Detailed Assessment for PM_{10}

Executive Summary

The Government and the Devolved Administrations have adopted two Air Quality Objectives for fine particles (PM_{10}), which are equivalent to the EU Stage 1 limit values in the first Air Quality Daughter Directive. The objectives are 40 µg/m^3 as the annual mean, and 50 µg/m^3 as the fixed 24-hour mean to be exceeded on no more than 35 days per year, both to be achieved by the end of 2004.

Where a screening assessment has indicated that there is a risk of the Air Quality Objectives not being achieved by 2004, then the authority will need to carry out a Detailed Assessment.

Continuous monitoring results at one site in Breckland showed that in 2002 there had been 43 exceedences of the daily mean, and in 2003 there had been 45. Based on these results, Breckland Council proposed that a detailed assessment of PM_{10} should be made.

This Detailed Assessment concludes that the exceedences of the 24 hour mean are attributable to the wind erosion of the light sandy soils of the Breckland area and that it is not appropriate for local action such as the declaration of an Air Quality Management Area.

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The Detailed Assessment for PM_{10}

1.0 Introduction

1.1 The Government and the Devolved Administrations have adopted two Air Quality Objectives for fine particles (PM_{10}), which are equivalent to the EU Stage 1 limit values in the first Air Quality Daughter Directive. The objectives are 40 µg/m^3 as the annual mean, and 50 µg/m^3 as the fixed 24-hour mean to be exceeded on no more than 35 days per year, both to be achieved by the end of 2004. Stage 2 limit values led to the setting of further objectives for 2010 and are 20 µg/m^3 as the annual mean, and 50 µg/m^3 as the fixed 24-hour mean to be exceeded on no more than 7 days per year, both to be achieved by the end of 2010 (Defra 2003). The objectives are based upon measurements carried out using the European gravimetric transfer reference sampler or equivalent. Appendix 1 is a table of the standard and objectives for all pollutants.

1.2 Where the screening assessment has indicated that there is a risk of the Air Quality Objectives not being achieved by 2004, then the authority will need to carry out a Detailed Assessment. Authorities in England, Wales and Northern Ireland are also encouraged to carry out a Detailed Assessment against the provisional 2010 objectives, if the screening assessment has indicated a risk of exceedence.

1.3 In 2003 in the Breckland Council area, modelling of PM_{10} for the Updating and Screening Assessment, using background concentrations supplied by the UK National Air Quality Information Archive, showed that there was very little likelihood of exceedence of the air quality standard for PM_{10} in 2004 or 2010 for industrial or traffic sources (Breckland Council 2003).

1.4 However, continuous monitoring results at one site showed that in 2002 there had been 43 exceedences of the daily mean, and that there was a likelihood of an exceedence of the annual mean for 2010 and the daily mean for 2004 and 2010. This site is in an area surrounded by arable land where there are no significant contributions of PM_{10} indicated by modelling using the Design Manual for Roads and Bridges or emissions monitoring from local industry.

1.5 Based on these results, Breckland Council proposed that a detailed assessment of PM_{10} should be made.

2.0 Previous research relevant to the Detailed Assessment

2.1 This Detailed Assessment (DA) will not attempt to summarise the vast amount of literature produced on particles and PM_{10}. The science underlying the setting of the standards and objectives are not discussed, neither are the implications for human health and the environment. Instead it outlines the few documents and reports with specific relevance to this DA.

2.2 Local Air Quality Management: Technical Guidance (LAQM.TG(03) is the main source of guidance for local authorities on the Air Quality Management function. The document sets out the approximate contributions to PM_{10} concentrations. This states that a significant proportion of current annual mean PM_{10} is derived from regional (including long distance transport from Europe) background sources. It goes on to state that where exceedences are predicted that local authorities are advised to focus their efforts on the identification of the contribution of local sources to overall PM_{10} concentrations. However local sources are presumed to be from transport, industry or power generation, none of which are relevant to the area of study.

2.3 APEG (1999) informs that PM_{10} is comprised of three main components:

Primary particulates: predominantly soot from combustion processes – e.g. traffic and industry from local sources.

Secondary particulates: formed through chemical reactions in the atmosphere, mainly from emissions of sulphur dioxide, nitrogen dioxide and ammonia. These can be transported over great distances.

Coarse particulates: mostly dust (both man-made and 'natural') but also including sea-salt, pollen, fungal spores and other biogenic material. Again these may also be transported from distant sources.

2.4 In a study of particulates carried out for seven Norfolk local authorities, Chatterton (2000) set out that around 20-30% of PM_{10} in rural and background locations, such as the monitoring station at East Wretham, is made up of secondary particulates though this can increase massively under certain meteorological conditions. Modelling work for the study indicated that over 50% of PM_{10} in Norfolk (even more in rural locations) may be comprised of coarse particulates. Coarse particles have also generally been seen to be outside the control of local regulators due to their 'natural' component.

2.5 Chatterton (2000) and LAQM TG(03) both state that national and European initiatives to reduce pollutants like nitrogen dioxide and sulphur dioxide will also help to lower levels of primary particulates within the eastern region and will also decrease the quantities of secondary particles formed in the atmosphere and transported elsewhere. Chatterton concluded that control of the coarse fraction may be necessary to meet future air quality objectives.

2.6 LAQM TG(03) states that the regional (including distant) sources of natural origins are likely to add 1-3 ug/m3 to the annual mean. Natural origins include soil and the report for DEFRA (2003a) entitled *A Long Term Policy Perspective for Sustainable Agriculture: Environmental Impacts,* set out in Appendix 2 to that report, that “the soil in the eastern part of the region, the low-lying fens, is mainly of excellent quality for agriculture (Grade 1). Soils are developed in marine silt or deep peat. However, the peaty fen soils have wasted over time through oxidation following their drainage and conversion to crop production. As a result the peat continues to shrink and suffer erosion, which threatens the land quality. ……. Parts of the region have light soils, for

example the sands of the Brecks and the peats of the Fens. This makes them susceptible to wind erosion."

3.0 Monitoring in Breckland.

3.1 Breckland Council has been carrying out air quality monitoring for nitrogen and sulphur dioxides using passive diffusion tubes located across the district, and also continuous monitoring of PM_{10}, oxides of nitrogen, ozone and meteorological conditions at East Wretham in Norfolk for 6 years. The site was originally selected for its proximity to a poultry litter fired power station operated by Fibrothet. Fibrothet part funded the equipment and Breckland Council produced reports of the results obtained. Figure 1 shows the location of the monitoring site.

3.2 In a period spanning 18 months before the power station was commissioned and the first 2 years of operation, monitoring results showed that there was no significant increase in any of the atmospheric pollutants measured. In fact in a comparison of the periods before and after operation commenced, the results for oxides of nitrogen showed a decrease in the measured concentration.

3.3 Breckland Council monitors PM_{10} continuously at a site in East Wretham using an Eberline ß-attenuation instrument. The instrument was fitted with a heated inlet in 1998 to dry the sampled air because moisture was leading to elevated readings. This means that the instrument was interpreting moisture as particulate matter. The instrument is serviced annually by Unicam Chromatography and calibrated every 12 months as required by the manaufacturer. Such ß-attenuation instruments are set out in LAQM TG(03) as being appropriate for providing information for a detailed assessment.

3.4 The site where the monitoring equipment is located is owned by The Norfolk Wildlife Trust and designated as a Site of Special Scientific Interest (SSSI). The area comprises 143 ha of heath land, meres and woodland surrounded by arable land. The site is 5km north east of Thetford, Grid Reference TF 913 887 (OS Landranger 144). Figure 2 shows pictures of the monitoring enclosure and the surrounding arable land.

3.5 The monitoring station is situated as shown in Figure 2. The nearest receptor within approximately 20 metres of the monitoring point is one domestic property, the other receptors, also residential properties, are approximately 400 - 600 metres distant (see Figure 1). In addition to this, although they may not be exposed for the 24 hour period of the air quality objective, public access to the site allows visits that may last for several hours because the site is a popular site for bird-watchers and walkers. Within a radius of 400m - 2km of the monitoring station there are approximately10 duck units and associated manager's living accommodation, a pet food factory and arable farming on light sandy soil (Figure 1).

4.0 Monitoring Results

4.1 The recommended methods for making measurements of PM_{10} for Detailed Assessments are gravimetric monitoring or automatic fixed-point monitors, such as TEOM, and ß-attenuation instruments. Gravimetric monitors produce concentrations equivalent to that of the EU reference samplers and can be directly compared with the objectives. Measurements of PM_{10} concentrations carried out using a TEOM or ß-attenuation instrument, operating with a heated manifold, should be adjusted by multiplying the data by 1.3 to estimate gravimetric equivalent concentrations (LAQM TG(03)).

4.2 PM_{10} results from the East Wretham site for 2002 were adjusted to reflect the heated inlet on the instrument, i.e. the results were multiplied by 1.3 to account for loss of volatile PM_{10} due to heating. The objective for PM_{10}, to be achieved by the end of 2004, is 50 $\mu g/m^3$ as the fixed 24-hour mean to be exceeded on no more than 35 days per year. In 2002, there were 42 days when this was exceeded, although the annual mean was 28 $\mu g/m^3$. Using the method set out in LAQM TG(03) boxes 8.6 and 8.7, the annual mean PM_{10} concentrations were projected for 2004 at 27.2 $\mu g/m^3$ and for 2007 at 24.27 $\mu g/m^3$.

4.3 In April 2003, based on the results for 2002, the decision was made that a Detailed Assessment for PM_{10} was required. The results for 2003 have since been examined and it was found that there were 45 days on which the 24-hour mean was exceeded.

5.0 Considerations Underlying the Detailed Assessment for Breckland Council

5.1 LAQM TG(03) sets out that the aim of a Detailed Assessment is to determine with reasonable certainty whether or not there is a likelihood of the objectives not being achieved. The assumptions within a Detailed Assessment should be considered in depth, and the data that are used or collected, quality-assured to a high standard. This is to allow the authority to have confidence in the decision that it reaches to declare, not declare, or revoke an Air Quality Management Area. Where a likely exceedence of the objectives is identified, then the authority will also need to determine the magnitude and geographical extent.

5.2 LAQM TG(03) goes on to state that "In undertaking the Detailed Assessment it is important to give consideration to the points of maximum relevant public exposure (i.e. those locations where the highest concentrations of PM_{10} are expected). It is essential that authorities take these potential 'hot spots' into consideration within their review and assessment.

5.2.1 • Ideally, sampling should be carried out for a full calendar year (particularly in respect of the 24-hour objective), with 90% data capture, and any gaps spread evenly throughout the year".

5.3 In the guidance set out in LAQM TG(03) for PM_{10} it is assumed that the main sources will be industrial or transport related and from a particular location or from an uncontrolled source. These can be further classified as arising from a point source such as an industrial stack, a line source such as a road, or a fugitive or uncontrolled source such as quarrying operations, landfill sites materials handling or major construction work. Due to the uncertainties associated with PM_{10} emission rates from uncontrolled and fugitive sources, it is likely that the Detailed Assessment will need to focus upon a detailed monitoring programme.

5.4 Whilst emissions data are available for a variety of fugitive sources, for example those published within the *Compilation of Air Pollution Emission Factors (USEPA-42)*, these factors are subject to a variable degree of uncertainty, and frequently require default assumptions to be made. Their principal application lies in allowing predictions to be made for the impact of operations which are currently not in existence, or which are expected to undergo significant change by 2004 or 2010. If applicable, guidance on emissions data and dispersion models may be sought from the relevant Emissions and Modelling Helpdesks.

5.5 It is suggested in LAQM TG(03) that in many cases a suitable monitoring programme will need to be established to determine the impact of these uncontrolled sources and the following points should be borne in mind:

5.5.1 • Monitoring should be undertaken at relevant locations. Consideration should be given to the siting of dust-emitting processes and their position in relation to these locations.

5.5.2 • Monitoring should focus upon those relevant locations where exposure to dust emissions is likely to be highest (for example, downwind from the source based on the prevailing wind direction).

5.5.3 • Ideally monitoring should be carried out for a period of at least 12 months. Where this is not possible, it is recommended that measurements should be carried out over the summer months, when wind-blown re-suspension is likely to be highest.

5.5.4 • In all cases, authorities are advised to compare the results of local monitoring programmes with data from national network sites, to assist with the interpretation of findings.

5.6 Where monitoring indicates that the objectives are likely to be exceeded, then it may be helpful to refine the monitoring strategy, in order to more clearly identify the source contributions. In such cases, authorities may find it useful to:

5.6.1 Undertake monitoring of wind speed and direction to assist with the interpretation of results and any reported exceedences.

5.6.2 Carry out monitoring at several locations, including an upwind site. This will allow a more accurate assessment of the source emission contribution to the measured data. Alternatively, 'directional' monitoring equipment (which allows measurements to be collected only within a pre-defined wind direction) can be employed.

5.6.3 Consider the use of various speciation and chemical analysis methods, once again to assess the source emission contribution to the measured data.

6.0 QA/QC of automatic monitoring data

6.1 The overall uncertainty of a given measurement is calculated from a summation of individual uncertainties for the monitoring method. For an automatic monitoring method these include:

6.1.1 • Precision of the analyser.

6.1.2 • Linearity errors of the analyser.

6.1.3 • Uncertainty of the gas standards.

6.1.4 • Stability of the output signal.

These points are included in the technical data sheet for the instrument in Appendix 2.

6.2 In order to minimise measurement uncertainty it is important to apply stringent QA/QC procedures to monitoring programmes such as those laid down for the UK automatic monitoring networks.

• *24-hour mean* – A 24-hour mean is the mean concentration for the preceding 24-hours. If the 24-hour mean is calculated from hourly means then at least 18 valid hourly means are required to produce a valid 24-hour mean.

7.0 Monitoring data considerations

7.1 Section 5.2 above sets out some considerations for a monitoring programme the first of which is that there should be at least 90% data capture.

7.2 Section 6.2 sets out that for a 24 hour mean based on a set of hourly means, there should be at least 18 out of 24 hourly results.

7.3 The data used for this assessment has at least a 90% capture rate and each 24 hour mean is based on no fewer than 20 hourly means.

7.4 Section 5.5 sets out that the monitoring programmes should ensure that all relevant locations are included, that these are the points of highest exposure and the programme should ideally cover a 12 month period. Comparisons should also be made with data from the national network.

7.5 All modelling results in previous air quality assessments have indicated that there are no likely exceedences of PM_{10} at road sides or from industrial sources in Breckland. It is because the monitoring site was initially selected due to its position with respect to the power station that any monitoring is actually carried out at this location. There was no previous reason to believe that an exceedence of the objectives was likely.

7.6 Monitoring has been carried out for longer than 12 months and the results were compared to those of Norwich City Council for the same period. These are discussed below.

7.7 The instrument is maintained and calibrated in accordance with the manufacturers requirements and meets those of LAQM TG(03).

8.0 Consideration of local sources of PM_{10}

8.1 It was thought that there may be point sources of PM_{10} that had been dismissed in previous assessments, but that should be reconsidered. The first of these was a group of 10 duck units totalling approximately 60 sheds, marked on Figure 1, which are owned by Kerry Foods Limited. The Barbary ducks are kept in enclosed sheds sited on concrete bases. Clearing of the sheds takes two days for each shed, and one of the ten sheds at each unit is cleaned out every two weeks. Cleaning out involves shovelling out the litter, which is wet, and then hosing the concrete floors with water and disinfectant. During occupation the litter is very wet and there were no signs of dust in the vicinity.

8.2 South Norfolk District Council is carrying out a Detailed Assessment for PM_{10} for poultry sheds. The poultry in this instance are chickens, which are raised in different conditions to ducks. Chickens do not like wet conditions, and the cleaning out of chicken sheds does give rise to dust from the dry litter in sufficient quantities to cause complaints from residents.

8.3 If the duck units were making a significant contribution to the exceedences it would be expected that they would occur throughout the year and exhibit some pattern. Of the 45 exceedences occurring in 2003, there were none in January, May, October, November or December. A message was next circulated on the local authority intranet “EHCNet” asking for any cases where ducks had led to complaints of dust. No incidences were reported. Thus a decision was made not to investigate the duck units any further at this time.

8.4 The other possible source is Doane Pet Care Limited. The company operate a pet food factory nearby which is permitted in accordance with the Pollution Prevention and Control Act 1999 and all atmospheric emissions are filtered and monitored. All emissions of total particulates in excess of 50mg/m^3 are

reported. There is no requirement to report PM_{10} and so the fraction of total particulates which is PM_{10} is not known. There were no exceedences for particulates reported in 2003. Prevailing winds for this part of the country are south westerly, however the wind must be in a north easterly direction to blow towards the monitoring site and this is not a very frequent direction.

8.5 The process at the factory operates thus: grains are delivered in tankers, ground, mixed with a ground meat slurry, and then extruded into biscuit form, cooled and bagged. The process gives rise to visible water vapour from the coolers and monitoring indicates that emissions are very low in particulates, in the region of 2-20mg/m^3. Theoretically, this is sufficient to give rise to exceedences, but previous monitoring has not indicated that this process contributes to episodes of PM_{10} (Breckland Council 2003).

9.0 Monitoring Data and Results

9.1 Results are presented at the end of the text in the order of; a list of the dates of exceedences and notes of activity on the site; hourly results for PM_{10}, wind speed and wind direction; wind roses; graphs of the data compared with Norwich City centre data for the same periods; one month of data from East Cambridgeshire PM_{10} monitoring; and a report on the analysis of filter papers from the Eberline instrument.

9.2 This detailed assessment draws on the results from 2003 and these are first listed as the dates on which there were exceedences of the 24 hr mean and then presented in tabular format for the months in which there were exceedences of the 24hr mean for PM_{10}. In November 2003 the air quality monitoring enclosure was moved approximately 20 metres north east to allow a new building to be erected at the site. A bonfire lit to burn old fence posts and assorted vegetation prior to the building work commencing explains one of the three exceedences. This was on 30 September. The first two, on 16 July and 11 August, were on days when weed spraying was being carried out. Not all weed spraying led to exceedences.

9.3 For each month the hourly results for PM_{10} are followed by the hourly results for windspeed (in metres per second) and the hourly results for wind direction (in degrees, where 0^o = North). On all three sheets the days on which there were exceedences of the 24hr mean for PM_{10} have been underlined and emboldened for ease of viewing. For the PM_{10} sheets the 1.3 TEOM adjustment has been added in a final column.

9.4 The windroses are drawn for each day on which there was an exceedence of the 24 hour mean. These windroses show the percentage of the time that the wind was blowing from a particular direction. Plotted on this is the concentration of PM10 for each wind direction. The wider the line, the greater the concentration of PM_{10} and the longer the line, the higher the percentage of time that the wind was in that direction. This is followed by two windroses that show the wind direction and PM_{10} and the wind speed for all of 2003. Although wind speeds were typically between 1 and 4 metres per second (approximately 1-9 miles per hour) when there were exceedences, there does not appear to be any association between high – or low - windpeeeds and high PM_{10} during these periods.

9.5 The prevailing wind direction at East Wretham is southwesterly. This can be seen in the first wind rose. It appears that some of the highest concentrations of PM_{10} were sustained while the wind was blowing from the east and that the predominant wind direction when there were exceedences was easterly. The second wind rose shows that easterly winds are generally lighter than the

prevailing southwesterly. Easterly winds generally carry less rain, but figures for rain fall in 2003 were not reliable as the rain gauge was faulty for several months (the electrical connection to the data logger was damaged). The first wind rose shows that PM_{10} can occur in high concentrations when the wind is any direction.

9.6 The results for days where the 24hr mean was exceeded for PM_{10} was next plotted as line graphs. Corresponding results were obtained for the same hourly periods from the national air quality archive for Norwich City Centre and plotted with those for East Wretham to assess whether the exceedences were affecting a larger area. The two lines follow each other reasonably closely, although the statistical correlation between the two data sets can be seen below to be fairly weak to moderate (the correlation coefficient (r) falls within the range of r = 0.201 – 0.777). This might be explained by a possible slight time lag between the two data sets. Norwich concentrations appear to be generally slightly lower than those at East Wretham. However the lines diverge significantly during exceedences at East Wretham. This would suggest that there is some local influence on the concentrations.

Month	Correlation coefficient
Jan	r = 0.307
Feb	r = 0.752
Mar	r = 0.541
Apr	r = 0.777
May	r = 0.305
Jun	r = 0.201
Jul	r = 0.241
Aug	r = 0.577
Sep	r = 0.228
Oct	r = 0.321
Nov	r = 0.669
Dec	r = 0.647

Table 9.1 Correlations coefficients for comparison of Norwich East Wretham data

9.7 It was thought that local combustion sources may be contributing to the exceedences and for this reason, where the data permitted, figures for oxides of nitrogen (NOx) were included where available in the graphs. It can be seen that these do not follow the exceedences, even on the one occasion when a bonfire was lit near to the monitoring station (30 September).

9.8 Next are the results for April 2003 from East Wretham and from Wicken Fen. Wicken Fen is a National Nature Reserve and very rural. The Wicken Fen data was supplied by East Cambridgeshire Council which has an identical instrument serviced by the same company as the Breckland Council instrument. The days on which the 24hr mean was exceeded for PM_{10} in Breckland were underlined and emboldened on both sets of results.

9.9 Wicken Fen is approximately 40 miles south west of East Wretham. The instruments used to measure PM_{10} are identical and supported by the same company. The similarities in results are quite striking with almost all the exceedences being on the same days. This might suggest that similar local environmental and meteorological conditions prevail and lead to exceedences, or that there is some source of PM_{10} upwind of both sites that leads to exceedences.

9.10 Finally there is a report on a study carried out for Breckland Council in 1998. Several sections of the glass fibre filter paper from the PM10 monitor was sent for analysis to AEA Technology. The sections were chosen to include

days when the particulate results were high in order to ascertain the source of the particulates.

9.11 The analysis showed that the particles on the filter were composed primarily of iron, chromium, nickel, silica and chlorine. This is consistent with soil. The soil chemistry pages on the web site of the University of Waterloo Canada (2003) gives the following information, presented below in tables 9.2 and 9.3, on the general elemental composition of soils.

Element	**Percentage of earths crust**
Silicon	27.7
Aluminium	8.1
Iron	5.0
Magnesium	2.1
Calcium	3.6
Potassium	2.6
Manganese	0.1
Phosphorus	0.1

Table 9.2 Percentage of various elements in earth's crust

Trace elements	**Parts per million**
Chlorine	130.0
Zinc	70.0
Copper	55.0
Cobalt	25.0
Nitrogen	20.0
Boron	10.0
Molybdenum	1.5

Table 9.3 Parts per million of various trace elements in earth's crust

10.0 Discussion

10.1 In summary, the results obtained from monitoring, comparisons with other local authorities' monitoring data, chemical analysis, and observation, suggest that while the East Wretham and Norwich City PM_{10} measurements appear to follow similar trends and experience similar concentrations, there is a local source of PM_{10} that leads to exceedences of the daily mean at East Wretham, but not in Norwich City centre.

10.2 The monitoring is carried out in an area of light soils, much of which is put to spring sown potatoes and wheat. This leaves the soil frequently heaped into ridges and exposed from the autumn harvest in August – September, to the development of crop cover in March – April. Robinson and Blackman (1989) reported that in short period erosive events in East Anglia, that soil loss can reach as much $250m^3$ per ha, and that the East Anglian Fens and Brecks are particularly susceptible. This supports the data obtained from both East Wretham and Wicken Fen.

10.3 A report on soil erosion by wind on light soils in Europe was presented to the EU Commission in 2000 (Warren 2000). One of the areas studied was Barnham in Suffolk, which is only 10km SSW of East Wretham Heath. Soil erosion is recognised as being severe and there is mention of "sand clouds" dating back to 1669. The soils are similar to those at East Wretham, as are the agricultural practices and cropping. The report also mentions that potato farmers often practice de-stoning of the soil, which further destroys the soil structure and increases erosion.

10.4 One month of monitoring data from Wicken Fen showed that the exceedences measured there were on the same days at those measured at East Wretham. Both sites are in rural locations and have similar environmental conditions, therefore it is thought that this points to the most likely source of the exceedences of PM_{10} as wind blown soil.

10.5 Defra (2004) have produced a draft soil action plan which outlines the actions to be taken to protect all soils, and recognises the importance of protective measures for arable land to prevent further erosion. If the action plan is successful and applied in these areas, then the future erosion of such soils should be reduced. However this council believes that the exceedences of the 24hr mean for PM_{10} experienced at East Wretham may be a potential problem for other areas of the UK that has been hitherto unrecognised due to the lack of rural monitoring.

11.0 Conclusion

11.1 Appendix 3 sets out a list of the points to be included in a Detailed Assessment and which will be used to assess the Detailed assessment by University of West of England. Not all of the criteria are relevant, i.e. there has been no modelling of PM10, all the conclusions are based on actual measured results.

11.2 There is a requirement to declare an Air Quality Management Area (AQMA) in situations where a Detailed Assessment indicates that there are actual exceedences (LAQM TG(03). It is also recommended that the extent of the area affected is determined. **However, in the light of the above, Breckland Council does not intend to proceed to the declaration of an AQMA or undertake additional monitoring at this point.**

11.3 This is because it is believed that the PM_{10} exceedences arise from wind blown soils, and while much of this is thought to be very local – approximately

1-10 km, it is likely that there is a more regional contribution. Further analysis of the PM_{10} on the filters is unlikely to be able to identify the precise source of the soils, and is thus not felt to be appropriate.

11.4 The nature of the source would make it very difficult, if not impossible, to define the boundaries of an AQMA. However, even if it were possible, an Action Plan, which is required to be produced within 12 months of the declaration of an AQMA, could not prevent further soil erosion giving rise to future exceedences.

11.5 It is of great concern however, that because the objective is health based, that Breckland residents living in rural areas may be exposed to levels of PM_{10} that frequently exceed the Air Quality Objective and which are detrimental to their health.

11.6 Breckland Council will continue monitoring PM_{10} at East Wretham, repeat the analysis of the filer paper to enable a comparison of the PM10 composition with the previous analysis, and will seek to obtain more results from Wicken Fen to determine whether the one month of data used in this DA is typical of the annual pattern of exceedences at each site. It should be mentioned that in 2004, results in the first quarter of the year show only approximately 3 exceedences of the 24 hr mean. If the results follow the same pattern as 2003, there are unlikely to be more than the permissible number. It is important to continue monitoring to determine this.

11.7 Guidance to local authorities (LAQM TG(03) only considers assessment for exceedences of PM_{10} which arise from industry and traffic. There is no mention of agriculture as a potential source. Further guidance is required on the health effects of PM_{10} from such sources, and whether local action is appropriate to control it. In the belief that such exceedences may be more widespread and not monitored, it is also suggested that more research is required to assess the extent of this issue and, if appropriate, to tie it in with the current national initiatives aimed at reducing soil erosion.

Appendix 1

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	**Measured as**	
Benzene	16.25 µg/m^3 (5 ppb)	Running Annual Mean	31 December 2003
1,3-Butadiene	2.25 µg/m^3 (1 ppb)	Running Annual Mean	31 December 2003
Carbon monoxide	10 mg/m^3 (8.6 ppm)	Running 8 Hour Mean	31 December 2003
Lead	0.5 µg/m^3	Annual Mean	31 December 2004
	0.25 µg/m^3	Annual Mean	31 December 2008
Nitrogen dioxide*	200 µg/m^3 (105 ppb) Not to be exceeded more than 18 times per year	1 Hour Mean	31 December 2005
	40 µg/m^3 (21 ppb)	Annual Mean	31 December 2005
Particles (PM_{10})	**50 µg/m^3** **Not to be exceeded more than 35 times per year**	**24 Hour Mean**	**31 December2004**
	40 µg/m^3	**Annual Mean**	**31 December 2004**
	50 µg/m^3 **Not to be exceeded more than 7 times per year**	**24 Hour Mean**	**31 December 2010**
	20 µg/m^3	**Annual Mean**	**31 December 2010**
Sulphur dioxide	350 µg/m^3 (132 ppb) Not to be exceeded more than 24 times per year	1 Hour Mean	31 December 2004
	125 µg/m^3 (47 ppb) Not to be exceeded more than 3 times per year	24 Hour Mean	31 December 2004
	266 µg/m^3 (100 ppb) Not to be exceeded more than 35 times per year	15 Minute Mean	31 December 2005

APPENDIX 2

TECHNICAL DATA SHEET
EBERLINE FH 62 I-R

Device name: Continuous Particulate Monitor FH 62 I-R
Model:FH 62 I-R Beta Gauge - Real Time Mass Concentration (Air flow = 1 m³/h)
Measuring principle: Direct mass collection and simultaneous measurement during sampling by a two-beam compensation method and single filter-spot position (no step-wise response with pre-selected time and range intervals).
Type of basic output function: *Integral function* mass over time (Continuously observed)
Measuring range: 0 to 5000 µg/m³ and 0 to 10000 µg/m³
Minimum detectable limit:
typ. 4 µg/m³ (measured values) typ. 3 µg/m³ (1/2 hour average)
typ. 2 µg/m³ (3 hour average) typ. 0,5 µg/m³ (24 hour average)
Resolution: 1 µg/m³
Accuracy: 1 µg/m³ (24 h)
Measurement cycles: - no cycles
Continuous observation of the increasing dust mass **during** sampling on one filter spot (no step-wise operation; no disadvantages from frequency methods). The time of full load of filter in which one single filter spot remains in the same position is at an ambient concentration of e.g. 50 µg/m³ = 30 h (1 m³/h)
Filtering system: glass fibre filter type GF 10 One roll (width 40 mm; length: 42 m) is good for approx. one year stand alone running
Source: Krypton-85 ; 1.85 GBq (= 50 mCi); special safety source
Output signals: Two analog channels 0 4 20 mA or 0 2 10 V for concentration and mass over time (without potential free separation)
Optional output signal: Potential-free separation for two current-loops.
Printer/computer interface: two V24/RS 232 C serial interfaces (COM1 and COM2)
Total mass averaging with scanning time: 1 sec.
Long term averaging: 30 min ; 1 h ; 3 h ; 24 h; averages on LCD and COM outputs.
Air flow rate: directly 1 m³/h through filterspot measured with internal pressure drop orifice (no loss of particles due to flow splitter)
Flow rate regulation: internal (PI-type)
Stability of flow rate: ± 1 % with RPM - regulated pump
Operating temperature: -10 °C ... +50°C
Sample relative humidity: 0 - 100 % (no condensation)
Pump type: RPM regulated rotary vane pump with carbon dry rotor
Time between calibration checks and maintenance: 12 month (if used as specified) = one year stand alone operation without any service
Type of calibration checks: set with 2 mica foils = very easy real mass calibration (used in more than 50 air quality networks worldwide)
Consumable materials per year:
1 set carbon vanes for the pump 1-2 filter tapes = **very low costs**
Sampling head (inlets):
PM_{10} (1 m³/h) inhalable particulate 10 µm
Preseparation cyclone 5 µm median fine dust at workplace PM 2,5 ; PM 1.0
Fully microprocessor-controlled
two unindependent serial RS232 interfaces
Auto calculation, one year data storage of 1/2 h averages with RAM expansion option
Built-in diagnostics self tests
Status signals:
Operating status:
filter change, zero adjustment mass, zero adjustment concentration, maintenance, calibration free, power on
Error status:
filter break, memory-error, offset, "balance", air flow rate, sampling tube heater.
Warning status:
Immission value 1 and 2, offset out of range, age of source > 10 years, test pin deviation
Power supply: 100 V to 240 V; 50 to 60 Hz ± 10 %

Appendix 3

ASSESSMENT FOR	Traffic		Industry		Domestic		Fugitive / Aircraft	

Assessment criteria	Refer to
Monitoring	Section Number
• Has new monitoring been carried out?	4.3
• Have appropriate monitoring methods been used?	3.3, 4.1
• Has appropriate qa/qc been used?	6.1, 6.2, 7.7
• Have data been adjusted to gravimetric equivalent?	9.3
• Was data capture sufficient?	7.3
• Have the monitoring locations been adequately described?	Figures 1 and 2 3.2, 3.5
• Have appropriate (worst-case) locations been used?	N/A
• Was monitoring carried out for a suitable time period?	3.3
• Have short period data been adjusted appropriately?	N/A
• Has monitoring identified exceedences?	Yes: data sheets
• Are the results what would be expected from experience?	Yes : 1.4
Modelling	
• Has appropriate modelling been carried out?	N/A
• Has background been properly added?	N/A
• Have appropriate source data been used?	N/A
• Have verification and adjustment been carried out?	N/A
• Has modelling identified exceedences?	N/A
General	
• Have combined sources been considered?	2.1-2.6, 8.1-8.5
• Has exposure been considered?	3.5
• Have exceedence areas been fully defined?	N/A
• Does the decision to declare or not declare an AQMA appear to be soundly based?	Breckland Council believes so

Checklist for Detailed Assessment of PM_{10}. Taken from the University of West of England - Air Quality Consultants

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