane Farm) and this, together with other elevated levels recorded over the bonfire night weekend and even up to 18 November 2009, contributed to this location having the highest monthly average concentration for PM₁₀. Similar trends were also observed at the other continuous monitoring stations from Friday 6 to Sunday 8 November 2009, suggesting that the key adverse effect to local air quality during the month was of bonfire night, and not activities associated with the Avenue site.

Figure 1 – 24-hour Average Concentrations of PM₁₀ Particulate Matter ($\mu\text{g m}^{-3}$)



Notes:

* Concentration measured at Site 7 using Mini-Vol sampler. All other measurements using APM950 instrumentation

2.1.2 PM_{2.5} Concentrations

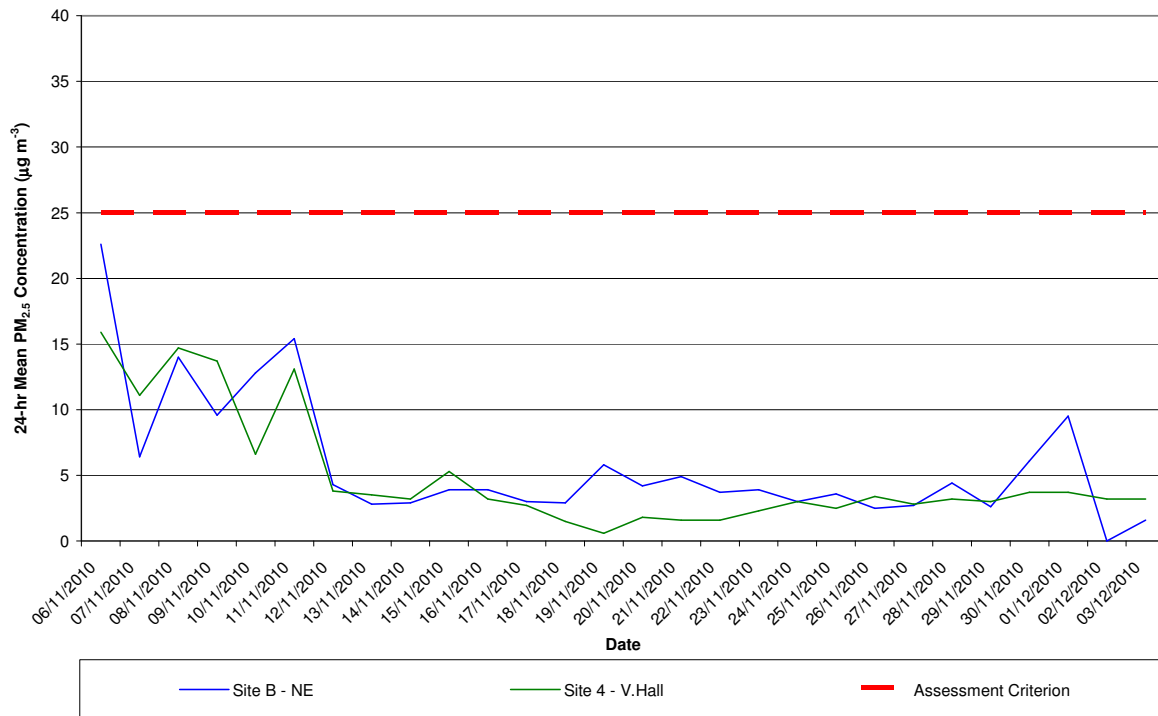
Table 4 presents monthly average concentrations of PM_{2.5} at the two fixed monitoring sites; as observed for PM₁₀, concentrations of PM_{2.5} are slightly lower in November than in October. The highest average concentration of 6 $\mu\text{g m}^{-3}$ occurred at Site B (located on the north east boundary of the Avenue site), but this is less than the 25 $\mu\text{g m}^{-3}$ annual mean national air quality objective.

Table 4 – Monthly Average Concentrations of PM_{2.5} Particulate Matter ($\mu\text{g m}^{-3}$)

Monitoring Site	PM _{2.5} Monthly Average Concentration ($\mu\text{g m}^{-3}$)
Site B: Avenue (NE)	6.0
Site 4 – Village Hall, Hasland	4.9

Figure 2 presents 24-hour average concentrations of PM_{2.5} at the fixed monitoring sites, to provide an indication of the monthly variation in measured values. The figure shows the monitored concentrations at both monitors being of a similar magnitude for the whole period. Following the 12th November both monitors show a drop in concentration of PM_{2.5} as a 24 hour average to around 4 $\mu\text{g m}^{-3}$. This concentration is broadly maintained for the rest of the period at Site 4 with some small variation from this concentration at Site B. The 24 hour concentrations of PM_{2.5} at Site B and 4 do not exceed the assessment criterion during the period.

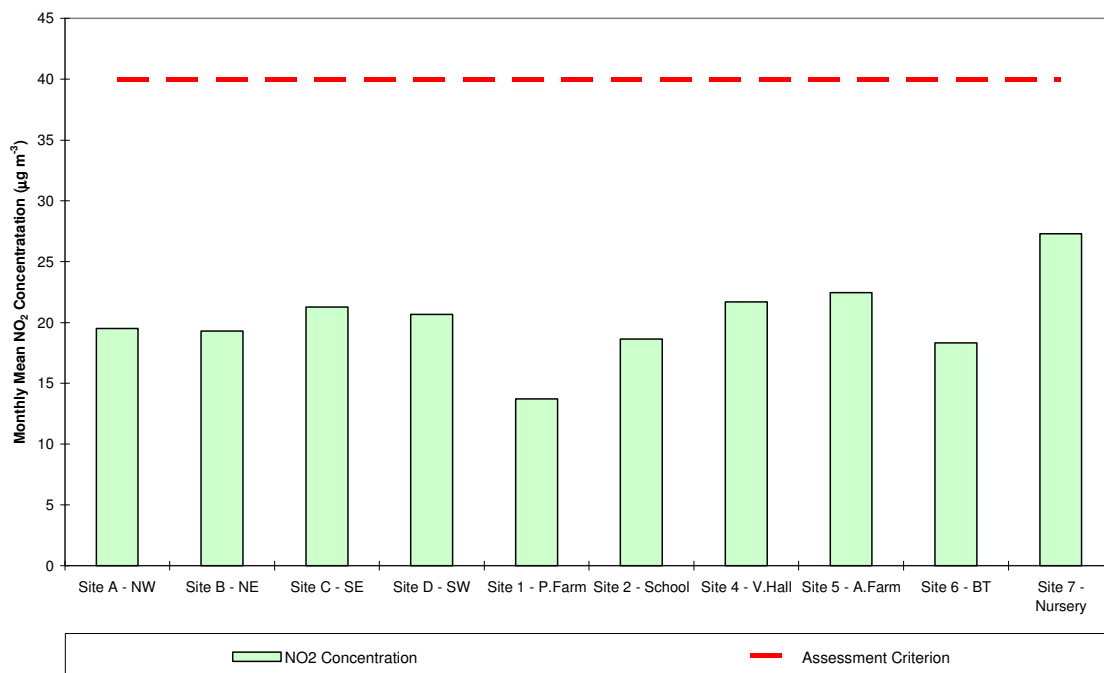
Figure 2 – 24-hour Average Concentrations of PM_{2.5} Particulate Matter ($\mu\text{g m}^{-3}$)



2.1.3 Nitrogen Dioxide Concentrations

Figure 3 presents monthly average concentrations of nitrogen dioxide across each of the fixed monitoring sites. At all locations, measured concentrations were below the $40 \mu\text{g m}^{-3}$ annual mean air quality objective. The maximum measured concentration was $27.31 \mu\text{g m}^{-3}$ at Site 7 (the nursery at Stretton), although levels of NO_2 at this location would be primarily affected by road traffic emissions unconnected to The Avenue.

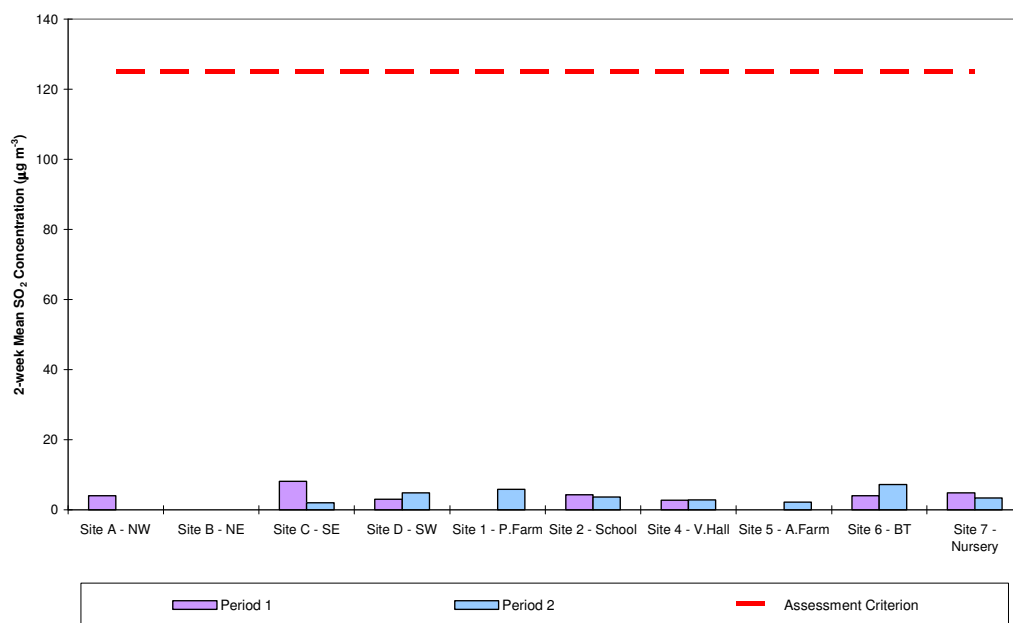
Figure 3 – Monthly Average Concentrations of Nitrogen Dioxide ($\mu\text{g m}^{-3}$)



2.1.4 Sulphur Dioxide Concentrations

Figure 4 presents 2-week average concentrations of sulphur dioxide across each of the fixed monitoring sites. At all locations, measured concentrations were significantly below the $125 \mu\text{g m}^{-3}$ target level. The maximum measured concentration was $9.41 \mu\text{g m}^{-3}$ and occurred at Site C (Avenue SE) during the first monitoring period. At Site A (Avenue NW) concentrations of SO_2 were below the limits of detection during the second period of monitoring. At Site B (NE) concentrations of SO_2 were below the limits of detection during both periods of monitoring, and at Sites 1 (Press Farm) and 5 (Avenue Farm) concentrations of SO_2 were below the limits of detection during the first period of monitoring.

Figure 4 – 2-week Average Concentrations of Sulphur Dioxide ($\mu\text{g m}^{-3}$)

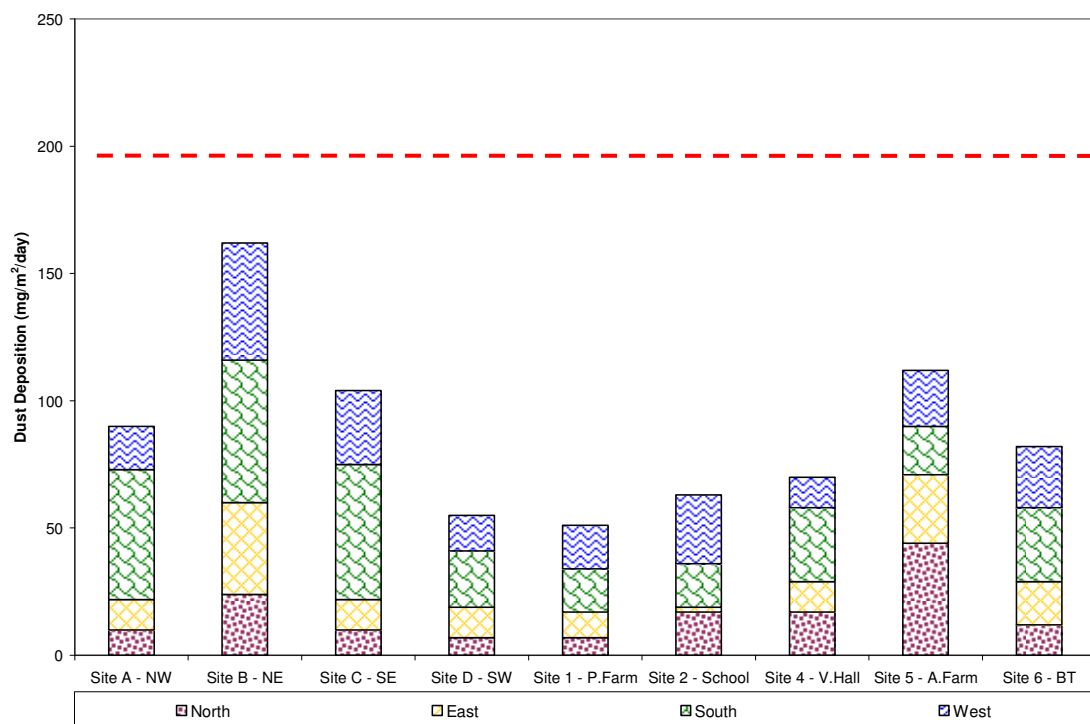


2.1.5 Deposited Dust Levels

Figure 5 presents the monthly levels of deposited dust at each of the monitoring stations and the source direction.

The highest recorded levels of deposited dust were recorded at Site B (Avenue NE) and the measured levels do not represent an exceedence of the target level. At Site B, approximately 30% of the deposited dust originated from the west and the south (in equal proportions) with the remainder of the dust mainly originating from the east. Levels of deposited dust at Site 5 were elevated, but were below the target level and, approximately 50% of the deposited dust originated from the north, with the remainder of the dust originating from the west, east and south in similar proportions. The pattern of dust deposition levels would suggest the Avenue site was a contributing element to these elevated levels, along with other local sources of dust (e.g. farming activity).

Figure 5 – Measured Dust Deposition Levels (mg/m²/day)



2.1.6 Volatile Organic Compounds

The assessment criteria limits for benzene and toluene are 5 µg m⁻³ and 1.9 mg m⁻³ as a 2-week average, respectively.

During the first and second 2-week monitoring periods no stations recorded levels of benzene above the limit of detection 2.1 µg m⁻³. The maximum measured concentration of toluene in period 1 (6th to 18th November) was 0.036 mg m⁻³ and in period 2 (18th November to 3rd December) no stations recorded levels above the limit of detection of 0.008 mg m⁻³.

2.1.7 Metals

The only metal with an air quality objective is lead, with a concentration of 0.25 µg m⁻³ as an annual average. The maximum measured concentration of lead was 0.06 µg m⁻³, recorded at Site 2 (School) during the first monitoring period, which is less than 25% of the objective concentration.

Concentrations of all other metals were in most cases below limits of detection; where concentrations were above limits of detection the concentrations were significantly below target levels.

2.1.8 Cyanide

There are no air quality objectives for cyanide. The assessment criteria for The Avenue is a maximum concentration of 50 µg m⁻³ as a 2-week average. The maximum concentration of cyanide was 0.3 µg m⁻³.

2.1.9 Phenol(s)

The target levels for phenol and cresol at The Avenue are 48 µg m⁻³ and 220 µg m⁻³ as a 2-week average respectively. The reporting of phenols is subject to a lower detection limit of 0.2 µg m⁻³ and there were no measured concentrations above this level.

2.1.10 Poly-Aromatic Hydrocarbons

The target level of Coal Tar Pitch Volatiles at The Avenue is 0.48 µg m⁻³, whilst for naphthalene the level is 126 µg m⁻³. There were no exceedences of these criteria during the month. The highest measured concentration of total Coal Tar Pitch Volatiles was 0.042 µg m⁻³ and the highest measured concentration of naphthalene was 0.0005 µg m⁻³.

2.1.11 Quality Control Samples

Media Blanks

The analysis of media blanks indicated no issues with the contamination of media used for the collection of samples.

Duplicates

Duplicate PM₁₀ measurements at Site A correlated well with original data during the month. The monthly average concentration at Site A was 9.8 µg m⁻³ compared to 9.2 µg m⁻³ for the duplicate monitor.

Duplicate metals results taken at Site A correlated well during both monitoring periods. The most significant variation in measurements was for lead, where concentrations in the first period were 0.05 µg m⁻³ and 0.04 µg m⁻³.

Duplicate PAH results from Site 1 showed that the largest magnitude difference in measured concentrations was 0.004 µg m⁻³ for Phenanthrene, a 27% difference between the two measurements. For several of the PAHs, the difference in measurements was greater than 50%, but in the context of the measured concentrations and the assessment levels, these differences are not considered significant. The largest percentage difference was for dibenzo (ah) anthracene during the first period of monitoring; the measurements were 0.00027 µg m⁻³ and 0.00056 µg m⁻³, a difference of 107%, but an absolute difference of only 0.00029 µg m⁻³.

Duplicate phenol samples were taken at Location 1. No results were reported above the limit of detection (LOD) of 0.2 µg m⁻³ during either of the two monitoring periods.

The duplicate SO₂ measurements during the first and second period of monitoring could not be compared as one set of samples in period 1 (6th to 18th November) were below the limit of detection and in period 2 (18th November to 3rd December) both sets of duplicate samples were below the limit of detection.

For total VOC measurements, the measured concentrations from the duplicate diffusion tubes, is the same for both the first and second periods of monitoring.

The duplicate NO₂ measurements gave concentrations of 20.4 µg m⁻³, for the first diffusion tube, and 19.3 µg m⁻³ for the second tube. The diffusion tube measurements are therefore considered to be accurate.

2.2 Targeted Air Quality Monitoring

On the basis of limited site activities with the potential to cause air quality effects, no targeted air monitoring was undertaken during the month.

2.3 Odour Monitoring

2.3.1 Odour Diaries

Background monitoring using odour diaries was suspended at the end of October 2008 following an 18 month period of monitoring; it was considered that a sufficient level of background data had been collected during this period. The odour diary programme is scheduled to resume during Stage 3.

2.3.2 Sensory Field Odour Surveys

Sensory field odour surveys were carried out on 2 and 10 November at each of the fixed monitoring stations. During each survey, the maximum odour annoyance impact level was 'Low-Medium' and, therefore, the effects of odour are not considered significant.

2.3.3 Odour Complaints

No odour-related complaints were received during the month.