



Air Quality Review and Assessment

Detailed Assessment

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Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government Guidance when undertaking such work. This Detailed Assessment is a requirement of the second round of review and assessment for local authorities that have identified areas for further assessment in their previously submitted Updating and Screening Assessment. This Report has been undertaken in accordance with the Technical Guidance LAQM.TG (03), (DEFRA, 2003).

The first phase of the second round of review and assessment, the USA, was completed in June 2003 and this provided an update with respect to air quality issues within the North West Leicestershire District on the conclusions of the previous round. The USA concluded that a Detailed Assessment was required for PM₁₀ in the vicinity of Bradgate Drive, Greenhill Estate, Coalville. This location has been identified as a potential area where the UK Air Quality Objective for PM₁₀ may exceed the 24-hour mean of 50µgm⁻³ due to emissions from Bardon Quarry. The Department of Food and Rural Affairs (DEFRA) has accepted the USA conclusions.

An Osiris real-time PM₁₀ analyser and a Partisol gravimetric PM₁₀ monitor were co-located at Tillson House; a residential care home located approximately 200m North of the boundary of Bardon Quarry. Monitoring was conducted between January 2004 and February 2005. The number of exceedences that were recorded in 2004 were below the permitted 35 per year, therefore an Air Quality Management Area will not need to be declared in the vicinity of Bradgate Drive, Greenhill Estate, Coalville.

There were 21 exceedences of the 50µgm⁻³ 24-hour mean limit for PM₁₀ as set within the UK National Air Quality Strategy and EU Air Quality Daughter Directive during the 9-months for which data was collected.

Monitoring is scheduled to continue at Tillson House with results being reported annually in the Progress Report.

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1. Introduction

1.1 Purpose of Report

This report has been produced by Environmental Protection section for the purposes of providing a detailed summary of North West Leicestershire District Council's recent PM₁₀ monitoring in the vicinity of Bradgate Drive, Coalville.

1.2 Introduction to Local Air Quality Management

Part IV of the Environment Act 1995 requires local authorities to review and assess the current, and likely future, air quality in their areas against those objectives in the National Air Quality Strategy. Where objectives are not likely to be met, the local authority is required to designate an Air Quality Management Area (AQMA) at the relevant locations. The local authority must then draw up an action plan setting out the measures it intends to take in pursuit of the air quality objectives within the area covered by the AQMA.

North West Leicestershire District Council undertook the first round of review and assessment between 1998 and 2004. The final conclusions of the first round have been that with the exception of the NO₂ objective, the Air Quality Objectives were expected to be met by the target dates. Exceedence of the NO₂ objective due to road traffic led to two AQMA's being retained, the M1 AQMA and the Kegworth (A6) AQMA.

The second round of review and assessment commenced in January 2003 and was conducted in accordance with new technical guidance, LAQM.TG(03), (DEFRA, 2003). The new guidance sets the framework for the requirements of review and assessment for future years, taking into account experiences from the previous round of review and assessment. The structure of the Second Round differs from the first round and the process is now conducted in two steps.

Step one is an Updating and Screening Assessment to identify those aspects that have changed since the first round. The Updating and Screening Assessment covers the

seven pollutants of concern to health and assesses whether Air Quality Objectives for these pollutants will be met. The Updating and Screening Assessment should include an explanation of all conclusions reached as to whether a local authority should proceed to a Detailed Assessment or not.

Step two is the Detailed Assessment of those pollutants highlighted in the Updating and Screening Assessment and should be specific to locations that have been identified as requiring further work. The detailed assessment should conclude whether Air Quality Objectives are likely to be met by the relevant year and hence whether an Air Quality Management Area should be declared.

1.3 Recommendations of Updating and Screening Assessment

In accordance with the revised guidance an Updating and Screening Assessment report for North West Leicestershire District Council was submitted to, and accepted by DEFRA in June 2003. The Updating and Screening Assessment concluded that it was necessary to proceed with a detailed assessment for PM₁₀ in the vicinity of Bradgate Drive, Greenhill Estate, Coalville.

This location has been identified as a potential area where the UK Air Quality Objective for PM₁₀ may exceed the 24 hour mean of 50µgm⁻³ due to emissions from Bardon Quarry, Grid Reference SK4433 3114. The Greenhill estate is predominantly council housing and many of the properties still receive concessionary coal.

The Updating and Screening Assessment examined all relevant domestic and industrial sources of PM₁₀ that may affect the detailed assessment area and concluded that no other significant sources of PM₁₀ were present. As a result Bardon Quarry is considered to be the main source of PM₁₀ in the immediate vicinity. The location of the PM₁₀ monitors at Tillson House is indicated by the red mark on Figure 1.1.

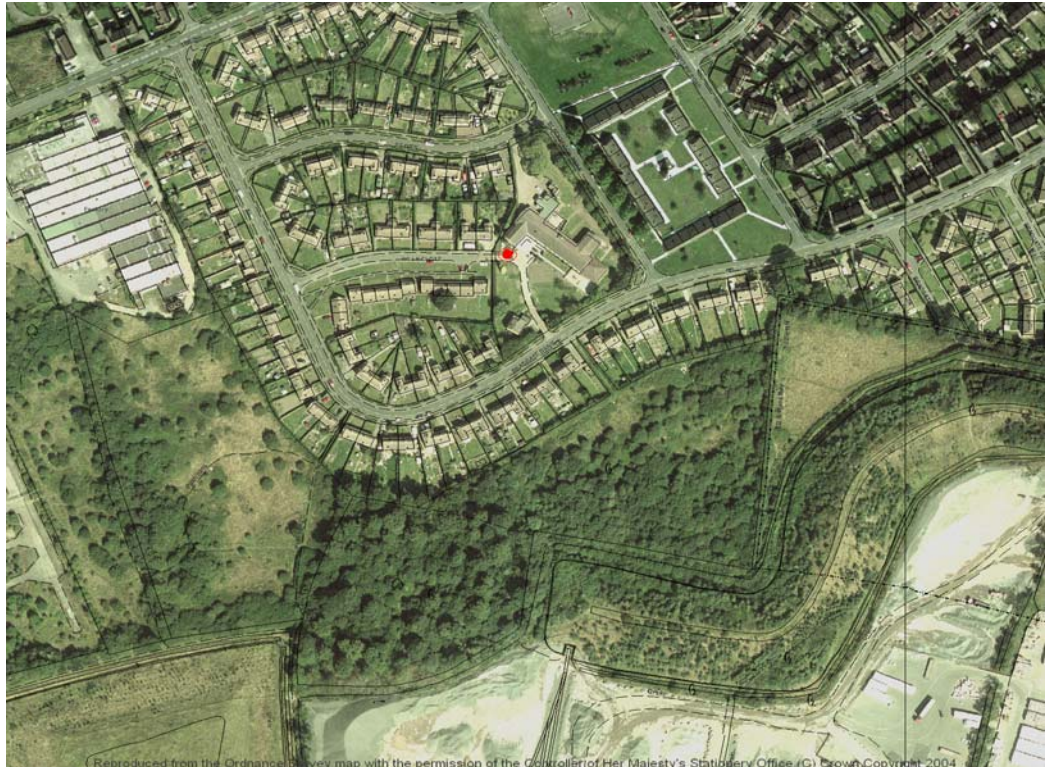


Figure 1.1 Location of Tillson House showing proximity to Bardon Quarry

The current Air Quality Objectives are set out in the Air Quality Regulations (England) (Wales) 2000 and in the Air Quality (England) (Wales) (Amendment) Regulations 2002 which are made under the Environment Act 1995. The objectives currently included in the regulations for the purposes of Local Air Quality Management for PM₁₀ are given in Table 1.1.

Table 1.1 Objectives included in the Regulations for the purposes of Local Air Management

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Particulate Matter (PM ₁₀)	50µgm ⁻³ not to be exceeded more than 35 times per year	24-hour Mean	31/12/2004
	40µgm ⁻³	Annual Mean	31/12/2004

1.4 Current Situation at Bardon Quarry

The Quarry has been authorised by North West Leicestershire District Council since 1992 and is required to comply with several of the standard Secretary of States, Process Guidance Notes, including:

- PG3/8(2004) – Quarry Processes (DEFRA 2004a)
- PG3/15a(2004) – Roadstone Coating Processes (DEFRA 2004b)
- PG3/15b(2004) – Mineral Drying and Cooling (DEFRA 2004c)
- PG3/16(2004) – Mobile Crushing and Screening Processes (DEFRA 2004d)

Stone is quarried in the traditional manner by drilling and blasting. It is transported from the quarry face to the primary crusher by means of dump trucks. From the primary crusher, the conveyor passes the stone to ancillary, secondary and tertiary crushers and screen houses. Graded stone is either stockpiled or stored in the 60,000 tonne capacity ‘toast rack’, or fed to the three roadstone coating plants. Bitumen for the coating plants, is delivered by tanker lorries and fed directly into heated silos. The plant area and access roads are all hard surfaced.

Aggregate feed to the coating plants is direct from the ‘toast rack’ and the drystone plant, with smaller quantities occasionally fed from ground stocks. Outloading from the coating plant is either to lorries or to heated storage silos. Each coating plant is fitted with dust arrestment. Reclaimed dust is used in the process, returned to line or conditioned with water.

Bardon Quarry operate an Osiris light scatter monitor manufactured by Turnkey, which determines the particulate concentration by measuring the degree of scattering occurring when the particle stream is passed through a beam of laser light. The monitor is located on Greenhill Estate, approximately 200m from the boundary of the quarry site, at a residential care home, Tillson House, as detailed in Figure 1.1. This is the monitor from which the data was taken to conduct the Updating and Screening Assessment the results from which indicated an exceedance of the current objective.

Over recent months, and since completion of the PM₁₀ monitoring conducted by Advance Environmental, Aggregate Industries have made a number of improvements to help reduce the emissions of PM₁₀ from the site, they include:

- Installation of a water curtain to the road and rail load out – on the site adjacent to the Greenhill estate.
- Planned installation of a ring main suppression system, on the boundary of the quarry adjacent to the Greenhill estate.

Aggregate Industries have approved funding for the acquisition of a new asphalt plant for the quarry site, and planning permission is being sought with the intention that the new plant will be commissioned for use in Spring 2005. The new plant will replace two existing small-scale plants and will relieve the remaining main plant of 'base load' production demands. The changes will provide a number of key environmental improvements compared to the current situation and are detailed below:

- Electrostatic precipitators, which will remove fumes and PM₁₀ with extraction at the load out area.
- Plant will be fully enclosed and the load out area, mixer areas and plant building will be kept under slight negative pressure by extraction through the bag house. This will minimise the emissions of dust.
- The stack emission performance is designed to comply with the new process guidance notes of 50mgm⁻³, however, in reality the design is such that it should achieve less than 25mgm⁻³ at all times. Due to the nature of the filtration the mineral fraction will be largely PM₁₀ and should achieve a 75% reduction when compared to the old plant.

2. Results

2.1 Results from the Initial Study

Advance Environmental, air quality consultants, undertook a monitoring exercise jointly funded by this Council and Aggregate Industries UK Limited, to sample and characterise ambient PM₁₀ concentrations on the Greenhill estate, Coalville. Sampling was undertaken at the same location as the monitoring undertaken for the Updating and Screening Assessment, at Tillson House, a residential care home located approximately 200 metres North from the boundary of Bardon Quarry.



Figure 2.1 PM₁₀ Concentrations ($\mu\text{g}\text{m}^{-3}$) Recorded by the Partisol and Osiris PM₁₀ Monitors During the Initial Study Period

The 3-month investigation of PM₁₀ on the Greenhill estate, Coalville was conducted between January 2004 and March 2004. The report produced by Advanced Environmental will be referred to within this report.

PM₁₀ sampling was undertaken between 10th December 2003 and 16th March 2004, during which a total of 92 days sampling was achieved out of a total of 97 days, which equated to approximately 95% data capture the results of which are displayed in Figure 2.1. During the sampling period 11 exceedences of the 50µgm⁻³ limit set within UK National Air Quality Strategy and EU Air Quality Daughter Directive (DEFRA, 2001) were registered at Tillson House by the Partisol PM₁₀ analyser. The number of exceedences recorded by the Partisol equates to, in excess, of 40 exceedences per annum, greater than the 35 permitted within the 2004 objective of the Strategy. However, there could be seasonal variation, which may either dictate an increase or decrease of this ratio.

A selection of 10 PM₁₀ samples were characterised using Scanning Electron Microscopy with Energy Dispersive Spectrometry. The selected samples demonstrated that granite mineral particles were responsible for many of these exceedences, typical of the rock type quarried at Bardon Hill. Real time data suggests that high levels of PM₁₀ often occurred between 06.00 and 10.00 and 19.00 and 22.00 during the day. Probable sources of this include the grounding of exhaust stack plumes from the asphalt plants and fugitive emissions from other site activities. However, as a result of confounding wind direction data, the precise provenance has thus so far not been identified.

Data derived from the Osiris real time 'optical' monitor may be considered as indicative but comparison with the gravimetric data confirms that it should not be used for detailed studies within the Air Quality Review and Assessment programme (DEFRA, 2003). Therefore, historical data from this instrument should be considered with a degree of scepticism. The positioning of the instrument adjacent to a wall at Tillson House is not ideal.

Depending on the source or sources of granite dust, fugitive emissions have the potential to either increase during dry summer months, they may not alter, or they may decrease. The first scenario implies emissions from sources resuspension from roads, or the movement of materials, whilst the others could include grounding of exhaust stack plumes. If the latter is responsible, it may be influenced by winter

temperature inversions in the vicinity of the quarry void when the plumes tend to 'ground'.

2.2 Conclusion and Recommendations from the Initial Monitoring

Based on the results of the in depth monitoring conducted so far, it now follows that this council should declare part of the Greenhill estate, Coalville an Air Quality Management Area due to a predicted exceedance of the 24-hour mean objective for PM₁₀, from Bardon Quarry.

However, as detailed in the Technical Guidance (DEFRA, 2003) the aim of the Detailed Assessment is to determine with **reasonable certainty** whether or not there is a likelihood of the objectives not being achieved. In summary, the 96-day sampling period was not considered adequate to assess the compliance with the requirements of the present Air Quality Strategy. It is therefore recommended that before making a decision on declaring an AQMA based on predictive data that:

- An extended period of sampling is undertaken in conjunction with real time data and good quality wind data to provide more detailed information to be compared directly with the 24-hour mean objective. This will also highlight any seasonal variations.
- There should also be a high degree of co-ordination between logging site activities with an impact on air quality, thereby allowing the identification of sources and appropriate remedial action.

3. Aim of Detailed Assessment

North West Leicestershire District Council in conjunction with Aggregate Industries have commissioned Advanced Environmental to conduct further monitoring of PM₁₀ in the vicinity of the Greenhill estate, Coalville. As the objective for PM₁₀ applies at the end of 2004 further monitoring will extend from August to December 2004, which will provide 8 months data and allow for seasonal variations. The purpose of the extended Detailed Assessment is to establish the following:

- Determine with certainty whether the 2004 objectives for PM₁₀ are exceeded.
- Obtain meaningful wind direction data.
- Aggregate Industries to continue with the logging of on site activities, thereby allowing the identification of sources and appropriate remedial action, if needed.
- Confirm whether an AQMA should be declared for PM₁₀ for the Greenhill estate, to the northern boundary of Bardon Quarry.
- Should an AQMA be needed the further study should also determine the boundaries of the AQMA.

4. Results

4.1 Results from Extended Sampling Period

The extended period of gravimetric sampling in conjunction with real time data and wind data commenced in August 2004. The results of the monitoring are displayed in Figure 4.1. During the 6-month study period the Partisol PM₁₀ analyser recorded 16 exceedences of the 50µgm⁻³ limit as set within the UK National Air Quality Strategy. During the same period the Osiris PM₁₀ analyser recorded 17 exceedences of the 50µgm⁻³ limit of which 5 exceedences were recorded during the same 24hr period by both the Partisol and Osiris. Overall for the monitoring period January 2004 to January 2005 the Partisol recorded 21 exceedences of the 50µgm⁻³ limit whilst the Osiris recorded 23 exceedences.

As previously stated the data obtained by the Osiris PM₁₀ monitor should only be considered as indicative. The Partisol gravimetric analyser is considered to provide more representative data, hence these results will be used within this Detailed Assessment.

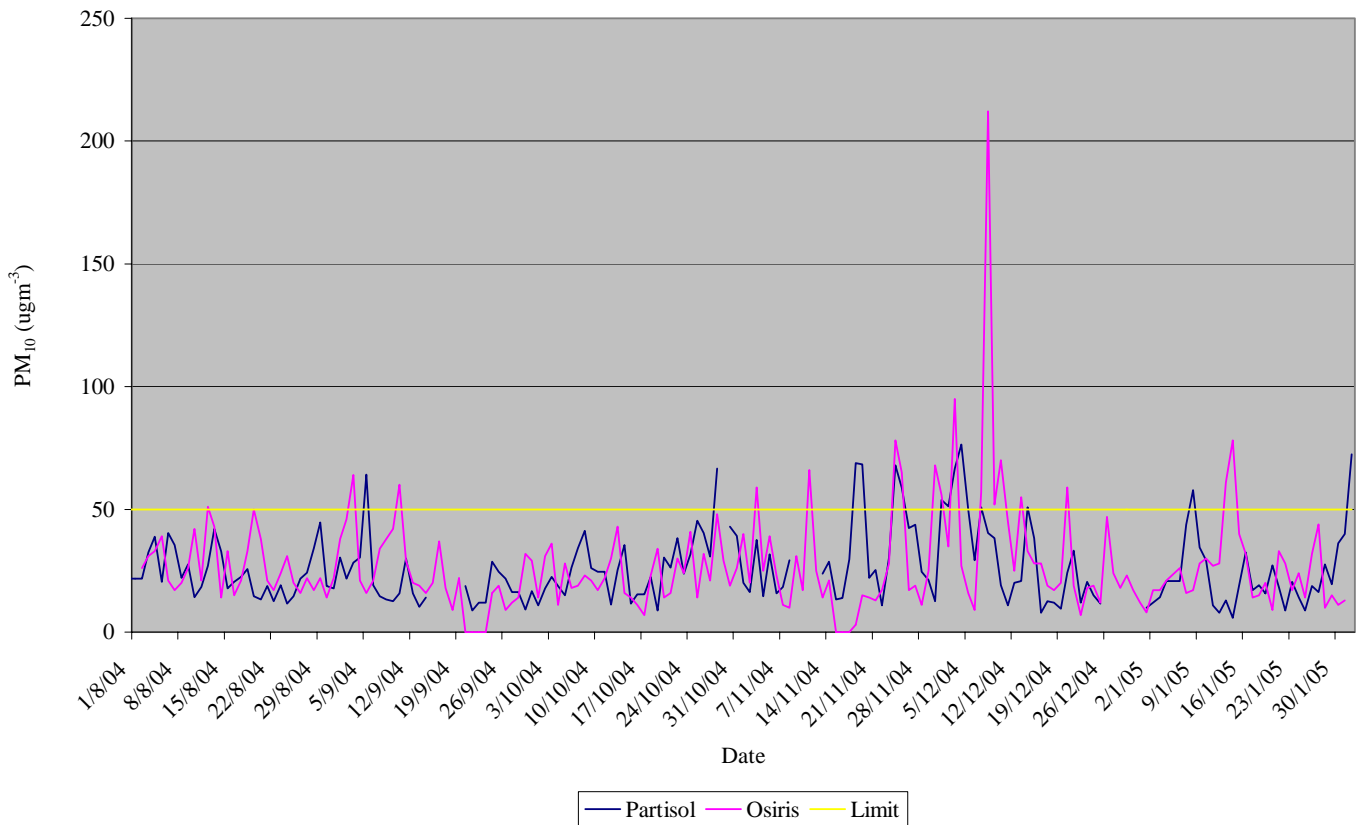


Figure 4.1 PM₁₀ Concentrations (μgm^{-3}) recorded by the Partisol and Osiris PM₁₀ Monitors during the 6-month Study Period

Wind speed and directional data was obtained from the meteorological station based at the Council offices in Coalville, approximately 1km west of Tillson House. Wind speed and directional data are presented in Table 4.1 for days on which the $50\mu\text{gm}^{-3}$ limit was exceeded as recorded by either the Partisol or Osiris monitors.

The highest 24-hour mean concentrations of PM₁₀ registered by the Partisol and Osiris were recorded when the wind was predominantly in a Southerly direction. The average wind speeds were generally below 10mph with the highest average wind speeds being recorded on 8th January 2005 of 18.9mph (Table 4.1). The generally low average wind speeds may indicate that the PM₁₀ loading during these periods may contain a significant contribution from local sources.

The predominant wind direction recorded during the sampling period was Southerly followed by South-South-Easterly and South-South-Westerly. Wind blown in these

directions is likely to have passed across Bardon Quarry before reaching the monitoring station at Tillson House.

To the West of Tillson House a major development of 269 residential properties has been under construction since January 2004. Fugitive PM₁₀ emissions from this site are most likely to be recorded by the monitoring station at Tillson House when the wind is in a North-Westerly to West-South-Westerly direction. The amount of dust emitted from a construction site depends on the size of the site and the amount of construction activity. Although construction only contributes a small amount to emissions of PM₁₀ nationally, it can dominate emissions locally over a period of time (QUARG, 1996).

A number of properties surrounding Tillson House are still eligible for concessionary coal. The subsequent burning of this coal may contribute to the PM₁₀ loading although this is unlikely to be a significant source.

Table 4.1 Meteorological Data Obtained for the 24-hr Periods During Which the 50 μgm^{-3} limit was exceeded

Date	Day	Partisol (μgm^{-3})	Osiris (μgm^{-3})	Wind Speed (mph)	Wind Direction
12 th Jan 2004	Thur	71.7	76	9.3	S
1 st Mar 2004	Mon	51.7	18	1.7	NE
3 rd Mar 2004	Wed	72.1	36	8.0	S
4 th Mar 2004	Thur	49.6	55	2.9	S
5 th Mar 2004	Fri	59.6	130	2.1	N
6 th Mar 2004	Sat	30.8	189	6.3	NW
12 th Mar 2004	Fri	61.7	27	6.6	NE
3 rd Apr 2004	Sat	-	57	9.9	S
12 th May 2004	Wed	-	72	3.7	NNE
29 th Jul 2004	Thur	51.7	-	4.0	ESE
12 th Aug 2004	Thur	27.1	51	3.9	SSE
19 th Aug 2004	Thur	14.6	50	8.7	SSE
5 th Sep 2004	Sun	64.2	16	2.4	WSW
28 th Oct 2004	Thur	66.7	48	8.7	E
3 rd Nov 2004	Wed	37.5	59	4.5	SSE
11 th Nov 2004	Thur	-	66	2.9	WSW
18 th Nov 2004	Thur	68.8	3	7.0	NNE
19 th Nov 2004	Fri	68.3	15	3.8	W
24 th Nov 2004	Wed	67.9	78	3.0	S
25 th Nov 2004	Thur	58.8	65	4.9	S
30 th Nov 2004	Thur	12.5	68	4.3	SSE
1 st Dec 2004	Wed	53.8	56	1.4	SE
2 nd Dec 2004	Thur	51.3	35	1.1	W
3 rd Dec 2004	Fri	66.7	95	2.7	SSW
4 th Dec 2004	Sat	76.3	27	3.3	SSW
5 th Dec 2004	Sun	50	16	3.5	SSW
7 th Dec 2004	Tue	50.8	57	1.1	SSW
8 th Dec 2004	Wed	40.4	212	3.3	S
9 th Dec 2004	Thur	38.3	52	3.4	SSE
10 th Dec 2004	Fri	19.2	70	4.2	S
13 th Dec 2004	Mon	20.8	55	4.1	S
14 th Dec 2004	Tue	50.8	33	10.3	S
20 th Dec 2004	Mon	24.2	59	5.6	S
8 th Jan 2005	Sat	57.9	17	18.9	WSW
13 th Jan 2005	Thur	12.9	61	5.5	WSW
14 th Jan 2005	Fri	5.8	78	6.3	SSE
1 st Feb 2005	Tue	72.5	-	6.2	NW

5. Conclusions

The main conclusions that can be drawn from this Detailed Assessment are:

- There were 21 exceedences of the $50\mu\text{gm}^{-3}$ 24-hour limit for PM_{10} as set within the UK National Air Quality Strategy and EU Air Quality Daughter Directive during the 9 months of the study. These exceedences were recorded by the Partisol gravimetric PM_{10} monitor sited at Tillson House, Bradgate Drive, Coalville.
- The $50\mu\text{gm}^{-3}$ 24-hour mean was not exceeded more than 35 times, therefore an Air Quality Management Area will not need to be declared.
- Whilst PM_{10} emissions from Bardon Quarry may be the dominate source in the vicinity of Tillson House this contribution is likely to reduce as more of the measures detailed in Appendix 1 are introduced.
- Monitoring of PM_{10} using the Osiris real-time PM_{10} analyser will continue.

6. References

DEFRA (2003) LAQM.TG (03) Local Air Quality Management Technical Guidance.

DEFRA (2004a) PG 3/8 Secretary of State's Guidance for Quarry Processes.

DEFRA (2004b) PG 3/15a Secretary of State's Guidance for Roadstone Coating Processes.

DEFRA (2004c) PG 3/15b Secretary of State's Guidance for Mineral Drying and Cooling.

DEFRA (2004d) PG 3/16 Secretary of State's Guidance for Mobile Crushing and Screening Processes

QUARG (1996) Airborne Particulate Matter in the United Kingdom. Quality of Urban Air Research Group.

7. Appendix

7.1 Work conducted in the last 12 months

- Sprays have been added to road outside the control cabin
- Drainage to the area of rail track between A511 to the old weighbridge improved and track raised to prevent train running in water (splashing that dries out and creates dust)
- Sprinklers installed on conveyors around replant
- All plant doors have been replaced from wood to steel
- Dust suppression sprays in rinsing shed re-connected
- Water curtains installed at Toast rack load out points – Greenhill side
- Upgrade of sprays in Toast rack load out chute
- Bay 2 of Toast rack load out sheeted in to reduce wind whip
- Larger pump installed in Severn Trent Lagoon to cope with severe rainfall and prevent discharge of mucky water
- Perimeter water sprays fitted (almost complete)
- General improvements to site drainage systems
- Fogging system fitted in Primary crash box
- North side of re-plant sheeted to ground level to reduce wind whip
- Progressive lagging of water pipes to prevent freezing and subsequent failure of wet suppression
- Water curtains fitted at re-plant load out and Primary Tunnel
- Wet suppression system fitted in selector station
- Trial and hire of industrial vacuum system for cleaning inside and outside of plant rooms
- 6" Main extended to Wheel-washes to prevent running out of water
- Sprays on exit road moved from right to left to take account of the road camber
- Induction training for contractors now includes the showing of an Environmental Awareness video
- Air mist sprays fitted to the link conveyor
- Air mist sprays fitted to the aggregate transfer conveyor

- Bag filter – replaced bags, cleaned out all ducting, full service
- Replaced exhaust fan with a more effective model.

7.2 Work being planned or under investigation

- Replace Millars with a state of the art ‘environmentally friendly’ Benninghoven Asphalt Plant
- Order placed to fit air mist sprays to the chop gate
- Microwave sensors to monitor moisture content of material which will automatically control water addition
- Automate perimeter spray cannons to link to ground moisture and wind direction
- Extend perimeter sprays to North Ramp
- Fit fogging system to Toast rack side of train load out
- Repair entrance and yard asphalt
- Surface road to Toast rack loading point
- Surface main haul road past replant control room
- Additional concrete around replant to include silt traps and hose pipes – all buildings
- Trial vacuum system to take off surplus materials on overloaded vehicles
- Washing plant to wash dust and reduce stocks
- Look into viability of foam addition as dust suppression
- Look at viability of wheel washes at every point to internal metalled roads