

# Avenue Remediation Project

## Air Quality and Odour Monitoring Programme

### Summary of Results: February 2010

## 1. Overview

### 1.1 Summary of Monthly Air Quality Monitoring Results

Table 1 provides an overview of the air quality measurement data for February 2010 (1<sup>st</sup> February to 2<sup>nd</sup> March<sup>1</sup>) 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 <sub>2</sub> )	Monthly Mean	40 µg m <sup>-3</sup>	18.19 – 29.56	Low
Fine Particulate Matter (PM <sub>10</sub> )	Monthly Mean	40 µg m <sup>-3</sup>	9.2 - 20.8	Low
Fine Particulate Matter (PM <sub>10</sub> )	24-hr Mean	50 µg m <sup>-3</sup>	3.1 – 30.5	Low
Fine Particulate Matter (PM <sub>2.5</sub> )	Monthly Mean	25 µg m <sup>-3</sup>	5.9 – 6.0	Low
Sulphur Dioxide (SO <sub>2</sub> )	2-week Mean	125 µg m <sup>-3</sup>	6.50 max	Low
Metals - Lead	Monthly Mean	0.25 µg m <sup>-3</sup>	0.03 max	Low
Cyanide	2-week Mean	50 µg m <sup>-3</sup>	0.07 max	Low
PAHs - Coal Tar Pitch Volatiles	2-week Mean	0.48 µg m <sup>-3</sup>	0.21 max	Low
PAHs - Naphthalene	2-week Mean	126 µg m <sup>-3</sup>	0.018 max	Low
Phenols – Phenol	2-week Mean	48 µg m <sup>-3</sup>	<0.2	Low
Phenols – Cresols	2-week Mean	220 µg m <sup>-3</sup>	<0.2	Low
VOCs - Benzene	2-week Mean	5 µg m <sup>-3</sup>	<1.8	Low
Dust Deposition - Directional Gauge	Monthly Mean	200 mg m <sup>-2</sup> day <sup>-1</sup>	24 – 65	Low
Dust Soiling – Sticky Pad	% EAC*	5 % EAC	1.1 max	Low
Odours	n/a	n/a	Low-Med	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.

\* %EAC refers to percentage area covered per day.

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

*In summary:*

*There was one air quality related complaint recorded during the month; this occurred on 24<sup>th</sup> February and was from a member of the public, a resident of Wingerworth, complaining about odours from the site. The complainant was invited to the site to speak with the environmental team and discuss the nature of the odours in more detail. The possible source of these odours was identified as areas Z2 and Z4, where material works were taking place. The wind direction on 24<sup>th</sup> was from the east-south-east direction and the wind strength was between 0.3 and 6.4 ms<sup>-1</sup>. Given the wind direction, Wingerworth would experience odours originating from The Avenue site.*

*In terms of the monitoring results, there were no exceedences of the target at any of the locations for any of the pollutants during the month.*

*None of the other pollutants exceeded their target levels during the month.*

*Monthly average concentrations of particulate matter (PM<sub>10</sub>) were slightly higher than measurements in January 2010, by approximately 1 µg m<sup>-3</sup>. None of the monitoring stations recorded measurements which would have resulted in an exceedence of the 24-hour Air Quality Objective. Concentrations of PM<sub>2.5</sub> were almost double the concentrations in January, although this represents only a small increase of approximately 2.5 µg m<sup>-3</sup>. Concentrations of nitrogen dioxide (NO<sub>2</sub>) were slightly lower than measurements in January 2010 by approximately 2 µg m<sup>-3</sup>. In general there were no significant differences between the measured concentrations for January and February for PM<sub>10</sub>, PM<sub>2.5</sub> and NO<sub>2</sub>.*

*Although the magnitude of change was generally small, concentrations of sulphur dioxide, were lower than January, while concentrations of particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), cyanide, metals, VOCs and naphthalene coal tar pitch volatiles (PAHs) and levels of deposited dust were higher than January.*

## **1.2 Work Activity**

The site remediation operations (known as Stage 3 of the Avenue project) officially commenced on 9 September 2009. Some site-based works, with the potential to affect air quality, have taken place during February 2010. The earthworks included the following activities:

- Borrow Pit Infilling with material from Plant Area;
- Completion of the construction of the River Rother pipe crossing in Zone 1;
- Construction of the site of waste tip processing and washing area in Zone 3;
- Crushing activities in Zone 5;
- Remediation in the Ruberoid part of the plant area (including the breaking out of the hardstandings);
- Haul Route construction to the east of the High Level Stocking Area and adjacent to the River Rother;
- Removal of the red shale bank in Zone 1 for the purposes of creating an appropriate haulage route to the temporary crossing;
- Red shale and crushed materials, formerly stockpiled in Zone 5, used to create a piling mat for sheetpile wall construction;
- Culvert “Cut-off Wall” reparation; and
- Placement of contaminated material in the High Level Stocking bunded area as a temporary measure ahead of the construction of the treatment areas.

## **1.3 Alterations, Downtime and Technical Difficulties**

A summary of alterations 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
<b>Alternations to Monitoring Programme:</b>		
All locations	First reporting period of February (1 <sup>st</sup> -15 <sup>th</sup> February)	Collection of Tenax tubes staggered over a three day period as stocks of replacement tubes became available from the laboratory.
<b>Downtime and Technical Difficulties:</b>		
Site 4	Second period of February (15 <sup>th</sup> February – 2 <sup>nd</sup> March)	APM Data: Residual filter weight outside the expected parameters and filter when checked by laboratory had become stained. Results for metals at this site, for the second half of February, should therefore be treated with caution as they cannot be verified.

## 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 PM<sub>10</sub> Concentrations

Table 3 presents monthly average concentrations of PM<sub>10</sub> at the fixed monitoring sites. The highest average concentration of 20.8 µg m<sup>-3</sup> at Site 7 (Nursery at Stretton), which is located ~6 km to the south of the site, is approximately 50% of the 40 µg m<sup>-3</sup> annual mean air quality objective. The second highest monthly average of 12.5 µg m<sup>-3</sup> was recorded at Sites 4 and 5 (located to the north and east of the site), whilst the additional stations within and close to the Avenue recorded levels in the 9.2-11.6 µg m<sup>-3</sup> range. As there are only slight variations in monitored concentrations at sites bordering The Avenue, it could be concluded that The Avenue is having no discernable effect on concentrations of particulate matter.

**Table 3 – Monthly Average Concentrations of PM<sub>10</sub> Particulate Matter (µg m<sup>-3</sup>)**

Monitoring Site	PM <sub>10</sub> Monthly Average Concentration (µg m <sup>-3</sup> )
Site A: Avenue (NW)	11.1
Site B: Avenue (NE)	11.1
Site C: Avenue (SE)	10.8
Site D: Avenue (SW)	11.3
Site 1: Press Lane Farm, Old Tupton	9.5
Site 2: Hunloke Primary School	9.2
Site 4: Village Hall, Hasland	12.5
Site 5: Avenue Farm	12.5
Site 6: BT Offices (Pioneer House) Mill Lane	11.6
Site 7: Nursery at Stretton*	20.8

Notes:

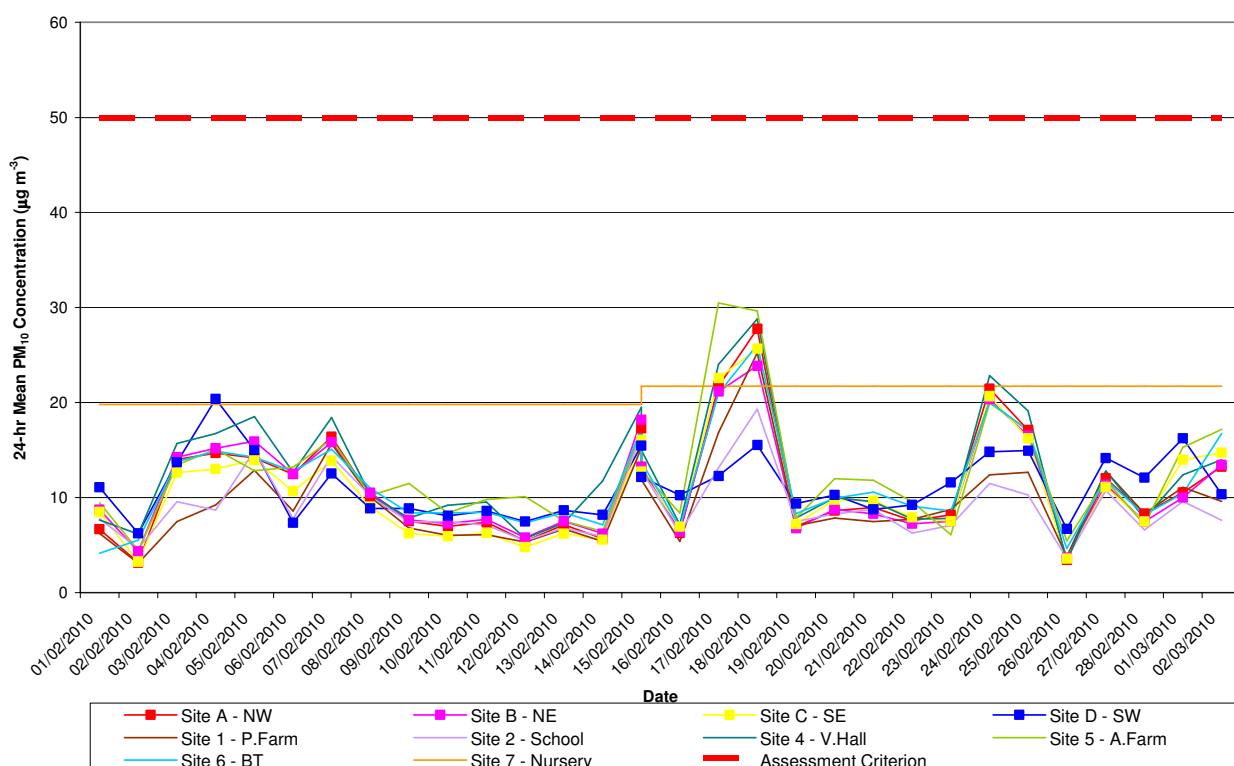
\* Concentration measured at Site 7 using Mini-Vol sampler. All other measurements using APM950 instrumentation

Figure 1 presents 24-hour average concentrations of PM<sub>10</sub> at the fixed continuous monitoring sites; measured concentrations in the February monitoring period were generally higher than those measured during January and there were more defined peaks in measured concentrations.

The maximum measured 24-hour concentration of  $30.5 \mu\text{g m}^{-3}$  was recorded at Site 5 (Avenue Farm) on 17th February; no other maximum values occurred on this date. On the 17th February the main wind direction was from the south-east until 4pm, when the wind direction changed to the north-east. Both of these wind directions would result in Site 5 being upwind of The Avenue site, and therefore, it would be unlikely for The Avenue to be the source of the elevated concentrations at Site 5 on 17th February.

The date of the maximum measured concentration at most of the other sites (A, B, C, 1, 2, 4, and 6) was 18th February. The wind direction on the 18th February was mainly from the north-north-east. This would potentially result in some sites being downwind of work activities taking place on The Avenue site. In particular, sites A, B and C are located close to areas where a new haul road is being constructed as well as the location of the waste tip and washing area, which was also being constructed in February. The maximum 24-hour average for Site D occurred on 4th February when the wind direction was generally from the south-south-east. Given the location of Site D the potential source of  $\text{PM}_{10}$  on 4th February could have been The Avenue site.

**Figure 1 – 24-hour Average Concentrations of  $\text{PM}_{10}$  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. The highest average concentration of  $6.0 \mu\text{g m}^{-3}$  occurred at Site B (located on the north east boundary of the Avenue site), and this was  $1.3 \mu\text{g m}^{-3}$  higher than the concentration measured in January. At Site 4 (Village Hall, Hasland) located beyond the north east boundary of the Avenue site, the monthly average concentration of  $\text{PM}_{2.5}$  increased from  $2.4 \mu\text{g m}^{-3}$  in January to  $5.9 \mu\text{g m}^{-3}$  in February. All measured concentrations are significantly less than the  $25 \mu\text{g m}^{-3}$  annual mean national air quality objective.

**Table 4 – Monthly Average Concentrations of PM<sub>2.5</sub> Particulate Matter (µg m<sup>-3</sup>)**

Monitoring Site	PM <sub>2.5</sub> Monthly Average Concentration (µg m <sup>-3</sup> )
Site B: Avenue (NE)	6.0
Site 4 – Village Hall, Hasland	5.9

Figure 2 presents 24-hour average concentrations of PM<sub>2.5</sub> at the fixed monitoring sites, to provide an indication of the monthly variation in measured values. The figure shows more variability in the range of concentrations measured at Site B (located on the north east boundary of the Avenue site) compared to Site 4 (Village Hall, Hasland), although the overall shape of the graphs is similar.

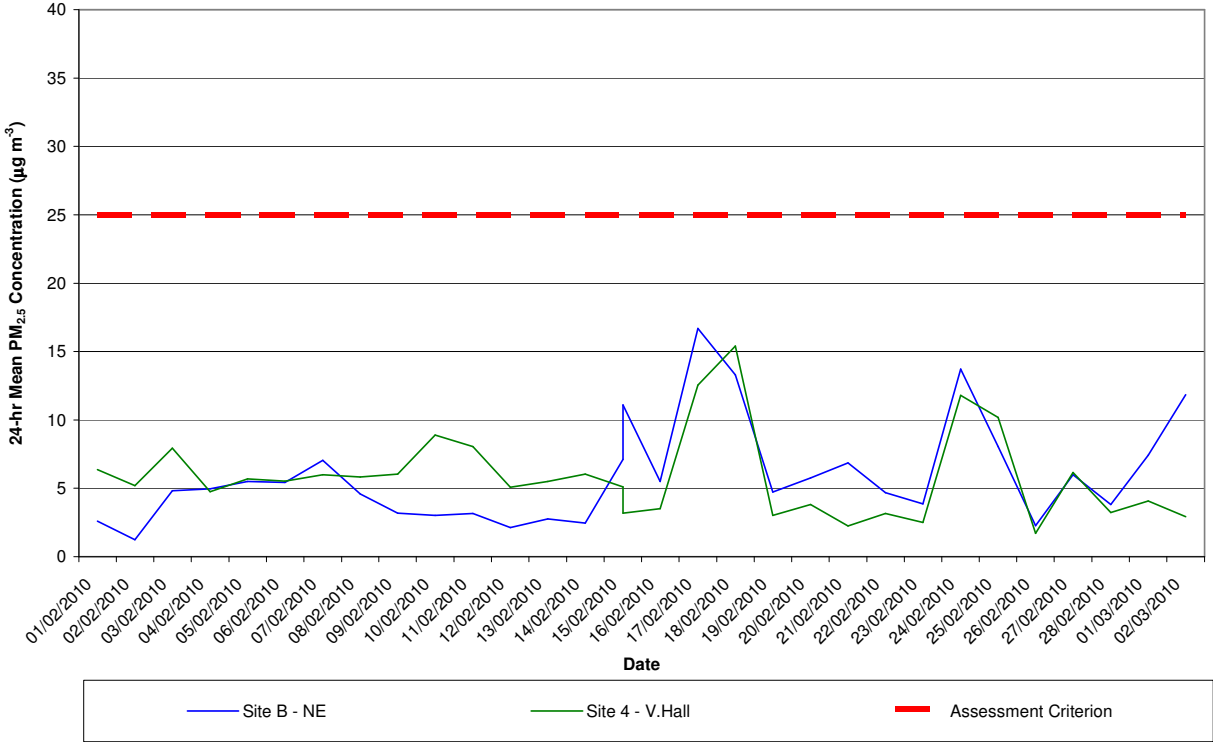
Measured concentrations at Site B deviate from the measured concentrations at Site 4 during the month, at some points concentrations at Site B are higher than those at Site 4 and at other times during the month this situation reversed. This suggests that there are localised sources of PM<sub>2.5</sub> close to the two monitors. On 10<sup>th</sup> February when the concentrations measured at Site B are lower than those at Site 4 the wind direction was from the east-north-east. This could suggest a localised source close to Site 4 was responsible for higher values at this site, whereas at Site B is located upwind of The Avenue site and there are no other likely local sources of PM<sub>2.5</sub> hence the low values at this site for 10<sup>th</sup> February.

On 15<sup>th</sup> February when a peak in PM<sub>2.5</sub> concentrations was shown at Site B, but not at Site 4, the wind direction was from the south-west. At Site B, PM<sub>2.5</sub> concentrations rose sharply from 10.30 in the morning, until 15:00 in the afternoon. Works were taking place in the area to the south-west of Site B in February and these could be the source of these elevated PM<sub>2.5</sub> concentrations.

The peaks at both Sites B and 4 on 17<sup>th</sup> and 18<sup>th</sup> and 24<sup>th</sup> February are when the wind direction was from the south west on 17<sup>th</sup>, moving to the north-north-east on 18<sup>th</sup> and from the south-west on 24<sup>th</sup>. This suggests that The Avenue was a source of PM<sub>2.5</sub> on 17<sup>th</sup> (Site B) and 24<sup>th</sup> (Site B and Site 4), when the wind was from the south-west, and a localised source close to Site 4 was perhaps responsible for the peak on 18<sup>th</sup> when the wind was from the north-north-east.

In any event, the 24-hour concentrations of PM<sub>2.5</sub> at Site B and Site 4 did not exceed the assessment criterion during the period; the highest 24-hour average concentrations measured at Site B and Site 4 were less than 50% of the 25 µg m<sup>-3</sup> annual mean national air quality objective.

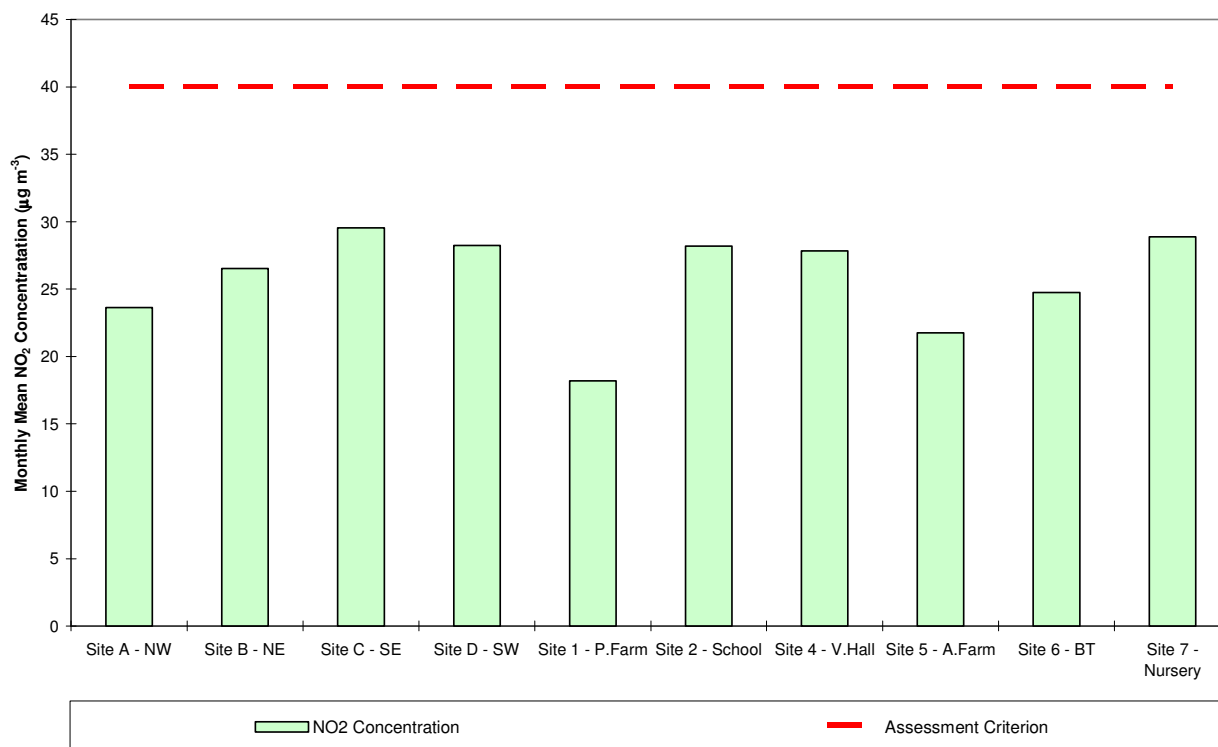
Figure 2 – 24-hour Average Concentrations of PM<sub>2.5</sub> Particulate Matter (µg m<sup>-3</sup>)



### 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 monthly average concentration was  $29.56 \mu\text{g m}^{-3}$  at Site C (Avenue SE), although several of the other sites have monthly average concentrations approaching this maximum value. This suggests there was not a localised source close to Site C which resulted in this maximum value for  $\text{NO}_2$ . Concentrations of  $\text{NO}_2$  in February were generally lower than those measured in January, where the maximum monthly average concentration, was  $32.44 \mu\text{g m}^{-3}$  at Site 4.

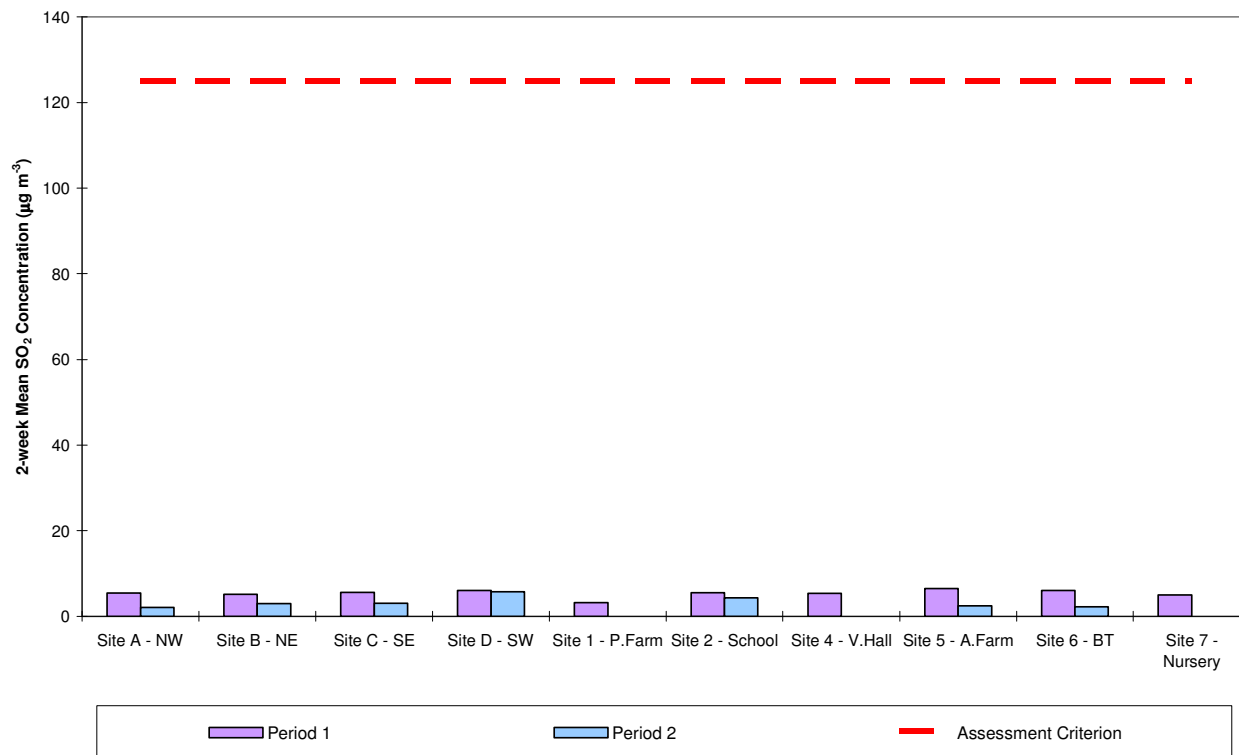
Figure 3 – Monthly Average Concentrations of Nitrogen Dioxide ( $\mu\text{g m}^{-3}$ )



### 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  $6.5 \mu\text{g m}^{-3}$  and occurred at Site 5 (Avenue Farm) during the first monitoring period.

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

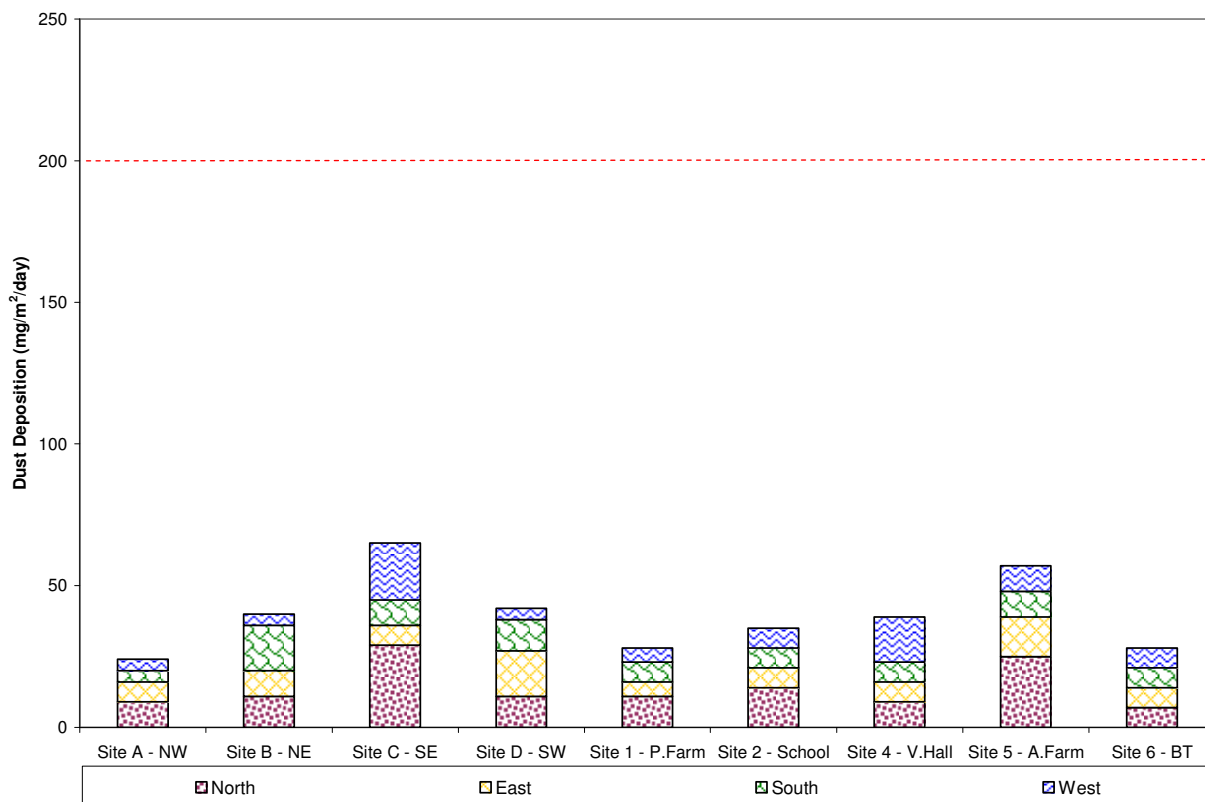


### 2.1.5 Deposited Dust Levels

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

The highest measured level of deposited dust of 65 mg/m<sup>2</sup>/day was recorded at Site C (Avenue SE) and the measured levels did not represent an exceedence of the target level. At Site C, approximately 50% of the deposited dust originated from the north and 30% was from the west. This pattern of dust deposition levels would suggest the Avenue site was a contributing element to these dust levels, although other local sources of dust from the north (e.g. farming activity) could also be significant.

**Figure 5 – Measured Dust Deposition Levels (mg/m<sup>2</sup>/day)**



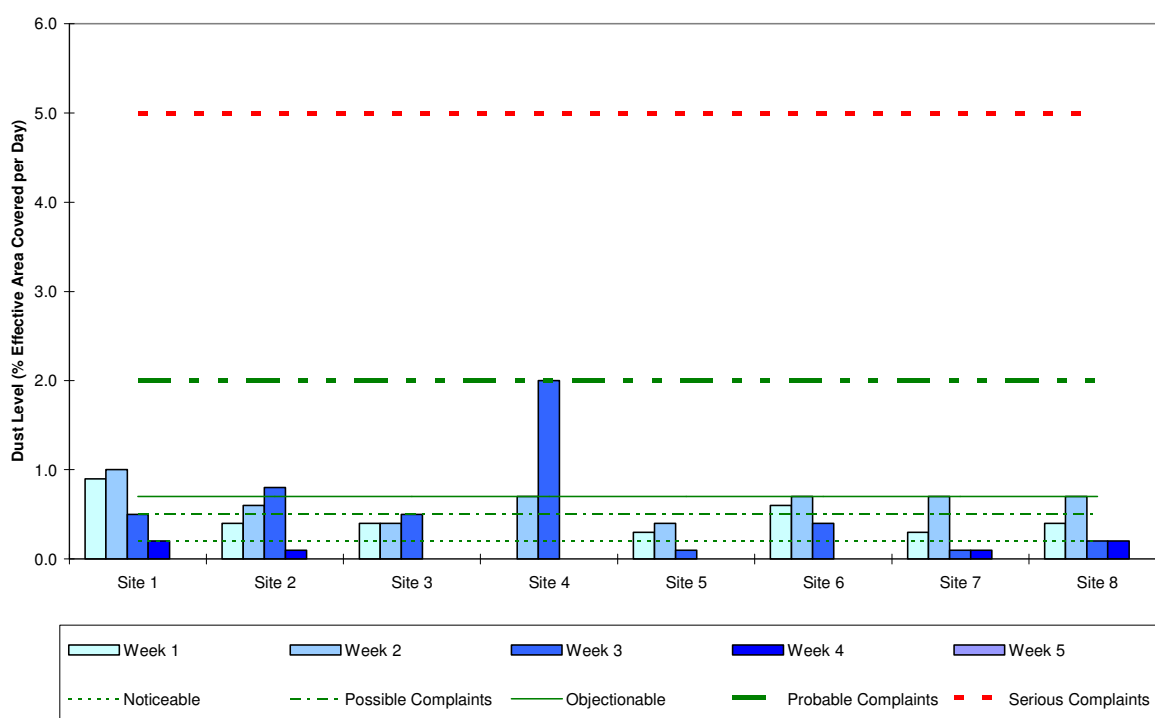
### 2.1.6 Dust Soiling Levels

Measurements of dust soiling continue to be undertaken using sticky pads at 8 locations, over periods of approximately seven days, for comparison against target levels measured in units of effective area covered per day (% EAC).

Figure 6 shows the maximum measured weekly levels of dust from the sticky pads at each of the 8 sticky pad monitoring locations. The highest level of dust of 2.0 %EAC was measured in Week 3 at Site 4 (Northern Corner of the site). However, Week 2 was the period when the highest levels of coverage were recorded at a number of other monitoring locations. This value was recorded for the northern side of the sticky pad, suggesting that the source of dust was from the north, and is therefore unlikely to be The Avenue site. The results would suggest that a source local to Site 4 was the primary source of dust during week 3, and not works taking place at The Avenue site.

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.

**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  $1.9 \text{ mg m}^{-3}$  as a 2-week average, respectively.

During the first and second 2-week monitoring periods all recorded levels of benzene were below the limit of detection of  $1.8 \mu\text{g m}^{-3}$  in the first monitoring period (1st February to 15<sup>th</sup> February) and  $1.7 \mu\text{g m}^{-3}$  in the second monitoring period (15th February to 2<sup>nd</sup> March). The assessment criterion for benzene has therefore been achieved at all monitoring stations.

The maximum measured concentration of toluene in period 1 was  $0.0056 \text{ mg m}^{-3}$  and in period 2 the maximum measured concentration was  $0.0062 \text{ mg m}^{-3}$ . At most of the monitoring stations the levels of toluene were below limits of detection. The assessment criterion for toluene has therefore been comfortably achieved at all monitoring stations.

### 2.1.8 Metals

During the second period of February at Site 4 the APM filter was found when weighed to be outside the normal parameters and had also become stained. As a result of this the results presented here for metals for Site 4 for the second half of February have not been verified and therefore should be treated with caution.

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  $0.03 \mu\text{g m}^{-3}$ , recorded at Site 7 (Nursery) during the first monitoring period and Site 4 (Village Hall) during the second monitoring period.

For cadmium in the second monitoring period the maximum measured concentration exceeded the target level of  $0.005 \mu\text{g m}^{-3}$  at Site 7 (Nursery) with a measured concentration of  $0.009 \mu\text{g m}^{-3}$ .

Concentrations of all other metals were in most cases below limits of detection (0.003); where concentrations were above limits of detection the concentrations were significantly below target levels.

#### 2.1.9 Cyanide

There are no air quality objectives for cyanide. The assessment criterion for The Avenue is a maximum concentration of  $50 \mu\text{g m}^{-3}$  as a 2-week average. At all locations concentrations of cyanide were below limits of detection.

#### 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 these compounds 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 the target level for Coal Tar Pitch Volatiles during the month and no exceedences of the target level for naphthalenenaphthalene. The highest measured concentration of total Coal Tar Pitch Volatiles was  $0.20707 \mu\text{g m}^{-3}$  at Site AQA (NW boundary of the site) during the first week of monitoring. The highest measured concentration of naphthalene was  $0.018 \mu\text{g m}^{-3}$ , at Site AQB (NE boundary of the site), and also in the first week of monitoring. Given the location of these monitoring sites and the fact that these monitoring sites are located on The Avenue site, it is likely the source of Poly-Aromatic Hydrocarbons is localised activities close to these monitoring sites, on The Avenue site.

#### 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. The laboratory blank corrected VOC results due to the presence of toluene in the laboratory.

##### **Duplicates**

Duplicate  $\text{PM}_{10}$  measurements at Site A correlated well with original data during the month. The monthly average concentration at Site A was  $11.1 \mu\text{g m}^{-3}$  compared to  $10.6 \mu\text{g m}^{-3}$  for the duplicate monitor.

Duplicate metals results taken at Site A produced the same results during both the first and the second monitoring periods. The only variation in measurements was for chromium and copper, where concentrations in the second period were  $0.003 \mu\text{g m}^{-3}$  and  $0.006 \mu\text{g m}^{-3}$  for chromium and  $0.009 \mu\text{g m}^{-3}$  and  $0.006 \mu\text{g m}^{-3}$  for copper.

Duplicate PAH results from Site 1 showed that the magnitude of difference in the measured concentrations of each compound were not significant.

Duplicate phenol samples were taken at Site 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.

Duplicate  $\text{SO}_2$  measurements were taken at Site B. In period 1 the measured concentrations were  $5.43 \mu\text{g m}^{-3}$  and  $5.13 \mu\text{g m}^{-3}$ ; in the second period, the measured concentrations were  $2.12 \mu\text{g m}^{-3}$  and  $2.96 \mu\text{g m}^{-3}$ . It is therefore considered that the measurements are in good agreement.

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

The duplicate  $\text{NO}_2$  measurements gave concentrations of  $32.99 \mu\text{g m}^{-3}$  for the first diffusion tube, and  $26.52 \mu\text{g m}^{-3}$  for the second tube. The diffusion tube measurements are therefore different by  $6.5 \mu\text{g m}^{-3}$  which is not considered to be significant.

## 2.2 Targeted Air Quality Monitoring

### 2.2.1 Asbestos

Reassurance air testing for asbestos was carried out on 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup> and 24<sup>th</sup> February. The monitoring was undertaken downwind and at the boundary of the following works:

- Downwind of Zone 4 Ruberiod works on 3<sup>rd</sup>, 10<sup>th</sup> and 17<sup>th</sup> February;
- Downwind of Crusher on 3<sup>rd</sup> and 17<sup>th</sup> February;
- Downwind of Zone 2 Central and West on 3<sup>rd</sup> February;
- Downwind of the edge of the Borrow Pit on 10<sup>th</sup> and 17<sup>th</sup> February;
- West of crusher, south of Zone 4 activities on 17<sup>th</sup> February;
- Downwind of the eastern boundary on 17<sup>th</sup> February;
- Downwind of Zone 4 on 24<sup>th</sup> February;
- Downwind of crusher in Zone5 on 24<sup>th</sup> February; and
- Zone 1 Holding Pond, downwind of Piling Mat works on 24<sup>th</sup> February.

All measured concentrations of fibres were  $< 0.01 \text{ f ml}^{-1}$  (fibres per milli-litre) and are therefore comfortably within the control limit.

## 2.3 Odour Monitoring

### 2.3.1 Odour Diaries

Odour diaries for February show that there were four Odour Days when odour intensity was rated greater than 4.

These occurred on 20<sup>th</sup> and 22<sup>nd</sup> February, with the odour being described as Smokey and Creosote respectively. Given the wind direction (SW and NE) and the location of these odour diarists (NE and SW), The Avenue could have been the source of the odour.

The Odour Days on 23<sup>rd</sup> and 25<sup>th</sup> February described the odour as being chemical in nature. Given the wind direction on these days (SE) and the location of this odour diarist to the north-west of the site, The Avenue could have been the source of the odour.

### 2.3.2 Sensory Field Odour Surveys

Sensory field odour surveys were carried out on 1<sup>st</sup>, 11<sup>th</sup>, 17<sup>th</sup> and 24<sup>th</sup> February at each of the fixed monitoring stations. During each survey, the maximum odour annoyance impact level at the times when the wind was blowing from the Avenue was recorded. At all times and locations the maximum odour annoyance impact were 'Low-Medium' and, therefore, the effects of odour are not considered significant.

### 2.3.3 Odour Complaints

One odour-related complaint was received during the month, on 24<sup>th</sup> February. The complainant visited the site and during a meeting with the environmental team it was determined that the odours, were probably associated with the excavation of material in Zone 4 and deposition in Zone 2 and were therefore attributable to operations at the Avenue.