

Avenue Remediation Project

Air Quality and Odour Monitoring Programme

Summary of Results: October 2009

1. Overview

1.1 Summary of Monthly Air Quality Monitoring Results

Table 1 provides an overview of the air quality measurement data for October 2009 (1 October to 6 November¹) 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	15.02 – 26.72	Low
Fine Particulate Matter (PM ₁₀)	Monthly Mean	40 µg m ⁻³	11.90 – 19.69	Low
Fine Particulate Matter (PM ₁₀)	24-hr Mean	50 µg m ⁻³	4.60 – 36.70	Low
Fine Particulate Matter (PM _{2.5})	Monthly Mean	25 µg m ⁻³	4.51 – 7.24	Low
Sulphur Dioxide (SO ₂)	2-week Mean	125 µg m ⁻³	9.41 max	Low
Metals - Lead	Monthly Mean	0.25 µg m ⁻³	0.07 max	Low
Cyanide	2-week Mean	50 µg m ⁻³	0.06 max	Low
PAHs - Coal Tar Pitch Volatiles	2-week Mean	0.48 µg m ⁻³	0.118 max	Low
PAHs - Naphthalene	2-week Mean	126 µg m ⁻³	0.002 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	<1.4	Low
Dust Deposition - Directional Gauge	Monthly Mean	200 mg m ⁻² day ⁻¹	85 – 247	Medium
Dust Soiling - Sticky Pad	Weekly	5% EAC day ⁻¹	0 – 2.3	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 deposited dust at Site B (Avenue NE) and Site C (Avenue SE).

The pattern of dust deposition levels would suggest the Avenue site was a contributing element to these elevated levels and that further dust mitigation measures are likely to be required to minimise emissions.

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. Furthermore, there were issues with data loss at Site 6 and Site C and this should have been identified and resolved more quickly.

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 41 (5-11 October):
 - Vegetation stripping and stockpiling in Zone 2 (Low Level Stocking Area); and
 - Breaking out of concrete in Zone 4 (Car Park).
- Week 42 (12-18 October):
 - Stockpiling and haul route construction in Zone 2 (Low Level Stocking Area); and
 - Breaking out of concrete in Zone 3a (High Level Stocking Area).
- Week 43 (19-25 October):
 - Stockpiling and haul route construction in Zone 2 (Low Level Stocking Area);
 - Breaking out of concrete in Zone 3a (High Level Stocking Area); and
 - Stockpiling of slab from High Level Stocking Area in Zone 5.
- Week 44 (26 October – 1 November):
 - Stockpiling and haul route construction 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
 - Stockpiling in Zone 5 of woodchip formerly stockpiled in Zone 2 (Low 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
Alternations to Monitoring Programme:		
None	n/a	n/a
Downtime and Technical Difficulties:		
Site 5	Period 1 (1–19 October)	There was no APM950 sample submitted for metals analysis, as the sample was mislaid during transit.
Site 6	7 October – 2 November	A technical fault with the APM950 at Site 6 resulted in no data collection until the fault was identified and repaired on 2nd November 2009.
Site C	2–6 November	An interruption to the power supply at around 13:00 on 1st November 2009 resulted in a loss of APM950 data at Site C between the power interruption and the end of the period on 6 th November 2009.

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 19.7 µg m⁻³ at Site 7 (Stretton) is less than 50% of the 40 µg m⁻³ annual mean air quality objective.

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)	12.1
Site B: Avenue (NE)	16.0
Site C: Avenue (SE)	13.9
Site D: Avenue (SW)	11.9
Site 1: Press Lane Farm, Old Tupton	12.1
Site 2: Hunloke Primary School	15.6
Site 4: Village Hall, Hasland	13.7
Site 5: Avenue Farm	15.3
Site 6: BT Offices (Pioneer House) Mill Lane	13.4
Site 7: Nursery at Stretton*	19.7

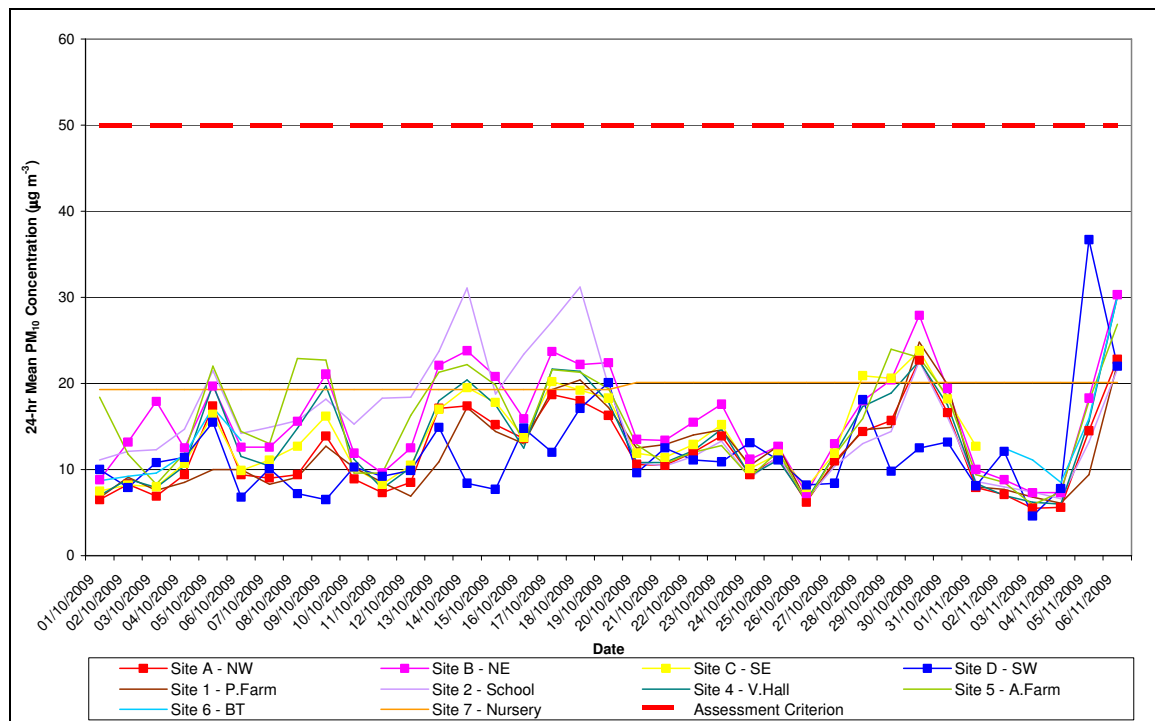
Notes:

* 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 October monitoring period are generally higher than those measured during September. The maximum measured

concentration of $36.7 \mu\text{g m}^{-3}$ at Site D, which is located near to the western boundary of the Avenue site, is comfortably below the $50 \mu\text{g m}^{-3}$ 24-hour mean air quality objective. A peak in PM_{10} concentrations was observed at all continuous monitoring stations on 5 and 6 November and is likely to be due to the effects of Bonfire Night on local air quality, as opposed to activities on the Avenue site.

Figure 1 – 24-hour Average Concentrations of PM_{10} 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 $\text{PM}_{2.5}$ Concentrations

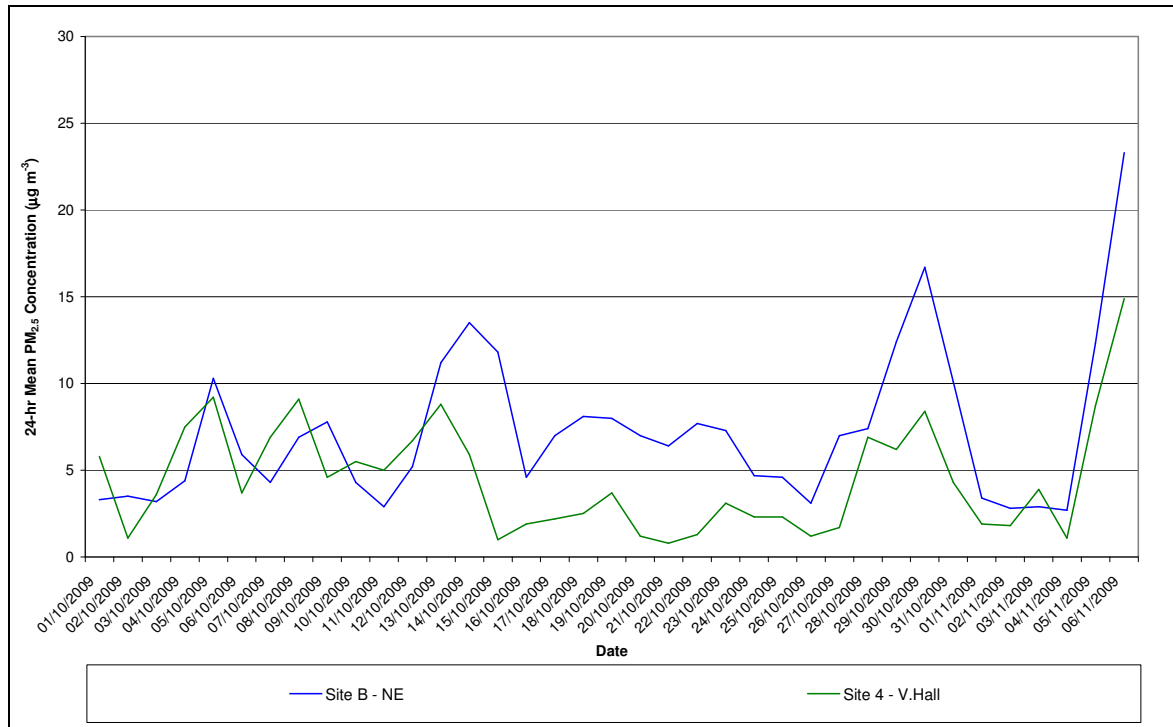
Table 4 presents monthly average concentrations of $\text{PM}_{2.5}$ at the two fixed monitoring sites; as observed for PM_{10} , concentrations of $\text{PM}_{2.5}$ are higher in October than in September. The highest average concentration of $7.2 \mu\text{g m}^{-3}$ occurred at Site 4 (located at the Village Hall in Hasland, to the north-east of the Avenue site), but this is significantly less than the $25 \mu\text{g m}^{-3}$ annual mean national air quality objective.

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

Monitoring Site	$\text{PM}_{2.5}$ Monthly Average Concentration ($\mu\text{g m}^{-3}$)
Site B: Avenue (NE)	7.2
Site 4 – Village Hall, Hasland	4.5

Figure 2 presents 24-hour average concentrations of $\text{PM}_{2.5}$ at the fixed monitoring sites, to provide an indication of the monthly variation in measured values. There were three minor spikes in concentrations, but the highest measured concentrations, on the 5 and 6 November, likely to be due to the effects of Bonfire Night, did not exceed $24 \mu\text{g m}^{-3}$.

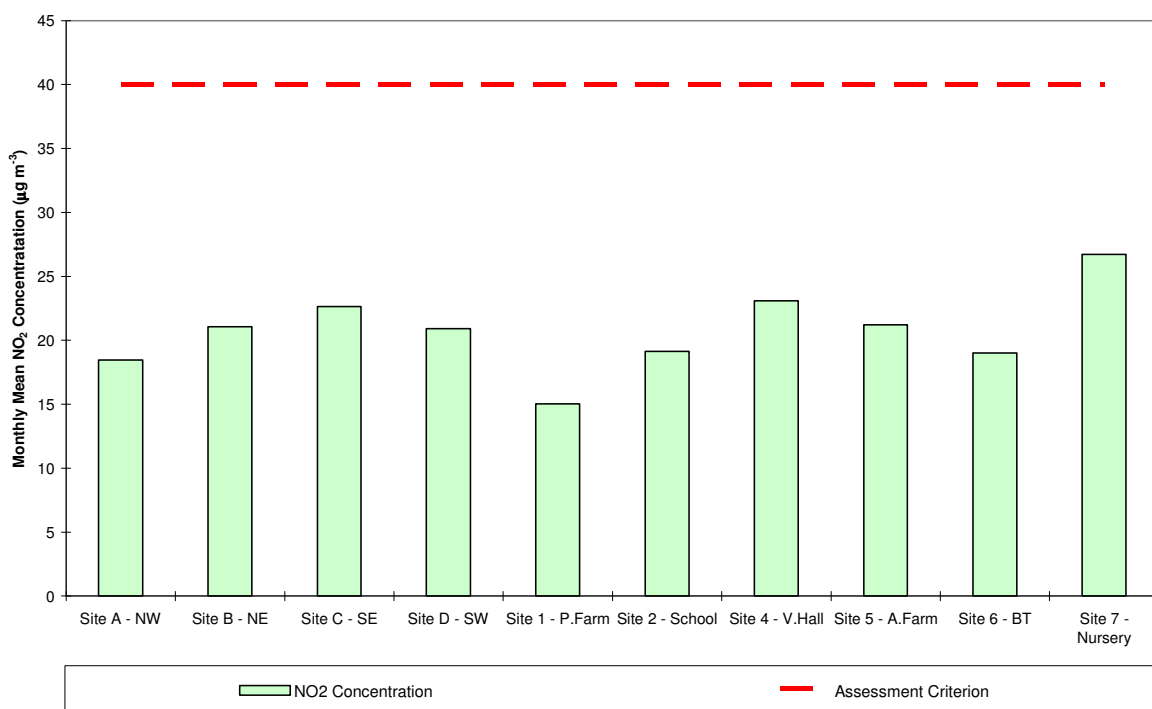
Figure 2 – 24-hour Average Concentrations of PM_{2.5} Particulate Matter ($\mu\text{g m}^{-3}$)



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 $26.72 \mu\text{g m}^{-3}$ 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.

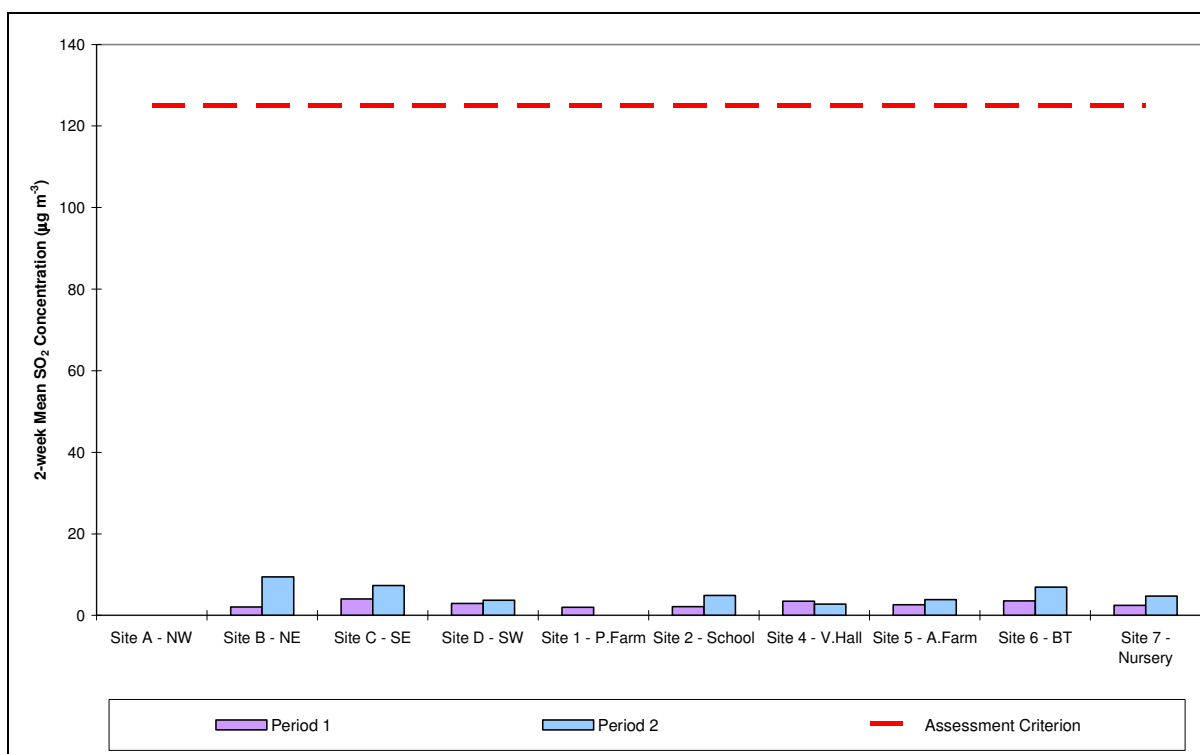
Figure 3 – Monthly Average Concentrations of Nitrogen Dioxide ($\mu\text{g m}^{-3}$)



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 B (Avenue NE) during the second monitoring period. At Site A (Avenue NW) concentrations of SO_2 were below the limits of detection during both periods of monitoring.

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

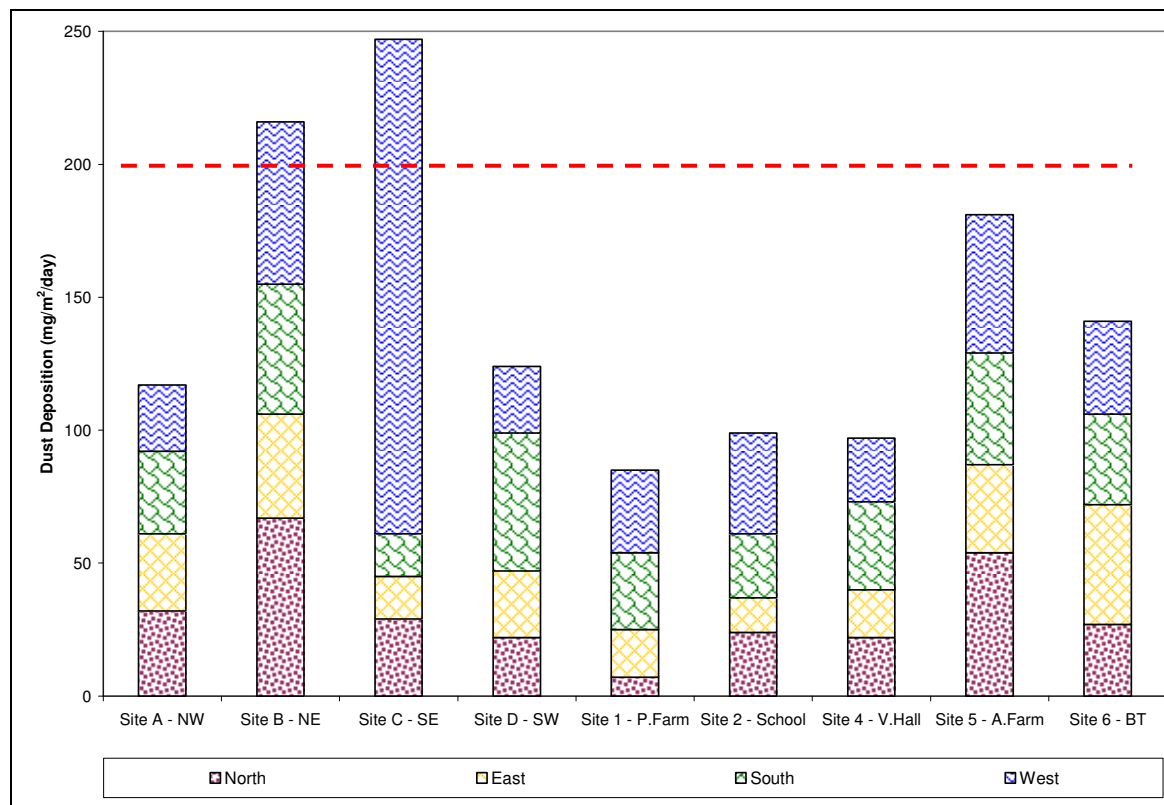


2.1.5 Deposited Dust Levels

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 C (Avenue SE) and Site B (Avenue NE) and the measured levels represent a minor exceedence of the target level. At Site B, approximately 60% of the deposited dust originated from the north and the west (in equal proportions) and at Site C, 75% of the dust originated from the west. Levels of deposited dust at Site 5 were elevated, but were below the target level and, as with Site B, approximately 60% of the deposited dust originated from the north and the west (in equal 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)

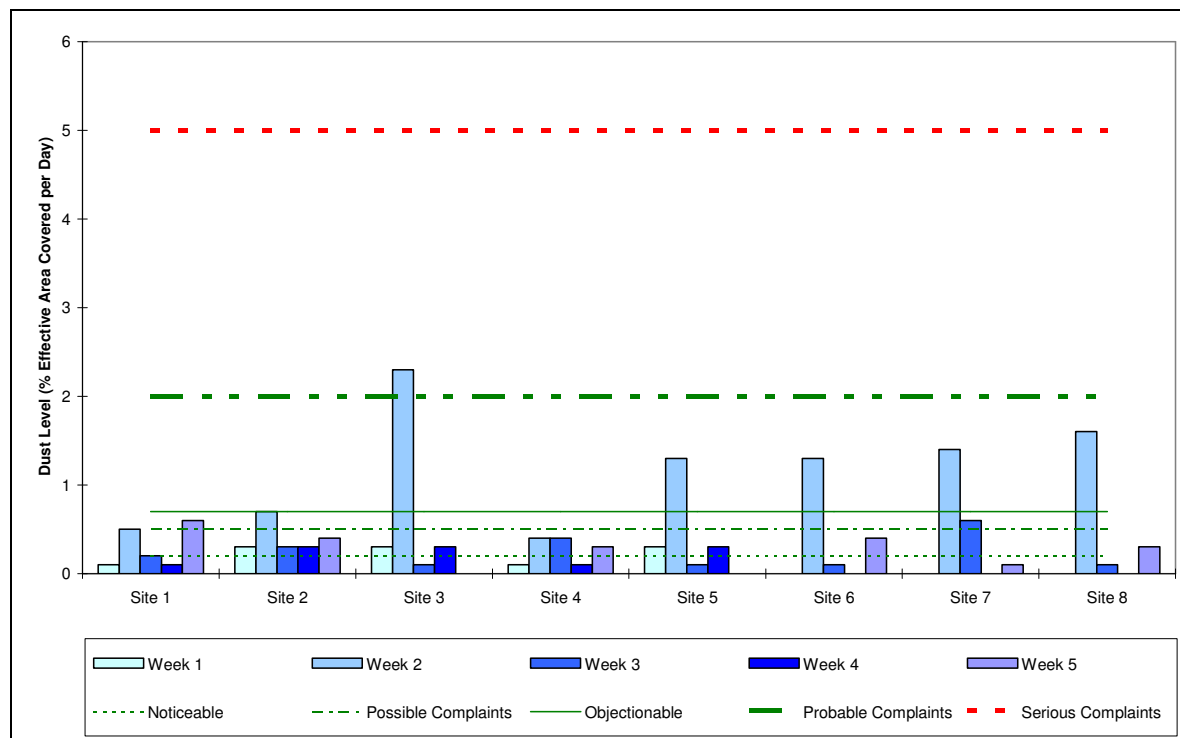


2.1.6 Dust Soiling Levels

Measurements of dust soiling continue to be undertaken using sticky pads at 8 locations over a five periods of seven days, for comparison against target levels measured in units of effective area covered per day (% EAC). As stated last month, Site 1 is the only boundary monitoring location (is located north of the site entrance in Zone 2, as opposed to south of the main site entrance) that is not directly comparable with the external monitoring locations identified in the Air Quality Management Plan.

Figure 6 shows the maximum measured weekly levels of dust from the sticky pads at each of the 8 monitoring locations. The highest levels of dust were measured in Week 2 at all locations, except Site 1 where the maximum levels were measured in Week 5. The maximum dust level of 2.3% EAC was measured at Site 3 in Week 2, which was close to on site earthworks activity; all other measured values were below 2% EAC. At all locations, measured levels of dust were below the target level of 5% EAC and would therefore be unlikely to lead to complaints from receptors located further from the Avenue site. However, the measurements suggest that the effectiveness of dust mitigation should be reviewed and enhancements made where appropriate.

Figure 6 – Maximum Weekly Measured Dust Levels using Sticky Pad Technique (%EAC/day)



2.1.7 Volatile Organic Compounds

The assessment criteria limits for benzene and toluene are $5 \mu\text{g m}^{-3}$ and 1.9mg 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 of $1.4 \mu\text{g m}^{-3}$. The maximum measured concentration of toluene in period 1 was 0.044mg m^{-3} and in period 2 no stations recorded levels above the limit of detection of 0.008mg m^{-3} .

2.1.8 Metals

The only metal with an air quality objective is lead, with a concentration of $0.25 \mu\text{g m}^{-3}$ as an annual average. The maximum measured concentration of lead was $0.07 \mu\text{g m}^{-3}$, recorded at Station D during the second monitoring period.

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. At Site 6 (Pioneer House) a technical fault with the APM950 monitor resulted in no data collection between 7 October and 2 November and the lower volume of sampled air led to the limit of detection increasing to $<0.01 \mu\text{g m}^{-3}$, which is higher than the target level of $0.005 \mu\text{g m}^{-3}$, but is not considered as a genuine exceedence.

2.1.9 Cyanide

There are no air quality objectives for cyanide. The assessment criteria for The Avenue is a maximum concentration of $50 \mu\text{g m}^{-3}$ as a 2-week average. The maximum concentration of cyanide was $0.06 \mu\text{g m}^{-3}$.

2.1.10 Phenol(s)

The target levels for phenol and cresol at The Avenue are $48 \mu\text{g m}^{-3}$ and $220 \mu\text{g m}^{-3}$ as a 2-week average, respectively. The reporting of phenols is subject to a lower detection limit of $0.2 \mu\text{g m}^{-3}$ and there were no measured concentrations above this level.

2.1.11 Poly-Aromatic Hydrocarbons

The target level of Coal Tar Pitch Volatiles at The Avenue is $0.48 \mu\text{g m}^{-3}$, whilst for naphthalene the level is $126 \mu\text{g m}^{-3}$. There were no exceedences of these criteria during the month. The highest measured concentration of total Coal Tar Pitch Volatiles was $0.116 \mu\text{g m}^{-3}$ and the highest measured concentration of naphthalene was $0.002 \mu\text{g m}^{-3}$.

2.1.12 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 PM_{10} measurements at Site A correlated well with original data during the month. The monthly average concentration at Site A was $22.8 \mu\text{g m}^{-3}$ compared to $22.5 \mu\text{g m}^{-3}$ 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 zinc, where concentrations in the second period were $0.03 \mu\text{g m}^{-3}$ and $0.02 \mu\text{g m}^{-3}$.

Duplicate PAH results from Site 1 showed that the largest magnitude difference in measured concentrations was $0.0036 \mu\text{g m}^{-3}$ for Phenanthrene, a 56% 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 Chrycene during the first period of monitoring; the measurements were $0.00037 \mu\text{g m}^{-3}$ and $0.00088 \mu\text{g m}^{-3}$, a difference of 138%, but an absolute difference of only $0.00051 \mu\text{g m}^{-3}$.

Duplicate phenol samples were taken at Location 1. No results were reported above the limit of detection (LOD) of $0.2 \mu\text{g m}^{-3}$ during either of the two monitoring periods.

The duplicate SO_2 measurements during the first period of monitoring gave concentrations of $2.09 \mu\text{g m}^{-3}$ for the first diffusion tube and $4.03 \mu\text{g m}^{-3}$ for the second tube. In the second monitoring period the concentrations were $9.41 \mu\text{g m}^{-3}$ for the first tube and $7.30 \mu\text{g m}^{-3}$ for the second tube. In the context of the absolute concentrations, the measurements would be considered satisfactory.

For total VOC measurements, the measured concentrations from the duplicate diffusion tubes were 0.0091mg m^{-3} compared to 0.0046mg m^{-3} in the first period and 0.027mg m^{-3} compared to 0.051mg m^{-3} in the second period. In percentage terms these differences appear large, but in the context of the magnitude of the concentrations and the target levels, the differences are small.

The duplicate NO_2 measurements gave concentrations of $19.33 \mu\text{g m}^{-3}$ for the first diffusion tube and $21.05 \mu\text{g m}^{-3}$ 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 5, 12 and 23 October 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.