

# Avenue Remediation Project

## Air Quality and Odour Monitoring Programme

### Summary of Results: July 2010

## 1. Overview

### 1.1 Summary of Monthly Air Quality Monitoring Results

Table 1 provides an overview of the air quality measurement data for July 2010 (1<sup>st</sup> July to 31<sup>st</sup> July<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>	10.81 – 14.52	Low
Fine Particulate Matter (PM <sub>10</sub> )	Monthly Mean	40 µg m <sup>-3</sup>	9.72 – 16.64	Low
Fine Particulate Matter (PM <sub>10</sub> )	24-hr Mean	50 µg m <sup>-3</sup>	5.45 – 29.97	Low
Fine Particulate Matter (PM <sub>2.5</sub> )	Monthly Mean	25 µg m <sup>-3</sup>	3.83 – 4.37	Low
Metals - Lead	Monthly Mean	0.25 µg m <sup>-3</sup>	0.01 max	Low
Metals – Cadmium	Monthly Mean	0.005 µg m <sup>-3</sup>	< 0.01 LOD**	Low**
Cyanide	2-week Mean	50 µg m <sup>-3</sup>	< 0.03 max	Low
PAHs - Coal Tar Pitch Volatiles	2-week Mean	0.48 µg m <sup>-3</sup>	0.05 max	Low
PAHs - Naphthalene	2-week Mean	126 µg m <sup>-3</sup>	0.0006 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>	2 max	Low
Dust Deposition (off-site monitoring)	Monthly Mean	200 mg m <sup>-2</sup> day <sup>-1</sup>	92 – 168	Low
Dust Deposition (on-site monitoring)	Monthly Mean	200 mg m <sup>-2</sup> day <sup>-1</sup>	183 - 526	Medium***
Dust Soiling – Sticky Pad	% EAC*	5 % EAC	4.7 max	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.

\* %EAC refers to percentage area covered per day. \*\* Concentration below limit of detection but above target level

\*\*\* Locations where dust levels are recorded as 'medium' are within the site boundary and are primarily situated to monitor on-site levels. The nearest receptor properties are some 500m away and are unlikely to be affected by elevated levels of dust.

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

*In summary:*

*During July there were exceedences of the target level for deposited dust at two on-site monitoring locations, in addition to a potential exceedence of the target level for cadmium. There were no air quality or odour related complaints received during the month.*

*There was an exceedence of the 200 mg/m<sup>2</sup>/day deposited dust target level at Site B (526 mg/m<sup>2</sup>/day) and a marginal exceedence at Site D (201 mg/m<sup>2</sup>/day); there were no exceedences at the off-site monitoring locations. At both sites, the direction from which the dust originated indicated that the Avenue remediation activities were likely to be a significant contributor to the exceedences.*

*At Site B the exceedences were likely to be due to the proximity of this location to vehicular activities, haul route construction and dry surfaces (within 10m of the monitor); dust emissions were likely to be very localised and the deposited dust gauge is sited very close to these activities and is predominantly downwind. The monitoring location is not representative of a sensitive receptor location, the closest of which is several hundred metres away. The sticky pad monitoring did not show exceedences of the 5 %EAC target level, although Site B again recorded the highest level of soiling, which at 4.7 %EAC is close to the target and higher than desirable. Although the measured levels of dust at Site D marginally exceeded the target level, there appear to be a range of emission source directions, both on-site and off-site, that contributed to this exceedence.*

*Concentrations of particulate matter (PM<sub>10</sub>) were of similar magnitude to previous months, although there was one exceedence of the 1-hour PM<sub>10</sub> trigger level of 100 µg m<sup>-3</sup> which occurred on 8<sup>th</sup> July at 1500hrs when the average concentration reached 101 µg m<sup>-3</sup> at Site B. The maximum measured 24-hour average concentration across the month was 30 µg m<sup>-3</sup> which was also recorded at Site B (Avenue NE) on 8<sup>th</sup> July. Despite the slight exceedence of the 1-hour trigger level, the magnitudes of the measured concentrations at all sites were comfortably within the target value of 50 µg m<sup>-3</sup> and the remediation works were therefore not having a significant effect on ambient concentrations of particulate matter.*

*Additional PM<sub>2.5</sub> continuous monitoring equipment was in place from July and therefore, additional hourly data are now available to further assess the contribution of the Avenue site to ambient air quality. In the context of the 25 µg m<sup>-3</sup> annual mean national air quality objective for PM<sub>2.5</sub>, average concentrations for the month were very low, and were typically less than 20 percent of the value of the air quality objective (2.1 µg m<sup>-3</sup> - 4.5 µg m<sup>-3</sup>). Daily concentrations at all monitoring sites followed the same trend, closely following the pattern of PM<sub>10</sub> concentrations. The measured concentrations at Site A located to the north-west of the Avenue site and at Site B, located at the north-east boundary of the Avenue site, were those showing more variation in measured concentrations across the month, indicating perhaps, a small PM<sub>2.5</sub> contribution from the Avenue site; the maximum measured 24-hour concentration was 9.5 µg m<sup>-3</sup> at Site A and occurred on 8<sup>th</sup> July, corresponding with the peak in PM<sub>10</sub> concentrations. All measured concentrations were significantly less than the 25 µg m<sup>-3</sup> annual mean national air quality objective and the data indicate that during July the Avenue remediation activity did not have a discernable effect on PM<sub>2.5</sub> concentrations. There were no exceedences of the 1-hour trigger level of 50 µg m<sup>-3</sup>.*

*Concentrations of cadmium were below limits of detection in both monitoring periods at all monitoring sites. However, at Site A (Avenue NW) in the first monitoring period the limit of detection (0.007 µg m<sup>-3</sup>) was above the Avenue target value (0.005 µg m<sup>-3</sup>); in the second period of monitoring, the limit of detection (0.01 µg m<sup>-3</sup>) was also above the Avenue target value (0.005 µg m<sup>-3</sup>) and consequently, these measured values have been identified as an exceedence of the target level. In practice, the actual concentration, if comparable with other monitoring sites, would be expected to be below the target level.*

*Concentrations of nitrogen dioxide (NO<sub>2</sub>) were between approximately 11 and 15 µg m<sup>-3</sup> and were therefore less than 50% of the 40 µg m<sup>-3</sup> annual mean air quality objective. Concentrations of cyanide, metals, VOCs and PAHs were below limits of detection or within their respective target levels.*

*At all locations where the sensory field odour surveys were conducted, the maximum odour annoyance impact was 'low-medium'. There was a report from an odour diarist of odours that may have been linked to the Avenue. However, based on the short duration of the observation, the distance of the odour diarist from the Avenue site and that the odour was not detected by other odour diarists, it is considered unlikely that the Avenue was the source of odour.*

## 1.2 Work Activity

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

### Zone 1: River Flood Plain

- Construction of the sheet pile wall continued, but piling has been completed. Current works involve the excavation of material from between the twin pile section and the fixing of struts to the inside of the cofferdam;
- Construction of the temporary bridge over the river has been completed and the construction of concrete haul road up to the bridge and beyond the bridge to Lagoon 4 continued;
- Naphthalene impacted gas main pipes have been removed and placed on the High Level Stocking Area (HLSA).

### Zone 2: Low Level Stocking Area (western boundary, adjacent to A61)

- Filling of the borrow-pit in the southern part of Zone 2 took place, with material excavated from Zone 4 (former plant area); and
- Vegetation stripping took place in the north-west section, in order to prepare Holding Pond 2.

### Zone 3: High Level Stocking Area and Waste Tip

- Temporary stockpiling took place of small volumes of contaminated material from Zone 4 that required further treatment in advance of the availability of the treatment processes;
- The picking station has been constructed on the HLSA;
- Red shale was excavated from the northern part of the HLSA for use as fill in the development area in Zone 4;
- The dirty water holding pond (HP4) associated with the waste-tip separation / soil washing processes was excavated; and
- Naphthalene impacted gas main pipes have been removed and placed on the HLSA in advance of cleaning.

### Zone 4: Former Plant Area

- Construction of the Thermal Treatment Plant continued;
- Site establishment works (offices, mess facilities, etc) associated with the Thermal Desorption Plant continued;
- Excavations and concrete breakout works continued to the south of the site water treatment plant where construction of the proposed new water treatment plant is to take place;
- Breakout of structures north of the Coke Oven basements associated with old cooling tower and pumping sumps was undertaken. Rubble from sumps was excavated and refilling activities were undertaken;
- Licensed asbestos removal works were undertaken in an area north of the site water treatment plant;
- Crushing activities were moved to Zone 5; and
- Construction of the new Water Treatment Plant continued, with the construction of the associated Holding Pond 7.

### Zone 5: Eastern Area

- Works associated with site surface drainage redirection and works involving the positioning of the holding pond (HP11) associated with the bioremediation area was completed; and
- The concrete hardstanding area for bioremediation was 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
<b><i>Alternations to Monitoring Programme:</i></b>		
Sites D, 2, 5 and 6	1st July	In line with the proposed revisions to the Avenue Air Quality Management Plan (AQMP) the ambient air quality monitoring network has been extended to include PM <sub>2.5</sub> monitoring at sites D, 2, 5 and 6. All current monitoring stations now include the real-time measurement of both PM <sub>10</sub> and PM <sub>2.5</sub> .
Trigger Alert System	1st July	As prescribed in the AQMP, a trigger alert system has been established for PM <sub>10</sub> and PM <sub>2.5</sub> . This system automatically alerts VSD and its consultants of elevated levels of PM <sub>10</sub> and PM <sub>2.5</sub> based on measured 1-hour average concentrations of particulate matter at each of the fixed continuous monitoring sites. This system has been undergoing testing throughout July.
Mobile PM <sub>10</sub> and PM <sub>2.5</sub> Monitoring	1st July	Two mobile OSIRIS monitors are available for short-term monitoring of PM <sub>10</sub> and PM <sub>2.5</sub> . These battery powered units will be used in areas where work activity has greater potential to lead to elevated levels of particulate matter, or can be deployed in the event of air quality related complaints.
<b><i>Downtime and Technical Difficulties:</i></b>		
Site B	July	The nitrogen dioxide diffusion tube was not present at the site when scheduled for collection. Therefore, no monitoring results are presented for this site for July 2010.

## 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. Concentrations of PM<sub>10</sub> within and close to the Avenue were in the range of 9.7–16.6 µg m<sup>-3</sup>. Average concentrations of PM<sub>10</sub> in the month of July were of a similar magnitude to previous months. The maximum measured monthly concentration in July of 16.6 µg m<sup>-3</sup> was recorded at Site B (Avenue NE) and this was higher than recorded in June (13.2 µg m<sup>-3</sup>), but lower than in May (17.2 µg m<sup>-3</sup>). However, this concentration was still less than 50% of the 40 µg m<sup>-3</sup> annual mean air quality objective. As there were only slight variations in monitored concentrations at sites bordering the Avenue, it could be concluded that the Avenue had no discernible 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)	12.4
Site B: Avenue (NE)	16.6
Site D: Avenue (SW)	11.7
Site 2: Hunloke Primary School	9.7
Site 4: Village Hall, Hasland	10.4
Site 5: Avenue Farm	13.4
Site 6: BT Offices (Pioneer House) Mill Lane	12.0

Figure 1 presents 24-hour average concentrations of PM<sub>10</sub> at the fixed continuous monitoring sites.

The maximum measured 24-hour average concentration of 30.0 µg m<sup>-3</sup> was recorded at Site B (Avenue NE) on 8<sup>th</sup> July. The monitoring stations on the Avenue site and closest to its boundary showed the highest concentrations, thus perhaps indicating the contribution of activities at the Avenue to short-term rises in concentrations of particulate matter. However, the wind direction on the 8<sup>th</sup> July was predominantly from the west and south-west and therefore, monitoring stations B, 4 and 5 would have been downwind of the Avenue.

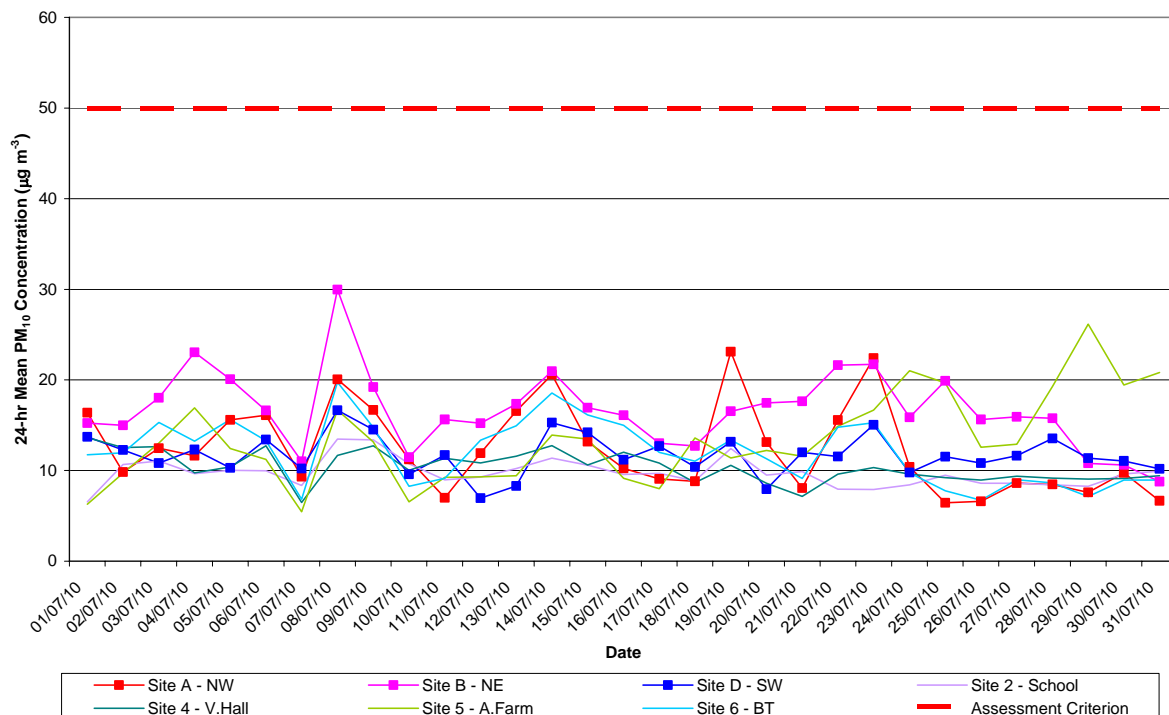
As shown by Figure 1, at all monitoring stations, concentrations on 8<sup>th</sup> July were generally higher than on both the 7<sup>th</sup> and 9<sup>th</sup> July, perhaps indicating the contribution of regional pollution which may have been in addition to a local source of particulate matter. Although Site B measured the highest concentrations on 8<sup>th</sup> July, there was not a clear relationship at the other monitoring sites between wind direction and measured concentrations.

There was one exceedence of the 1-hour PM<sub>10</sub> trigger level of 100 µg m<sup>-3</sup> which occurred on 8<sup>th</sup> July at 1500hrs when the average concentration reached 101 µg m<sup>-3</sup> at Site B. The weather conditions during this period were dry and the potential for dust generation from bare ground was therefore higher; activities taking place at the Avenue on 8<sup>th</sup> July, with the potential to generate dust, were no different to those on 7<sup>th</sup> and 9<sup>th</sup> July, although these activities, it would seem, contributed to the elevated levels of dust and the exceedence of the trigger level. Mitigation measures at the Avenue are continually reviewed to ensure that they are fully effective at controlling dust.

The graph shows that that measured concentrations across the month were generally consistent at each of the sites, although there was more variability in 24-hour average concentrations at Site A and Site B compared to the others. This variability is likely to be due to these being on-site monitoring locations which are close to activities that have the potential to generate emissions of fine particulate matter. At Site A, localised emissions from vehicles manoeuvring around the car park adjacent to the monitoring station may be partly responsible for the observed variations in PM<sub>10</sub> concentrations, whilst at Site B, activities associated with haul road construction are the most likely explanation for the variation.

Although there have been some slightly elevated results, the magnitudes of the measured concentrations at all of the sites are comfortably within the target value of  $50 \mu\text{g m}^{-3}$ . Furthermore, as the trends in increasing and decreasing concentrations were generally observed simultaneously at both upwind and downwind sites, it would seem that the remediation works were not the only factor and that ambient concentrations of particulate matter also made a notable contribution to the monitoring results.

**Figure 1 – 24-hour Average Concentrations of PM<sub>10</sub> Particulate Matter ( $\mu\text{g m}^{-3}$ )**



### 2.1.2 PM<sub>2.5</sub> Concentrations

Table 4 presents monthly average concentrations of PM<sub>2.5</sub> at the two long-term fixed monitoring sites (4 and B) and at the additional sites that have been added to the monitoring programme as part of the proposed revisions to the Avenue Air Quality Management Plan.

In the context of the  $25 \mu\text{g m}^{-3}$  annual mean national air quality objective for PM<sub>2.5</sub>, average concentrations for the month were very low, and were typically less than 20 percent of the value of the air quality objective. There was also little variation in the monthly average concentrations across the monitoring network, with PM<sub>2.5</sub> concentrations in the range of  $2.1 \mu\text{g m}^{-3}$  at Site 2 (Hunloke Primary School) to  $4.5 \mu\text{g m}^{-3}$  at Site 4 (Village Hall, Hasland) and Site 6 (Pioneer House). There was no particular geographic pattern with the monitoring results, as both the lowest and highest measured concentrations occurred at off-site monitoring stations, with the on-site monitoring stations measuring concentrations that fell in between.

The slightly higher levels of PM<sub>2.5</sub> at Site B ( $4.4 \mu\text{g m}^{-3}$ ), compared to Site A ( $3.8 \mu\text{g m}^{-3}$ ) and Site D ( $3.1 \mu\text{g m}^{-3}$ ), are likely to be due to the proximity of this location to vehicular activities, haul route construction and dry surfaces (within 10 m of the monitor). However, unsurprisingly the effect on the PM<sub>2.5</sub> results is less marked than from the other particulate and dust monitoring, since most dust generated by earthmoving will be of the larger size fractions. It is therefore concluded that during July the Avenue remediation activity did not have a discernable effect on PM<sub>2.5</sub> concentrations.

All measured concentrations were 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>)**

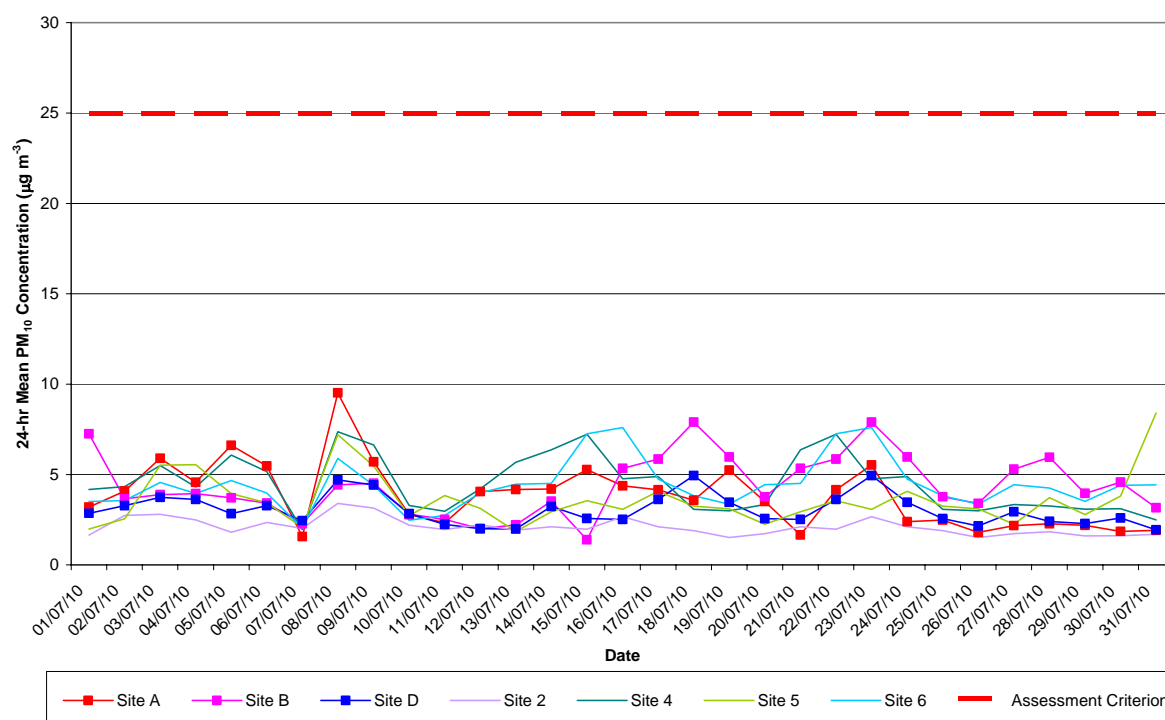
Monitoring Site	PM <sub>2.5</sub> Monthly Average Concentration (µg m <sup>-3</sup> )
Site A: Avenue (NW)	3.8
Site B: Avenue (NE)	4.4
Site D: Avenue (SW)	3.1
Site 2: Hunloke Primary School	2.1
Site 4: Village Hall, Hasland	4.5
Site 5: Avenue Farm	3.6
Site 6: BT Offices (Pioneer House) Mill Lane	4.5

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. Concentrations at all sites generally followed the same trend in terms of increasing and decreasing daily concentrations, although the measured concentrations at Site A located to the north-west of the Avenue site and at Site B, located at the north-east boundary of the Avenue site, are typically those showing the most variation in measured concentrations across the month, indicating perhaps, a small PM<sub>2.5</sub> contribution from the Avenue site.

Concentrations at Site 2 (Hunloke Primary School) are perhaps best representative of background concentrations of PM<sub>2.5</sub> and where measured concentrations at off-site and on-site monitoring stations are above those at Site 2, a more local emission source is likely to influence the measured values.

As would be expected, the measured concentrations of PM<sub>2.5</sub> closely follow the pattern of PM<sub>10</sub> concentrations as shown above in Figure 1, although PM<sub>2.5</sub> particles are a sub-fraction of PM<sub>10</sub>, hence the measured concentrations were lower than those for PM<sub>10</sub>. The peak of PM<sub>2.5</sub> concentrations during July of 9.5 µg m<sup>-3</sup> at Site A, occurred on 8<sup>th</sup> July, corresponding with the peak in PM<sub>10</sub> concentrations, as discussed in Section 2.1.1 above. This maximum measured 24-hour concentration of 9.5 µg m<sup>-3</sup> was less than half 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>)**

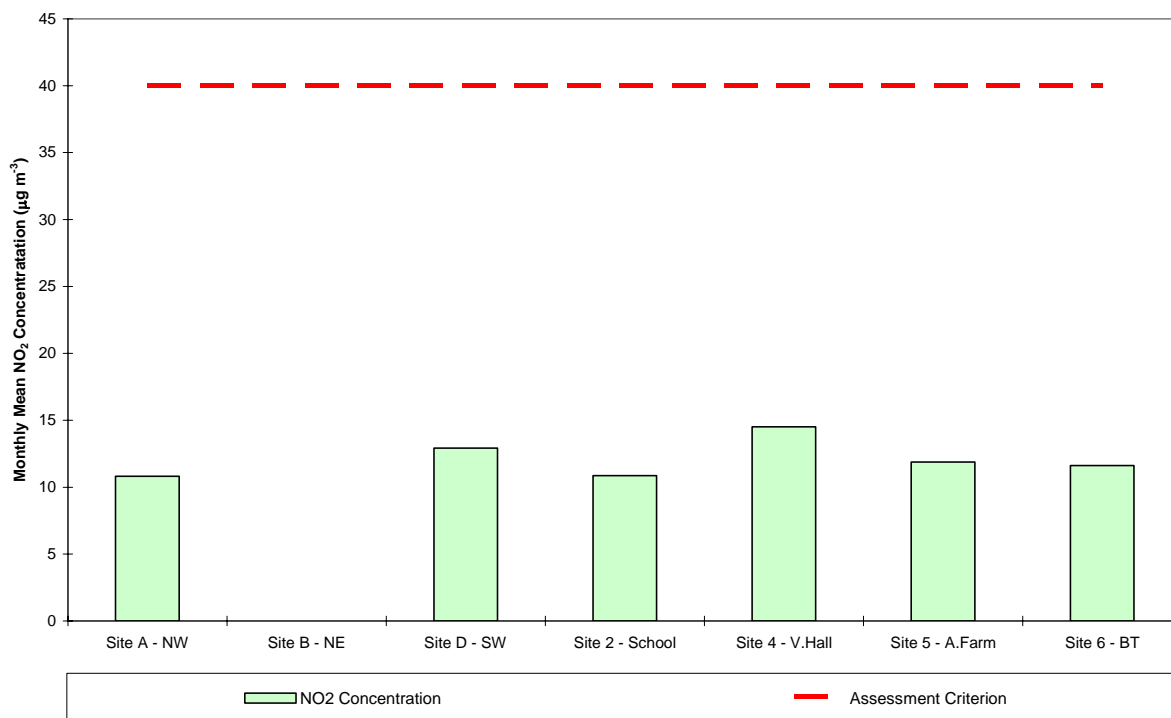


### 2.1.3 Nitrogen Dioxide Concentrations

Figure 3 presents monthly average concentrations of nitrogen dioxide across each of the fixed monitoring sites. The diffusion tube at Site B was not present at the monitoring location when scheduled for collection and therefore, no results are presented for July. At all locations, measured concentrations were below the 40  $\mu\text{g m}^{-3}$  annual mean air quality objective.

The measured concentrations ranged from 10.81  $\mu\text{g m}^{-3}$  at Site A (Avenue north-west) to 14.52  $\mu\text{g m}^{-3}$  that was measured at Site 4 (Village Hall, Hasland). In the context of the 40  $\mu\text{g m}^{-3}$  annual mean air quality objective, there is little variation in concentrations across the monitoring network and no clear geographic trends emerge.

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



### 2.1.4 Deposited Dust Levels

Figure 5 presents the monthly levels of deposited dust at each of the monitoring stations and the source direction. The sites with an identifier beginning with a letter (A, B and D) are located on the Avenue site, whilst numerically referenced sites (2, 4, 5 and 6) are located off-site.

During the month there were no exceedences of the Avenue target level of 200  $\text{mg/m}^2/\text{day}$  at off-site monitoring locations. The maximum measured level of dust deposition at an off-site location was recorded at Avenue Farm and was 168  $\text{mg/m}^2/\text{day}$ . At this location, over half of the deposited dust originated from the north and the south, with only 20% originating from the west, which is the direction of the Avenue and the dust was therefore most likely to originate from local emission sources associated with activities at Avenue Farm. At the three further off-site monitoring locations (sites 2, 4 and 6), the distribution of deposited dust at each of the compass points was more even, suggesting no dominant local source direction of dust.

There were exceedences of the 200  $\text{mg/m}^2/\text{day}$  target level at two of on-site monitoring locations. These included the clear exceedence at Site B (526  $\text{mg/m}^2/\text{day}$ ) and a marginal exceedence at Site D (201  $\text{mg/m}^2/\text{day}$ ). At Site A the deposition level was below the target level at 183  $\text{mg/m}^2/\text{day}$ .

At Site B (Avenue NE), approximately two-thirds of the deposited dust originated from the south and west, with around one-quarter originating from the north. This pattern of dust deposition levels would suggest the Avenue site was a contributing element to these dust levels, and was arguably the main contributor. As identified above in relation to

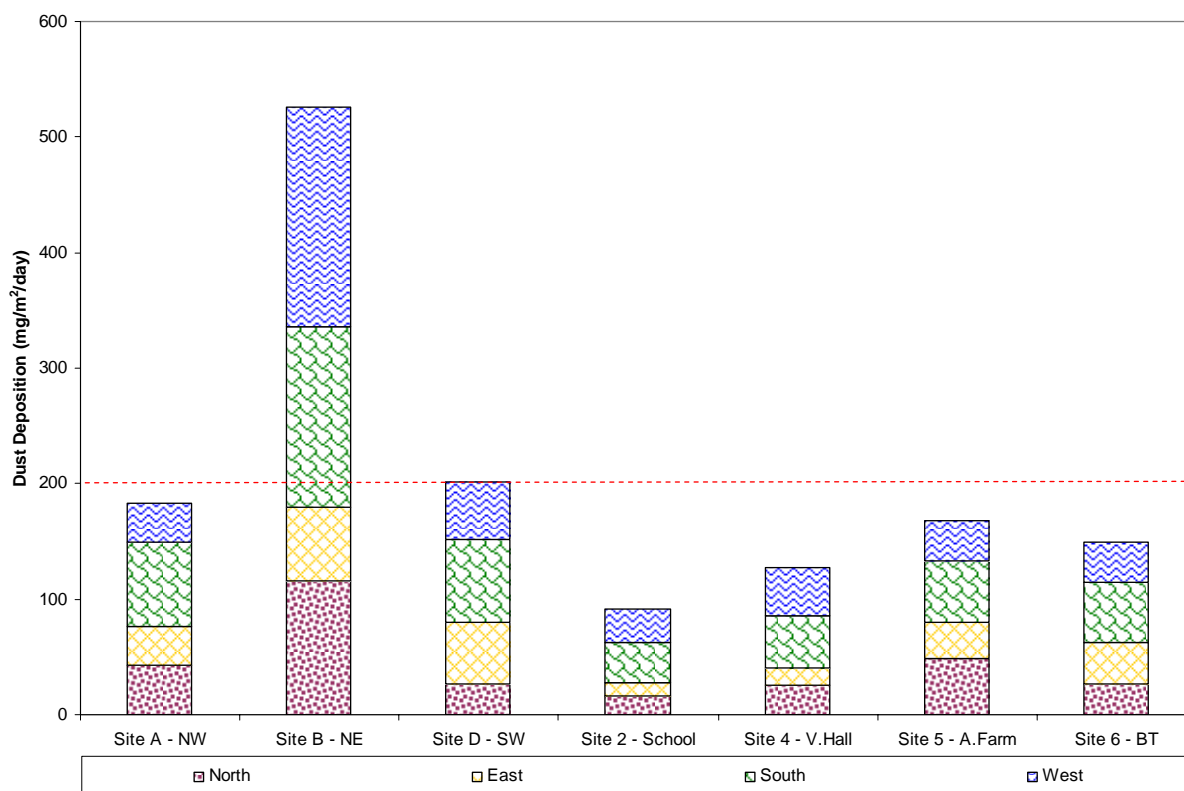
measured concentrations of fine particulate matter, the elevated levels of dust at Site B were likely to be due to the proximity of this location to vehicular activities, haul route construction and dry surfaces (within 10 m of the monitor); dust emissions were likely to be very localised and the deposited dust gauge is sited very close to these activities and is predominantly downwind. The monitoring location is not representative of a sensitive receptor location, the closest of which is several hundred metres away.

At Site D (Avenue SW) approximately one-quarter of dust originated from the east, the predominant direction of the Avenue site. Just over one-third of dust originated from the south, with one-eighth from the north; dust from both the north and the south may have originated from the Avenue. One-quarter of the dust originated from the west and would therefore not be associated with the Avenue. Although the measured levels of dust at Site D exceeded the target level, there appear to be a range of emission sources that contributed to this exceedence, both on-site and off-site.

At Site A, two-fifths of the dust originated from the south, with a further two-fifths from the north and east combined. As with Site D, it's primarily dust from the west that is most unlikely to originate from the Avenue site, and therefore, it is likely that the Avenue site did contribute towards the measured levels of deposited dust at all on-site monitoring locations.

Mitigation measures employed on site include; the use of two water bowsers and a road sweeper, which are in operation around the site during working hours; speed limits are observed onsite, trafficking on un-dampened roads is minimised; and daily checks for nuisance dust levels offsite are undertaken. During the month, exceedences of the 200 mg/m<sup>2</sup>/day target level were restricted to on-site monitoring locations; the monitoring provides no indication that activities on the Avenue site are affecting levels of dust at off-site receptors, and therefore, the mitigation measures could be viewed as being effective in terms of managing the migration of dust off-site.

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



### 2.1.5 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 on-site monitoring locations. There were no measured values that would be expected to lead to serious complaints if these values were to be observed at a sensitive receptor location.

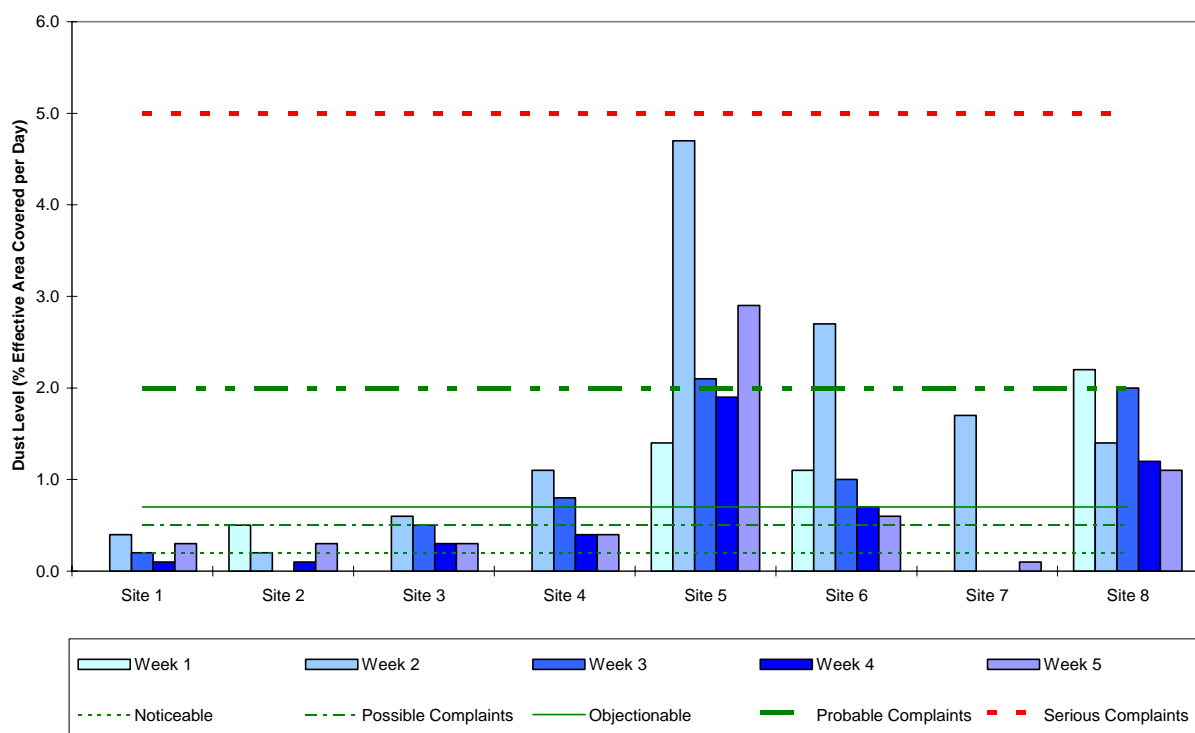
The highest level of dust of 4.7 %EAC was measured in Week 2 at Site 5 (north-east, adjacent to Site B). This value was recorded for the western side of the sticky pad, indicating that the source of dust was from the west, and was therefore likely to originate from the Avenue site. The level of dust experienced at this location would be undesirable if this monitoring site was located at a receptor, rather than the edge of the Avenue site, within the site boundary. Levels of dust soiling at Site 5 were on average, higher than those at all other monitoring locations during the month. As discussed above, the elevated levels of dust at Site B were likely to be due to the proximity of this location to vehicular activities, haul route construction and dry surfaces (within 10 m of the monitor); dust emissions are likely to be very localised and the sticky pad is sited very close to these activities and is predominantly downwind. The monitoring location is not representative of a sensitive receptor location, the closest of which is several hundred metres away.

Site 8 consistently experienced levels of dust between 1 and 2 %EAC in July. This site was moved at the beginning of July, approximately 20 m east of its original location, as the levels of soiling were previously considered to be more of a reflection of dust generated from the car park than from the wider Avenue site; vehicles manoeuvring in the car park had been observed to cause surface dust to become airborne which then deposited on the sticky pad a few metres away. It is now possible to isolate the Avenue site contribution to dust soiling from dust that originates from the car park or off-site to the west. Levels of dust on the eastern side of the sticky pad during the first two weeks of the month reflected dust generated by the Avenue site, but with a prevailing westerly/south-westerly wind direction, dust from the car park continued to contribute to the total levels of soiling at the monitoring location. The total levels of dust soiling peaked at 2.2 %EAC in week 1, but would not be of a magnitude to lead to serious complaints.

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.

The threshold values will be re-evaluated in the current review of the site Air Quality Management Plan.

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



## 2.1.6 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.

In period 1, measured concentrations of benzene did not exceed the limit of detection of  $1.3 \mu\text{g m}^{-3}$ . In period 2 the limit of detection of  $2 \mu\text{g m}^{-3}$  was not exceeded at any of the monitoring locations. The assessment criterion for benzene was therefore comfortably achieved at all monitoring stations.

The maximum measured concentrations of toluene in period 1 were less than the limit of detection of  $0.0043 \text{ mg m}^{-3}$  and in period 2 the measured concentrations were less than the limit of detection of  $0.0063 \text{ mg m}^{-3}$ . The assessment criterion for toluene was therefore comfortably achieved at all monitoring stations.

## 2.1.7 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 in the first monitoring period was  $0.01 \mu\text{g m}^{-3}$  at Site 2 (Hunloke School, Wingerworth). During the second monitoring period the measured concentrations of lead were  $0.01 \mu\text{g m}^{-3}$  at all sites.

Concentrations of cadmium were below limits of detection in both monitoring periods at all monitoring sites. However, at Site A (Avenue NW) in the first monitoring period the limit of detection ( $0.007 \mu\text{g m}^{-3}$ ) was above the Avenue target value ( $0.005 \mu\text{g m}^{-3}$ ); in the second period of monitoring, the limit of detection ( $0.01 \mu\text{g m}^{-3}$ ) was also above the Avenue target value ( $0.005 \mu\text{g m}^{-3}$ ) and consequently, these measured values have been identified as an exceedence of the target level. In practice, the actual concentration, if comparable with other monitoring sites, would be expected to be below the target level.

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

## 2.1.8 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 the limit of detection.

## 2.1.9 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.

## 2.1.10 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  $0.048 \mu\text{g m}^{-3}$  at Site B (Avenue NE) during the second period of monitoring. The highest measured concentration of naphthalene was  $0.00081 \mu\text{g m}^{-3}$  at Site B (Avenue NE) in the first period of monitoring,

Given the location of Site B, it is likely the source of Poly-Aromatic Hydrocarbons was the Avenue site. The activities taking place near this monitoring location during July included the stockpiling, prior to treatment, of small quantities of contaminated material from Zone 4 in Zone 3 close to the monitoring location.

## 2.2 Targeted Air Quality Monitoring

### 2.2.1 Asbestos

Reassurance air testing for asbestos was carried out on 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup>, 14<sup>th</sup>, 15<sup>th</sup>, 22<sup>nd</sup>, 23<sup>rd</sup>, 27<sup>th</sup> and 28<sup>th</sup> July.

The monitoring was undertaken downwind and at the boundary of the following works:

- Zone 4 and 5: Downwind of earthworks, crushing, stockpiling, excavation works and licensed asbestos removal south of the Roman Baths (underground liquid holding tanks).

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 July show that there were two Odour Days when odour intensity was rated as 4 or greater when wind was blowing from the Avenue.

The odour day of 9<sup>th</sup> July had odours that were described as “*smokey*”, with an odour intensity rated as 5. The wind direction was from the south-east which could result in odours from the site being transported to the location where the odour was recorded. However, there were no activities on site which could have generated the smokey odours.

The observation on 13<sup>th</sup> July was from a location approximately 1km to the west of the Avenue site and the odours had “*tar/asphalt*” characteristics with an odour intensity of 6. Tar/asphalt odours can be generated during remediation activities and the wind direction at the time of the observation was from the north-east, the direction of the Avenue site. The odour was detected for a period of only 10 minutes and was not observed by other odour diarists; based on the distance of the odour diarist from the Avenue and the short duration of the odour, it’s perhaps unlikely that the odour originated from the Avenue site.

### **2.3.2 Sensory Field Odour Surveys**

Sensory field odour surveys were carried out on 1<sup>st</sup>, 7<sup>th</sup>, 15<sup>th</sup> and 28<sup>th</sup> July 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**

There were no odour complaints during July 2010.