

Avenue Remediation Project

Air Quality and Odour Monitoring Programme

Summary of Results: March 2010

1. Overview

1.1 Summary of Monthly Air Quality Monitoring Results

Table 1 provides an overview of the air quality measurement data for March 2010 (2nd March to 1st April¹) 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	9.82 – 22.86	Low
Fine Particulate Matter (PM ₁₀)	Monthly Mean	40 µg m ⁻³	9.43 – 21.75	Low
Fine Particulate Matter (PM ₁₀)	24-hr Mean	50 µg m ⁻³	1.74 – 23.96	Low
Fine Particulate Matter (PM _{2.5})	Monthly Mean	25 µg m ⁻³	4.84 – 5.19	Low
Sulphur Dioxide (SO ₂)	2-week Mean	125 µg m ⁻³	25.46 max	Low
Metals - Lead	Monthly Mean	0.25 µg m ⁻³	0.03 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	0.028 max	Low
PAHs - Naphthalene	2-week Mean	126 µg m ⁻³	0.001 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	<2.5	Low
Dust Deposition - Directional Gauge	Monthly Mean	200 mg m ⁻² day ⁻¹	33 - 164	Low
Dust Soiling – Sticky Pad	% EAC*	5 % EAC	2.2 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.

¹ 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 23rd March and was from a member of the public, a resident of Hasland, complaining about creosote odours. It was unclear whether the Avenue or fencing operations close to the property was responsible for the odours. The complainant maintained it was the Avenue site and not fencing operations in subsequent discussions. The complainant was approached to become an odour diarist and has accepted.

In terms of the monitoring results, there were no exceedences of the target levels of any of the pollutants during the month.

Concentrations of particulate matter (PM₁₀) were slightly higher than measurements in February 2010 by 1 µg m⁻³, and concentrations of PM_{2.5} showed a similar pattern. None of the monitoring stations recorded measurements which would have resulted in an exceedence of the 24-hour Air Quality Objective. In general there were no significant differences between the values for February and March for PM₁₀, and PM_{2.5}. Concentrations of nitrogen dioxide (NO₂) were lower than measurements in February 2010 by 7 µg m⁻³, which could be considered as a significant difference.

Although the magnitude of change was generally small, concentrations of sulphur dioxide, cyanide, metals, VOCs, naphthalene coal tar pitch volatiles (PAHs) and levels of deposited dust were higher than in February. The maximum sulphur dioxide value was recorded at Site 5 (Avenue Farm) in the second period of monitoring was significantly higher than any of the other monitors, the value recorded at this site did not reflect the trend of slightly higher sulphur dioxide concentrations in March when compared to February.

1.2 Work Activity

The site remediation operations are now well established and some site-based works with the potential to adversely affect air quality have taken place during March 2010. The earthworks included the following activities:

Zone 1:

- The diversion of 180 m of river, that is along the route of the sheet pile wall, into a new channel. The old river channel was filled with red shale and compacted to construct the piling mat on which the sheet pile wall will be constructed. Construction, from the western end of the sheet pile wall, has commenced.
- The excavation of the former rail embankment between the river and Lagoon 4 has commenced. This is to allow access for the temporary bridge to be constructed over the river and a concrete haul road to be constructed from the bridge up to Lagoon 4. Material from the excavation has been used to fill the former river channel.
- The strengthening of existing piped river crossing has been completed.

Zone 2:

- Borrow Pit 1 in the southern part of Zone 2 is being filled with material excavated from Zone 4 (former plant area).

Zone 3:

- Contaminated material from Zone 4 requiring further treatment is being stockpiled as a temporary measure in advance of the availability of the treatment processes.
- Construction of the concrete stocking bays and hardstandings for the waste tip processing and soil washing plant has been ongoing.

Zone 4:

- The site of the old Ruberoid plant has been remediated; this is where the Thermal Treatment Plant is to be constructed.
- Excavations and concrete breakout works have moved to south of the site water treatment plant where the proposed new water treatment plant is to be constructed.
- Crushing operations have moved to Zone 4.

- Construction of the Thermal Treatment Plant foundations and works associated with the gas supply pipeline have been undertaken and are ongoing.

Zone 5:

- Crushing of existing rubble and concrete stockpiles have been undertaken and completed.

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
Alternations to Monitoring Programme:		
All locations	n/a	n/a
Downtime and Technical Difficulties:		
Site 1	First period of March (2 nd March – 14 th March)	Minor loss of data for period of 2 hours during data transfer.
Site 6	First period of March	Loss of power resulting in loss of data from 14 th to 17 th March.
Site 5	Second period of March	Filter designated for Cyanide became damaged and could not be used.

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 21.8 µg m⁻³ 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⁻³ annual mean air quality objective. Although it should be remembered that there is not a continuous monitor for Site 7 and the results reported are for the period mean. The second highest monthly average of 14.6 µg m⁻³ was recorded at Site 4 (located to the north-east), whilst the additional stations within and close to the Avenue recorded levels in the 9.8-14.2 µg m⁻³ range. As there are only slight variations in monitored concentrations at sites bordering The Avenue, it could be concluded The Avenue is having no discernable effect on concentrations of particulate matter.

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

Monitoring Site	PM₁₀ Monthly Average Concentration (µg m⁻³)
Site A: Avenue (NW)	13.1
Site B: Avenue (NE)	13.9
Site C: Avenue (SE)	10.5
Site D: Avenue (SW)	13.1
Site 1: Press Lane Farm, Old Tupton	9.8
Site 2: Hunloke Primary School	11.9
Site 4: Village Hall, Hasland	14.6
Site 5: Avenue Farm	14.2
Site 6: BT Offices (Pioneer House) Mill Lane	13.5
Site 7: Nursery at Stretton*	21.8

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 continuous monitoring sites; measured concentrations in the March monitoring period were generally higher than those measured during February.

The maximum measured concentration of 24 µg m⁻³ was recorded at Site 4 (Village Hall) on 3rd March and this was also the date when the maximum concentrations were recorded at Sites A and D. On the 3rd March the main wind direction was from the east-north-east. This wind direction would result in Site 4 being upwind of The Avenue site and therefore unlikely to be the source of the elevated concentrations. However Sites A and D would be downwind of the eastern side of the site with an east-north-east wind and therefore the Avenue site could be the source of the elevated PM₁₀ concentrations at these locations on 3rd March.

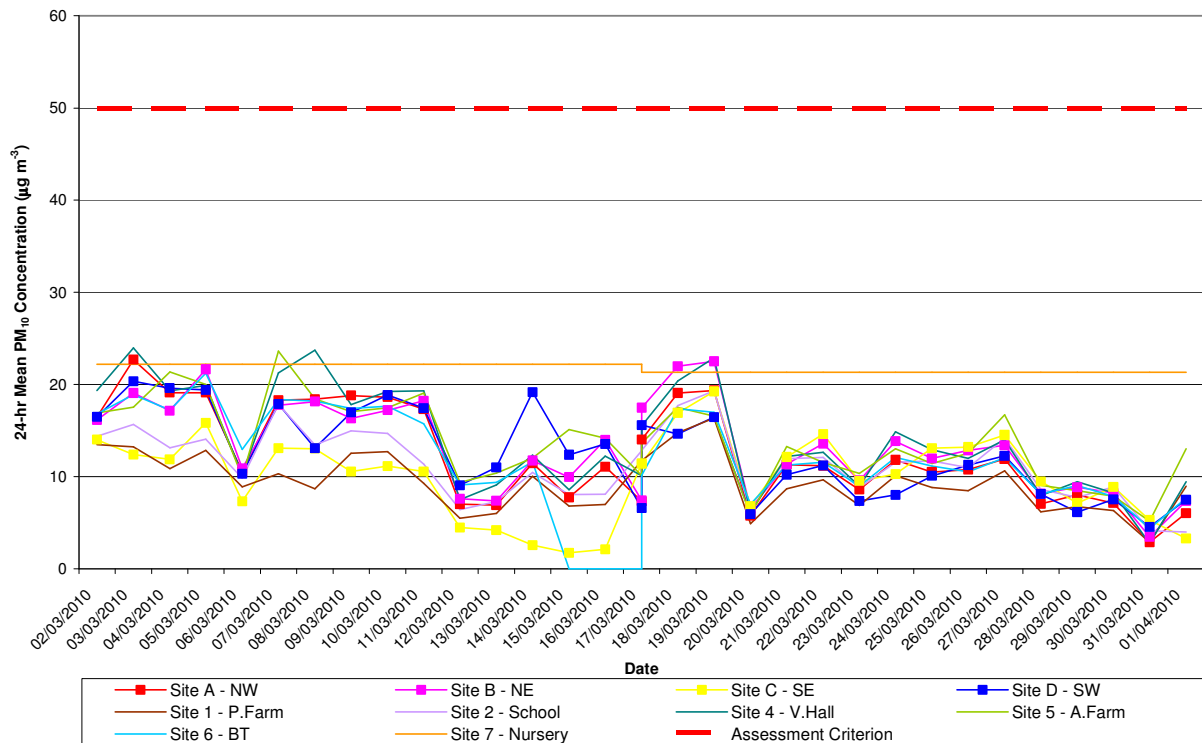
The date of the maximum measured concentration at most of the other sites (B, C, 1 and 2) was 19th March. The wind direction on the 19th March was mainly from the south-west. This would potentially result in the Sites B and C being downwind of work activities taking place on The Avenue site, so The Avenue may have contributed to the measured concentrations. Sites 1 and 2 would be upwind of the site and therefore the Avenue site is unlikely to be the source of the elevated PM₁₀ concentrations at these sites.

The maximum for Site 6 occurred on 5th March and the maximum for Site 5 occurred on the 7th March. The wind direction was from the west-north-west on 5th March and south-south-east on 7th March. Given the location of Site 6, the potential source of PM₁₀ on 5th March could have been The Avenue site, although given the wind direction and the location of Site 5 the Avenue site is unlikely to be the source of PM₁₀ on 7th March.

From the graph the trend in PM₁₀ concentrations across the month suggest higher concentrations during the 1st period at most of the Sites, with the second period showing a much lower trend in PM₁₀ concentrations at all of the monitoring locations.

The zero concentrations in PM₁₀ at Site 6 from 14th to 17th March are the result of a loss of power to this monitor over these 4 days.

Figure 1 – 24-hour Average Concentrations of PM₁₀ Particulate Matter (µg 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. The highest average concentration of 5.5 µg m⁻³ occurred at Site B (located on the north east boundary of the Avenue site), and this was 0.5 µg m⁻³ lower than the concentration measured in February. At Site 4 (Village Hall, Hasland) located beyond the north east boundary of the Avenue site, the monthly average concentration of PM_{2.5} decreased from 5.9 µg m⁻³ in February to 5.1 µg m⁻³ in March. All measured concentrations are significantly less than the 25 µg m⁻³ annual mean national air quality objective.

Table 4 – Monthly Average Concentrations of PM_{2.5} Particulate Matter (µg m⁻³)

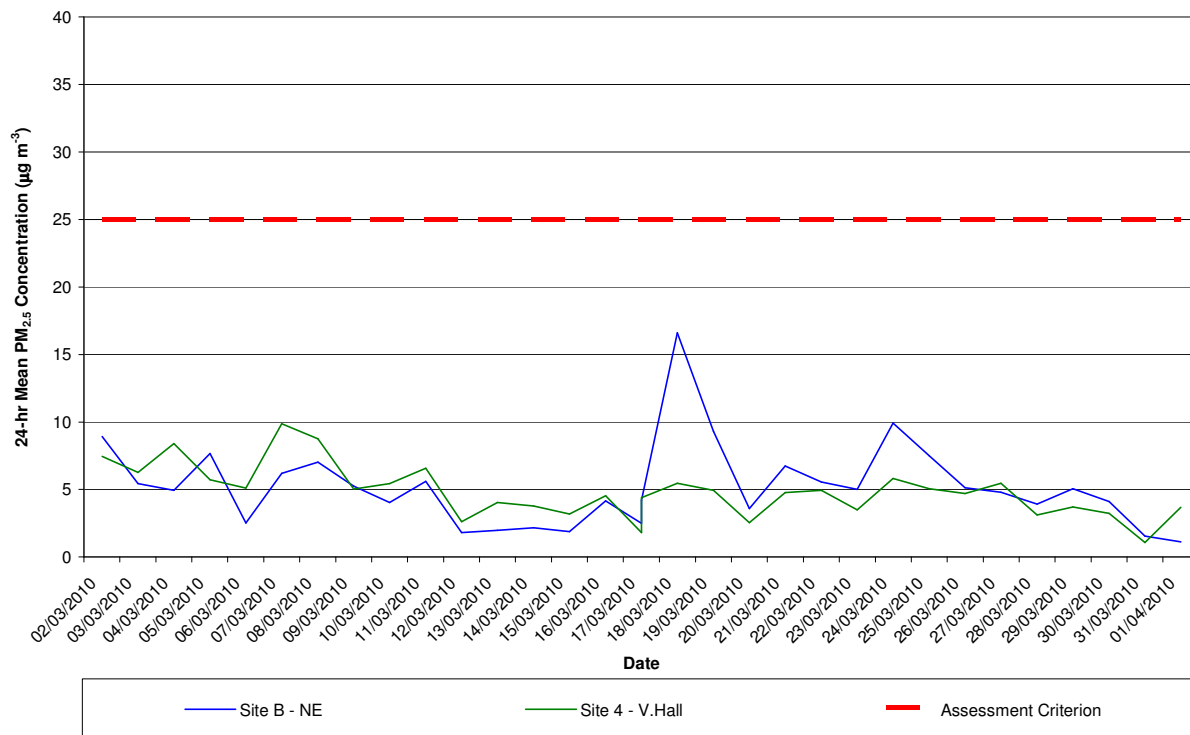
Monitoring Site	PM _{2.5} Monthly Average Concentration (µg m ⁻³)
Site B: Avenue (NE)	5.5
Site 4 – Village Hall, Hasland	5.1

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 little variability in concentrations measured at Site B compared to Site 4 except on 18th, 19th and 24th March. On 18th and 19th March when a peak in PM_{2.5} concentrations (16.6 µg m⁻³ and 9.3 µg m⁻³ respectively) was measured at Site B but not at Site 4 the wind direction was from the south-west. Crushing activities and construction of concrete bays and hardstandings were taking place in the area to the west and south-west of Site B in March, and these could have contributed to the increase in PM_{2.5} concentrations on these particular occasions.

The peak in concentrations on 24th March at Site 5 also occurred when the wind was coming from the south-west. This again suggests the works taking place on the Avenue site to the south-west of Site B are likely to have contributed to the increase in PM_{2.5} concentrations at Site B.

In any event, the 24-hour concentrations of PM_{2.5} at Site B and 4 do not exceed the assessment criterion during the period, and despite the peak in PM_{2.5} concentrations of 10 µg m⁻³ on 7th March at Site 4 and 16.6 µg m⁻³ on 18th March at Site B, the monthly averages of 5.5 and 5.1 µg m⁻³ are significantly less than the annual mean national air quality objective of 25 µg m⁻³.

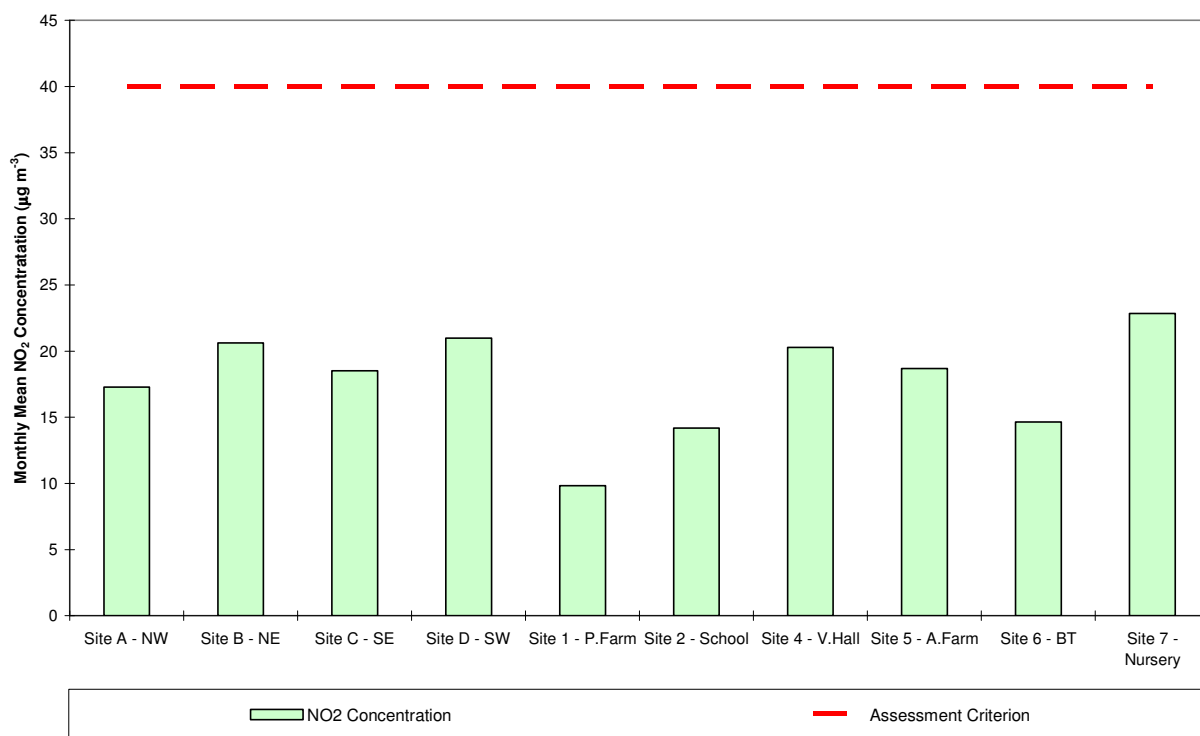
Figure 2 – 24-hour Average Concentrations of PM_{2.5} Particulate Matter (µg m⁻³)



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 monthly average concentration was 22.86 $\mu\text{g m}^{-3}$ at Site 7 (Nursery in Stretton), although several of the other sites have monthly average concentrations approaching this maximum value. Concentrations of NO_2 in March were generally lower than those measured in February, where the maximum monthly average concentration, at Site C was 29 $\mu\text{g m}^{-3}$.

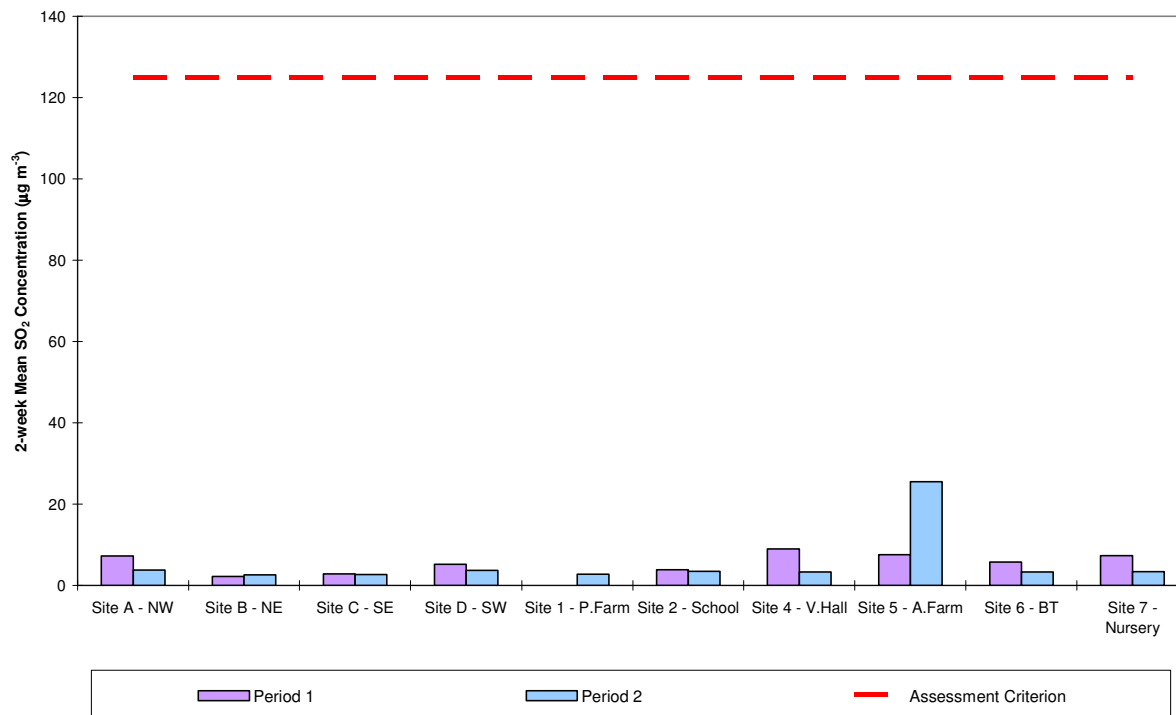
Figure 3 – Monthly Average Concentrations of Nitrogen Dioxide ($\mu\text{g m}^{-3}$)



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 $25.46 \mu\text{g m}^{-3}$ and occurred at Site 5 (Avenue Farm) during the second monitoring period. This is substantially higher than the SO_2 concentration recorded at any of the other sites including Sites C and B which are both on the eastern boundary of The Avenue site, which suggest the SO_2 concentrations in the second monitoring period are from a very localised source to Site 5 and not from The Avenue.

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



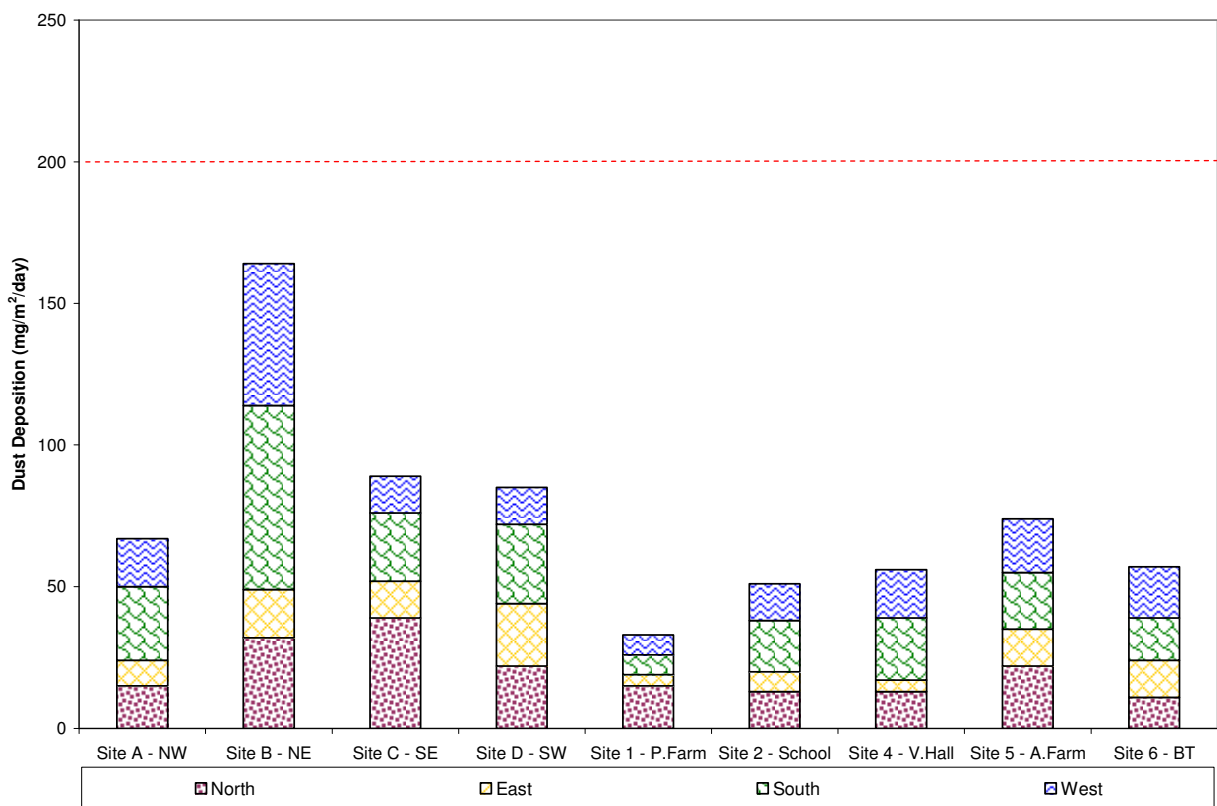
2.1.5 Deposited Dust Levels

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 164 mg/m²/day was recorded at Site B (Avenue NE) and the measured levels did not represent an exceedence of the target level. At Site B, approximately a third of the deposited dust originated from the south and just less than a third was from the west. This pattern of dust deposition levels would suggest the Avenue site was a contributing element to these dust levels.

The other monitoring stations also measured deposited dust levels which were higher than those measured in February. At Sites A, D, 2 and 4, most of the dust originated from the south. The Avenue could have contributed to the dust at Site 4 but is unlikely to be a contributing factor at Sites A, D and 2, given their location. At Sites C, 1, and 5, the majority of the dust originated from the north. Again given the locations of these monitoring stations The Avenue is unlikely to be a contributing factor to the dust deposited at these Sites.

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



2.1.6 Dust Soiling Levels

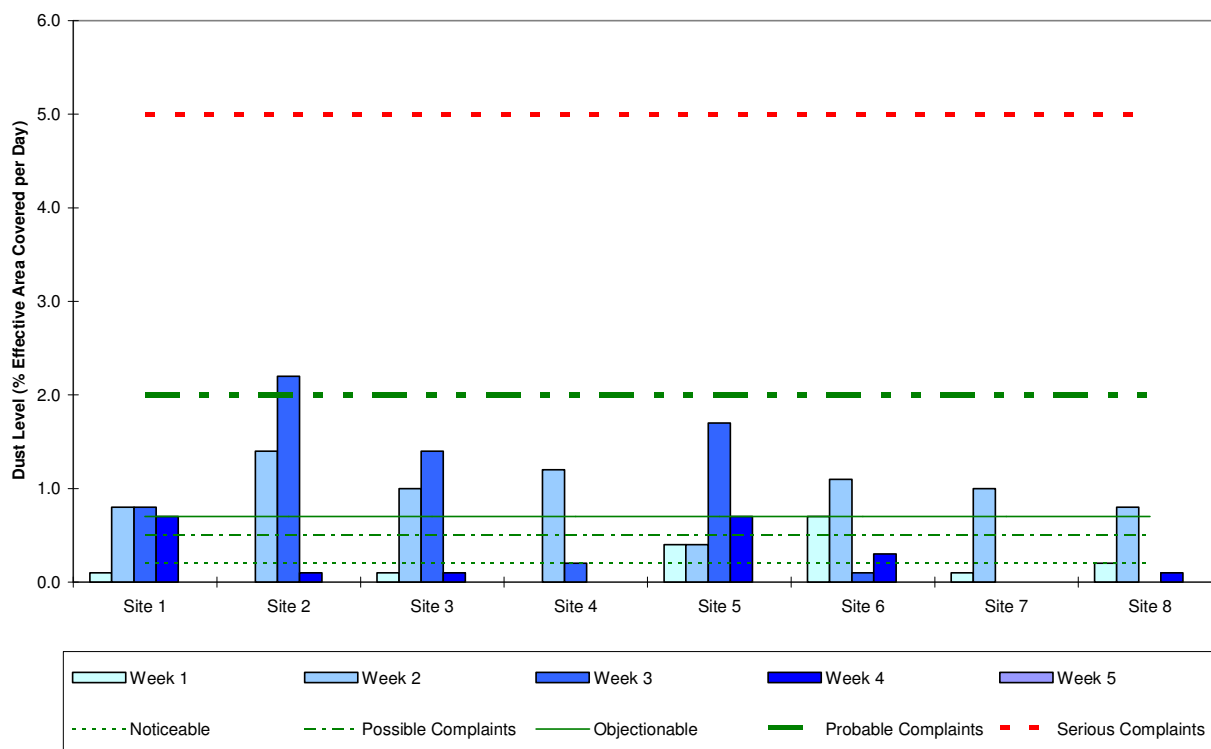
Measurements of dust soiling continue to be undertaken using sticky pads at 8 locations, over periods of approximately seven days, for comparison against target levels measured in units of effective area covered per day (% EAC).

Figure 6 shows the maximum measured weekly levels of dust from the sticky pads at each of the 8 monitoring locations. The highest level of dust of 2.2 %EAC was measured in Week 3 at Site 2 (north-west corner of site in Zone 2). This was also the week when the highest levels of coverage were recorded at a number of other monitoring locations. This value was recorded for the eastern side of the sticky pad suggesting that the source of dust was from the east, and could therefore be The Avenue site. The level of dust experienced at this location could result in probable complaints if this monitoring site was located at a receptor, rather than the edge of The Avenue site, within the site boundary.

The dust levels shown in week 3 at Site 5 for the sticky pads coincides with the elevated deposited dust levels at Site B, these sites are located in the same position, which suggests that the activity in week 3 contributed the most to deposited dust levels at Site B, as it has been established that a contributing source of deposited dust at Site B is The Avenue (Section 2.1.5) in March.

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 mg m^{-3} as a 2-week average, respectively.

The maximum measured concentration of benzene in period 1 was 0.0025 mg m^{-3} and in period 2 the maximum measured concentration was 0.0023 mg m^{-3} . The assessment criterion for toluene has therefore been comfortably achieved at all monitoring stations.

The measured concentrations of toluene in period 1 were less than the limit of detection of 0.0055 mg m^{-3} and in period 2 the measured concentrations were less than the limit of detection of 0.0053 mg m^{-3} . The assessment criterion for toluene has therefore been comfortably achieved at all monitoring stations.

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 $0.02 \mu\text{g m}^{-3}$ Site B (North-east of the site) during the first monitoring period and $0.03 \mu\text{g m}^{-3}$, recorded at Site 7 (Nursery) during the second monitoring period.

For cadmium in the second monitoring period the maximum measured concentration did not exceed the limit of detection of less than $0.009 \mu\text{g m}^{-3}$. The target value for cadmium at The Avenue site is $0.005 \mu\text{g m}^{-3}$.

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.

2.1.9 Cyanide

The filter for Cyanide for Site 5 during the second period of monitoring became damaged and therefore the results for this monitoring site for the second period are not reported.

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 naphthalene. The highest measured concentration of total Coal Tar Pitch Volatiles was $0.028 \mu\text{g m}^{-3}$ at Site B (North east boundary of the avenue site) during the second period of monitoring and the highest measured concentration of naphthalene was $0.001 \mu\text{g m}^{-3}$ also at Site B and also in the second period of monitoring. Given the location of this monitoring station, it is likely the source of Poly-Aromatic Hydrocarbons is The Avenue site. The activities taking place near this monitoring location during the second period of monitoring were stockpiling of material from Zone 4 in Zone 3 (close to the monitoring location) and this could be the source of the higher concentrations of PAHs at this location.

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 $12.4 \mu\text{g m}^{-3}$ compared to $12.3 \mu\text{g m}^{-3}$ 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 copper, where concentrations in the first period were $0.009 \mu\text{g m}^{-3}$ and $0.006 \mu\text{g m}^{-3}$.

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 SO_2 measurements were taken at Site B. In period 1 the measured concentrations were $2.14 \mu\text{g m}^{-3}$ and $2.53 \mu\text{g m}^{-3}$; in the second period, the measured concentrations were $2.60 \mu\text{g m}^{-3}$ and $3.76 \mu\text{g m}^{-3}$. It is therefore considered that the measurements are in good agreement.

For total VOC measurements, the measured concentrations from the duplicate diffusion tubes were all below the limit of detection for the first and second monitoring periods.

The duplicate NO₂ measurements gave concentrations of 19.17 µg m⁻³ for the first diffusion tube, and 20.63 µg m⁻³ for the second tube. The diffusion tube measurements are therefore different by 1.46 µg 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 3rd, 10th, 16th and 24th March. The monitoring was undertaken downwind and at the boundary of the following works:

- Zone 5: Downwind of Crusher – 3rd March;
- Zone 4: Downwind of excavation and earth moving activities – 3rd March;
- Zone 5: Downwind of grab crushing concrete – 3rd March;
- Zone 4: Downwind of Ruberoid – 10th March;
- Zone 4: Downwind of crusher – 10th, 16th and 24th March;
- Zone 4: Downwind of peckering activities – 16th and 24th March;

All measured concentrations of fibres were < 0.01 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 March show that there were eleven Odour Days when odour intensity was rated greater than 4.

The odour days of the 2nd, 9th, 10th, 16th, 19th and 20th March had odours that were described as Smokey, with most rated as having an odour intensity of 4. However, the odours noted on 9th March were rated as having an odour intensity of 6, with odours on 10th March rated as an odour intensity of 5.

In addition, the odours of 2nd and 10th March were also described as Tar/asphalt, with the odour days of the 4th, 8th, 7th and 13th had odours which were described as tar/asphalt. With the exception of the 8th March (rated with an odour intensity of 5), all other tar/asphalt odours were rated as an odour intensity of 4.

The odours noted on 11th March were described as burnt, with odours on 13th were described as manure. One odour diarist could not determine the type of odour on 2nd March; these odours were rated as odour intensity of 4.

For the days when smokey odours were recorded, the wind direction was mainly from the north-east, which could result in odours from the site being transported over Wingerworth, where most of these types of odours were reported from. On those days when tar/asphalt odours were recorded the wind direction was mainly from the south-west, although these odours were reported by odour diarists in Wingerworth, which is located to the west of The Avenue site, and therefore these odours were unlikely to be generated by the Avenue site.

2.3.2 Sensory Field Odour Surveys

Sensory field odour surveys were carried out on 2nd, 11th, 17th and 24th March 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 locations the maximum odour annoyance impact was '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 23rd March from a resident in Hasland. The complainant telephoned the local authority (Chester Borough Council), who then emailed the site. The complaint was in regard to creosote odours over the course of 23rd March. The wind direction on 23rd March was mainly from the south, and therefore, The Avenue site could have been contributing to the odours at the complainant's residence in Hasland. Possible works on the Avenue site which could have been the source of the odour were the movement of contaminated material requiring further treatment, from Zone 4 to Zone 3 (High Level Stocking area). The following day an Avenue staff member visiting the complainant observed a contractor replacing fencing in Hasland close to where the complainant was located, which could also have contributed to the creosote odours at the complainant's residence. The complainant

however was certain that the odour emanated from The Avenue site. Following discussions regarding this complaint, the complainant was invited to become an odour diarist, an offer which they have accepted.