



2010 Air Quality Detailed Assessment for North Dorset District Council.

In fulfillment of Part IV of the Environment Act, 1995,
Local Air Quality Management.

A report produced for North Dorset District Council

January 2010



1 Samian Way
Stoke Gifford
Bristol
BS34 8UQ

Local Authority Officer	Mr Kerry Pitt-Kerby
Department	Environmental Protection
Address	North Dorset District Council Nordon Salisbury Road Blandford Forum Dorset DT11 7LL
Telephone	01258 484311
Email	KPitt-Kerby@north-dorset.gov.uk
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Executive Summary.

This report has been produced as a result of the identification in the 2009 Updating & Screening Assessment of a poultry farm housing in excess of 400,000 birds and equipped with mechanical ventilation. East Down Farm holds an EPR permit for 418,000 birds and there are residential properties within 100 metres of the poultry units.

Monitoring for particles was carried out adjacent to the residential properties for a three month period between September and December 2009 using an OSIRIS optical monitor capable of measuring Total Suspended Particles (TSP), PM₁₀, PM_{2.5} and PM₁.

The data were compared with available data for PM₁₀ and PM_{2.5} from appropriate national network sites. From this it was concluded that the possibility of the Air Quality Objectives for PM₁₀ being exceeded at East Down Farm was very low and that there are no grounds for declaring an Air Quality Management Area.

From the available evidence there are no grounds for proceeding further with assessment of air quality in this location although it is recommended that developments at the site be reviewed on a regular basis provided the criteria for assessment of poultry farms in the Technical Guidance remain unchanged.

1. Introduction.

- 1.1 The 2009 Air Quality Updating and Screening Assessment for North Dorset Council identified one poultry farm, East Down Farm, holding an EPR permit for 418,000 birds with residential properties within 100 metres of the establishment. The latest Technical Guidance, LAQM TG(09), requires further assessment of concentrations of particles measured as PM₁₀ where a poultry farm houses more than 400,000 birds, is fitted with mechanical ventilation and there is relevant exposure within 100 metres of the establishment. East Down Farm meets all these criteria and so further investigations were undertaken as described in this report.

2. Monitoring programme.

2.1 Although the most probable “worst case” location for monitoring this establishment would be to the North East of the site the location selected for locating a sampler was to the South West at the location shown in Figure 1.



Figure 1 Monitoring location.

2.2 This location was selected for two reasons. One practical reason was that electrical power to operate the sampler was readily available here. The main reason, however, was that it was close to the residential properties (enclosed in red box). The exact location was decided on to minimise any screening effect that might be caused by the trees visible in Figure 1 between the residential properties and the poultry farm.

2.3 The nature of the location also influenced the choice of sampler. Although it would have been preferable to use a sampler with proven equivalence to the European reference method the costs and infrastructure involved with locating such a sampler would

have made the exercise unviable. As a result of this it was decided to use an OSIRIS optical sampler. This was mounted, at head height, in a weather proof casing on a pole located in the garden of the residential property closest to the poultry farm.

3. Results and discussion.

- 3.1 Monitoring commenced on 8 September 2009 and concluded on 10 December 2009. An overall data capture of 94.7% was achieved for PM₁₀ with some data being lost due to software problems and some readings being eliminated in ratification as being unreliable. There were two short periods where data were eliminated from the final dataset. The first was a period of 8 hours beginning at midnight on 24 October when the hourly average concentration of PM₁₀ jumped from about 1 µg m⁻³ to in excess of 3,000 µg m⁻³. The second was a period of 14 hours from midday on 12 November when the hourly average concentration of PM₁₀ jumped from about 20 µg m⁻³ to almost 400 µg m⁻³.
- 3.2 The output from the OSIRIS gives 15 minute average concentrations which were processed to give hourly average data for analysis. The OSIRIS also gives data for TSP, PM_{2.5} and PM₁. Software limitations resulted in the data capture for these metrics being 58.2%.
- 3.3 For comparison data from the following Automated Urban and Rural Network (AURN) sites, Bristol St Pauls, Harwell, Narberth, Portsmouth and Plymouth Centre, were downloaded from the National Air Quality Information Archive (NAQIA) for the period of the monitoring exercise. The Bristol, Portsmouth and Plymouth sites were selected as being the closest sites to East Down Farm where particles are measured whilst Harwell and Narberth are rural sites where particles are measured. These data were only ratified for the period 8 to 30 September and so must be treated with a measure of caution. The data are summarized in Table 1.

Site	Metric	PM ₁₀ (µg m ⁻³)	PM _{2.5} (µg m ⁻³)
East Down Farm	Period Mean	18.3	7.5
	90 th Percentile	27.6	N/A
Bristol St Pauls	Period Mean	16.8	9.5
	90 th Percentile	27.7	N/A
Harwell	Period Mean	15.9	6.4
	90 th Percentile	22.5	N/A
Narberth	Period Mean	11.6	N/A
	90 th Percentile	17.0	N/A
Portsmouth	Period Mean	26.1	7.7
	90 th Percentile	32.8	N/A

Plymouth	Period Mean	18.9	9.3
	90 th Percentile	28.3	N/A

Table 1 PM₁₀ and PM_{2.5} data, September to December 2009.

- 3.4 This shows that the concentrations of PM₁₀ at East Down Farm during this period were substantially higher than at Narberth in Pembroke but only slightly higher than at Harwell and Bristol St Pauls. They were comparable with those at Plymouth and substantially lower than those recorded at Portsmouth. There are grounds for suspecting that the Portsmouth data, although possibly genuine, may not be truly representative of this site. This is also discussed later. The concentrations of PM_{2.5} at East Down Farm were generally comparable with those recorded at the other sites where this is measured.
- 3.5 Figure 2 shows the daily average concentrations of PM₁₀ at all six sites and Figure 3 shows the same data for East Down Farm and Bristol St Pauls only. There is a reasonably good agreement between the daily average concentrations recorded at the latter two sites. It is noticeable that for the earliest part of the monitoring period the concentrations recorded at East Down Farm were higher than at Bristol St Pauls. This will be discussed further later in this report.

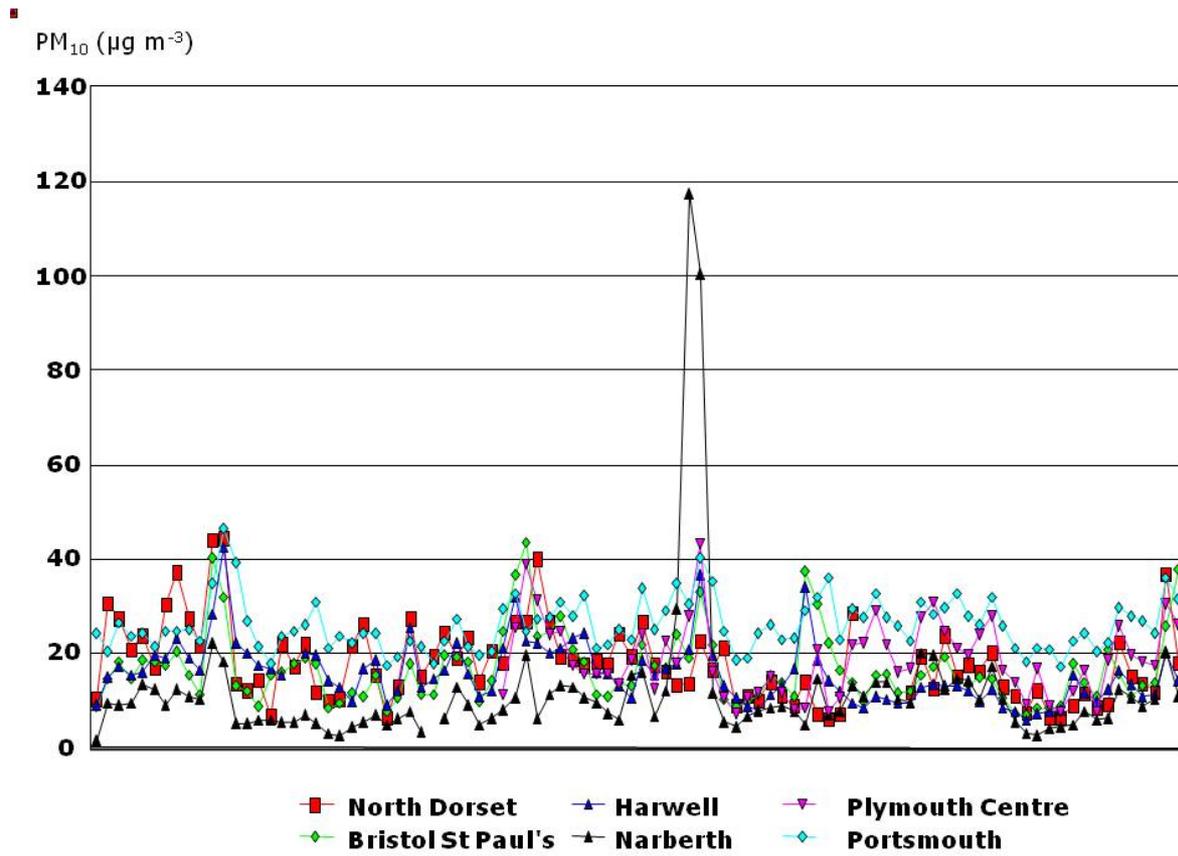


Figure 2 Daily average concentrations of PM₁₀, September to December 2009.

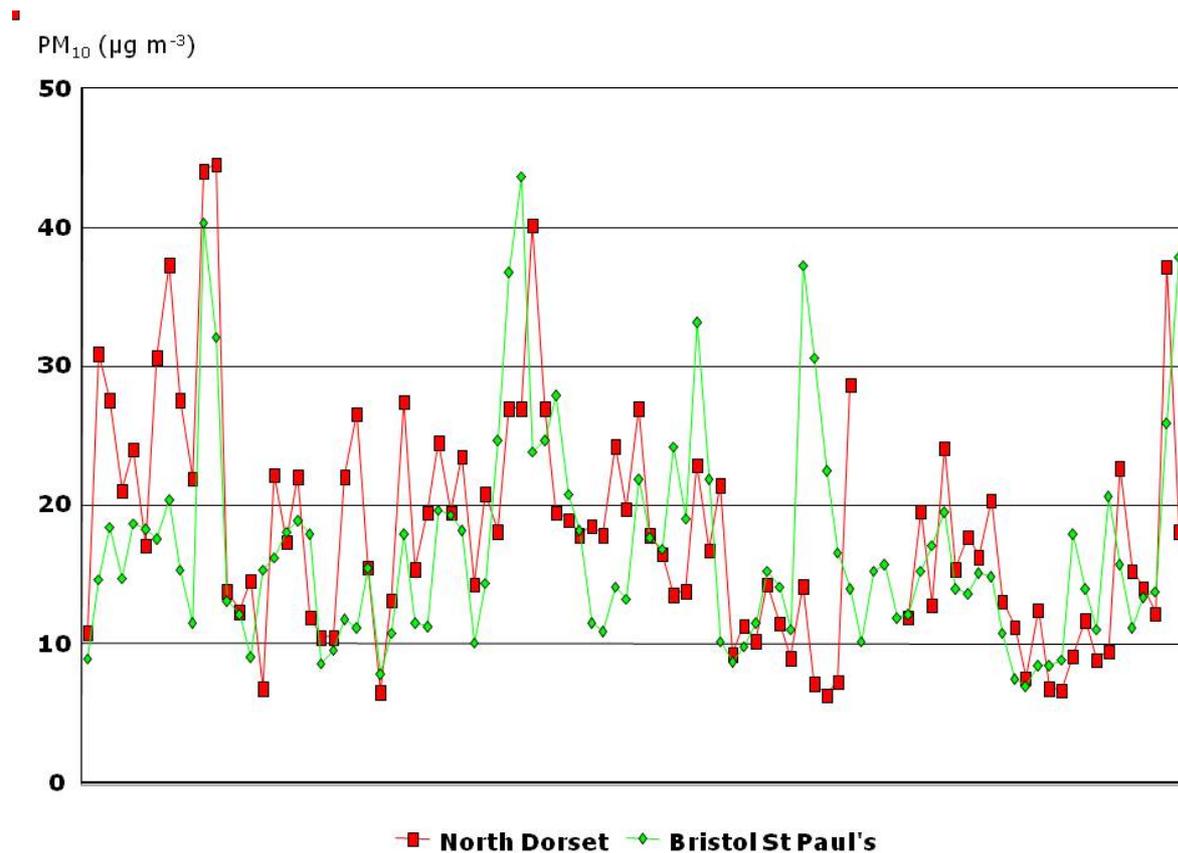


Figure 3 Daily average concentrations of PM₁₀ East Down Farm and Bristol St Paul's, September to December 2009.

- 3.6 Although the concentrations of PM₁₀ recorded at East Down Farm by the OSIRIS were somewhat higher than might be expected at a rural site and it is reasonable to suggest that this might be a consequence of the monitoring methodology Figures 2 and 3 show that the trend in daily average concentrations matched those at the other sites considered here sufficiently well for the data to be considered "fit for purpose".
- 3.7 It is important to link the air quality measurements with meteorological measurements, especially wind direction and speed. As it has proved impossible to trace any local measurements of these parameters data has been obtained from the Swansea City Council Air Quality Data website for the Cwm Park 30m weather mast using the data for 10m wind speed and direction. It is fully appreciated that these data can only be indicative but they do provide some useful information in this analysis.
- 3.8 Figures 4 shows the wind directions for the complete period and Figure 5 shows the average concentrations of PM₁₀ for each

octant for the period. The overall distribution of wind directions is typical of the UK in general with a predominance of winds from the South West/West. Figure 5, however, shows that higher concentrations of PM₁₀ are associated with winds from North East through East to South. Provided the wind direction data can be considered to be representative this suggests that there is some contribution from the poultry farm to PM₁₀ measured at the residential properties. The contribution from the southerly direction cannot be overlooked and, as this area is predominantly agricultural, it would seem that these activities are also contributing the overall PM₁₀ at the monitoring site. North Dorset Council confirmed that there was agricultural activity that may have resulted in the generation of airborne particulate matter during part of the monitoring period.

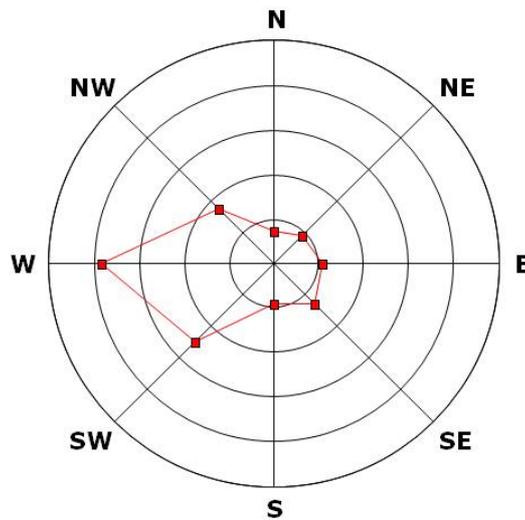


Figure 4 Swansea wind directions, September to December 2009.

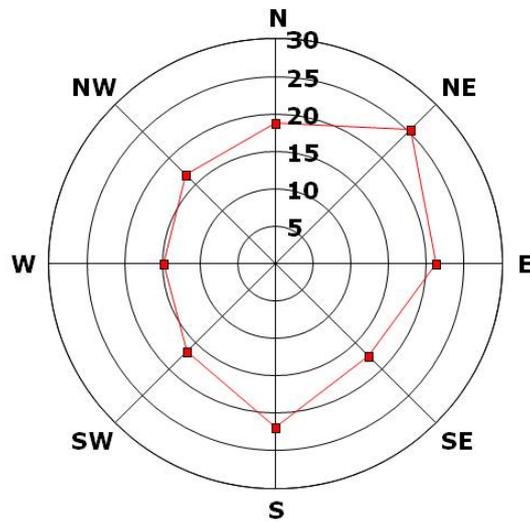


Figure 5 East Down Farm PM₁₀ and wind direction, September to December 2009.

3.9 In addition to the analysis of wind direction data and concentrations of PM₁₀ the comparable data for wind speed and PM₁₀ have been examined. With the possible exception of the few occasions when the wind speed recorded at Swansea was in excess of 7 ms⁻¹ which related to an average concentration of 27 µg m⁻³ of PM₁₀ there were no meaningful conclusions that could be drawn from this comparison.

3.10 Reference has already been made to the slightly higher concentrations of PM₁₀ recorded in the early period of monitoring. Examination of the Swansea wind direction for this period shows that the wind was predominantly from the North/North East (Figure 6) and a pollution rose for PM₁₀ (Figure 7) shows that a substantial proportion of the PM₁₀ measured during that period originated from the direction of the poultry farm. There was, however, also a noticeable contribution from the South East/South which, assuming the wind direction are reasonably reliable, suggests a contribution from the agricultural activities referred to earlier.

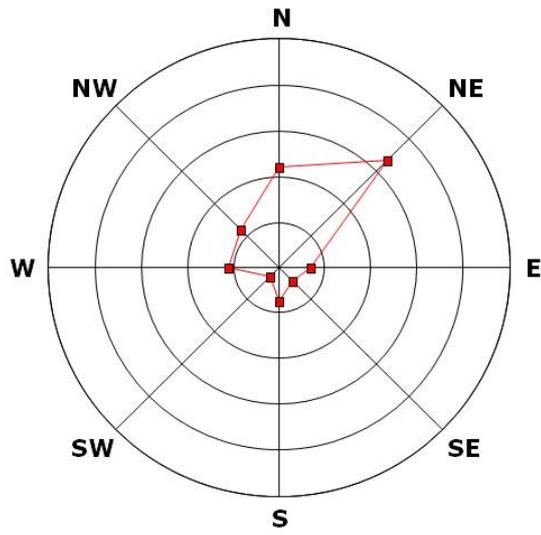


Figure 6 Swansea wind directions, 8 to 16 September 2009.

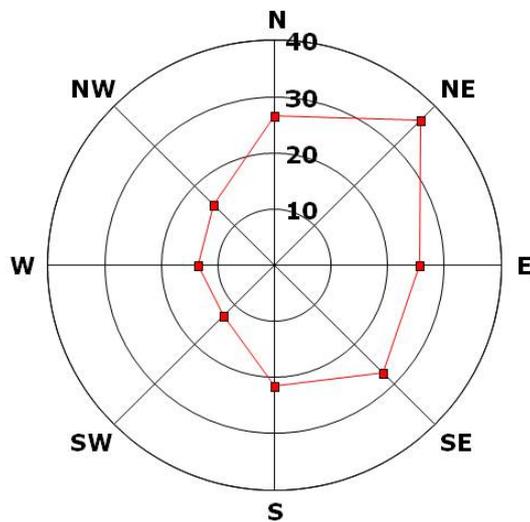


Figure 7 East Down Farm PM₁₀ and wind direction, 8 to 16 September 2009.

3.11 The final piece of analysis undertaken was an examination of the ratios of concentrations of PM_{2.5} to those of PM₁₀ where data were available. The results of this are given in Table 2.

Site	PM _{2.5} :PM ₁₀ concentration ratio
East Down Farm	0.52
Bristol St Pauls	0.57
Harwell	0.40
Portsmouth	0.29
Plymouth	0.49

Table 2 PM_{2.5}:PM₁₀ concentration ratios.

3.12 This shows that there was a higher proportion of PM_{2.5} in the total PM₁₀ at East Down Farm than at the rural Harwell site whereas there was little to differentiate it from Bristol St Pauls or Plymouth. The ratio at Portsmouth is abnormally low suggesting, especially when taken with the markedly higher average concentration of PM₁₀ at this site, that there was localized activity, possibly construction work, nearby resulting in generation of PM₁₀ rather than PM_{2.5} and reducing the value of comparison with this site.

3.13 Overall it is felt that the closest comparison that can be made with the East Down Farm site is Bristol St Pauls despite the different natures of the locations. Data from the NAQIA show that the annual average and 90th percentile concentrations for those years for which valid datasets are available are as given in Table 3.

Year	Annual average ($\mu\text{g m}^{-3}$)	90 th percentile ($\mu\text{g m}^{-3}$)
2008	20	37
2009	19	30

Table 3 Annual average and 90th percentile concentrations of PM₁₀, Bristol St Pauls 2008 and 2009.

3.14 Taking these figures as a baseline, and based on the methodology given in TG(09), it appears reasonable to assume that the annual average concentration of PM₁₀ at East Down Farm is highly unlikely to be in excess of 25 $\mu\text{g m}^{-3}$ and is more probably in the range 20 to 22 $\mu\text{g m}^{-3}$. Although it is more debatable to draw similar conclusions about the 90th percentile concentrations it again seems reasonable to assume that the values for East Down Farm would be similar to those given in Table 3. In both cases this would mean that there is no likelihood of the Air Quality Objectives for PM₁₀ being exceeded at East Down Farm.

3.15

4. Conclusions and recommendations.

- 4.1 It is unlikely that the Air Quality Objectives for PM₁₀ will be exceeded at East Down Farm.
- 4.2 In view of this there is no need for the declaration of an Air Quality Management Area in this locality.
- 4.3 As this investigation has shown that the poultry farm does appear to contribute to local concentrations of PM₁₀ it is recommended that activities at this establishment are kept under review and, assuming there is no change in the Technical Guidance, further assessment be considered if there is any substantial increase in the capacity of East Down Farm.

5. References.

Defra, Part IV of the Environment Act 1995, Local Air Quality Management Technical Guidance LAQM, TG(09), 2009.

North Dorset District Council, Local Air Quality Updating and Screening Assessment, 2009.