Dust and Air Quality Innovation and Expertise

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Quarterly non-technical summary: Mountsorrel particulate matter, dust and weather monitoring

Date range: **Quarter 4 2023 (25 August – 10 November 2023)**

Date Report Issued: **24 January 2024**

Introduction

Every month, the results of ongoing dust and particulate matter monitoring at Mountsorrel Quarry are compiled and summarised in 'compliance' reports, which are then shared with Charnwood Borough Council (CBC), Leicestershire County Council (LCC) and the Environment Agency. The monitoring results are discussed in more detail during liaison meetings held with CBC and LCC on a quarterly basis.

Once the quarterly liaison meetings are held, we prepare these cover letters to provide a non-technical overview of the most recent three months of finalised reports. This letter covers the period from 25 August to 10 November 2023.

An explanation of how and why dust and air quality are measured on site is available here.

Weather summary

September was abnormally warm and dry, with daily average temperatures peaking at 24 °C, and there was an 11-day dry spell. During this time winds were recorded from the south and west predominantly. In October, conditions were more mixed, with generally mild to cool temperatures, and typical levels of rainfall. Winds were overwhelmingly from the south. In November, it became quite wet and cool, with winds normally from the south.

Deposited dust

During this period, deposited dust levels were below the site-specific limit level at all locations, with the exception of a single exceedance at Stn 9 (Hawcliffe Road) during October. From the available information, it appears that this elevated dust level was caused by both on-site and off-site activities.

The frequency of limit level exceedances over the previous three months is shown for each monitoring location in Figure 1 using pie charts.

Figure 1: Frequency of high dust levels, Quarter 4 2023

Particulate Matter – $PM_{2.5}$

$PM_{2.5}$ concentrations remained well within the relevant Air Quality Objective (AQO) at both Hawcliffe Road and Quorn House during the fourth quarter of 2023, as shown in Figure 2, with concentrations being virtually identical at both locations during this quarter. This suggests that little $PM_{2.5}$ was being generated by the quarry during this time.

Figure 2: $PM_{2.5}$ monitoring summary, Quarter 4 2023

Particulate Matter – PM_{10}

Although the results were higher at Hawcliffe Road than at Quorn House for the fourth quarter of 2023, PM_{10} concentrations were within the annual AQO and the daily AQO at both locations.

No days were recorded with concentrations above the daily AQO threshold (50 µg/m^3) at either location during this quarter.

Figure 3: PM_{10} monitoring summary, Quarter 4 2023

Complaints

During the fourth quarter of 2023 a number of complaints related to dust were received by the quarry. Each complaint was responded to in accordance with the process outlined in the Dust Management and Monitoring Plan.

DustScanAQ
January 2024

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September 2023 particulate matter, dust and weather monitoring report for Mountsorrel Quarry

Client:	**Tarmac Trading Limited**
Site:	**Mountsorrel Quarry, Quorn**
Job Code:	**ZLFMS**
Report Start Date:	**25 August 2023**
Report End Date:	**14 September 2023**
Date Report Issued:	**08 January 2024**

'Dust' is generally regarded as particulate matter up to 75 µm (micron) diameter and can be considered in two categories. Fine dust, essentially particles up to 10 µm, is commonly referred to as PM_{10} and is measured to agreed standards and forms part of the national Air Quality Objectives (AQO). The AQO for PM_{10} is currently 50 µg/m^3 for the 24-hour mean, not to be exceeded 35 times per year and 40 µg/m^3 for the annual mean. The previous AQO for $PM_{2.5}$ was 20 µg/m^3 however from 31 January 2023 the interim AQO for $PM_{2.5}$ is 12 µg/m^3 for the annual mean (to be achieved by 2028), whilst the legal AQO for $PM_{2.5}$ is 10 µg/m^3 for the annual mean (to be achieved by 2040) as per The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[1]. Following correspondence with Charnwood Borough Council, it was agreed to compare $PM_{2.5}$ measurements against the interim objective.

Coarser dust (essentially particles greater than 10 µm) is generally regarded as 'nuisance dust' and can be associated with annoyance, although there are no official standards (such as AQO) for dust annoyance.

Weather conditions can have a significant effect on the potential for dust propagation from a minerals site. Of particular importance are wind speed, wind direction, and precipitation. Dust can be carried from a source towards receptors (such as nearby homes and other businesses) according to the strength and direction of wind. Precipitation is recognised to suppress dust and 0.2 mm antecedent rainfall is considered sufficient to suppress windblown dust for a number of hours.

Mountsorrel Quarry has a comprehensive Dust Management and Monitoring Plan (DMMP). The DMMP was developed in 2011 and subject to regular review and revision, in consultation between Tarmac and the local regulators (Leicestershire County Council (LCC) and Charnwood Borough Council (CBC)).

The DMMP is enacted through the quarry Site Improvement Plan (SIP). The SIP sets out a programme of actions to reduce the environmental impact of specific areas of the site operation.

[1] Statutory Instrument. (2023), 'The Environmental Targets (Fine Particulate Matter) (England) Regulations', No. 96. King's Printer of Acts of Parliament

Particulate matter, dust and weather monitoring

Particulate matter (in the form of PM_{10} and $PM_{2.5}$) and weather are measured at one location each and deposited and directional dust are routinely measured at thirteen locations around Mountsorrel Quarry.

For particulate matter, a Turnkey Osiris sampler is currently located at Stn 9 (Hawcliffe Road). This recognised and certificated 'indicative' real-time device is connected to its own wind vane and anemometer and provides near-instantaneous directional PM_{10} $PM_{2.5}$ and PM_1 data directly to the quarry management team. Through the use of appropriate correction factors as agreed with CBC and LCC, data from the Osiris may be compared against the relevant Air Quality Objectives for particulate matter.

Charnwood Borough Council (CBC) operates a Zephyr air quality monitor which is located within the Leicestershire County Council (LCC) depot at the southern end of Hawcliffe Road, in close proximity to the Osiris device. This device measures a number of pollutants including PM_{10} and $PM_{2.5}$.

A weather station is located at the site offices off Wood Lane and collects a range of weather parameters over fifteen-minute intervals. Data from the weather station are available to the quarry management by means of a dedicated modem connection to the internet.

The majority of the dust samplers around Mountsorrel Quarry comprise the 'Frisbee-type' deposition gauge combined with an adhesive 'sticky pad' directional gauge. These samplers are used to monitoring 'nuisance' dust and samples from these instruments are collected on a monthly basis.

Key monitoring locations are set out in Table 1 and shown in Figure 1.

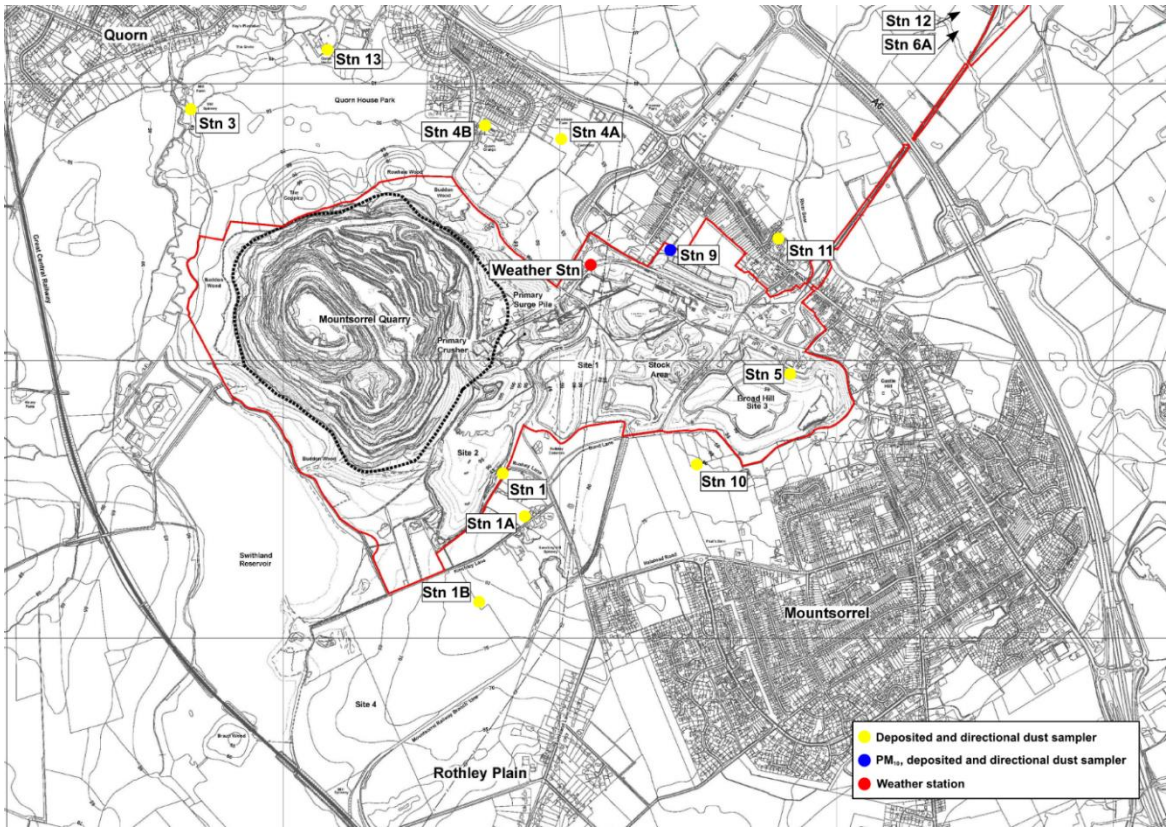

Figure 1: Particulate matter, dust and weather monitoring locations, Mountsorrel Quarry

Table 1: Weather station, PM_{10} and dust monitoring locations, Mountsorrel Quarry

Sampler reference	Easting	Northing	Locality monitored
Stn 1	456781	314577	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 1A	456891	314436	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 1B	456715	314109	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 3	455681	315847	Mill Farm; Quorn House
Stn 4A	457000	315805	Woodside Farm; Leicester Road
Stn 4B	456733	315778	Quorn Grange, Unitt Road, Northage Close, Quorn Park
Stn 5	457789	314941	Bond Lane; Crown Lane
Stn 6A	458660	316786	Sileby Road; Huston Close; Sileby Road (commercial)
Stn 9 (inc. PM)	457374	315398	Hawcliffe Road
Stn 10	457487	314626	Glebe Close; Halstead Road (south); Halstead Road (north)
Stn 11	457791	315458	Loughborough Road; River Soar (marina / caravan park)
Stn 12	458575	315459	Meadow Farm Marina and Caravan Park
Stn 13	456158	316090	Northage Close, Meeting Street
Weather Station	457126	315376	Wood Lane Site Offices

Site Improvement Plan (SIP)

The SIP is updated regularly by quarry management, with support from DustScanAQ through site visits and reports and quarterly reviews with LCC and CBC.

Weather monitoring summary

The key weather data which might affect dust propagation (wind speed, wind direction, total daily precipitation and average daily temperature) for this reporting period are summarised in Figure 2 and Figure 3.

The period 25 August 2023 – 14 September 2023 was characterised by abnormally warm temperatures for this time of year, with temperatures being generally higher than the previous monitoring period. The maximum daily average temperature was 24.0 °C recorded on 09 September and the minimum daily temperature was 13.3 °C recorded on 31 August.

The monitoring period was generally dry, with an extended dry period from the end of August until early September.

Whilst typical rainfall levels during later August and mid-September would have suppressed dust generation, the extended dry period in early September may have resulted in increased dust generation.

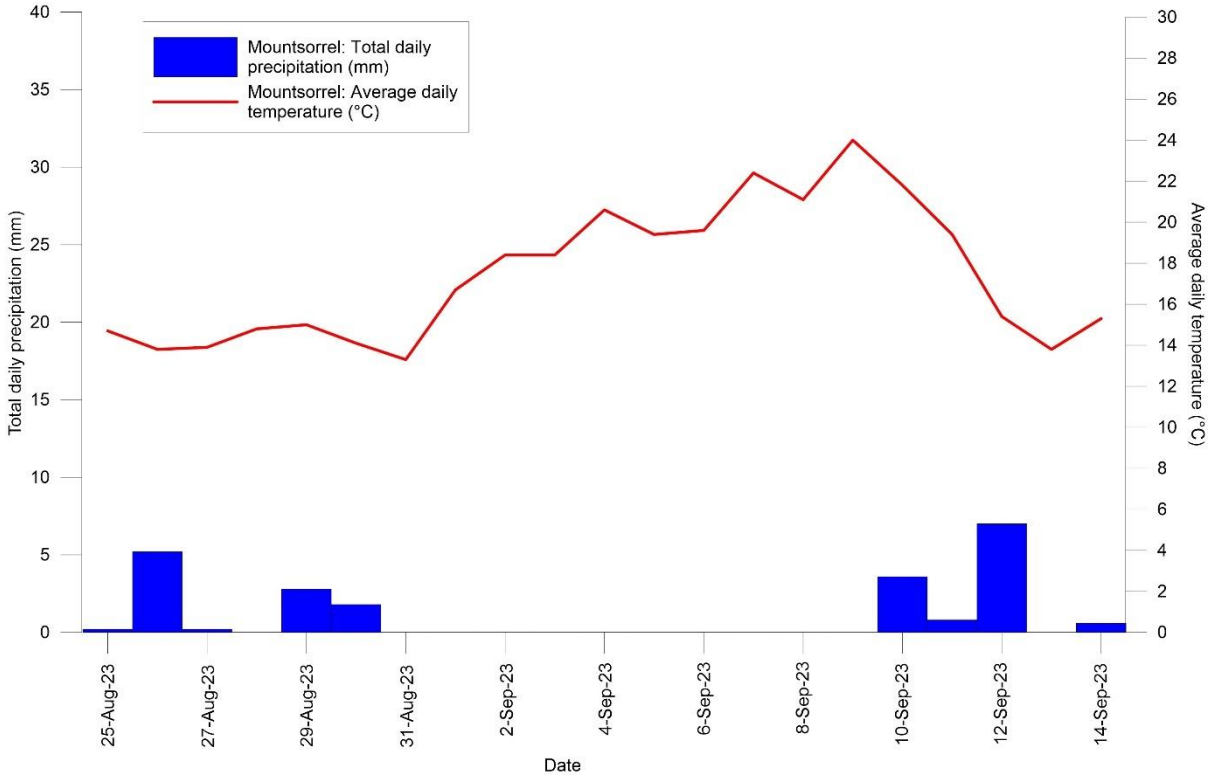

Figure 2: Total daily precipitation and average daily temperature, Mountsorrel Quarry, 25 August 2023 – 14 September 2023

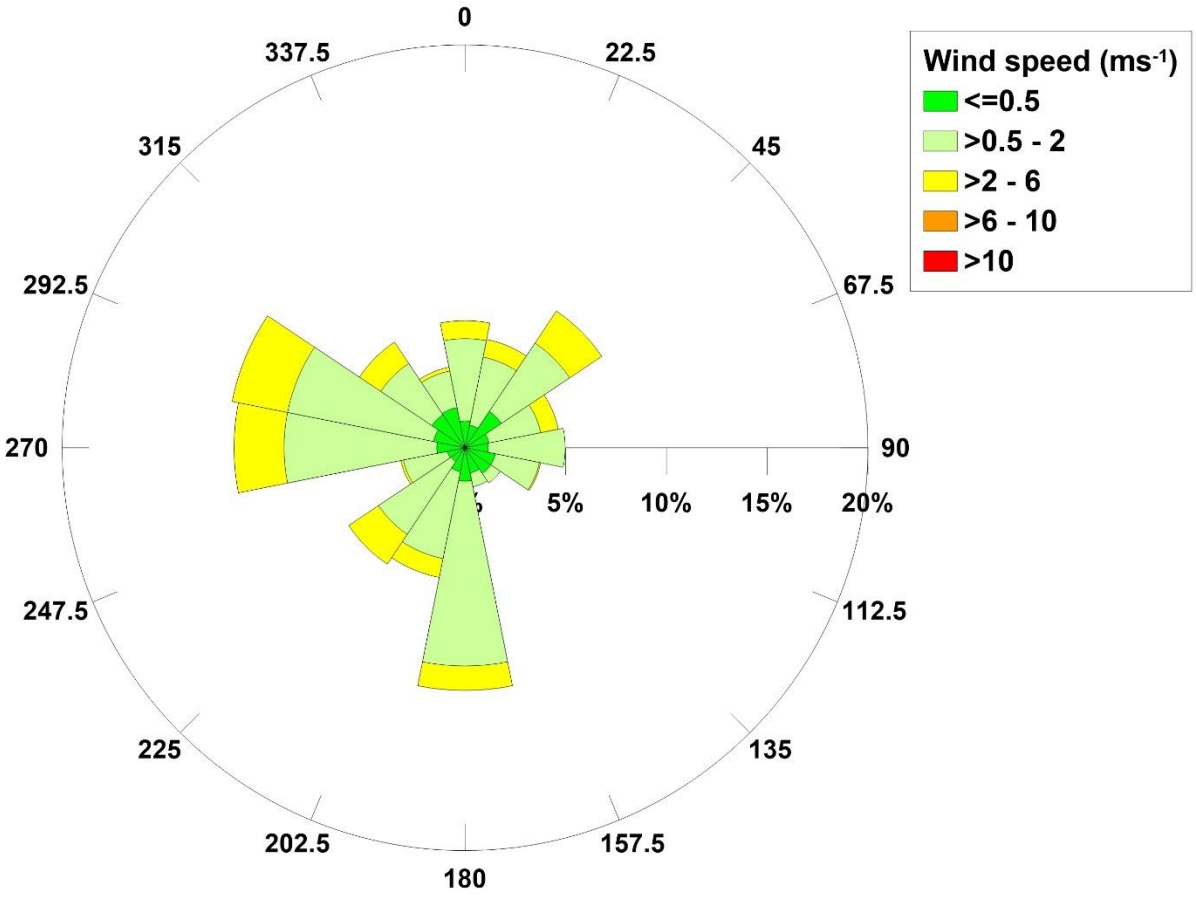

Figure 3: Wind rose, Mountsorrel Quarry, Mountsorrel, 25 August 2023 – 14 September 2023

As seen in Figure 3, winds for this monitoring period were predominantly light to moderate in speed (>2 – 6 m/s) and were typically recorded from the south and west. Consequently, there may have been a slight potential for dust propagation to the north and east.

PM_{10} and $PM_{2.5}$ monitoring summary

The available data from the past 3 months from the Osiris at Stn 9, together with data from the Defra Automatic Urban and Rural Network (AURN) station in Leicester University[2] are shown in Figure 4 and Figure 5.

Data from the AURN station are shown to consider correspondence with, or difference from, national air quality elsewhere in the UK. Where sufficient data are available, it is clear that PM_{10} levels at all locations occasionally track each other closely, and during other periods there can be considerable variation between the units. These patterns are typically indicative of regional and local PM_{10} and $PM_{2.5}$ signals respectively.

PM_{10}

With regard to numerical analysis of the data:

- For the 12 months up to 14 September 2023, there were 365 daily PM_{10} readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily PM_{10} concentration for the 12 months to date (and using the annual calibration factor) was 17.41 µg/m^3, which is approximately 43.5 % of the annual average PM_{10} concentration objective (40 µg/m^3); and

- For the 12 months up to 14 September 2023 there were 19 recorded instances where the daily average PM_{10} concentrations (using the daily factor) exceeded 50 µg/m^3. From the data collection rate this is equivalent to 19 days with a 24-hour average above 50 µg/m^3 in a full year as the data collection rate was 100 %.

In summary, for the 12 months up to 14 September 2023 neither the annual nor daily AQO were exceeded.

Figure 4 shows that over the previous three months of monitoring up to the time of this report, there were no exceedances of the daily average threshold.

Details of past exceedances can be found in previous compliance reports.

It is worth noting that the spike in data seen at both the AURN monitor and Stn 9 Osiris in early September is likely due to the Saharan dust event that affected many parts of the UK.

[2] http://uk-air.defra.gov.uk/networks/network-info?view=aurn

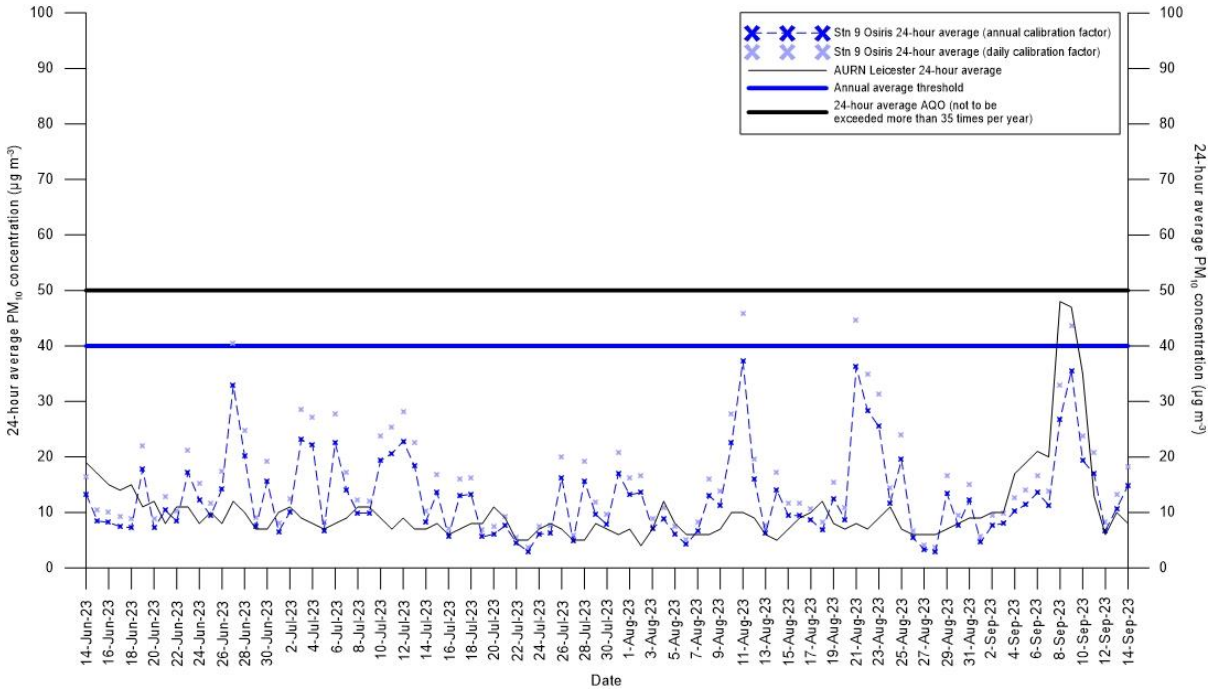

Figure 4: PM_{10} data, most recent 3 months (up to 14 September 2023)

Between 25 August 2023 – 14 September 2023, trigger emails alerting staff to high PM_{10} levels from the direction of site operations were sent out on two occasions. Details of the corresponding causes and investigations are provided in Table 2.

Table 2: Email alert responses, 25 August 2023 – 14 September 2023 (using the trigger threshold, 125 µg/m³ for the 15-minute average)

Date of alert	Details	Possible cause and investigation
25/08/2023	Exceedance recorded at 16:15 from the west-southwest	Investigated by loadout supervisor. Reclaiming ballast into the toastrack, all dust suppression working correctly. Ground conditions wet, no specific source identified.
09/09/2023	Exceedance recorded at 01:30 and 02:15 from the northwest	Off-site direction; signal not related to on-site activities

$PM_{2.5}$

With regard to numerical analysis of the $PM_{2.5}$ data:

- For the 12 months up to 14 September 2023, there were 365 daily $PM_{2.5}$ readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily $PM_{2.5}$ concentration for the 12 months was 6.76 µg/m^3, which is approximately 56.3 % of the interim annual average $PM_{2.5}$ concentration objective (12 µg/m^3) applicable from 31 January 2023.

As previously noted in the PM10 data, it is worth noting that the spike in data seen at both the AURN monitor and Stn 9 Osiris in early September is likely due to the Saharan dust event that affected many parts of the UK.

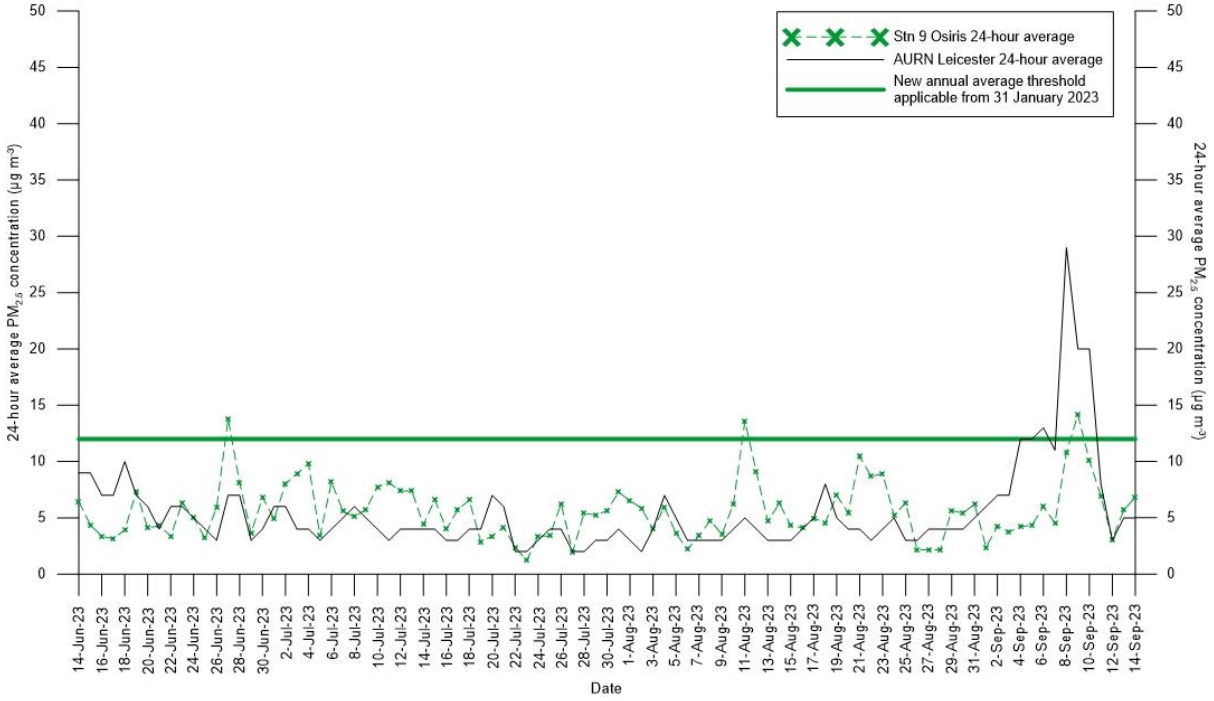

Figure 5: $PM_{2.5}$ data, most recent 3 months (up to 14 September 2023)

Deposited dust monitoring summary

The deposited dust data for 25 August 2023 – 14 September 2023 are summarised in Table 3. The DMMP sets out a site-wide deposited dust threshold of 125 mg/m^2/day 'undissolved solids' as a trigger limit for investigation to identify the potential dust source/s, taking account of the directional data.

Table 3 shows that, for the available data, deposited dust levels during 25 August 2023 – 14 September 2023 were within the site-wide threshold for all stations. Slightly Elevated levels (92 mg/m^2/day) were recorded at Stn 9. Low levels (77, 64 and 64 mg/m^2/day) were recorded at Stn 1B, Stn 4B and Stn 10, respectively. All other stations recorded Very Low depositional magnitudes.

Table 3: Summary of deposited dust (undissolved solids), 25 August 2023 – 14 September 2023

Undissolved solids (mg/m^2/day)				
This month report start date:		25-Aug-23		
This month report end date:		14-Sep-23		
Receptor location	**Nearest / appropriate dust monitoring point**	**Reported value**	**Trigger: ≥ 125[a]**	**Magnitude[b]**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	40	No	**Very Low**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	38	No	**Very Low**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	77	No	**Low**
Mill Farm; Quorn House	Stn 3	15	No	**Very Low**
Woodside Farm, Leicester Road	Stn 4A	29	No	**Very Low**
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	64	No	**Low**
Bond Lane; Crown Lane	Stn 5	31	No	**Very Low**
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	25	No	**Very Low**
Hawcliffe Road	Stn 9	92	No	**Slightly Elevated**
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	64	No	**Low**
Loughborough Road; River Soar (marina / caravan park)	Stn 11	34	No	**Very Low**
Meadow Farm Marina and Caravan Park	Stn 12	49	No	**Very Low**
Quorn House Park	Stn 13	18	No	**Very Low**

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of mass deposition rate assessed against typical rate for semi-rural areas (30 - 80 mg/m^2/day)

Regarding dust deposition over time, the rates across the sampling area have varied considerably. Trends in dust deposition rates (as undissolved solids) for the previous 12 months, together with the site-wide dust threshold are illustrated in Figure 6.

In general, as would be expected, dust deposition rates are typically lower in winter months than in summer months. This trend is clearly seen for most monitoring points in Figure 6, with some exceptions. Dust deposition rates have been consistently below the 'trigger limit' at all sampling locations except Stn 1B and 9, although the exceedances at Stn 1B are known to be related to nearby agricultural activities, rather than on-site processes.

In general, as shown in Figure 6, higher rates of dust deposition have been recorded near industrial settings (*i.e.* Stn 9) than in more residential areas (*e.g.* Stn 1, Kinchley Lane).

Figure 6 shows that dust deposition rates were largely well within the site-wide trigger level during the previous 12 months although rates at Stn 9 have been at or above the trigger level twice over this period and also twice at Stn 1B. At Stn 1B both exceedances are unlikely to be related to quarrying activities. The average dust deposition rate at Stn 9 for the previous 12 months (94 mg/m^2/day) is below the site-specific threshold.

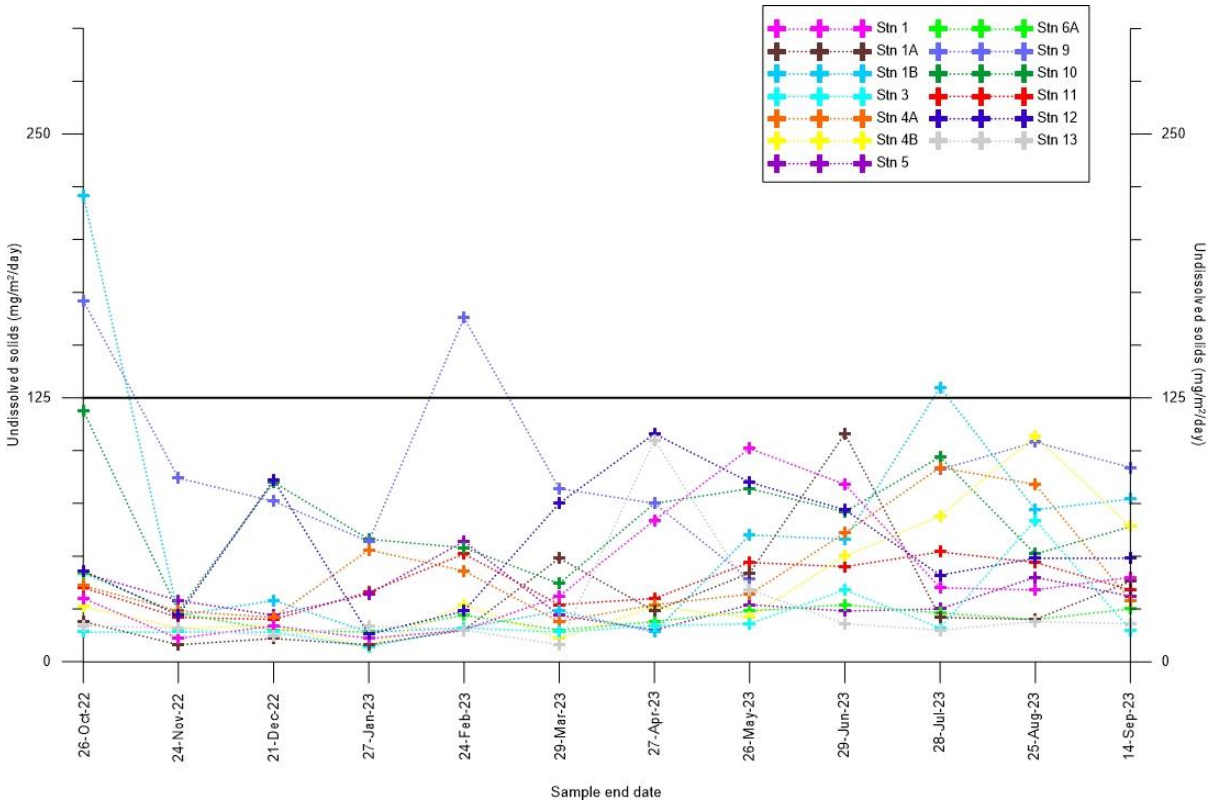

Figure 6: Dust deposition rates per sampling location over time (past 12 months)

Directional dust monitoring summary

The directional dust data for 25 August 2023 – 14 September 2023 are summarised in Table 4. As with deposited dust, the DMMP sets out a site-wide directional dust threshold. For directional dust soiling, 0.5 % effective area coverage (EAC) per day is a trigger limit for investigation to identify the likely dust source/s, again taking account of the direction.

Table 4 shows that during 25 August 2023 – 14 September 2023, most of the stations recorded Very Low dust levels from all directions. However up to Low levels (0.2 % EAC/day) were recorded at Stn 1B.

Table 4: Summary of directional dust soiling, 25 August 2023 – 14 September 2023

Directional dust soiling (%EAC/day) by direction (°)										
This month report start date:		25-Aug-23								
This month report end date:		14-Sep-23								
Receptor location	Nearest / appropriate dust monitoring point		Direction (°)							
			0	45	90	135	180	225	270	315
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	Reported value	0.1	0.1	0	0	0	0	0	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	Reported value	0.1	0.1	0	0	0	0	0	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	Reported value	0.1	0.1	0	0	0	0.2	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Very Low	Very Low
Mill Farm; Quorn House	Stn 3	Reported value	0.1	0.1	0	0	0	0	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Woodside Farm, Leicester Road	Stn 4A	Reported value	0.1	0.1	0	0	0	0.1	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	Reported value	0	0.1	0.1	0	0	0.1	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Bond Lane; Crown Lane	Stn 5	Reported value	0.1	0	0	0.1	0	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	Reported value	0	0.1	0.1	0.1	0	0.1	0.1	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Hawcliffe Road	Stn 9	Reported value	0.1	0.1	0.1	0	0	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	Reported value	0.1	0	0	0.1	0.1	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	Reported value	0	0.1	0	0	0	0	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	Reported value	0.1	0.1	0.1	0	0	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn House Park	Stn 13	Reported value	0.1	0	0	0	0	0	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of directional dust soiling derived from Beaman and Kingsbury, 1981

[c] Direction/s not determined for daily EAC below 0.1%/day (very low soiling)

Table 5 shows that average directional soiling rates have been at very low levels at most monitoring locations, for most directions, over the past year. At Stn 9, the annual average soiling rate to date was 0.2 % EAC/day from the southwest and west resulting in 'Low' magnitudes being recorded. The cause or causes of these consistently, but marginally elevated dust soiling rates at this monitoring point are under review, as they may be related to site activities such as operations at the PSV yard, Granite Way and/or the toast rack.

Table 5: Running average directional dust soiling (past 12 months)

Receptor location	Nearest / appropriate dust monitoring point		Direction (°)							
			0	45	90	135	180	225	270	315
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	Average value	0	0	0	0	0	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	Average value	0	0	0	0	0	0	0	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	Average value	0	0	0	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Mill Farm; Quorn House	Stn 3	Average value	0	0	0	0.1	0	0	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Woodside Farm, Leicester Road	Stn 4A	Average value	0	0.1	0	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	Average value	0	0.1	0.1	0	0	0	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Bond Lane; Crown Lane	Stn 5	Average value	0.1	0	0	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	Average value	0	0.1	0.1	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Hawcliffe Road	Stn 9	Average value	0	0.1	0.1	0.1	0	0.2	0.2	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Low	Very Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	Average value	0.1	0	0	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	Average value	0	0	0	0.1	0.1	0.1	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	Average value	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn House Park	Stn 13	Average value	0	0	0	0	0	0	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of directional dust soiling derived from Beaman and Kingsbury, 1981

[c] Direction/s not determined for daily EAC below 0.1%/day (very low soiling)

Complaints

During 25 August 2023 – 14 September 2023 four complaints relating to dust were received by the quarry. Each complaint was responded to in accordance with the process outlined in the DMMP.

DustScanAQ
January 2024

Dust and Air Quality Innovation and Expertise

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October 2023 particulate matter, dust and weather monitoring report for Mountsorrel Quarry

Client:	**Tarmac Trading Limited**
Site:	**Mountsorrel Quarry, Quorn**
Job Code:	**ZLFMS**
Report Start Date:	**14 September 2023**
Report End Date:	**12 October 2023**
Date Report Issued:	**24 January 2024**

'Dust' is generally regarded as particulate matter up to 75 µm (micron) diameter and can be considered in two categories. Fine dust, essentially particles up to 10 µm, is commonly referred to as PM_{10} and is measured to agreed standards and forms part of the national Air Quality Objectives (AQO). The AQO for PM_{10} is currently 50 µg/m^3 for the 24-hour mean, not to be exceeded 35 times per year and 40 µg/m^3 for the annual mean. The previous AQO for $PM_{2.5}$ was 20 µg/m^3 however from 31 January 2023 the interim AQO for $PM_{2.5}$ is 12 µg/m^3 for the annual mean (to be achieved by 2028), whilst the legal AQO for $PM_{2.5}$ is 10 µg/m^3 for the annual mean (to be achieved by 2040) as per The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[1]. Following correspondence with Charnwood Borough Council, it was agreed to compare $PM_{2.5}$ measurements against the interim objective.

Coarser dust (essentially particles greater than 10 µm) is generally regarded as 'nuisance dust' and can be associated with annoyance, although there are no official standards (such as AQO) for dust annoyance.

Weather conditions can have a significant effect on the potential for dust propagation from a minerals site. Of particular importance are wind speed, wind direction, and precipitation. Dust can be carried from a source towards receptors (such as nearby homes and other businesses) according to the strength and direction of wind. Precipitation is recognised to suppress dust and 0.2 mm antecedent rainfall is considered sufficient to suppress windblown dust for a number of hours.

Mountsorrel Quarry has a comprehensive Dust Management and Monitoring Plan (DMMP). The DMMP was developed in 2011 and subject to regular review and revision, in consultation between Tarmac and the local regulators (Leicestershire County Council (LCC) and Charnwood Borough Council (CBC)).

The DMMP is enacted through the quarry Site Improvement Plan (SIP). The SIP sets out a programme of actions to reduce the environmental impact of specific areas of the site operation.

[1] Statutory Instrument. (2023), 'The Environmental Targets (Fine Particulate Matter) (England) Regulations', No. 96. King's Printer of Acts of Parliament

Particulate matter, dust and weather monitoring

Particulate matter (in the form of PM_{10} and $PM_{2.5}$) and weather are measured at one location each and deposited and directional dust are routinely measured at thirteen locations around Mountsorrel Quarry.

For particulate matter, a Turnkey Osiris sampler is currently located at Stn 9 (Hawcliffe Road). This recognised and certificated 'indicative' real-time device is connected to its own wind vane and anemometer and provides near-instantaneous directional PM_{10} $PM_{2.5}$ and PM_1 data directly to the quarry management team. Through the use of appropriate correction factors as agreed with CBC and LCC, data from the Osiris may be compared against the relevant Air Quality Objectives for particulate matter.

Charnwood Borough Council (CBC) operates a Zephyr air quality monitor which is located within the Leicestershire County Council (LCC) depot at the southern end of Hawcliffe Road, in close proximity to the Osiris device. This device measures a number of pollutants including PM_{10} and $PM_{2.5}$.

A weather station is located at the site offices off Wood Lane and collects a range of weather parameters over fifteen minute intervals. Data from the weather station are available to the quarry management by means of a dedicated modem connection to the internet.

The majority of the dust samplers around Mountsorrel Quarry comprise the 'Frisbee-type' deposition gauge combined with an adhesive 'sticky pad' directional gauge. These samplers are used to monitoring 'nuisance' dust and samples from these instruments are collected on a monthly basis.

Key monitoring locations are set out in Table 1 and shown in Figure 1.

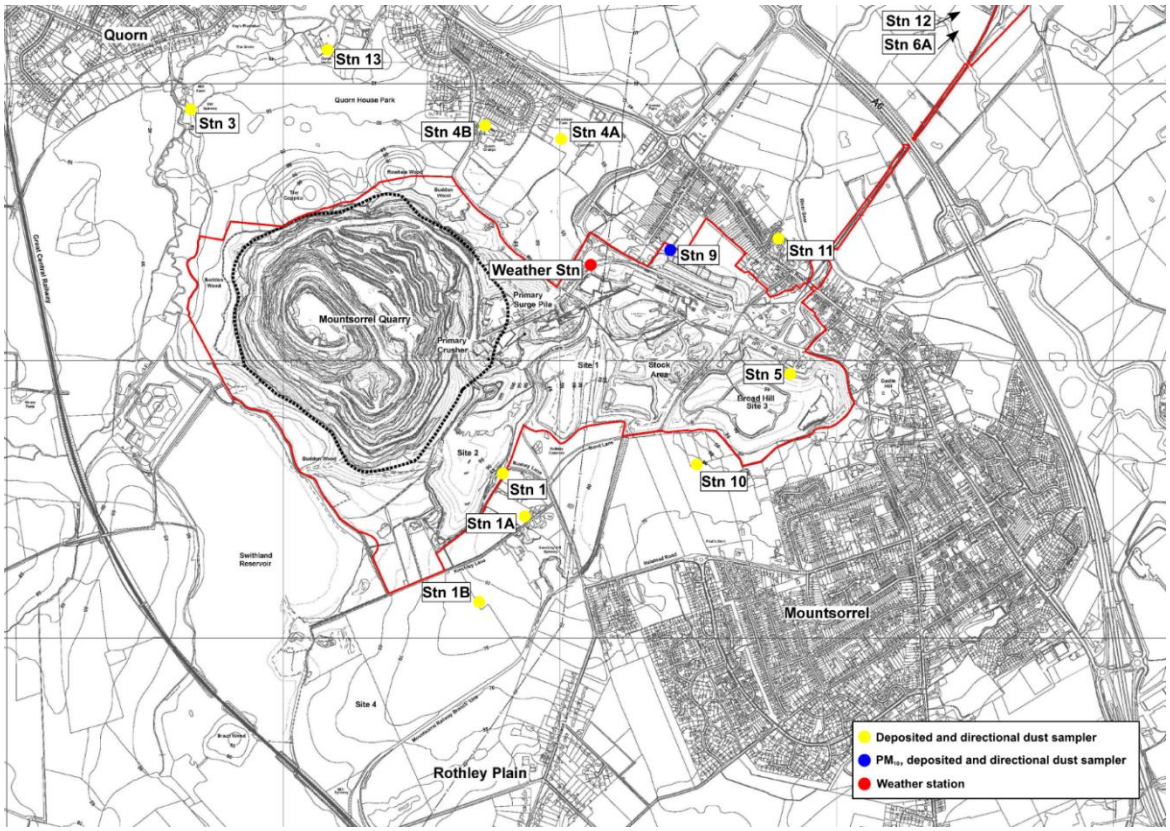

Figure 1: Particulate matter, dust and weather monitoring locations, Mountsorrel Quarry

Table 1: Weather station, PM_{10} and dust monitoring locations, Mountsorrel Quarry

Sampler reference	Easting	Northing	Locality monitored
Stn 1	456781	314577	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 1A	456891	314436	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 1B	456715	314109	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 3	455681	315847	Mill Farm; Quorn House
Stn 4A	457000	315805	Woodside Farm; Leicester Road
Stn 4B	456733	315778	Quorn Grange, Unitt Road, Northage Close, Quorn Park
Stn 5	457789	314941	Bond Lane; Crown Lane
Stn 6A	458660	316786	Sileby Road; Huston Close; Sileby Road (commercial)
Stn 9 (inc. PM)	457374	315398	Hawcliffe Road
Stn 10	457487	314626	Glebe Close; Halstead Road (south); Halstead Road (north)
Stn 11	457791	315458	Loughborough Road; River Soar (marina / caravan park)
Stn 12	458575	315459	Meadow Farm Marina and Caravan Park
Stn 13	456158	316090	Northage Close, Meeting Street
Weather Station	457126	315376	Wood Lane Site Offices

Site Improvement Plan (SIP)

The SIP is updated regularly by quarry management, with support from DustScanAQ through site visits and reports and quarterly reviews with LCC and CBC.

Weather monitoring summary

The key weather data which might affect dust propagation (wind speed, wind direction, total daily precipitation and average daily temperature) for this reporting period are summarised in Figure 2 and Figure 3.

The period 14 September 2023 – 12 October 2023 is characterised by generally warm temperatures. The maximum daily average temperature was 18.6 °C recorded on 07 October and the minimum daily temperature was 10.9 °C recorded on 12 October.

The monitoring period was generally wet, however there was a five-day dry period in early October (06 – 10). Consequently, the majority of the total rainfall occurred in the first half of the monitoring period.

Whilst rainfall levels throughout September would have likely suppressed dust generation, the five-day dry period in early October may have resulted in increased dust generation.

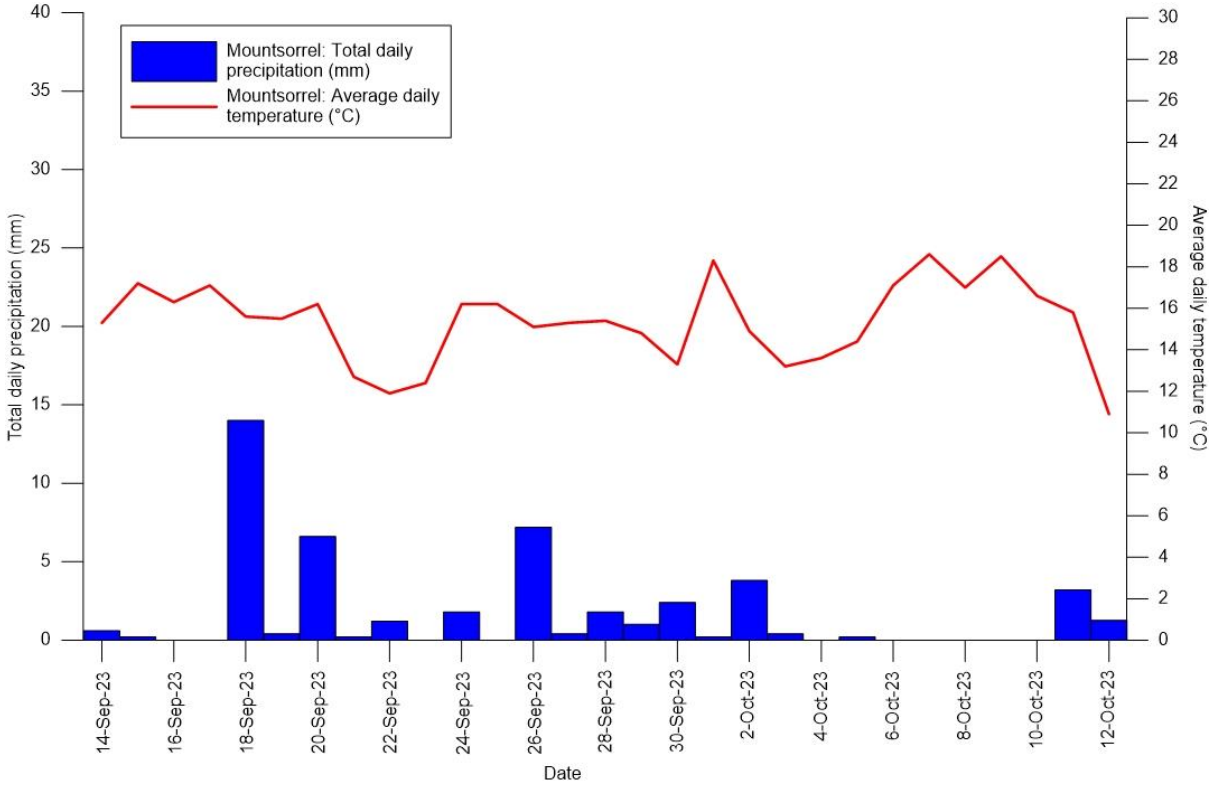

Figure 2: Total daily precipitation and average daily temperature, Mountsorrel Quarry, 14 September 2023 – 12 October 2023

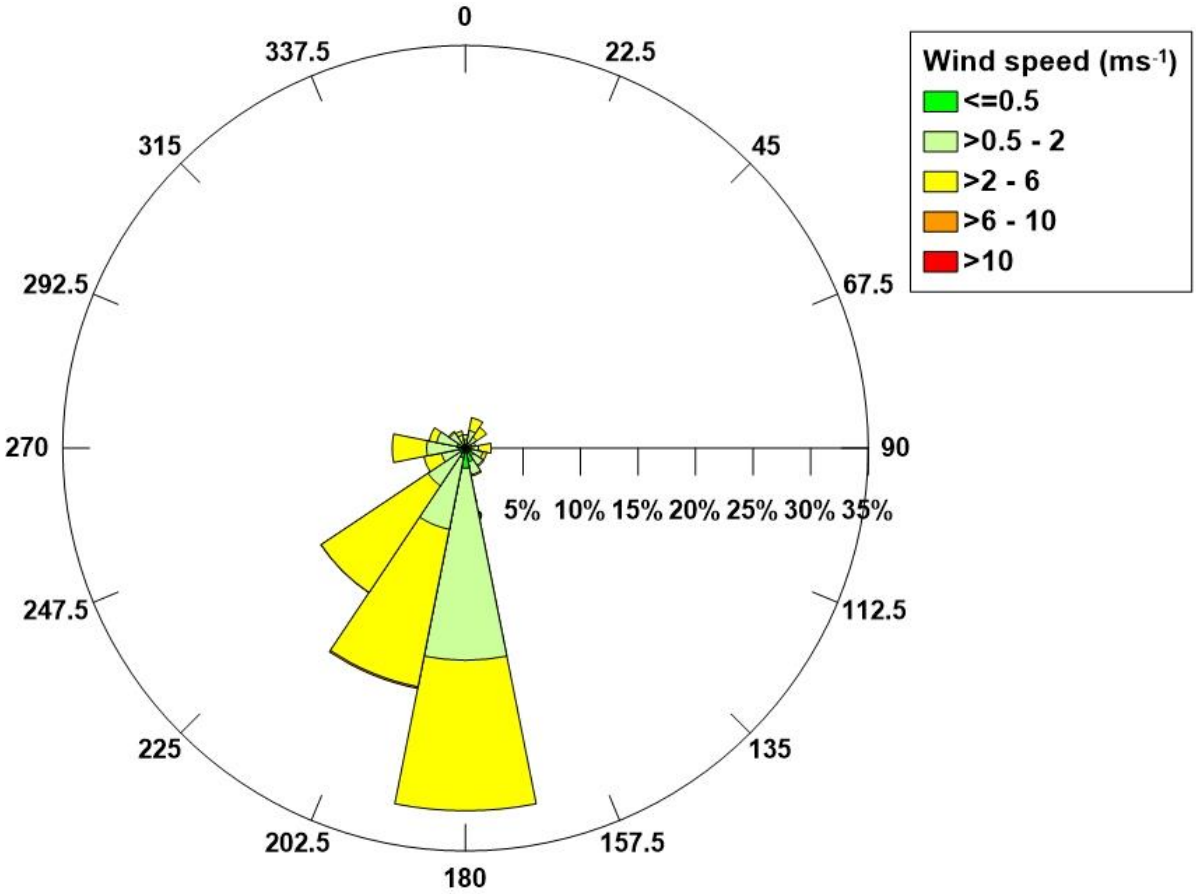

Figure 3: Wind rose, Mountsorrel Quarry, Mountsorrel, 14 September 2023 – 12 October 2023

As seen in Figure 3, winds for this monitoring period were predominantly light to moderate in speed (>0.5 – 6 m/s) and were mainly recorded from the south. Consequently, there may have been a slight potential for dust propagation to the north throughout the monitoring period.

PM_{10} and $PM_{2.5}$ monitoring summary

The available data from the past 3 months from the Osiris at Stn 9, together with data from the Defra Automatic Urban and Rural Network (AURN) station in Leicester University[2] are shown in Figure 4 and Figure 5.

Data from the AURN station are shown to consider correspondence with, or difference from, national air quality elsewhere in the UK. Where sufficient data are available, it is clear that PM_{10} levels at all locations occasionally track each other closely, and during other periods there can be considerable variation between the units. These patterns are typically indicative of regional and local PM_{10} and $PM_{2.5}$ signals respectively.

PM_{10}

With regard to numerical analysis of the data:

- For the 12 months up to 12 October 2023, there were 365 daily PM_{10} readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily PM_{10} concentration for the 12 months to date (and using the annual calibration factor) was 16.59 µg/m^3, which is approximately 41.5 % of the annual average PM_{10} concentration objective (40 µg/m^3); and

- For the 12 months up to 12 October 2023 there were 14 recorded instances where the daily average PM_{10} concentrations (using the daily factor) exceeded 50 µg/m^3. From the data collection rate this is equivalent to 14 days with a 24-hour average above 50 µg/m^3 in a full year as the data collection rate was 100 %.

In summary, for the 12 months up to 12 October 2023 neither the annual nor daily AQO were exceeded.

Figure 4 shows that over the previous three months of monitoring up to the time of this report, there were no exceedances of the daily average threshold.

Details of past exceedances can be found in previous compliance reports.

[2] http://uk-air.defra.gov.uk/networks/network-info?view=aurn

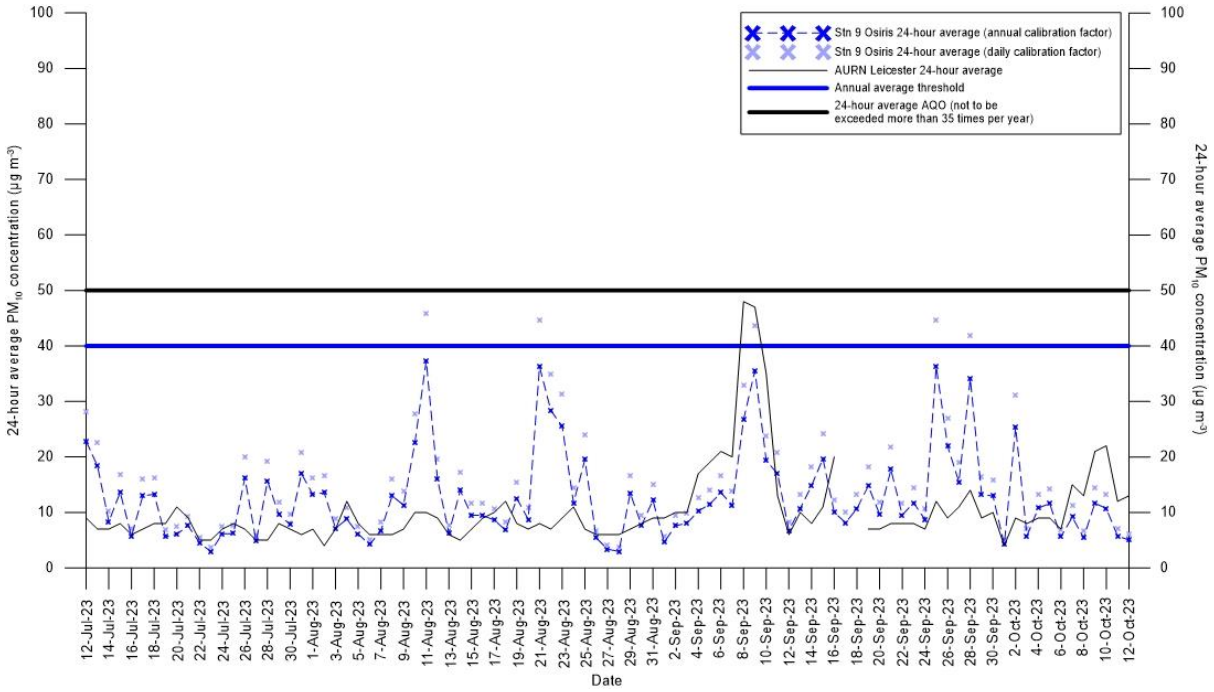

Figure 4: PM_{10} data, most recent 3 months (up to 12 October 2023)

Between 14 September 2023 – 12 October 2023, trigger emails alerting staff to high PM_{10} levels from the direction of site operations were sent out on two occasions. Details of the corresponding causes and investigations are provided in Table 2.

Table 2: Email alert responses, 14 September 2023 – 12 October 2023 (using the trigger threshold, 125 µg/m³ for the 15-minute average)

Date of alert	Details	Possible cause and investigation
02/10/2023	Exceedances recorded at 06:15, 06:45, 16:00 and 18:00 all from the northeast.	Off-site direction; signal not related to on-site activities
05/10/2023	Exceedance recorded at 18:00 from the southwest.	Exceedance from site direction, possibly related to activities to the west of the toast rack.

$PM_{2.5}$

With regard to numerical analysis of the $PM_{2.5}$ data:

- For the 12 months up to 12 October 2023, there were 365 daily $PM_{2.5}$ readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily $PM_{2.5}$ concentration for the 12 months was 6.76 µg/m^3, which is approximately 56.4 % of the interim annual average $PM_{2.5}$ concentration objective (12 µg/m^3) applicable from 31 January 2023.

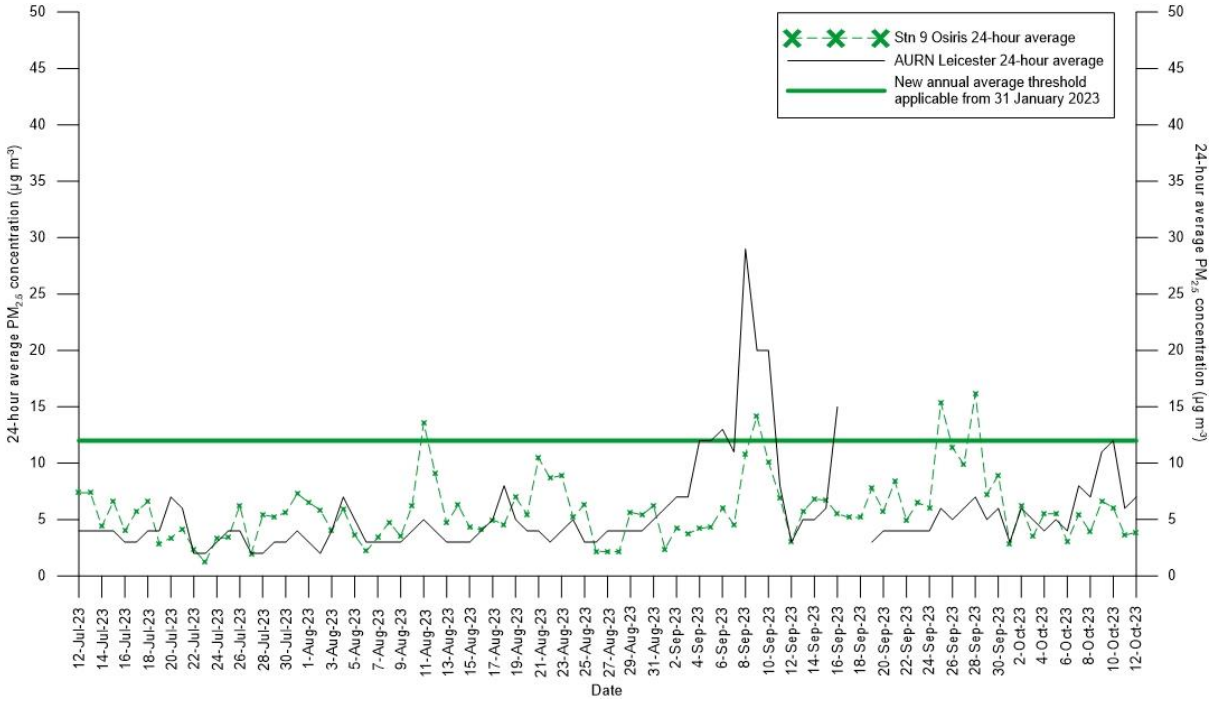

Figure 5: $PM_{2.5}$ data, most recent 3 months (up to 12 October 2023)

Deposited dust monitoring summary

The deposited dust data for 14 September 2023 – 12 October 2023 are summarised in Table 3. The DMMP sets out a site-wide deposited dust threshold of 125 mg/m^2/day 'undissolved solids' as a trigger limit for investigation to identify the potential dust source/s, taking account of the directional data.

Table 3 shows that, for the available data, deposited dust levels during 14 September 2023 – 12 October 2023 were within the site-wide threshold for all stations, excluding Stn 9 where Elevated levels were recorded (150 mg/m^2/day). The directional data from this location suggests a source to the southwest and west, so it is possible that the elevated dust level was due to both on-site and off-site sources.

Low levels (57, 61 and 63 mg/m^2/day) were recorded at Stn 1, Stn 4B and Stn 11, respectively. All other stations recorded Very Low depositional magnitudes.

Table 3: Summary of deposited dust (undissolved solids), 14 September 2023 – 12 October 2023

Undissolved solids (mg/m^2/day)				
This month report start date:		**14-Sep-23**		
This month report end date:		**12-Oct-23**		
Receptor location	**Nearest / appropriate dust monitoring point**	**Reported value**	**Trigger: ≥ 125[a]**	**Magnitude[b]**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	57	No	**Low**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	20	No	**Very Low**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	16	No	**Very Low**
Mill Farm; Quorn House	Stn 3	20	No	**Very Low**
Woodside Farm, Leicester Road	Stn 4A	29	No	**Very Low**
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	61	No	**Low**
Bond Lane; Crown Lane	Stn 5	27	No	**Very Low**
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	23	No	**Very Low**
Hawcliffe Road	Stn 9	150	**Yes**	**Elevated**
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	34	No	**Very Low**
Loughborough Road; River Soar (marina / caravan park)	Stn 11	63	No	**Low**
Meadow Farm Marina and Caravan Park	Stn 12	48	No	**Very Low**
Quorn House Park	Stn 13	16	No	**Very Low**

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of mass deposition rate assessed against typical rate for semi-rural areas (30 - 80 mg/m^2/day)

Regarding dust deposition over time, the rates across the sampling area have varied considerably. Trends in dust deposition rates (as undissolved solids) for the previous 12 months, together with the site-wide dust threshold are illustrated in Figure 6.

In general, as would be expected, dust deposition rates are typically lower in winter months than in summer months. This trend is clearly seen for most monitoring points in Figure 6, with some exceptions. Dust deposition rates have been consistently below the 'trigger limit' at all sampling locations except Stn 1B and 9, although the exceedances at Stn 1B are known to be related to nearby agricultural activities, rather than on-site processes.

In general, as shown in Figure 6, higher rates of dust deposition have been recorded near industrial settings (*i.e.* Stn 9) than in more residential areas (*e.g.* Stn 1, Kinchley Lane).

Figure 6 shows that dust deposition rates were largely well within the site-wide trigger level during the previous 12 months although rates at Stn 9 have been at or above the trigger level twice over this period and also once at Stn 1B. At Stn 1B the exceedance is unlikely to be related to quarrying activities. The average dust deposition rate at Stn 9 for the previous 12 months (92 mg/m^2/day) is below the site-specific threshold.

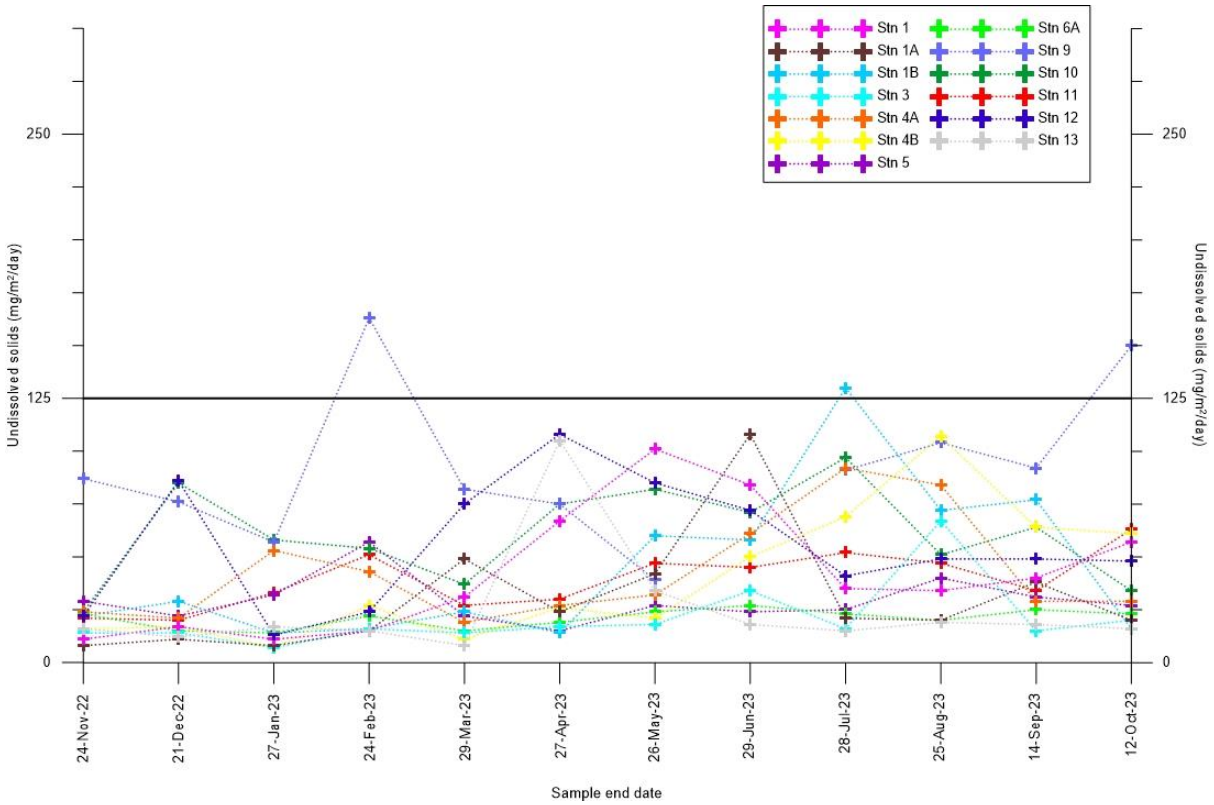

Figure 6: Dust deposition rates per sampling location over time (past 12 months)

Directional dust monitoring summary

The directional dust data for 14 September 2023 – 12 October 2023 are summarised in Table 4. As with deposited dust, the DMMP sets out a site-wide directional dust threshold. For directional dust soiling, 0.5 % effective area coverage (EAC) per day is a trigger limit for investigation to identify the likely dust source/s, again taking account of the direction.

Table 4 shows that during 14 September 2023 – 12 October 2023, most of the stations recorded Very Low dust levels from all directions. However up to Low levels (0.2 – 0.3 % EAC/day) were recorded at Stn 1, Stn 4B, Stn 6A and Stn 9.

Table 4: Summary of directional dust soiling, 14 September 2023 – 12 October 2023

Directional dust soiling (%EAC/day) by direction (°)										
This month report start date:		14-Sep-23								
This month report end date:		12-Oct-23								
Receptor location	Nearest / appropriate dust monitoring point		Direction (°)							
			0	45	90	135	180	225	270	315
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	Reported value	0.1	0.1	0.3	0.3	0.1	0.2	0.2	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Low	Low	Very Low	Low	Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	Reported value	0.1	0	0	0	0	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	Reported value	0	0	0	0.1	0.1	0.1	0.1	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Mill Farm; Quorn House	Stn 3	Reported value	0	0.1	0	0.1	0	0.1	0	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Woodside Farm, Leicester Road	Stn 4A	Reported value	0	0.1	0	0	0	0.1	0.1	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	Reported value	0	0.2	0.2	0.1	0.1	0.1	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low
Bond Lane; Crown Lane	Stn 5	Reported value	0	0	0	0	0.1	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	Reported value	0.1	0.1	0.1	0	0	0.2	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Very Low	Very Low
Hawcliffe Road	Stn 9	Reported value	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Low	Very Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	Reported value	0	0	0.1	0	0.1	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	Reported value	0.1	0	0	0.1	0.1	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	Reported value	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn House Park	Stn 13	Reported value	0.1	0	0	0.1	0.1	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of directional dust soiling derived from Beaman and Kingsbury, 1981

[c] Direction/s not determined for daily EAC below 0.1%/day (very low soiling)

Table 5 shows that average directional soiling rates have been at very low levels at most monitoring locations, for most directions, over the past year. At Stn 9, the annual average soiling rate to date was 0.2 % EAC/day from the southwest and west resulting in 'Low' magnitudes being recorded. The cause or causes of these consistently, but marginally elevated dust soiling rates at this monitoring point are under review, as they may be related to site activities such as operations at the PSV yard, Granite Way and/or the toast rack.

Table 5: Running average directional dust soiling (past 12 months)

Receptor location	Nearest / appropriate dust monitoring point		Direction (°)							
			0	45	90	135	180	225	270	315
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	Average value	0	0	0	0	0	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	Average value	0	0	0	0	0	0	0	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	Average value	0	0	0	0.1	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Mill Farm; Quorn House	Stn 3	Average value	0	0	0	0.1	0	0	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Woodside Farm, Leicester Road	Stn 4A	Average value	0	0.1	0	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	Average value	0	0.1	0.1	0	0	0	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Bond Lane; Crown Lane	Stn 5	Average value	0.1	0	0	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	Average value	0	0.1	0.1	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Hawcliffe Road	Stn 9	Average value	0	0.1	0.1	0.1	0	0.2	0.2	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Low	Very Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	Average value	0	0	0	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	Average value	0	0	0	0.1	0.1	0.1	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	Average value	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn House Park	Stn 13	Average value	0	0	0	0	0	0	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

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DustScanAQ
January 2024

Dust and Air Quality Innovation and Expertise

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November 2023 particulate matter, dust and weather monitoring report for Mountsorrel Quarry

Client:	**Tarmac Trading Limited**
Site:	**Mountsorrel Quarry, Quorn**
Job Code:	**ZLFMS**
Report Start Date:	**12 October 2023**
Report End Date:	**10 November 2023**
Date Report Issued:	**23 January 2024**

'Dust' is generally regarded as particulate matter up to 75 µm (micron) diameter and can be considered in two categories. Fine dust, essentially particles up to 10 µm, is commonly referred to as PM_{10} and is measured to agreed standards and forms part of the national Air Quality Objectives (AQO). The AQO for PM_{10} is currently 50 µg/m^3 for the 24-hour mean, not to be exceeded 35 times per year and 40 µg/m^3 for the annual mean. The previous AQO for $PM_{2.5}$ was 20 µg/m^3 however from 31 January 2023 the interim AQO for $PM_{2.5}$ is 12 µg/m^3 for the annual mean (to be achieved by 2028), whilst the legal AQO for $PM_{2.5}$ is 10 µg/m^3 for the annual mean (to be achieved by 2040) as per The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[1]. Following correspondence with Charnwood Borough Council, it was agreed to compare $PM_{2.5}$ measurements against the interim objective.

Coarser dust (essentially particles greater than 10 µm) is generally regarded as 'nuisance dust' and can be associated with annoyance, although there are no official standards (such as AQO) for dust annoyance.

Weather conditions can have a significant effect on the potential for dust propagation from a minerals site. Of particular importance are wind speed, wind direction, and precipitation. Dust can be carried from a source towards receptors (such as nearby homes and other businesses) according to the strength and direction of wind. Precipitation is recognised to suppress dust and 0.2 mm antecedent rainfall is considered sufficient to suppress windblown dust for a number of hours.

Mountsorrel Quarry has a comprehensive Dust Management and Monitoring Plan (DMMP). The DMMP was developed in 2011 and subject to regular review and revision, in consultation between Tarmac and the local regulators (Leicestershire County Council (LCC) and Charnwood Borough Council (CBC)).

The DMMP is enacted through the quarry Site Improvement Plan (SIP). The SIP sets out a programme of actions to reduce the environmental impact of specific areas of the site operation.

[1] Statutory Instrument. (2023), 'The Environmental Targets (Fine Particulate Matter) (England) Regulations', No. 96. King's Printer of Acts of Parliament

Particulate matter, dust and weather monitoring

Particulate matter (in the form of PM_{10} and $PM_{2.5}$) and weather are measured at one location each and deposited and directional dust are routinely measured at thirteen locations around Mountsorrel Quarry.

For particulate matter, a Turnkey Osiris sampler is currently located at Stn 9 (Hawcliffe Road). This recognised and certificated 'indicative' real-time device is connected to its own wind vane and anemometer and provides near-instantaneous directional PM_{10} $PM_{2.5}$ and PM_1 data directly to the quarry management team. Through the use of appropriate correction factors as agreed with CBC and LCC, data from the Osiris may be compared against the relevant Air Quality Objectives for particulate matter.

Charnwood Borough Council (CBC) operates a Zephyr air quality monitor which is located within the Leicestershire County Council (LCC) depot at the southern end of Hawcliffe Road, in close proximity to the Osiris device. This device measures a number of pollutants including PM_{10} and $PM_{2.5}$.

A weather station is located at the site offices off Wood Lane and collects a range of weather parameters over fifteen minute intervals. Data from the weather station are available to the quarry management by means of a dedicated modem connection to the internet.

The majority of the dust samplers around Mountsorrel Quarry comprise the 'Frisbee-type' deposition gauge combined with an adhesive 'sticky pad' directional gauge. These samplers are used to monitoring 'nuisance' dust and samples from these instruments are collected on a monthly basis.

Key monitoring locations are set out in Table 1 and shown in Figure 1.

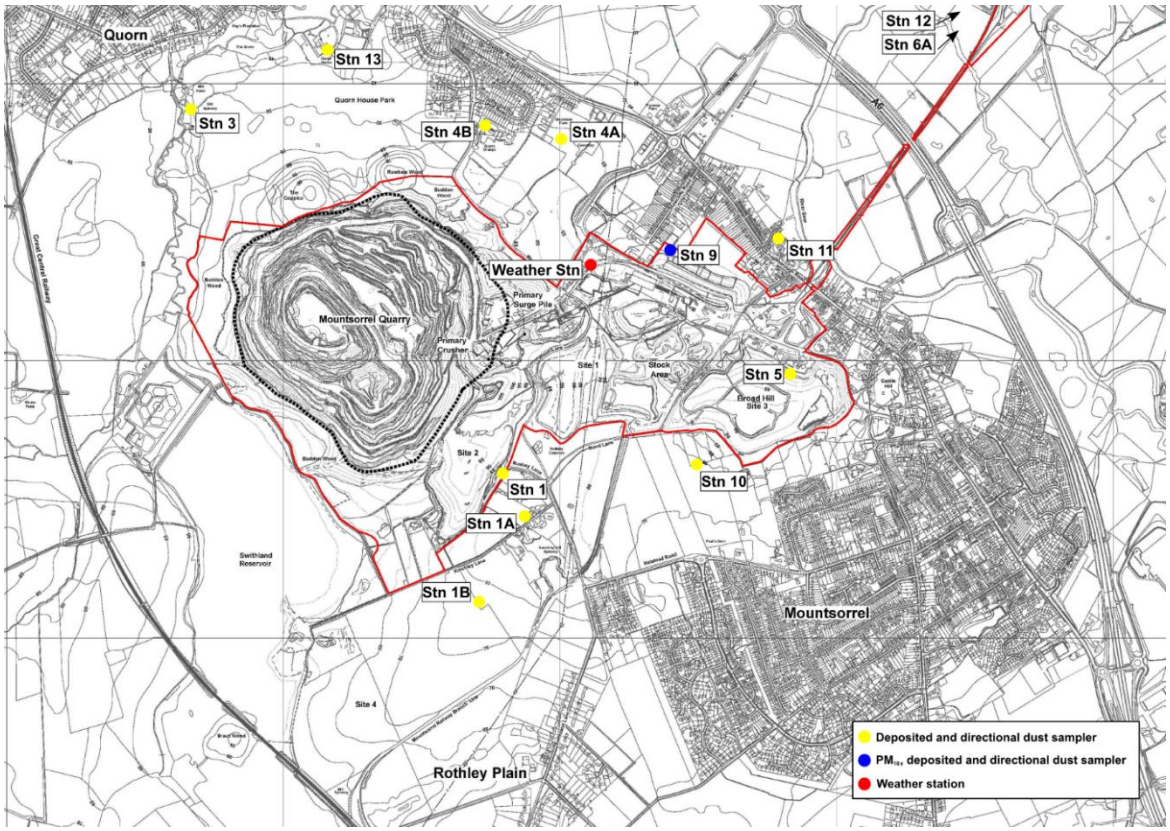

Figure 1: Particulate matter, dust and weather monitoring locations, Mountsorrel Quarry

Table 1: Weather station, PM_{10} and dust monitoring locations, Mountsorrel Quarry

Sampler reference	Easting	Northing	Locality monitored
Stn 1	456781	314577	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 1A	456891	314436	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 1B	456715	314109	Swithland Lane; Rushey Lane; Kinchley Lane
Stn 3	455681	315847	Mill Farm; Quorn House
Stn 4A	457000	315805	Woodside Farm; Leicester Road
Stn 4B	456733	315778	Quorn Grange, Unitt Road, Northage Close, Quorn Park
Stn 5	457789	314941	Bond Lane; Crown Lane
Stn 6A	458660	316786	Sileby Road; Huston Close; Sileby Road (commercial)
Stn 9 (inc. PM)	457374	315398	Hawcliffe Road
Stn 10	457487	314626	Glebe Close; Halstead Road (south); Halstead Road (north)
Stn 11	457791	315458	Loughborough Road; River Soar (marina / caravan park)
Stn 12	458575	315459	Meadow Farm Marina and Caravan Park
Stn 13	456158	316090	Northage Close, Meeting Street
Weather Station	457126	315376	Wood Lane Site Offices

Site Improvement Plan (SIP)

The SIP is updated regularly by quarry management, with support from DustScanAQ through site visits and reports and quarterly reviews with LCC and CBC.

Weather monitoring summary

The key weather data which might affect dust propagation (wind speed, wind direction, total daily precipitation and average daily temperature) for this reporting period are summarised in Figure 2 and Figure 3.

The period 12 October 2023 – 10 November 2023 was characterised by mild to cool temperatures. The maximum daily average temperature was 15.1 °C recorded on 19 October and the minimum daily temperature was 5.9 °C recorded on 16 October.

The monitoring period was generally wet, with precipitation recorded on about 70 % of days. These rainfall levels would have likely suppressed dust generation through much of the monitoring period.

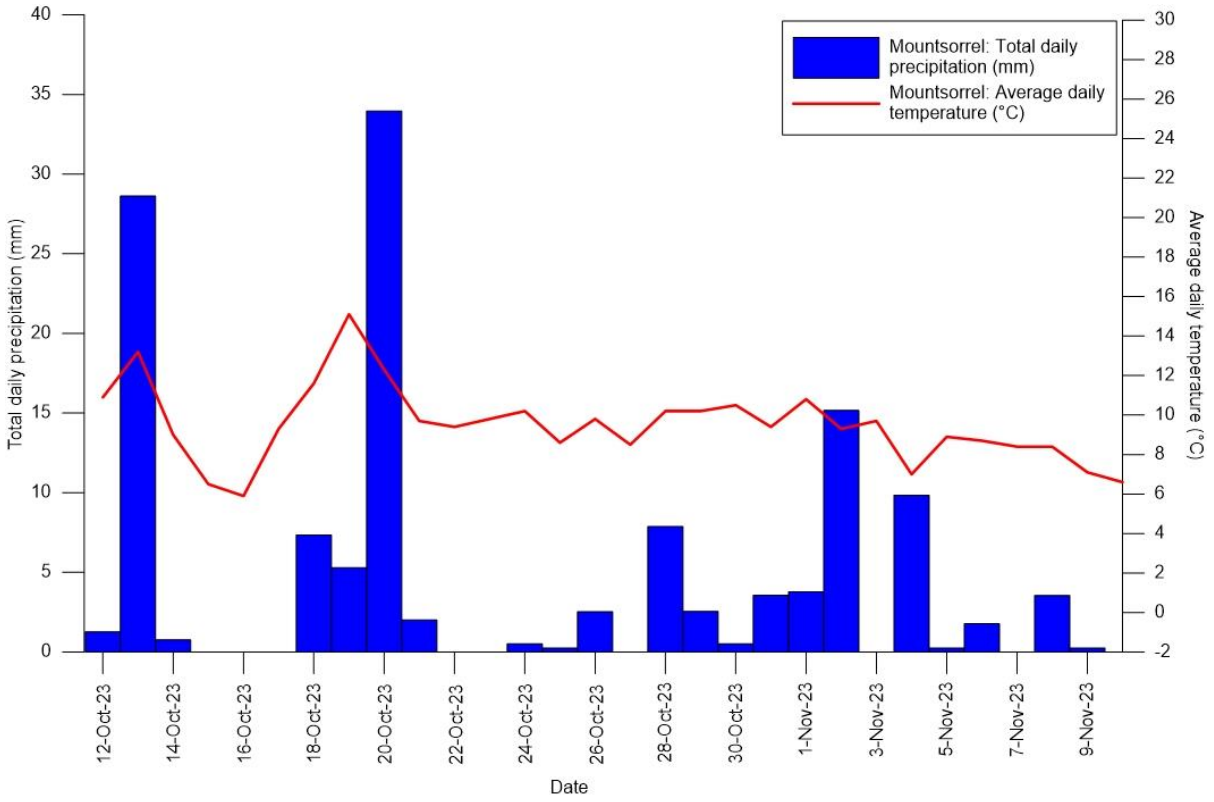

Figure 2: Total daily precipitation and average daily temperature, Mountsorrel Quarry, 12 October 2023 – 10 November 2023

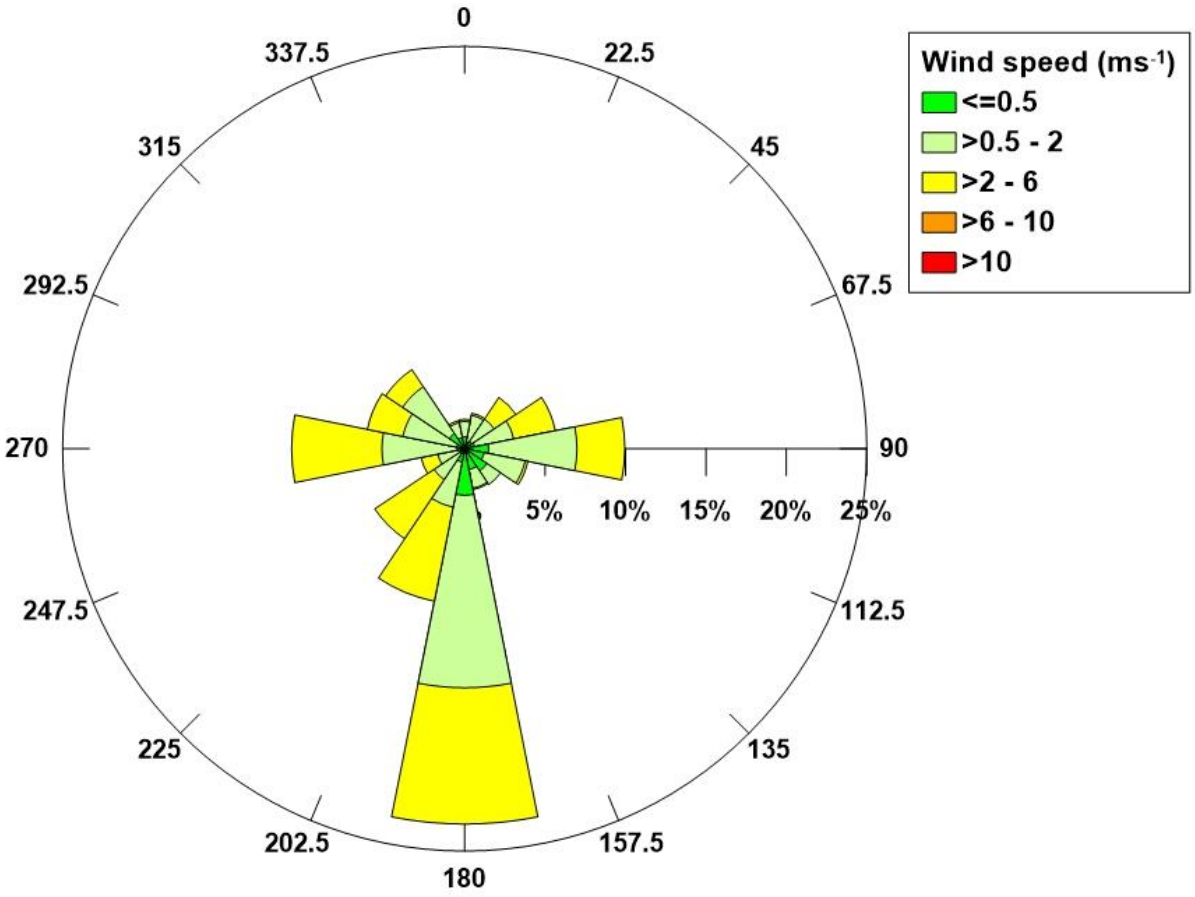

Figure 3: Wind rose, Mountsorrel Quarry, Mountsorrel, 12 October 2023 – 10 November 2023

As seen in Figure 3, winds for this monitoring period were predominantly light to moderate in speed (>0.5 – 6 m/s) and were mainly recorded from the south. Consequently, there may have been a slight potential for dust propagation to the north throughout the monitoring period.

PM_{10} and $PM_{2.5}$ monitoring summary

The available data from the past 3 months from the Osiris at Stn 9, together with data from the Defra Automatic Urban and Rural Network (AURN) station in Leicester University[2] are shown in Figure 4 and Figure 5.

Data from the AURN station are shown to consider correspondence with, or difference from, national air quality elsewhere in the UK. Where sufficient data are available, it is clear that PM_{10} levels at all locations occasionally track each other closely, and during other periods there can be considerable variation between the units. These patterns are typically indicative of regional and local PM_{10} and $PM_{2.5}$ signals respectively.

PM_{10}

With regard to numerical analysis of the data:

- For the 12 months up to 10 November 2023, there were 365 daily PM_{10} readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily PM_{10} concentration for the 12 months to date (and using the annual calibration factor) was 14.41 µg/m^3, which is approximately 36.0 % of the annual average PM_{10} concentration objective (40 µg/m^3); and

- For the 12 months up to 10 November 2023 there were 7 recorded instances where the daily average PM_{10} concentrations (using the daily factor) exceeded 50 µg/m^3. From the data collection rate this is equivalent to 7 days with a 24-hour average above 50 µg/m^3 in a full year as the data collection rate was 100 %.

In summary, for the 12 months up to 10 November 2023 neither the annual nor daily AQO were exceeded.

Figure 4 shows that over the previous three months of monitoring up to the time of this report, there were no exceedances of the daily average threshold.

Details of past exceedances can be found in previous compliance reports.

[2] http://uk-air.defra.gov.uk/networks/network-info?view=aurn

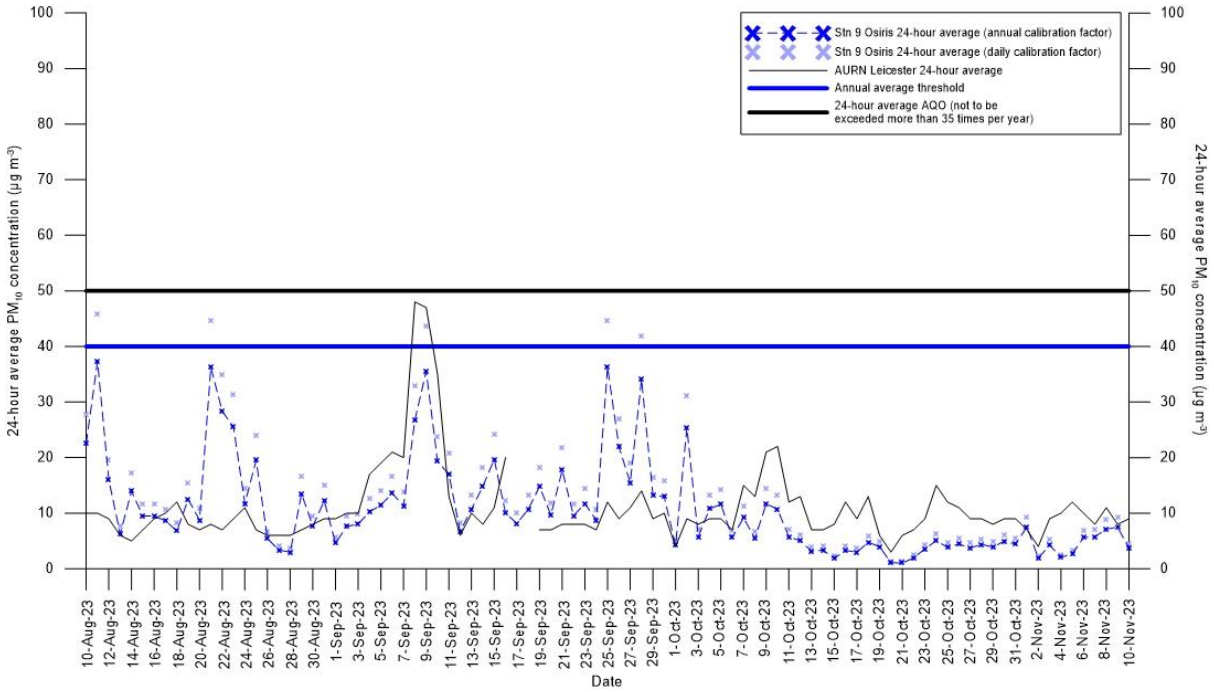

Figure 4: PM_{10} data, most recent 3 months (up to 10 November 2023)

Between 12 October 2023 – 10 November 2023, no trigger emails alerting staff to high PM_{10} levels from the direction of site operations were sent out.

$PM_{2.5}$

With regard to numerical analysis of the $PM_{2.5}$ data:

- For the 12 months up to 10 November 2023, there were 365 daily $PM_{2.5}$ readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily $PM_{2.5}$ concentration for the 12 months was 6.23 µg/m^3, which is approximately 51.9 % of the interim annual average $PM_{2.5}$ concentration objective (12 µg/m^3) applicable from 31 January 2023.

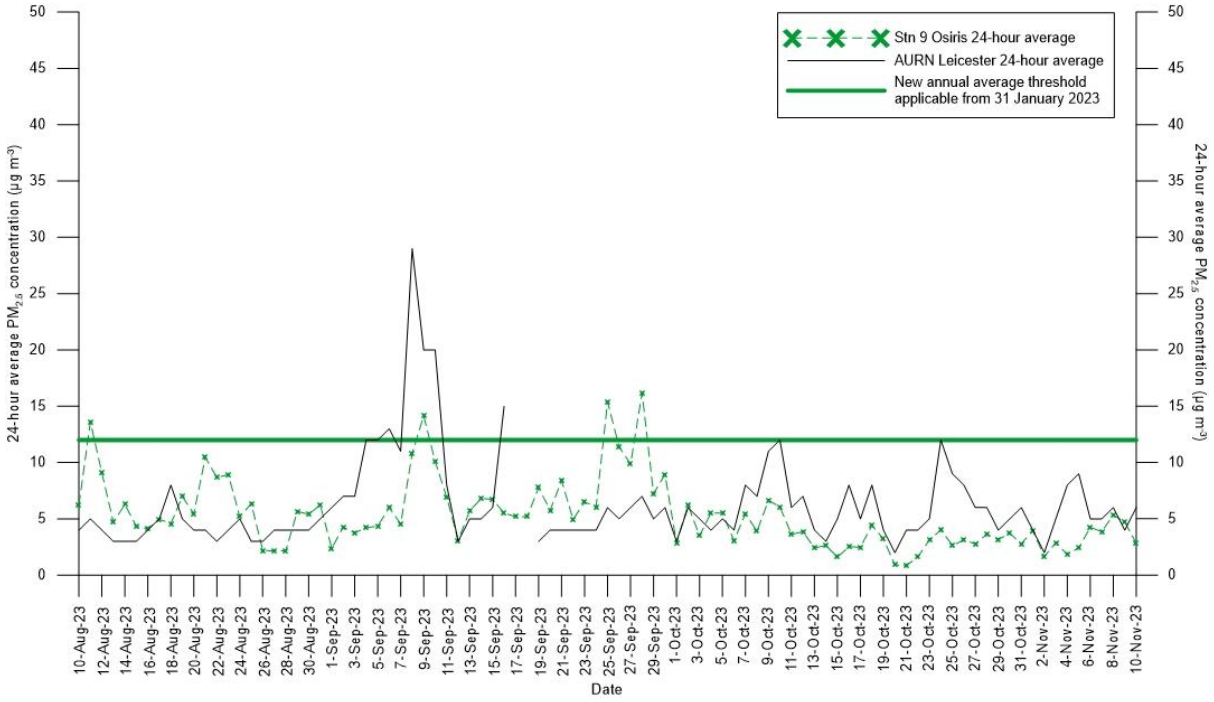

Figure 5: $PM_{2.5}$ data, most recent 3 months (up to 10 November 2023)

Deposited dust monitoring summary

The deposited dust data for 12 October 2023 – 10 November 2023 are summarised in Table 2. The DMMP sets out a site-wide deposited dust threshold of 125 mg/m^2/day 'undissolved solids' as a trigger limit for investigation to identify the potential dust source/s, taking account of the directional data.

Table 2 shows that, for the available data, deposited dust levels during 12 October 2023 – 10 November 2023 were within the site-wide threshold for all stations.

Low levels (68 and 69 mg/m^2/day) were recorded at Stn 9 and Stn 10, respectively. All other stations recorded Very Low depositional magnitudes.

Table 2: Summary of deposited dust (undissolved solids), 12 October 2023 – 10 November 2023

Undissolved solids (mg/m^2/day)				
This month report start date:		12-Oct-23		
This month report end date:		10-Nov-23		
Receptor location	**Nearest / appropriate dust monitoring point**	**Reported value**	**Trigger: ≥ 125[a]**	**Magnitude[b]**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	16	No	**Very Low**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	13	No	**Very Low**
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	10	No	**Very Low**
Mill Farm; Quorn House	Stn 3	8	No	**Very Low**
Woodside Farm, Leicester Road	Stn 4A	14	No	**Very Low**
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	16	No	**Very Low**
Bond Lane; Crown Lane	Stn 5	9	No	**Very Low**
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	13	No	**Very Low**
Hawcliffe Road	Stn 9	68	No	**Low**
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	69	No	**Low**
Loughborough Road; River Soar (marina / caravan park)	Stn 11	24	No	**Very Low**
Meadow Farm Marina and Caravan Park	Stn 12	22	No	**Very Low**
Quorn House Park	Stn 13	23	No	**Very Low**

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of mass deposition rate assessed against typical rate for semi-rural areas (30 - 80 mg/m^2/day)

Regarding dust deposition over time, the rates across the sampling area have varied considerably. Trends in dust deposition rates (as undissolved solids) for the previous 12 months, together with the site-wide dust threshold are illustrated in Figure 6.

In general, as would be expected, dust deposition rates are typically lower in winter months than in summer months. This trend is clearly seen for most monitoring points in Figure 6, with some exceptions. Dust deposition rates have been consistently below the 'trigger limit' at all sampling locations except Stn 1B and 9, although the exceedances at Stn 1B are known to be related to nearby agricultural activities, rather than on-site processes.

In general, as shown in Figure 6, higher rates of dust deposition have been recorded near industrial settings (*i.e.* Stn 9) than in more residential areas (*e.g.* Stn 1, Kinchley Lane).

Figure 6 shows that dust deposition rates were largely well within the site-wide trigger level during the previous 12 months although rates at Stn 9 have been at or above the trigger level twice over this period and also once at Stn 1B. At Stn 1B the exceedance is unlikely to be related to quarrying activities. The average dust deposition rate at Stn 9 for the previous 12 months (91 mg/m^2/day) is below the site-specific threshold.

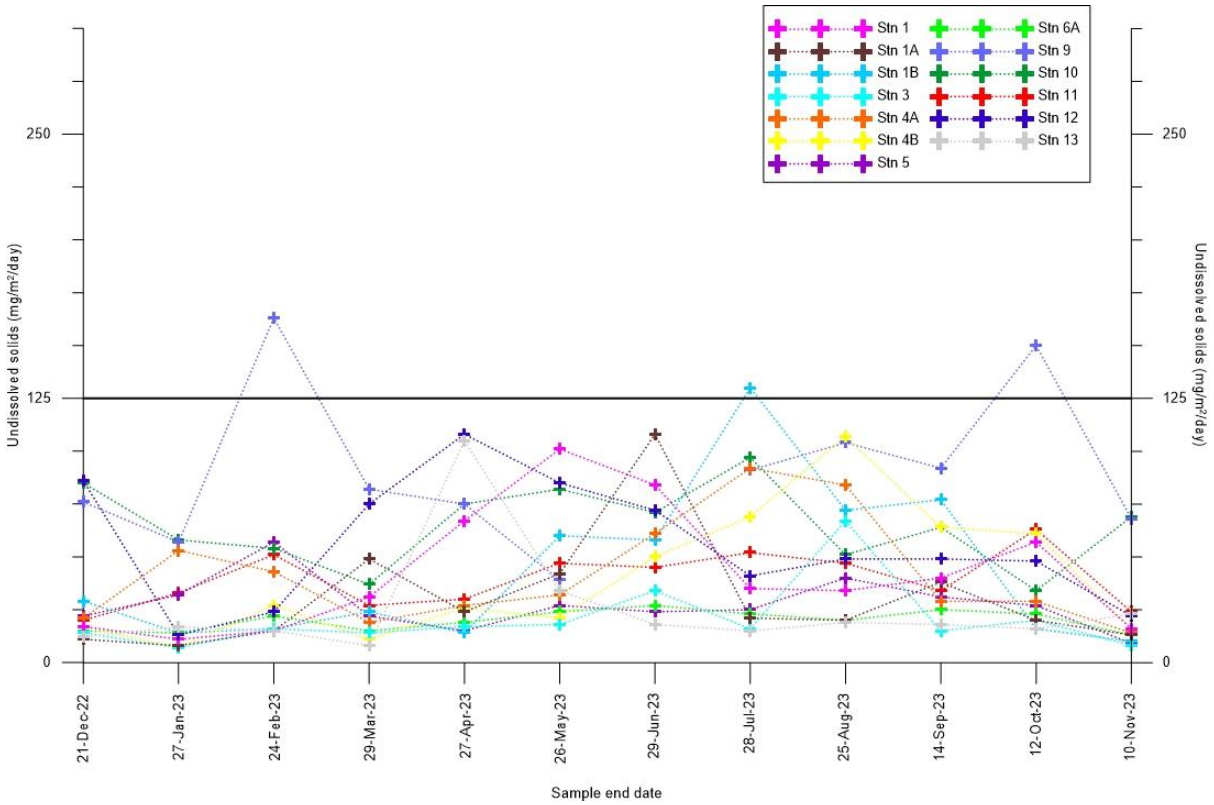

Figure 6: Dust deposition rates per sampling location over time (past 12 months)

Directional dust monitoring summary

The directional dust data for 12 October 2023 – 10 November 2023 are summarised in Table 3. As with deposited dust, the DMMP sets out a site-wide directional dust threshold. For directional dust soiling, 0.5 % effective area coverage (EAC) per day is a trigger limit for investigation to identify the likely dust source/s, again taking account of the direction.

Table 3 shows that during 12 October 2023 – 10 November 2023, all stations recorded Very Low dust levels from all directions.

Table 3: Summary of directional dust soiling, 12 October 2023 – 10 November 2023

Directional dust soiling (%EAC/day) by direction (°)										
This month report start date:		12-Oct-23								
This month report end date:		10-Nov-23								
Receptor location	Nearest / appropriate dust monitoring point		Direction (°)							
			0	45	90	135	180	225	270	315
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	Reported value	0	0.1	0	0	0	0.1	0.1	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	Reported value	0.1	0	0	0	0	0	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	Reported value	0	0	0	0	0	0	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Mill Farm; Quorn House	Stn 3	Reported value	0	0	0.1	0	0	0	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Woodside Farm, Leicester Road	Stn 4A	Reported value	0	0	0	0	0	0	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	Reported value	0	0	0.1	0	0	0	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Bond Lane; Crown Lane	Stn 5	Reported value	0	0	0	0.1	0	0	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	Reported value	0	0.1	0.1	0.1	0	0.1	0.1	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Hawcliffe Road	Stn 9	Reported value	0	0.1	0.1	0.1	0	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	Reported value	0	0	0	0.1	0	0.1	0	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	Reported value	0	0	0	0	0	0	0	0
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	Reported value	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn House Park	Stn 13	Reported value	0	0	0	0	0	0.1	0.1	0.1
		Trigger: ≥ 0.5[a]	No	No	No	No	No	No	No	No
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of directional dust soiling derived from Beaman and Kingsbury, 1981

[c] Direction/s not determined for daily EAC below 0.1%/day (very low soiling)

Table 4 shows that average directional soiling rates have been at very low levels at most monitoring locations, for most directions, over the past year. At Stn 9, the annual average soiling rate to date was 0.2 % EAC/day from the southwest and west resulting in 'Low' magnitudes being recorded. The cause or causes of these consistently, but marginally elevated dust soiling rates at this monitoring point are under review, as they may be related to site activities such as operations at the PSV yard, Granite Way and/or the toast rack.

Table 4: Running average directional dust soiling (past 12 months)

Receptor location	Nearest / appropriate dust monitoring point		Direction (°)							
			0	45	90	135	180	225	270	315
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	Average value	0	0	0	0	0	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	Average value	0	0	0	0	0	0	0	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	Average value	0	0	0	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Mill Farm; Quorn House	Stn 3	Average value	0	0	0	0	0	0	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Woodside Farm, Leicester Road	Stn 4A	Average value	0	0.1	0	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	Average value	0	0.1	0.1	0	0	0	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Bond Lane; Crown Lane	Stn 5	Average value	0.1	0	0	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	Average value	0	0.1	0.1	0	0	0.1	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Hawcliffe Road	Stn 9	Average value	0	0.1	0.1	0.1	0	0.2	0.2	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Low	Very Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	Average value	0	0	0	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	Average value	0	0	0	0.1	0.1	0.1	0	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	Average value	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Quorn House Park	Stn 13	Average value	0	0	0	0	0	0	0.1	0
		Magnitude[b]	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

[a] Trigger mass deposition and Effective Area Coverage rates as in Section 7.3, ZLFMS-AG008 Dust Management and Monitoring Plan (Updated), 2015

[b] Magnitude of directional dust soiling derived from Beaman and Kingsbury, 1981

[c] Direction/s not determined for daily EAC below 0.1%/day (very low soiling)

Complaints

During 12 October 2023 – 10 November 2023 no dust complaints were received by the quarry.

DustScanAQ
January 2024