



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 1 2023 (24 November 2022 – 24 February 2023)

Date Report Issued: 02 August 2023

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 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 24 November 2022 to 24 February 2023.

An explanation of how and why dust and air quality is measured on site is available [here](#).

Weather summary

December 2022 was typically cold, and there were some extended dry spells, whilst much of early January 2023 was quite wet. From mid-January through to the end of February it was abnormally dry, with several long periods of little rainfall.

Winds from the south were dominant during December and January, whilst it was a more mixed picture in February, with winds from the south, southwest and west in more or less equal measure.

Deposited dust

During this period, deposited dust levels were below the site-specific limit level at all locations except for Stn 9 at the top of Hawcliffe Road, which recorded dust levels above the limit during February 2023. During this time, the dust was coming from the southwest and west, so it's possible that both on-site and off-site sources dust may have been impacting this location.

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 1 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 this period, as shown in Figure 2. Concentrations were relatively similar at both locations, suggesting that a regional rather than local source was dominant during the first quarter of 2023.



Figure 2: PM_{2.5} monitoring summary, Quarter 1 2023

Particulate Matter – PM₁₀

Although the results were higher at Hawcliffe Road than at Quorn House, for the first quarter of 2023, PM₁₀ concentrations were within the annual AQO and the daily AQO at both locations.

At Hawcliffe Road a total of five days were recorded where the daily average PM₁₀ concentration was above the AQO threshold (50 µg/m³). These all occurred during February. An investigation was carried out on site to determine the potential causes, and it was found that the dust suppression was not working in some areas of Asphalt and Loadout. This issue has since been fixed and the PM₁₀ concentrations have reduced.



Figure 3: PM₁₀ monitoring summary, Quarter 1 2023

Complaints

During the first quarter of 2023 several 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
August 2023



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December 2022 particulate matter, dust and weather monitoring report for Mountsorrel Quarry

Client:	Tarmac Trading Limited
Site:	Mountsorrel Quarry, Quorn
Job Code:	ZLFMS
Report Start Date:	24 November 2022
Report End Date:	21 December 2022
Date Report Issued:	07 February 2023

'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 PM₁₀ and is measured to agreed standards and forms part of the national Air Quality Objectives (AQO). The AQO for PM₁₀ is currently 50 µg/m³ for the 24-hour mean, not to be exceeded 35 times per year and 40 µg/m³ for the annual mean. The AQO for PM_{2.5} is 20 µg/m³ for the annual mean.

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.

Particulate matter, dust and weather monitoring

Particulate matter (in the form of PM₁₀ 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 PM₁₀ PM_{2.5} and PM₁ 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 Partisol PM₁₀ sampler which is located within the Leicestershire County Council (LCC) depot at the southern end of Hawcliffe Road, in close proximity to the Osiris device. It also operates a Zephyr air quality monitor at the same location. This device measures a number of pollutants including PM₁₀ and PM_{2.5}.

A weather station is located at the site offices off Wood Lane and collects a range of weather parameters over half-hourly 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.

The particulate matter, dust and weather monitoring locations are set out in Table 1 and shown in Figure 1.

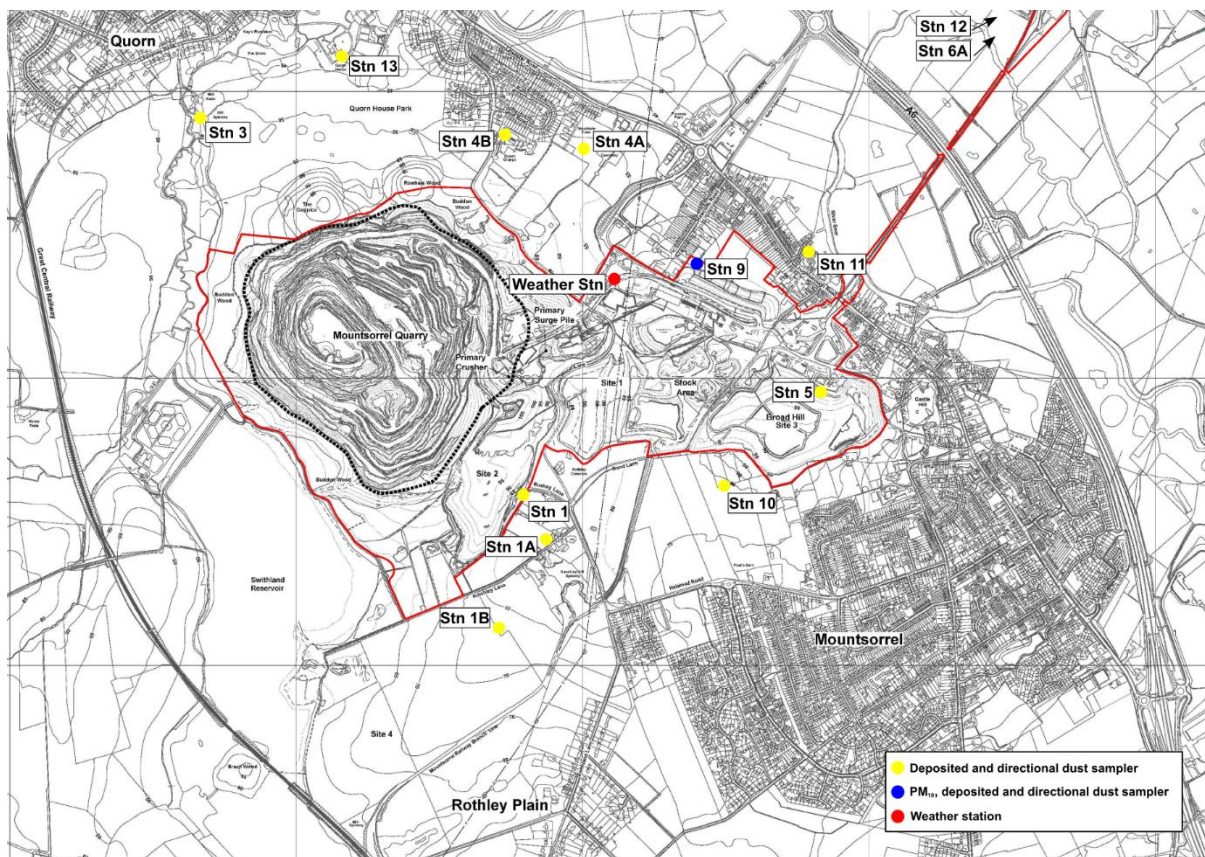


Figure 1: Particulate matter, dust and weather monitoring locations, Mountsorrel Quarry

Table 1: Weather station, PM₁₀ 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 assistance 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.

December 2022 was abnormally cold and dry. Precipitation was recorded on less than half of days (43%), with generally low levels of rainfall throughout the monitoring period. The highest daily rainfall was recorded on 20 December. The extended dry periods may have increased the potential for dust propagation on site.

Average daily temperatures were cold throughout, with temperatures steadily declining throughout the period before increasing at the end of the December. There were several consecutive days in mid-December where the daily average temperature remained below freezing. The maximum daily average temperature was 12.7 °C recorded on 19 December and the minimum daily temperature was -2.1 °C recorded on 15 and 16 December. These cold temperatures, especially on the days where temperatures averaged below freezing, would likely have decreased dust generation and propagation on site although it should be remembered that water-based dust suppression measures can rarely be used in freezing conditions due to the risk of ice.

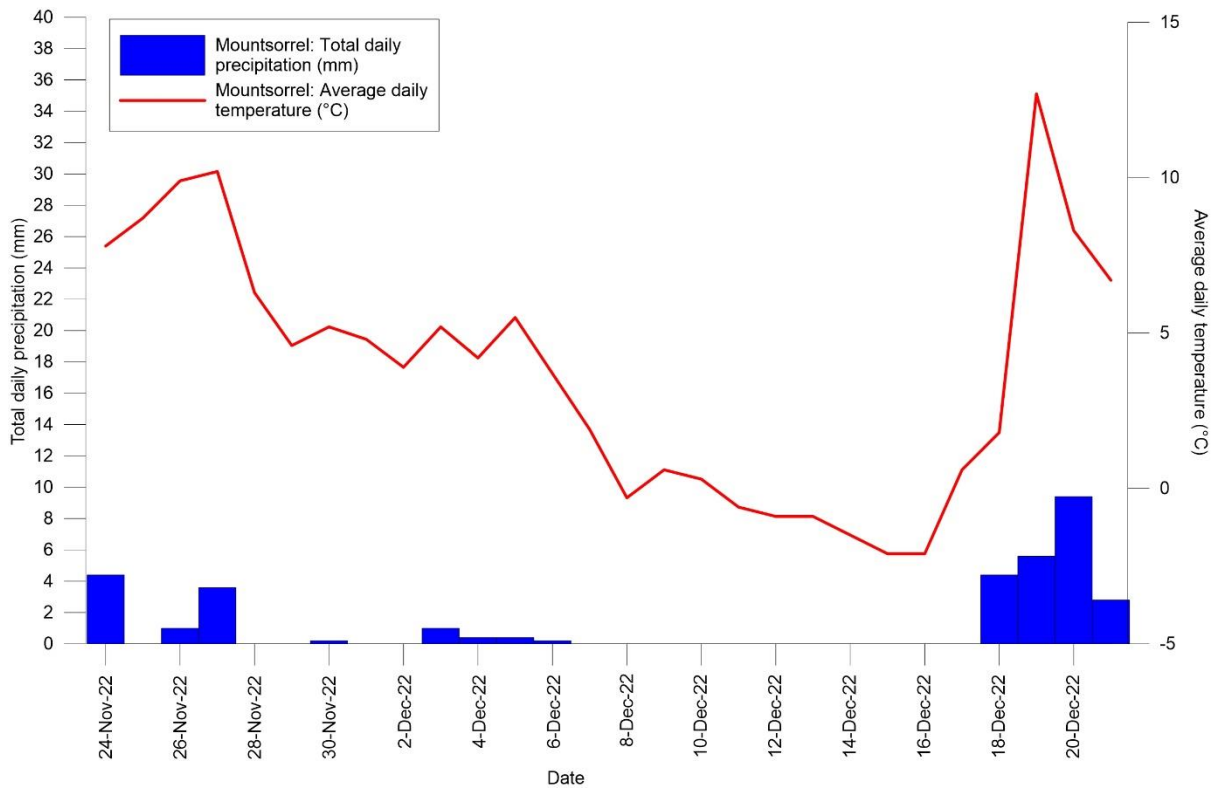


Figure 2: Total daily precipitation and average daily temperature, Mountsorrel Quarry, 24 November 2022 – 21 December 2022

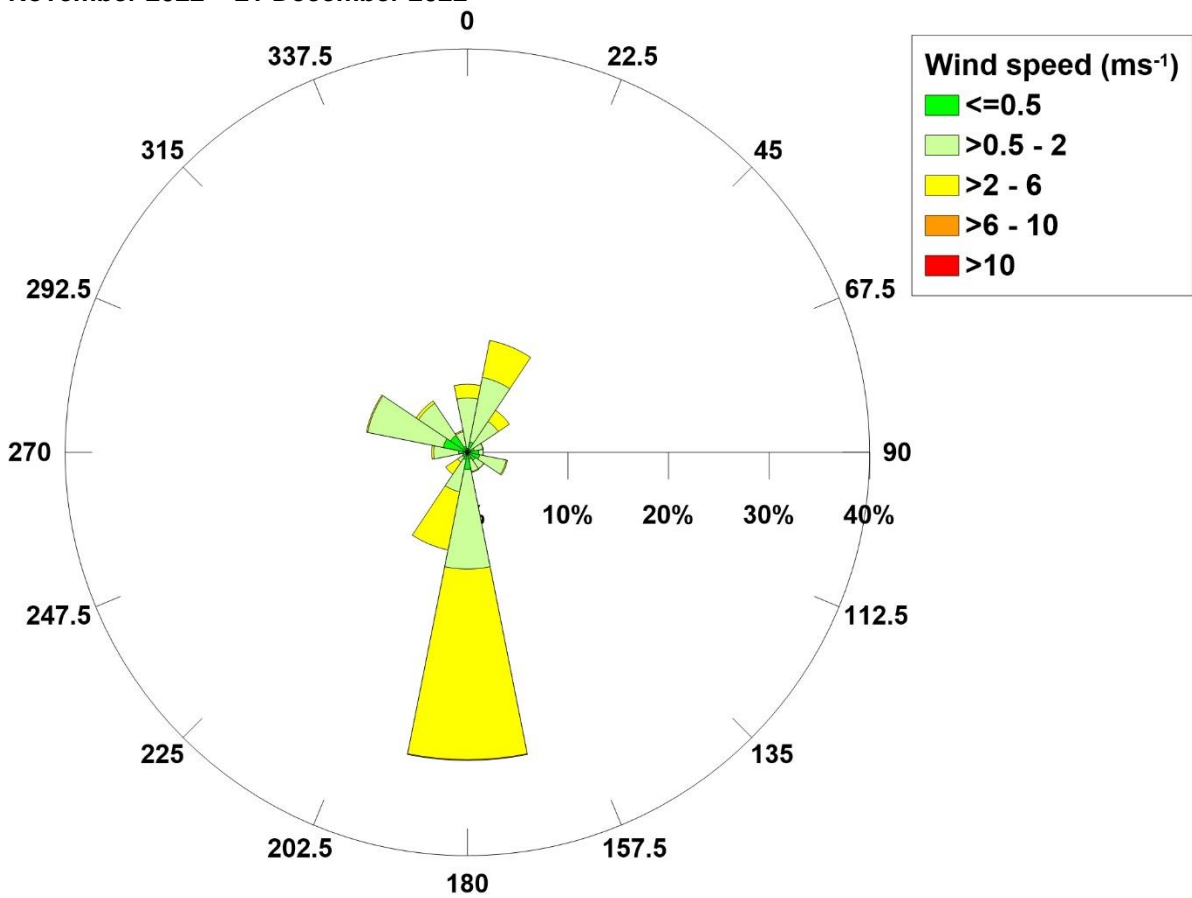


Figure 3: Wind rose, Mountsorrel Quarry, Mountsorrel, 24 November 2022 – 21 December 2022

Winds for the monitoring period were overwhelmingly recorded from the south, as seen in Figure 3 and were generally moderate in speed (>2 – 6 m/s).

Consequently, there may have been a reasonable potential for dust propagation mainly to the north.

PM₁₀ 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) stations in Nottingham Centre and Leicester University¹ are shown in Figure 4 and Figure 5. No data from the Partisol operated by CBC² were available for this monitoring period, although a full dataset from the Zephyr was available.

Data from the AURN stations 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 PM₁₀ 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 PM₁₀ and PM_{2.5} signals respectively.

PM₁₀

With regard to numerical analysis of the data:

- For the 12 months up to 21 December 2022, there were 332 daily PM₁₀ readings taken by the Osiris at Stn 9, representing an 91.0 % data collection rate. From the available data the annual average daily PM₁₀ concentration for the 12 months to date (and using the annual calibration factor) was 21.93 µg/m³, which is approximately 54.9 % of the annual average PM₁₀ concentration objective (40 µg/m³); and
- For the 12 months up to 21 December 2022 there were 27 recorded instances where the daily average PM₁₀ concentrations (using the daily factor) exceeded 50 µg/m³. From the data collection rate this is equivalent to 30 days with a 24-hour average above 50 µg/m³ in a full year.

In summary, for the 12 months up to 21 December 2022 neither the annual nor daily AQO were exceeded.

Figure 4 shows that over the previous three months of monitoring there were 11 exceedances of the daily average threshold, with none occurring in December. Although some of these exceedances coincide with periods of elevated concentrations elsewhere, it would appear that the majority may relate to local rather than regional PM₁₀ sources.

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

¹ <http://uk-air.defra.gov.uk/networks/network-info?view=aurun>

² https://www.charnwood.gov.uk/pages/mountsorrel_quarry

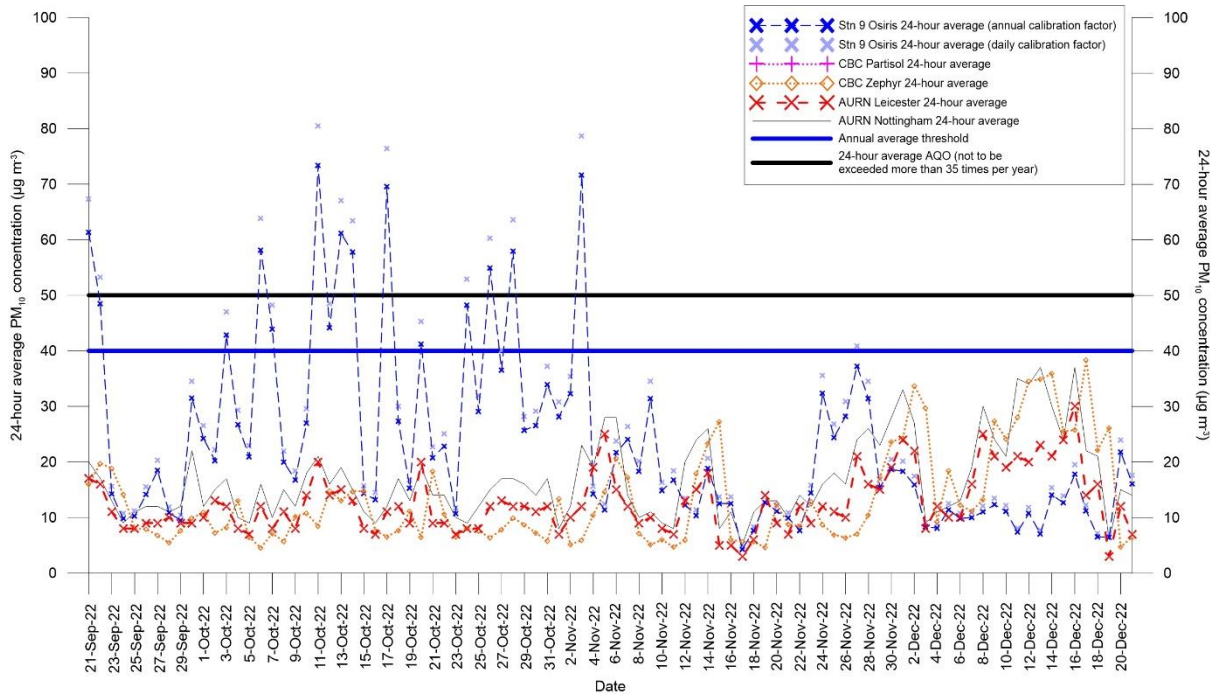


Figure 4: PM₁₀ data, most recent 3 months (up to 21 December 2022)

Between 24 November 2022 – 21 December 2022, no trigger emails alerting staff to high PM₁₀ levels from the direction of site operations were sent out.

The PM₁₀ data from the CBC Zephyr for this period are shown in orange in Figure 4. The data from this device typically corresponds relatively well with the AURN data from Nottingham and Leicester, whilst it doesn't generally correspond with the data from the Osiris which, it should be noted had previously been calibrated to correspond with the Partisol.

The PM₁₀ concentrations reported by the Osiris were consistently higher than those reported by the Zephyr and both AURN stations during September and October but were more closely aligned through November. In December however, PM₁₀ concentrations reported by the Osiris were significantly lower than those reported by the Zephyr and both AURN stations.

Importantly, these discrepancies must be recognised as typical for different monitoring equipment, demonstrating that in many cases there can be no definitive data, just a range of indicative results which must be interpreted with great care.

PM_{2.5}

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

- For the 12 months up to 21 December 2022, there were 332 daily PM_{2.5} readings taken by the Osiris at Stn 9, representing an 91.0 % data collection rate. From the available data the annual average daily PM_{2.5} concentration for the 12 months was 7.73 µg/m³, which is approximately 38.7 % of the annual average PM_{2.5} concentration objective (20 µg/m³).

Figure 5 shows that for the period between 24 November 2022 – 21 December 2022, PM_{2.5} concentrations measured by the Osiris remained within the relevant AQO. Exceedances of the annual AQO were recorded at the Zephyr and both AURN sites in early to mid-December. As with PM₁₀ data, differences in the magnitudes of values recorded by the different instruments demonstrate the challenge in accurately measuring air quality indicators and the significance of expert interpretation of the data.

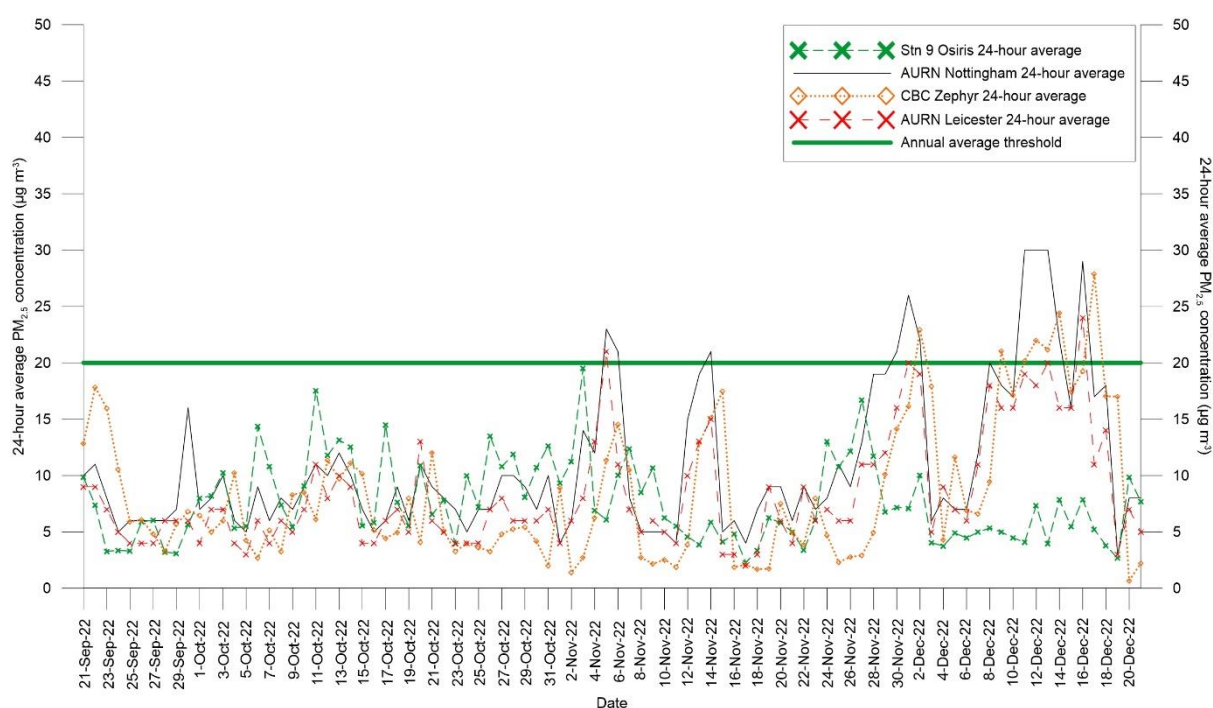


Figure 5: PM_{2.5} data, most recent 3 months (up to 21 December 2022)

Deposited dust monitoring summary

The deposited dust data for 24 November 2022 – 21 December 2022 are summarised in Table 2. The DMMP sets out a site-wide deposited dust threshold of 125 mg/m²/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 24 November 2022 – 21 December 2022 were within the site-wide threshold for all stations. All stations recorded Very Low depositional magnitudes excluding Stn 9, which recorded Low levels, and Stn 10 and 12 which both recorded Slightly Elevated levels.

The Slightly Elevated levels at Stn 10 are most likely due to the adjacent building site, whilst the Slightly Elevated levels recorded at Stn 12 may be related to ongoing works at Meadow Farm Marina and Caravan Park; it is unlikely to be related to quarrying activities.

Table 2: Summary of deposited dust (undissolved solids), 24 November 2022 – 21 December 2022

Undissolved solids (mg/m ² /day)				
This month report start date:		24-Nov-22		
This month report end date:		21-Dec-22		
Receptor location	Nearest / appropriate dust monitoring point	Reported value	Trigger: ≥ 125 ^a	Magnitude ^b
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	17	No	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	11	No	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	29	No	Very Low
Mill Farm; Quorn House	Stn 3	14	No	Very Low
Woodside Farm, Leicester Road	Stn 4A	21	No	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	17	No	Very Low
Bond Lane; Crown Lane	Stn 5	22	No	Very Low
Sibley Road; Huston Close; Sibley Road (commercial)	Stn 6A	15	No	Very Low
Hawcliffe Road	Stn 9	76	No	Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	85	No	Slightly Elevated
Loughborough Road; River Soar (marina / caravan park)	Stn 11	20	No	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	86	No	Slightly Elevated
Quorn House Park	Stn 13	12	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/m²/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).

Finally, it is important to note from Figure 6 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 5 times over this period and once at Stn 1B (although the latter is likely to be anomalous). The average dust deposition rate at Stn 9 for the previous 12 months is slightly below the site-specific threshold (113 mg/m²/day).

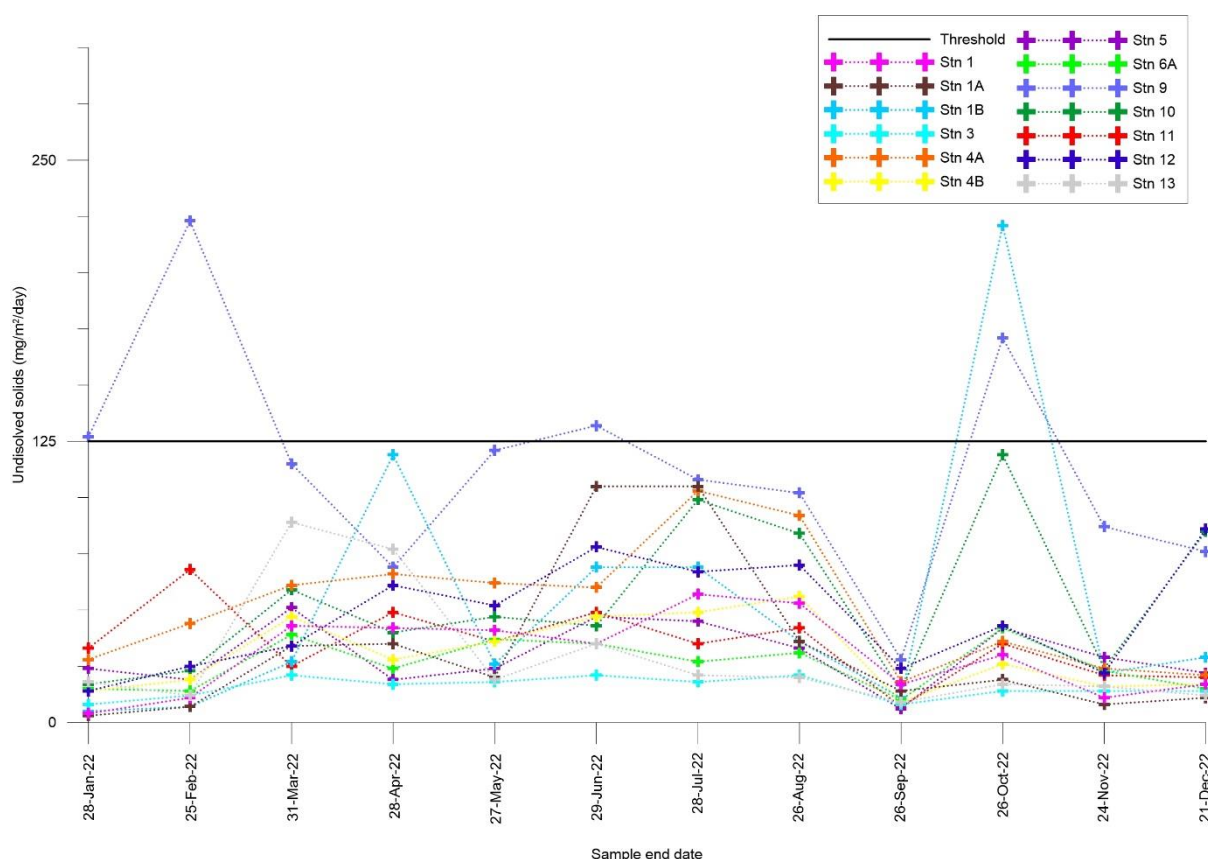


Figure 6: Dust deposition rates per sampling location over time (past 12 months)

Directional dust monitoring summary

The directional dust data for 24 November 2022 – 21 December 2022 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 24 November 2022 – 21 December 2022, all of the stations recorded Very Low dust levels from all directions.

Table 3: Summary of directional dust soiling, 24 November 2022 – 21 December 2022

Directional dust soiling (%EAC/day) by direction (°)										
This month report start date:		24-Nov-22								
This month report end date:		21-Dec-22								
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	0	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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	0	0	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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: $\geq 0.5^a$	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	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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: $\geq 0.5^a$	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	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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	0	0	0	0
		Trigger: $\geq 0.5^a$	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
Sibley Road; Huston Close; Sibley Road (commercial)	Stn 6A	Reported value	0	0	0	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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	0	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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	0	0	0	0
		Trigger: $\geq 0.5^a$	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: $\geq 0.5^a$	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	0	0	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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	0	0
		Trigger: $\geq 0.5^a$	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	0.1	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 1B	Average value	0	0	0	0	0.1	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	0.1	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	0.1	0.1	0	0	0.1	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	0.1	0.1	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	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	0.1	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
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	0.1	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
Meadow Farm Marina and Caravan Park	Stn 12	Average value	0.1	0.1	0.1	0.1	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
Quorn House Park	Stn 13	Average value	0	0	0	0.1	0	0	0	0.1
		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

It is understood that no dust complaints were received during this monitoring period.

**DustScanAQ
February 2023**



Dust and Air Quality Innovation and Expertise

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January 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:	21 December 2022
Report End Date:	27 January 2023
Date Report Issued:	24 March 2023

'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 PM₁₀ and is measured to agreed standards and forms part of the national Air Quality Objectives (AQO). The AQO for PM₁₀ is currently 50 µg/m³ for the 24-hour mean, not to be exceeded 35 times per year and 40 µg/m³ for the annual mean. The AQO for PM_{2.5} is 20 µg/m³ for the annual mean.

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.

Particulate matter, dust and weather monitoring

Particulate matter (in the form of PM₁₀ 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 PM₁₀ PM_{2.5} and PM₁ 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 Partisol PM₁₀ sampler which is located within the Leicestershire County Council (LCC) depot at the southern end of Hawcliffe Road, in close proximity to the Osiris device. It also operates a Zephyr air quality monitor at the same location. This device measures a number of pollutants including PM₁₀ and PM_{2.5}.

A weather station is located at the site offices off Wood Lane and collects a range of weather parameters over half-hourly 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.

The particulate matter, dust and weather monitoring locations are set out in Table 1 and shown in Figure 1.

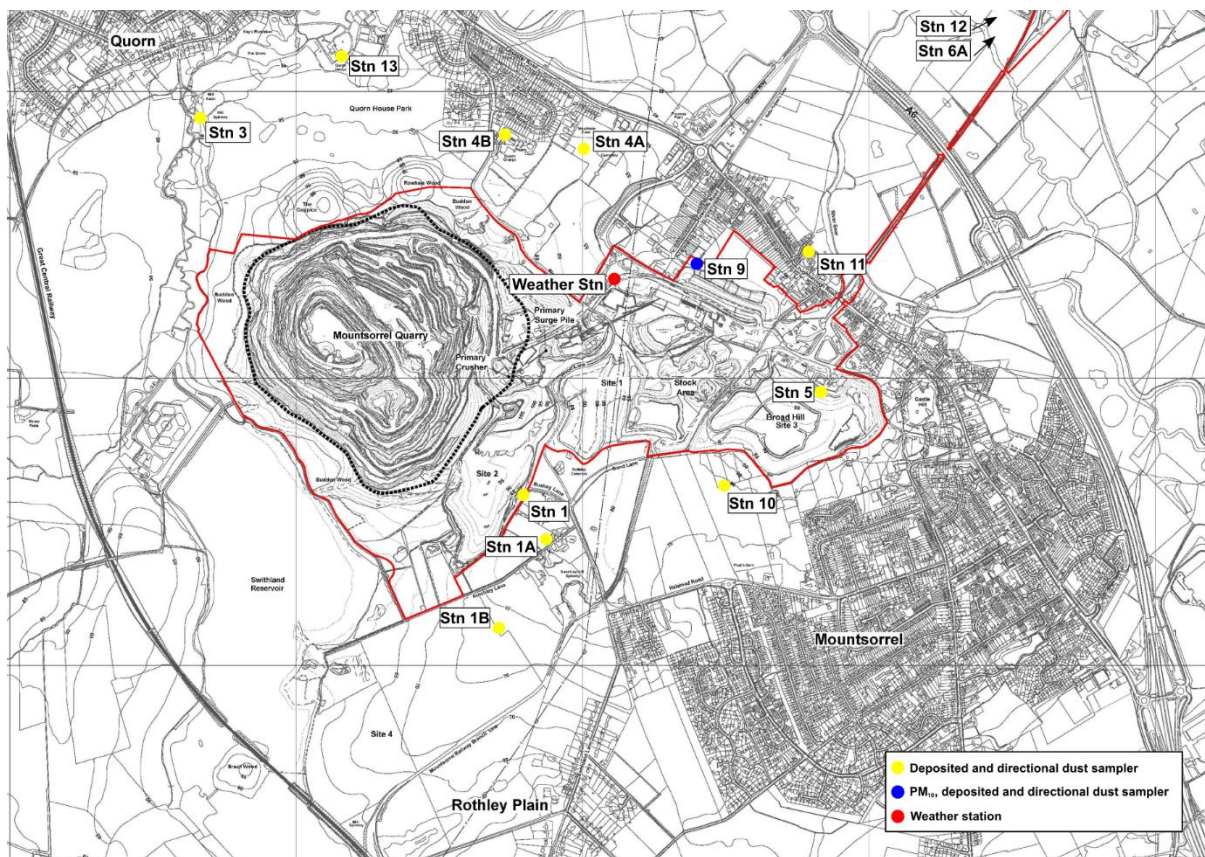


Figure 1: Particulate matter, dust and weather monitoring locations, Mountsorrel Quarry

Table 1: Weather station, PM₁₀ 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 assistance 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 21 December 2022 – 27 January 2023 is characterised by mild to cold temperatures, and was generally wet with precipitation recorded on 68% of days.

The maximum daily average temperature was 11.9 °C recorded on 04 January and the minimum daily temperature was -1.0 °C recorded on 17 January. There was a 5-day dry period from 17 – 21 January where temperatures on two of the days were below freezing. It should be noted that water-based dust suppression measures can rarely be used in freezing conditions due to the risk of ice.

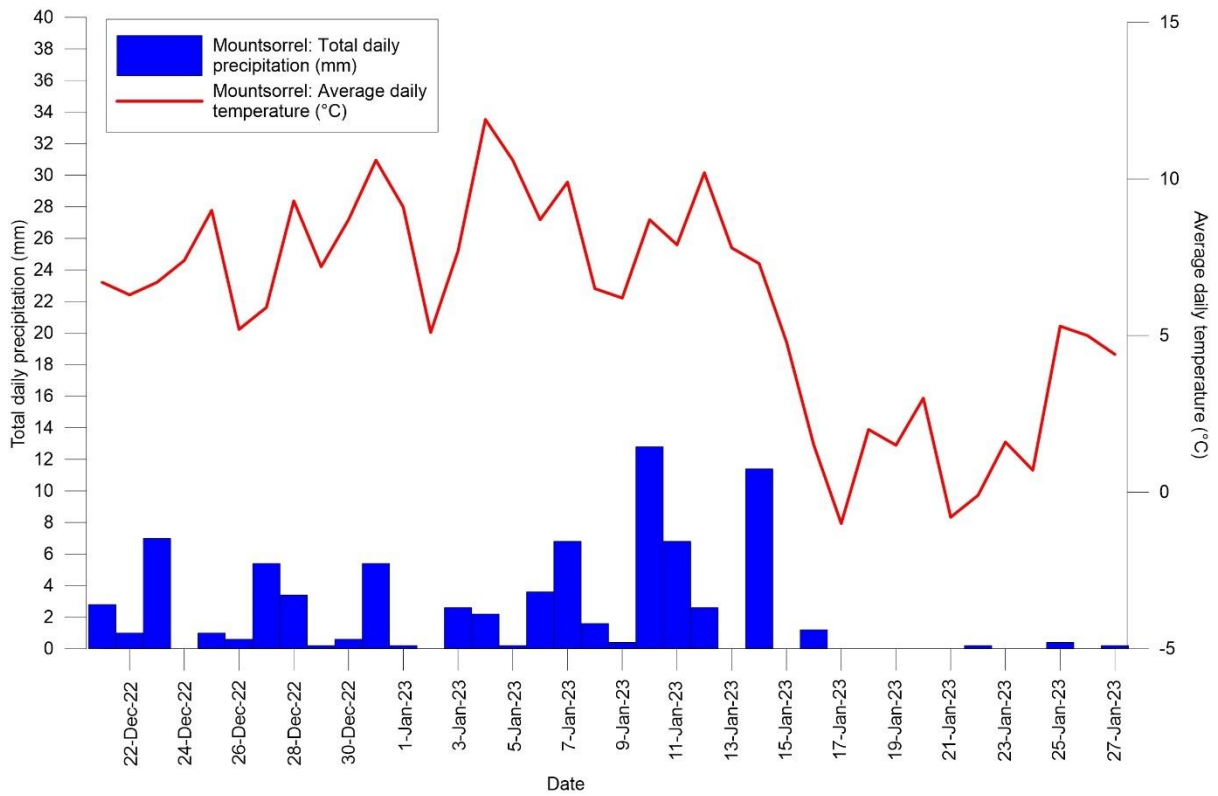


Figure 2: Total daily precipitation and average daily temperature, Mountsorrel Quarry, 21 December 2022 – 27 January 2023

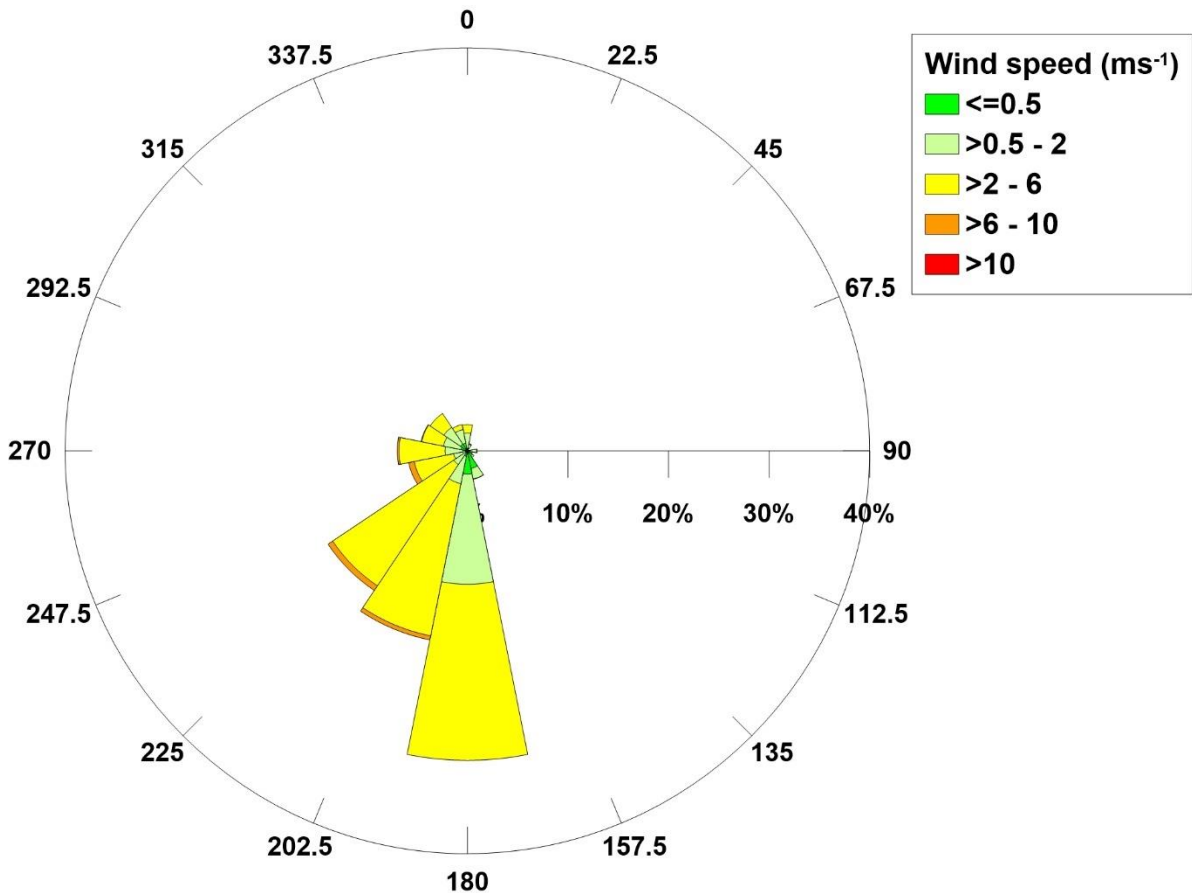


Figure 3: Wind rose, Mountsorrel Quarry, Mountsorrel, 21 December 2022 – 27 January 2023

Winds for the monitoring period were overwhelmingly recorded from the south, as seen in Figure 3 and were primarily moderate in speed (>2 – 6 m/s). Lesser amounts of wind were also recorded from the south-southwest and southwest.

Consequently, there may have been a reasonable potential for dust propagation mainly to the north, north-northeast and northeast.

PM₁₀ 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) stations in Nottingham Centre and Leicester University¹ are shown in Figure 4 and Figure 5. No data from the Partisol operated by CBC² were available for this monitoring period, although a full dataset from the Zephyr was available.

Data from the AURN stations 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 PM₁₀ 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 PM₁₀ and PM_{2.5} signals respectively.

PM₁₀

With regard to numerical analysis of the data:

- For the 12 months up to 27 January 2023, there were 365 daily PM₁₀ readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily PM₁₀ concentration for the 12 months to date (and using the annual calibration factor) was 21.07 µg/m³, which is approximately 52.7 % of the annual average PM₁₀ concentration objective (40 µg/m³); and
- For the 12 months up to 27 January 2023 there were 26 recorded instances where the daily average PM₁₀ concentrations (using the daily factor) exceeded 50 µg/m³. From the data collection rate this is equivalent to 26 days with a 24-hour average above 50 µg/m³ in a full year as the data collection rate was 100 %.

In summary, for the 12 months up to 27 January 2023 neither the annual nor daily AQO were exceeded.

Figure 4 shows that over the previous three months of monitoring there were 2 exceedances of the daily average threshold, with none occurring in December 2022 or January 2023. Two exceedances, recorded in late October and early November 2022 respectively, may relate to local rather than regional PM₁₀ sources.

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

¹ <http://uk-air.defra.gov.uk/networks/network-info?view=aurun>

² https://www.charnwood.gov.uk/pages/mountsorrel_quarry

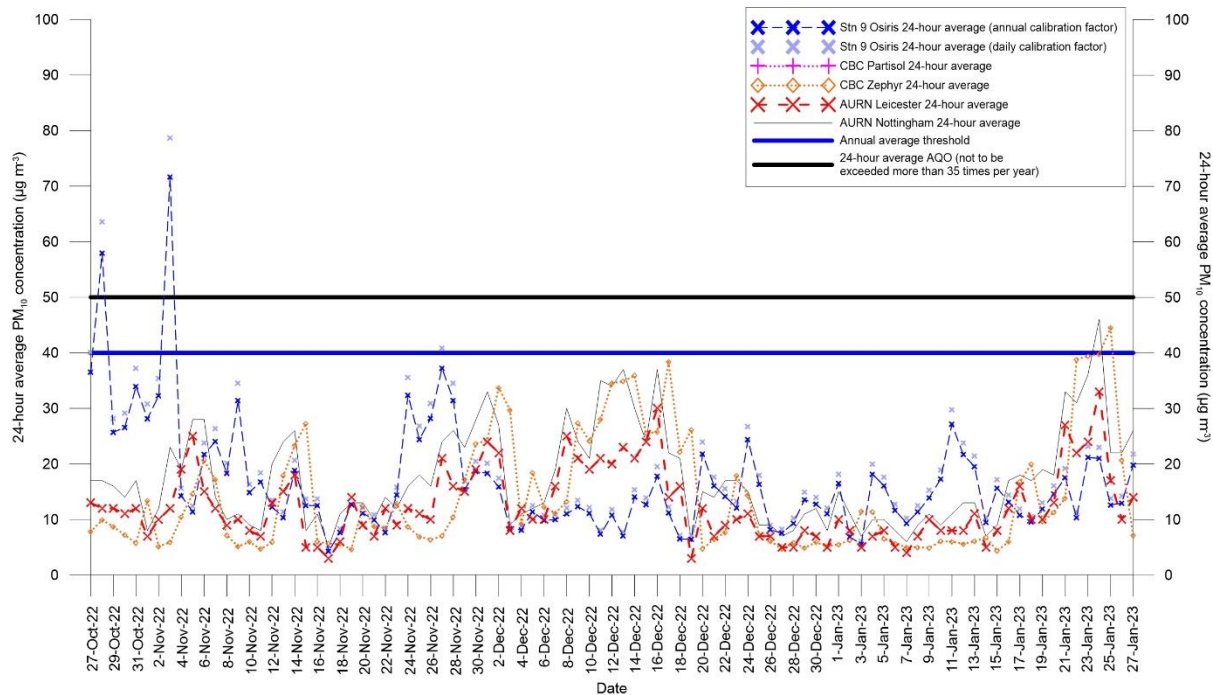


Figure 4: PM₁₀ data, most recent 3 months (up to 27 January 2023)

Between 21 December 2022 – 27 January 2023, no trigger emails alerting staff to high PM₁₀ levels from the direction of site operations were sent out.

The PM₁₀ data from the CBC Zephyr for this period are shown in orange in Figure 4. The data from this device typically corresponds relatively well with the AURN data from Nottingham and Leicester, whilst it doesn't generally correspond with the data from the Osiris which, it should be noted had previously been calibrated to correspond with the Partisol.

During late October and November the Osiris levels were generally higher than those reported by the other monitors. However, through early December the Osiris levels were consistently lower than those reported elsewhere. From mid-December to mid-January Osiris levels reverted to being higher than those reported by the other stations but from mid-January onwards, again the Zephyr and AURN stations reported higher PM₁₀ concentrations than those recorded on-site by the Osiris.

Importantly, these discrepancies must be recognised as typical for different monitoring equipment, demonstrating that in many cases there can be no definitive data, just a range of indicative results which must be interpreted with great care.

Discussions are ongoing between Tarmac, DustScanAQ, CBC and LCC regarding the discrepancies between the different datasets.

PM_{2.5}

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

- For the 12 months up to 27 January 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 7.59 µg/m³, which is approximately 37.9 % of the annual average PM_{2.5} concentration objective (20 µg/m³).

Figure 5 shows that for the period between 21 December 2022 – 27 January 2023, PM_{2.5} concentrations measured by the Osiris remained within the relevant AQO. Exceedances of the annual AQO were recorded at the Zephyr and both AURN sites in early to mid-December. As with PM₁₀ data, differences in the magnitudes of values recorded by the different instruments demonstrate the challenge in accurately measuring air quality indicators and the significance of expert interpretation of the data.

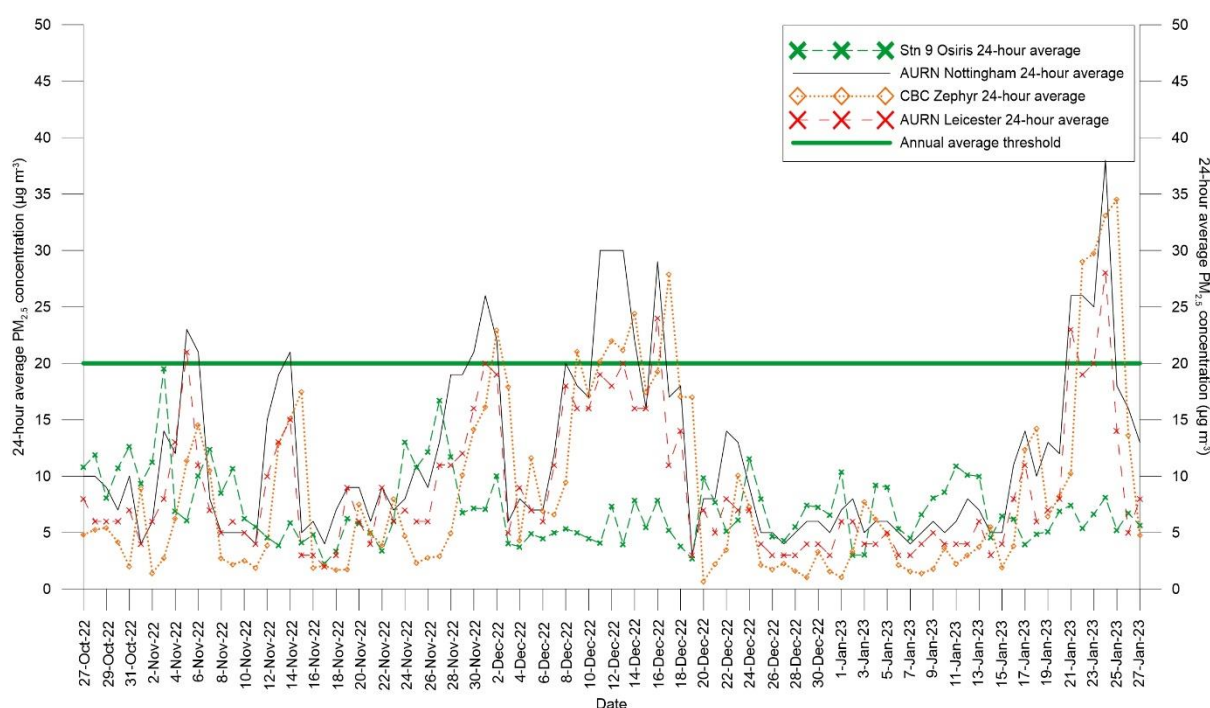


Figure 5: PM_{2.5} data, most recent 3 months (up to 27 January 2023)

Deposited dust monitoring summary

The deposited dust data for 21 December 2022 – 27 January 2023 are summarised in Table 2. The DMMP sets out a site-wide deposited dust threshold of 125 mg/m²/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 21 December 2022 – 27 January 2023 were within the site-wide threshold for all stations. All stations recorded Very Low depositional magnitudes excluding Stn 4A, 9 and 10, which recorded Low levels.

Table 2: Summary of deposited dust (undissolved solids), 21 December 2022 – 27 January 2023

Undissolved solids (mg/m ² /day)				
This month report start date:		21-Dec-22		
This month report end date:		27-Jan-23		
Receptor location	Nearest / appropriate dust monitoring point	Reported value	Trigger: ≥ 125 ^a	Magnitude ^b
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	11	No	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	8	No	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	14	No	Very Low
Mill Farm; Quorn House	Stn 3	7	No	Very Low
Woodside Farm, Leicester Road	Stn 4A	53	No	Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	7	No	Very Low
Bond Lane; Crown Lane	Stn 5	32	No	Very Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	14	No	Very Low
Hawcliffe Road	Stn 9	57	No	Low
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	58	No	Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	33	No	Very Low
Meadow Farm Marina and Caravan Park	Stn 12	13	No	Very Low
Quorn House Park	Stn 13	17	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/m²/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).

Finally, it is important to note from Figure 6 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 3 times over this period and once at Stn 1B (although the latter is likely to be anomalous). The average dust deposition rate at Stn 9 for the previous 12 months is slightly below the site-specific threshold (107 mg/m²/day).

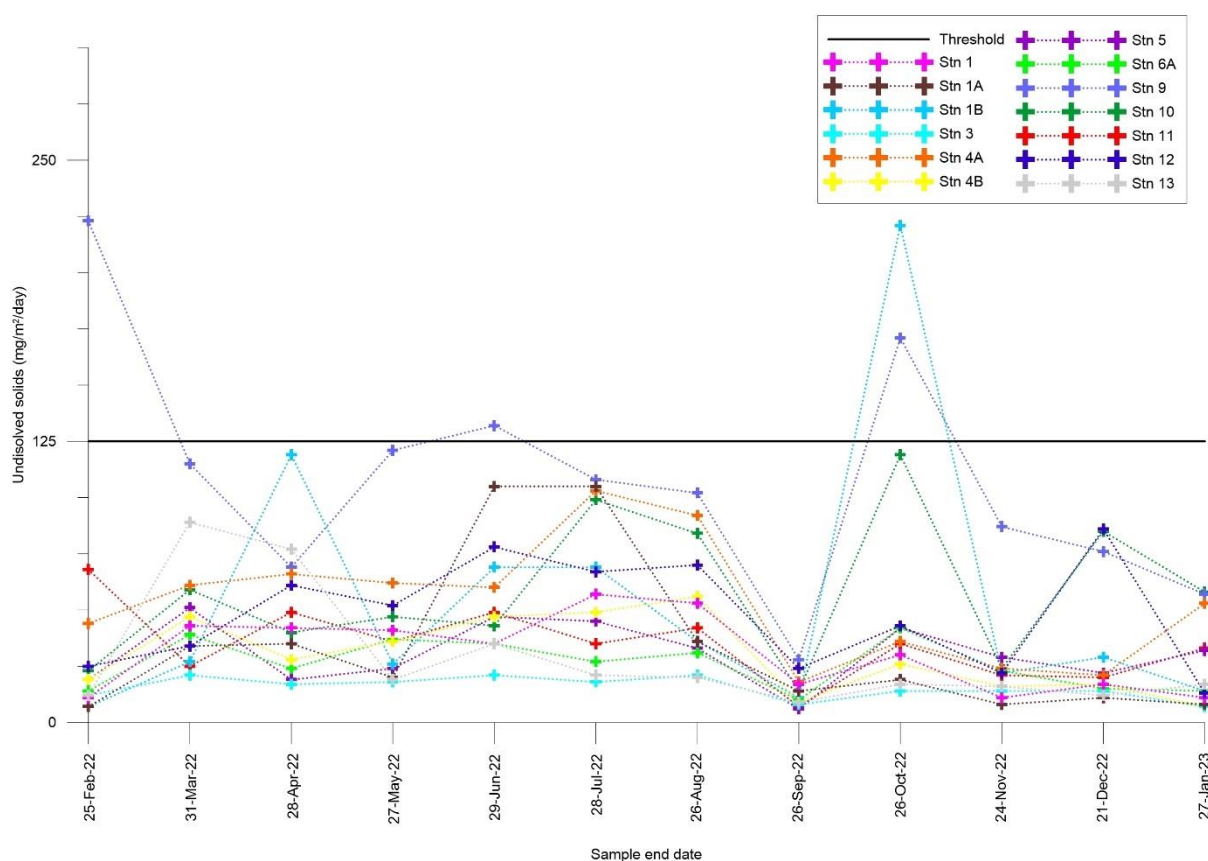


Figure 6: Dust deposition rates per sampling location over time (past 12 months)

Directional dust monitoring summary

The directional dust data for 21 December 2022 – 27 January 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 21 December 2022 – 27 January 2023, all of the stations recorded Very Low dust levels from all directions.

Table 3: Summary of directional dust soiling, 21 December 2022 – 27 January 2023

Directional dust soiling (%EAC/day) by direction (°)										
This month report start date:		21-Dec-22								
This month report end date:		27-Jan-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	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 1A	Reported value	0	0	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	0	0	0.1	0.1	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
Mill Farm; Quorn House	Stn 3	Reported value	0	0	0	0.1	0.1	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	0.1	0.1	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	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
Bond Lane; Crown Lane	Stn 5	Reported value	0	0	0	0.1	0.1	0.1	0.2	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	Low	Very Low
Sibley Road; Huston Close; Sibley Road (commercial)	Stn 6A	Reported value	0	0	0.1	0	0	0	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	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	0.1	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	0	0.1	0.1	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
Meadow Farm Marina and Caravan Park	Stn 12	Reported value	0	0	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 House Park	Stn 13	Reported value	0	0	0	0	0.1	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

^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 west resulting in a ‘Low’ magnitude 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	0.1	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 1B	Average value	0	0	0	0	0.1	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	0.1	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	0.1	0.1	0	0.1	0.1	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	0.1	0.1	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	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	0.1	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
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	0.1	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
Meadow Farm Marina and Caravan Park	Stn 12	Average value	0.1	0.1	0.1	0.1	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
Quorn House Park	Stn 13	Average value	0	0	0	0.1	0	0	0	0.1
		Magnitude ^b	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

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^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

It is understood that no dust complaints were received during this monitoring period.

**DustScanAQ
March 2023**



Dust and Air Quality Innovation and Expertise

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February 2023 particulate matter, dust and weather monitoring report for Mountsorrel Quarry (rev B)

Client:	Tarmac Trading Limited
Site:	Mountsorrel Quarry, Quorn
Job Code:	ZLFMS
Report Start Date:	27 January 2023
Report End Date:	24 February 2023
Date Report Issued:	10 May 2023

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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.

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

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 PM₁₀ PM_{2.5} and PM₁ 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.

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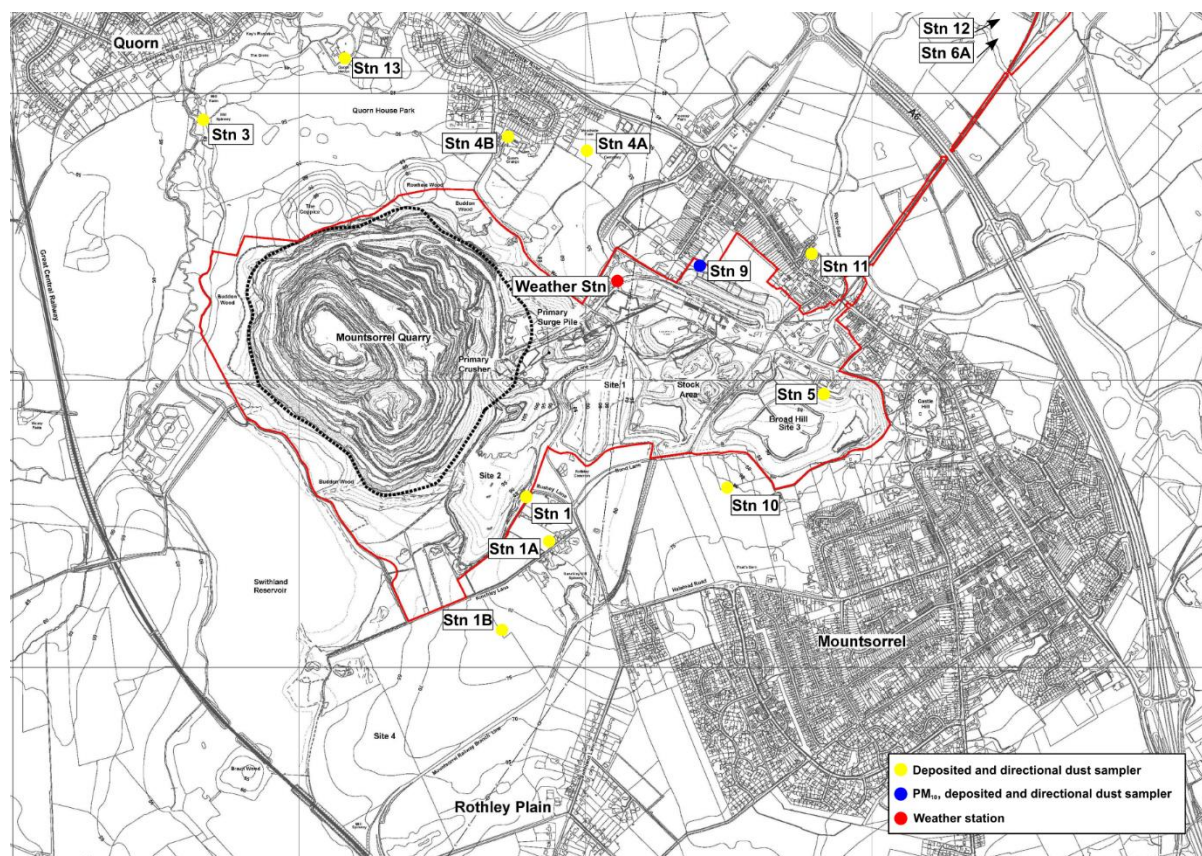


Figure 1: Particulate matter, dust and weather monitoring locations, Mountsorrel Quarry

Table 1: Weather station, PM₁₀ 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 assistance 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 27 January – 24 February 2023 is characterised by mild to cold temperatures, and was generally dry with precipitation recorded on only 28% of days.

The maximum daily average temperature was 12.3 °C recorded on 17 February and the minimum daily temperature was 2.0 °C recorded on 06 February. There were extended dry periods from 31 January – 07 February and 09 – 14 February where there may have been an increased potential for dust propagation from site activities beyond the site boundary due to the dry conditions.

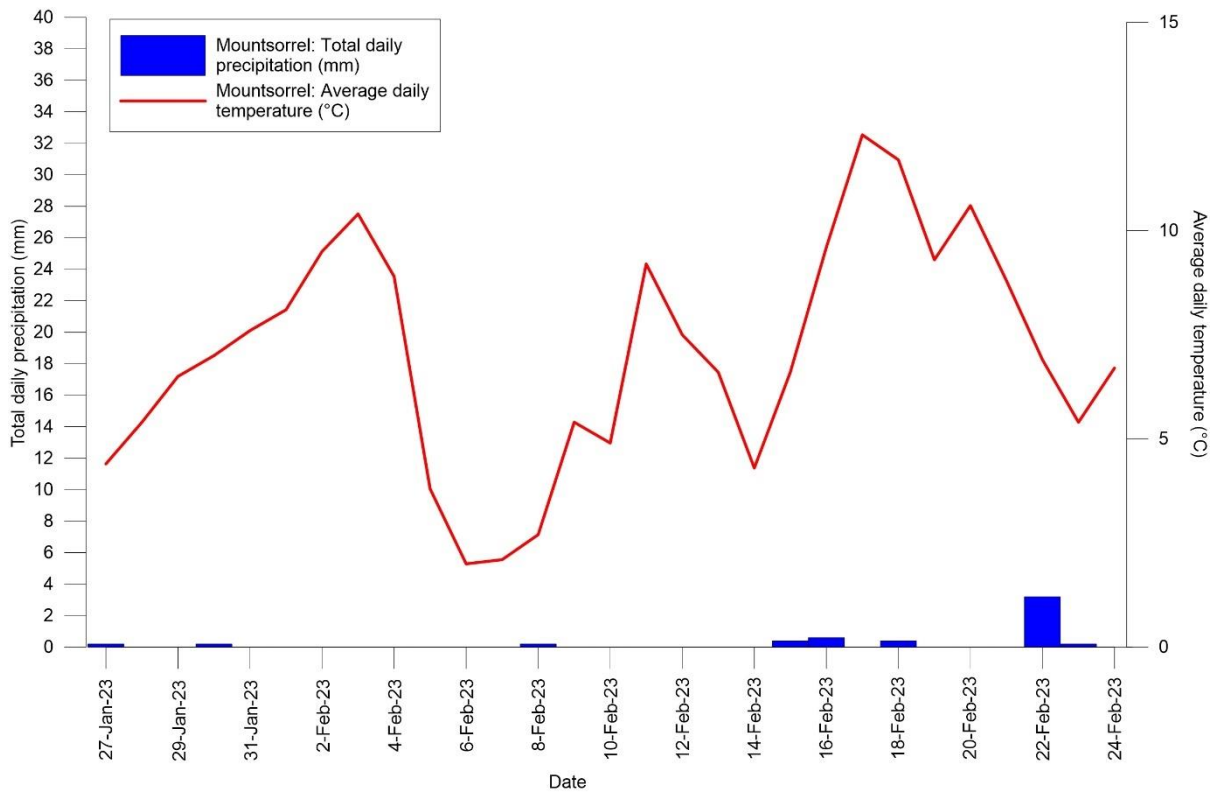


Figure 2: Total daily precipitation and average daily temperature, Mountsorrel Quarry, 27 January 2023 – 24 February 2023

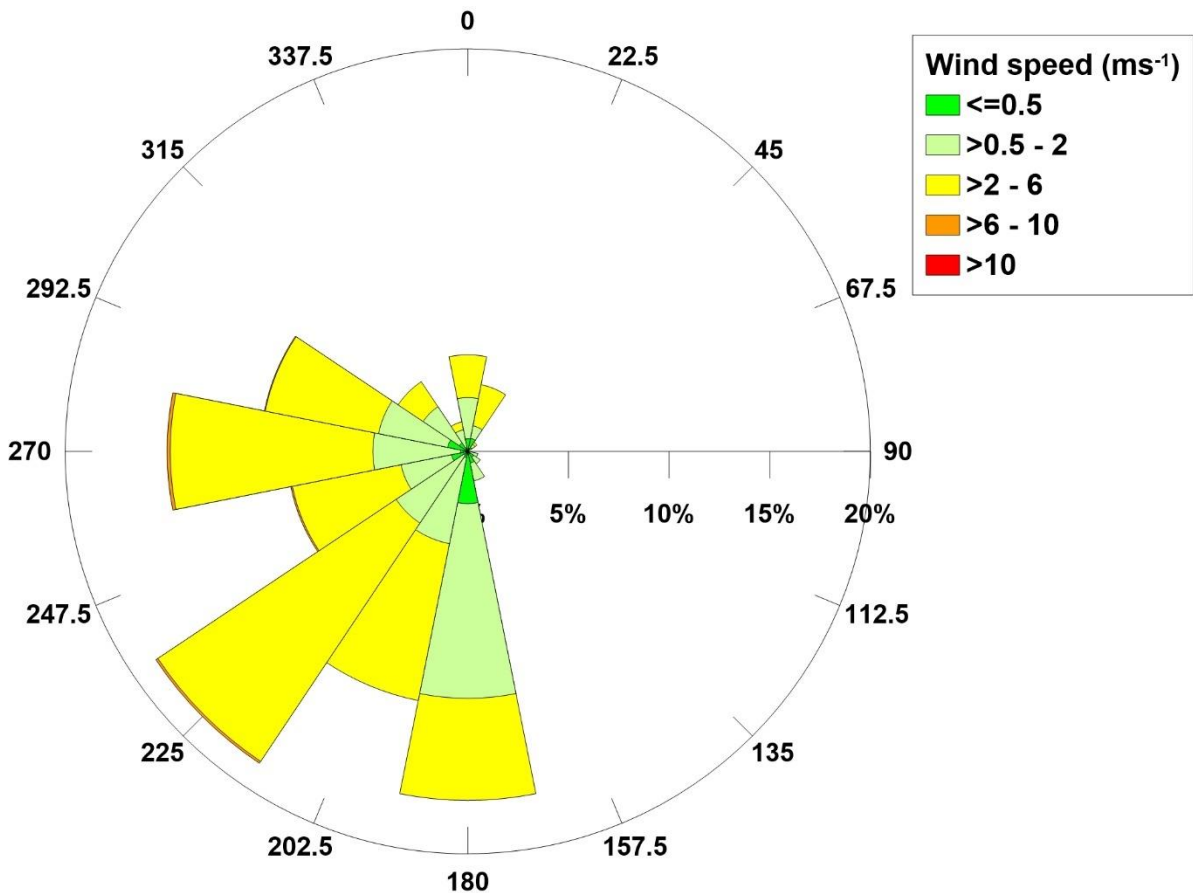


Figure 3: Wind rose, Mountsorrel Quarry, Mountsorrel, 27 January 2023 – 24 February 2023

As seen in Figure 3, winds for this monitoring period were generally south-westerly, arising from the west, south-west and west. The winds were primarily moderate in speed (>2 – 6 m/s).

Consequently, there may have been a reasonable potential for dust propagation mainly to the northeast but also to the north and the east.

PM₁₀ 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) stations in Nottingham Centre and Leicester University² are shown in Figure 4 and Figure 5. No data from the Partisol operated by CBC³ were available for this monitoring period, although a full dataset from the Zephyr was available.

Data from the AURN stations 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 PM₁₀ 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 PM₁₀ and PM_{2.5} signals respectively.

PM₁₀

With regard to numerical analysis of the data:

- For the 12 months up to 24 February 2023, there were 365 daily PM₁₀ readings taken by the Osiris at Stn 9, representing a 100 % data collection rate. From the available data the annual average daily PM₁₀ concentration for the 12 months to date (and using the annual calibration factor) was 21.28 µg/m³, which is approximately 53.2 % of the annual average PM₁₀ concentration objective (40 µg/m³); and
- For the 12 months up to 24 February 2023 there were 29 recorded instances where the daily average PM₁₀ concentrations (using the daily factor) exceeded 50 µg/m³. From the data collection rate this is equivalent to 29 days with a 24-hour average above 50 µg/m³ in a full year as the data collection rate was 100 %.

In summary, for the 12 months up to 24 February 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 4 exceedances of the daily average threshold, all occurring in early to mid-February 2023. As these 'spikes' in data appear across multiple datasets they may well relate to regional rather than local PM₁₀ sources. It is of note, however that although concentrations did not reach exceedance levels there was a notable local signal with elevated PM₁₀ concentrations around the 20th of February.

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

² <http://uk-air.defra.gov.uk/networks/network-info?view=aurun>

³ https://www.charnwood.gov.uk/pages/mountsorrel_quarry

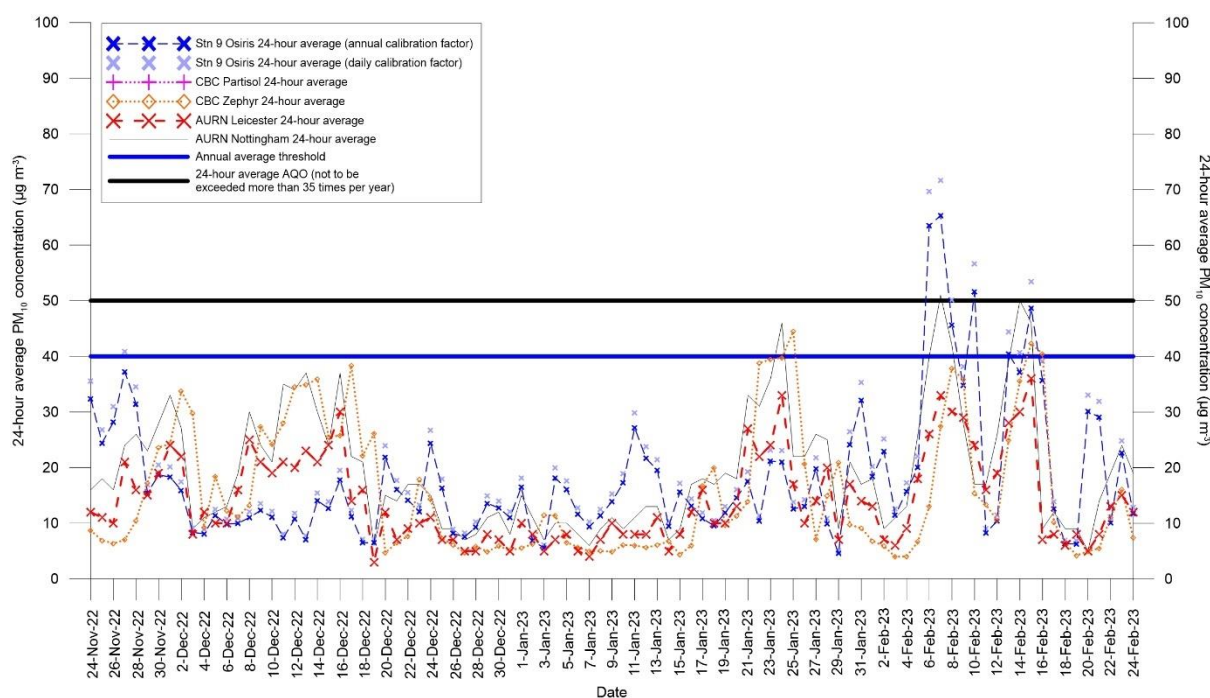


Figure 4: PM₁₀ data, most recent 3 months (up to 24 February 2023)

Between 27 January 2023 – 24 February 2023, trigger emails alerting staff to high PM₁₀ levels from the direction of site operations were sent out on a number of days. Details of the corresponding causes and investigations are provided in Table 2.

Table 2: Email alert responses, 27 January 2023 – 24 February 2023 (using the trigger threshold, 125 µg/m³ for the 15-minute average)

Date of alert	Details	Possible cause and investigation
27/01/2023	Exceedance recorded from the southeast in the late evening	One-off alert during a period of low dust levels
31/01/2023	Exceedance recorded from the west-southwest in the evening	Directional data suggests multiple sources including off-site
02/02/2023	Exceedance recorded from the south late at night	One-off alert during a period of low dust levels
06/02/2023	Exceedance recorded from the southwest at noon	
07/02/2023	Exceedance recorded from the west in the early evening	A&B bay dust suppression not working
08/02/2023	Exceedance recorded from the south-southwest in the afternoon	
09/02/2023	Exceedance recorded from the southwest at night	

Date of alert	Details	Possible cause and investigation
10/02/2023	Exceedance recorded from the south in the early afternoon	
14/02/2023	Exceedance recorded from the southeast in the evening	One-off alert during a period of low dust levels
15/02/2023	Exceedance recorded from the southeast in the afternoon	Elevated dust levels from multiple directions suggests elevated background concentrations
20/02/2023	Exceedance recorded from the east-southeast in the early evening	
23/02/2023	Exceedance recorded from the southwest in the evening	Issues with frozen pipes around site

The PM₁₀ data from the CBC Zephyr for this period are shown in orange in Figure 4. The data from this device typically corresponds relatively well with the AURN data from Nottingham and Leicester, whilst it doesn't generally correspond with the data from the Osiris which, it should be noted had previously been calibrated to correspond with the Partisol.

During late November the Osiris levels were generally higher than those reported by the other monitors. However, through early December the Osiris levels were consistently lower than those reported elsewhere. From mid-December to mid-January Osiris levels reverted to being higher than those reported by the other stations but from mid-January to late January, again the Zephyr and AURN stations reported higher PM₁₀ concentrations than those recorded on-site by the Osiris. From the last day of January through to the end of the monitoring period at the end of February, PM₁₀ concentrations recorded on-site by the Osiris were consistently higher than those reported elsewhere.

Importantly, these discrepancies must be recognised as typical for different monitoring equipment, demonstrating that in many cases there can be no definitive data, just a range of indicative results which must be interpreted with great care.

Discussions are ongoing between Tarmac, DustScanAQ, CBC and LCC regarding the discrepancies between the different datasets.

PM_{2.5}

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

- For the 12 months up to 24 February 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 7.47 µg/m³, which is approximately 74.7 % of the new annual average PM_{2.5} concentration objective (10 µg/m³) applicable from 31 January 2023.

Figure 5 shows that for the period between 27 January 2023 – 24 February 2023, PM_{2.5} concentrations measured by the Osiris, Zephyr and both AURN sites exceeded the relevant AQO several times between late January to mid-February.

As with PM₁₀ data, differences in the magnitudes of values recorded by the different instruments demonstrate the challenge in accurately measuring air quality indicators and the significance of expert interpretation of the data.

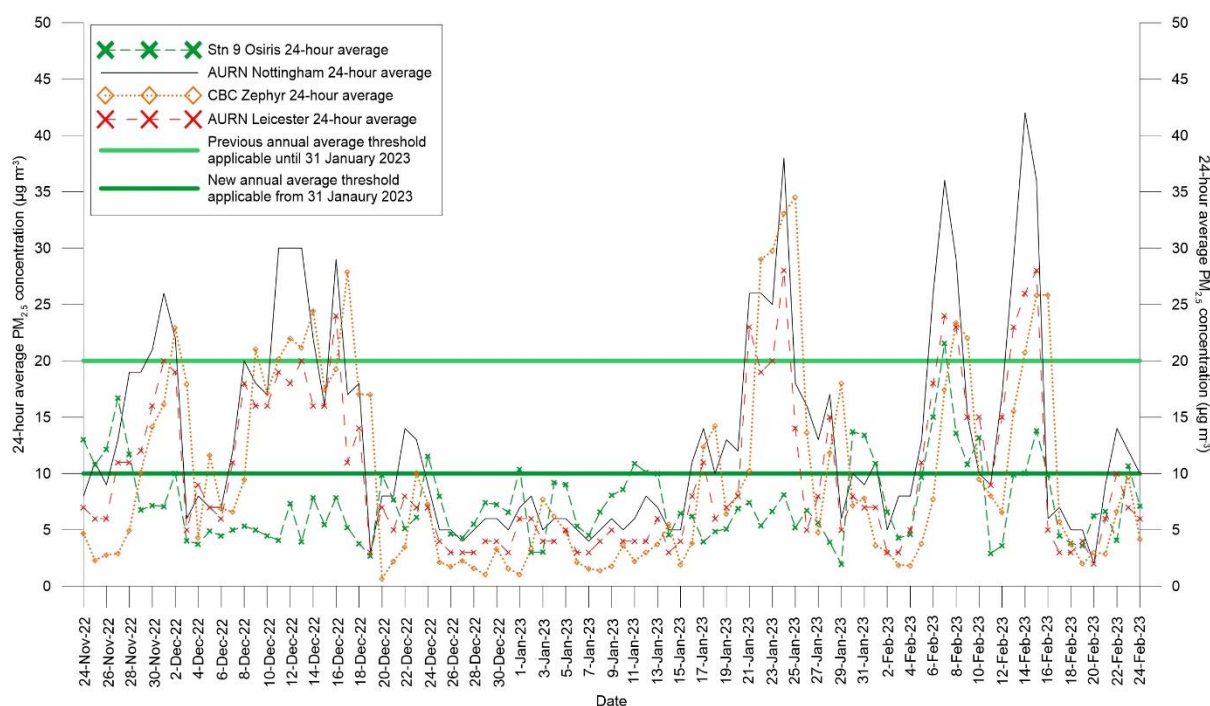


Figure 5: PM_{2.5} data, most recent 3 months (up to 24 February 2023)

Deposited dust monitoring summary

The deposited dust data for 27 January 2023 – 24 February 2023 are summarised in Table 3. The DMMP sets out a site-wide deposited dust threshold of 125 mg/m²/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 27 January 2023 – 24 February 2023 were within the site-wide threshold for all stations excluding Stn 9 which recorded High levels (163 mg/m²/day). All other stations recorded Very Low depositional magnitudes excluding Stn 5, 10 and 11, which recorded Low levels.

Table 3: Summary of deposited dust (undissolved solids), 27 January 2023 – 24 February 2023

Undissolved solids (mg/m ² /day)				
This month report start date:		27-Jan-23		
This month report end date:		24-Feb-23		
Receptor location	Nearest / appropriate dust monitoring point	Reported value	Trigger: ≥ 125 ^a	Magnitude ^b
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1	15	No	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1A	15	No	Very Low
Swithland Lane; Rushey Lane; Kinchley Lane	Stn 1B	16	No	Very Low
Mill Farm; Quorn House	Stn 3	16	No	Very Low
Woodside Farm, Leicester Road	Stn 4A	43	No	Very Low
Quorn Grange, Unitt Road, Northage Close, Quorn Park	Stn 4B	27	No	Very Low
Bond Lane; Crown Lane	Stn 5	57	No	Low
Sileby Road; Huston Close; Sileby Road (commercial)	Stn 6A	22	No	Very Low
Hawcliffe Road	Stn 9	163	Yes	High
Glebe Close; Halstead Road (south); Halstead Road (north)	Stn 10	54	No	Low
Loughborough Road; River Soar (marina / caravan park)	Stn 11	51	No	Low
Meadow Farm Marina and Caravan Park	Stn 12	24	No	Very Low
Quorn House Park	Stn 13	15	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/m²/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).

Finally, it is important to note from Figure 6 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 3 times over this period and once at Stn 1B (although the latter is likely to be anomalous). The average dust deposition rate at Stn 9 for the previous 12 months (102 mg/m²/day) is slightly below the site-specific threshold.

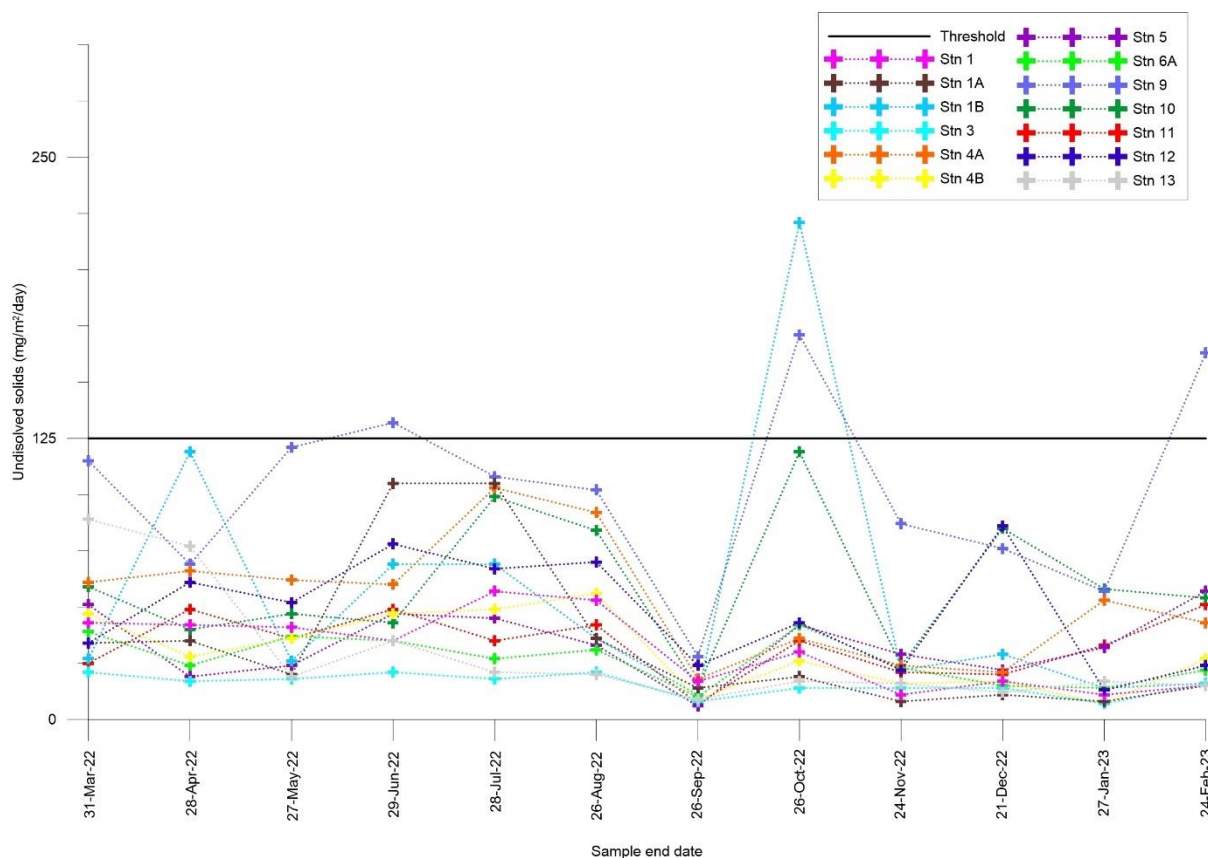


Figure 6: Dust deposition rates per sampling location over time (past 12 months)

Directional dust monitoring summary

The directional dust data for 27 January 2023 – 24 February 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 27 January 2023 – 24 February 2023, all of the stations recorded Very Low dust levels from all directions excluding Stn 5 and 9 which recorded Low levels.

Table 4: Summary of directional dust soiling, 27 January 2023 – 24 February 2023

Directional dust soiling (%EAC/day) by direction (°)										
This month report start date:		27-Jan-23								
This month report end date:		24-Feb-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	0	0	0	0.1	0.1	0.1
		Trigger: $\geq 0.5^a$	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	0	0	0	0	0	0	0.1
		Trigger: $\geq 0.5^a$	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	0.1	0.1	0
		Trigger: $\geq 0.5^a$	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	0	0	0	0
		Trigger: $\geq 0.5^a$	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	0.1	0.1	0.1	0.1	0.1	0.1
		Trigger: $\geq 0.5^a$	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	0	0	0	0	0
		Trigger: $\geq 0.5^a$	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	0.1	0.1	0.3	0.3
		Trigger: $\geq 0.5^a$	No	No	No	No	No	No	No	No
		Magnitude ^b	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Low
Sibley Road; Huston Close; Sibley Road (commercial)	Stn 6A	Reported value	0	0.1	0.1	0	0	0.1	0.1	0.1
		Trigger: $\geq 0.5^a$	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	0.1	0	0.3	0.2	0.1
		Trigger: $\geq 0.5^a$	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	0.1	0	0	0	0.1	0	0.1
		Trigger: $\geq 0.5^a$	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	0.1	0.1	0	0.1	0	0.1
		Trigger: $\geq 0.5^a$	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	0	0	0	0	0.1	0.1	0
		Trigger: $\geq 0.5^a$	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	0	0
		Trigger: $\geq 0.5^a$	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	0.1	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 1B	Average value	0	0	0	0	0.1	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	0.1	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	0.1	0.1	0	0.1	0.1	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	0.1	0.1	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	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	0.1	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
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	0.1	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	0.1	0	0.1	0.1	0.1	0	0.1
		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	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	0.1	0	0	0	0.1
		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 27 January 2023 – 24 February 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 DMMP.

DustScanAQ
May 2023