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TECHNICAL REPORT

BASELINE PM_{10} MONITORING AT CARRANSTOWN, CO. MEATH

FOR

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Our reference: EC/02/1398AR03
Date: 28 March 2002

EXECUTIVE SUMMARY

AWN Consulting has carried out a detailed baseline assessment of PM_{10} levels over a three-month period at a roadside location in Carranstown, Co. Meath. Ambient PM_{10} concentrations were measured for three months (December 2001 – March 2002) over successive 24-hour periods using a sequential air sampler. This report details the results obtained and compares them with the relevant EU Limit Values.

The 24-hour PM_{10} concentrations measured over the three-month period are generally significantly below the 24-hour EU limit value of 50 $\mu g/m^3$ which is applicable in 2005. Three exceedances of the 24-hour limit value were recorded over the three months of this monitoring campaign. However, the 24-hour limit value is expressed as a 90.1th%ile, which means the 36th highest value measured over a full year is compared to the limit value. Since only three exceedances were recorded over the 84 days of this monitoring survey (equivalent to the 96.4th%ile), it is unlikely that 35 exceedances would occur over 365 days at the current location.

The average PM_{10} concentration measured over the three month period is 18 $\mu g/m^3$ which is only 45% of the EU annual limit value of 40 $\mu g/m^3$. The PM_{10} levels measured at Carranstown are similar to those measured by Dublin City Council at the Phoenix Park in Dublin (an urban background location).

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1.0 INTRODUCTION

AWN Consulting was requested by Indaver Ireland to perform a detailed baseline assessment for PM_{10} (particulate matter <10μm) at a roadside location in Carranstown, Co. Meath. Ambient PM_{10} concentrations were measured for three months (December 2001 – March 2002) over successive 24-hour periods using a sequential air sampler. The daily results and the average concentration over the three month monitoring period are compared with the relevant 24-hour and annual limit values set by the European Union. In addition, the daily results are compared with wind speed data from Dublin Airport.

2.0 METHODOLOGY

The PM_{10} monitoring program, using a PM_{10} continuous monitor, focused on assessing 24-hour average concentrations over a three-month at a monitoring station located close to the R152 approximately 3.5 km north-east of Duleek (see Figure 1). PM_{10} sampling was carried out by means of an R&P Partisol®-Plus Sequential Air Sampler (Model 2025). The sampler is a manual air sampling platform which has been designed to meet US EPA Reference Designation (RFPS-1298-127). Approximately 24 m^3 of air was sampled daily through a size selective inlet, which removed particles with a diameter >10 μg. The remaining particles were collected on pre-weighed 47mm diameter filters. The Partisol® sampler was programmed to automatically replace each sampled filter by a new pre-weighed filter at midnight. This ensured that each filter represented a sampling period of exactly 24 hours. Gravimetric determination was carried out pre- and post-sampling at a NAMAS accredited laboratory. The gravimetric results allowed a calculation of the average PM_{10} concentration over each 24-hour period. The results, which are shown in Table 2, can be directly compared with the 24-hour limit value (which is set as a 90.1th%ile), and the three-month average can be indicatively compared with the annual limit value.

3.0 AMBIENT AIR QUALITY COMPLIANCE CRITERIA

EU Directive 1999/30/EC has set 24-hour and annual limit values for PM_{10} (see Table 1). A 24-hour limit of 50 μg/m^3 is set as a 90.1th%ile, which means it must not be exceeded more than 35 times per year. A margin of tolerance of 30% currently applies for this limit value, and this will reduce linearly to 0% by 2005. Thus the current 24-hour limit value is 65 μg/m^3. EU Directive 1999/30/EC has also set an annual limit value of 40 μg/m^3. However, a margin of tolerance of 12% currently applies, and this will also reduce linearly to 0% by 2005. In addition, an indicative limit value of 20 μg/m^3 may be applicable in 2010. However, this is to be reviewed in the light of further information on health and environmental effects, technical

feasibility and experience in the application of the current limit values in the EU Member States (see Table 1).

4.0 RESULTS AND DISCUSSION

Daily concentrations of PM_{10} measured using the sequential PM_{10} sampler are shown in Figure 2 and Table 2. The 24-hour PM_{10} concentrations measured over the three-month period are generally significantly below the 24-hour EU limit value of 50 $\mu g/m^3$ which is applicable in 2005.

Three exceedances of the 24-hour limit value were recorded over the three months of this monitoring campaign. However, the 24-hour limit value is expressed as a 90.1th%ile, which means the 36th highest value measured over a full year is compared to the limit value. Since only three exceedances were recorded over the 84 days of this monitoring survey, it is unlikely that 35 exceedances would occur over 365 days at the current location.

Average wind speed data measured by Met Eireann at Dublin Airport, which would be representative of conditions at Carranstown, are listed in Table 3 and are compared to the PM_{10} monitoring results in Figures 3 and 4. The data in Figures 3 and 4 indicate that the highest levels of PM_{10} measured at Carranstown generally correspond to days with calm winds. However, this relationship is not linear, since smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds, while fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. In addition, wind direction will also have an influence on the on-site PM_{10} concentrations.

The average PM_{10} concentration measured over the three-month period is 18 $\mu g/m^3$ which is only 45% of the EU annual limit value of 40 $\mu g/m^3$, which is applicable in 2005.

Average PM_{10} levels measured at Carranstown can be compared to results of monitoring carried out as part of the UK Air Quality Monitoring Network[1] at Lough Navar Lake, Co. Fermanagh (see Figure 5). The monitoring site at Lough Navar is defined as rural (i.e. distanced from population centres, roads and industrial areas). The annual average PM_{10} concentration recorded in both 2000 and 2001 was 10 $\mu g/m^3$. As expected the levels measured at the Carranstown monitoring station, which is a roadside location and is also in close proximity to an industrial facility, are generally higher than the average levels measured at Lough Navar. The results measured at Carranstown can also be compared to levels measured by Dublin City Council at the Phoenix Park in Dublin[2]. The monitoring site at the Phoenix Park is defined as urban background (i.e. an urban location distanced from sources and broadly representative of city-wide background concentrations). Annual average

PM_{10} levels at the Phoenix Park are around 16 $\mu g/m^3$ which are similar to those measured at Carranstown.

REFERENCES

(1) UK Air Quality Monitoring Archive (2001) http://www.aeat.co.uk/netcen/airqual/
(2) Dublin Corporation (2000) Air Monitoring Report 1999

FIGURE 1

Map Detailing Location of PM_{10} Monitoring Station

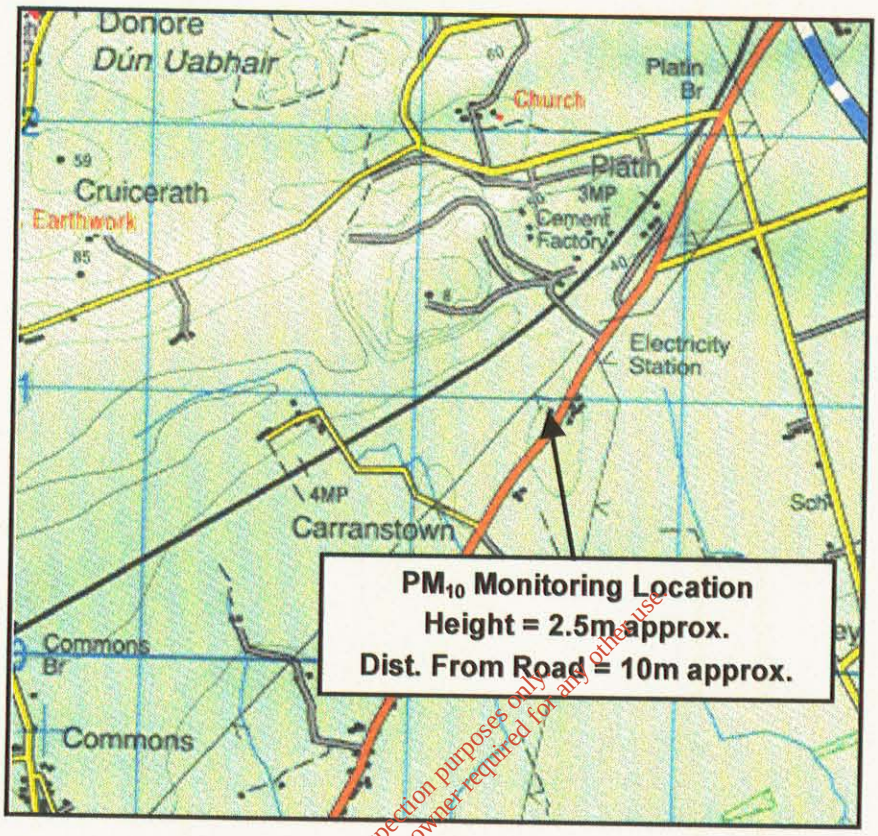


FIGURE 2

PM_{10} Monitoring Results at Carranstown, Co. Meath (December 2001 – March 2002)

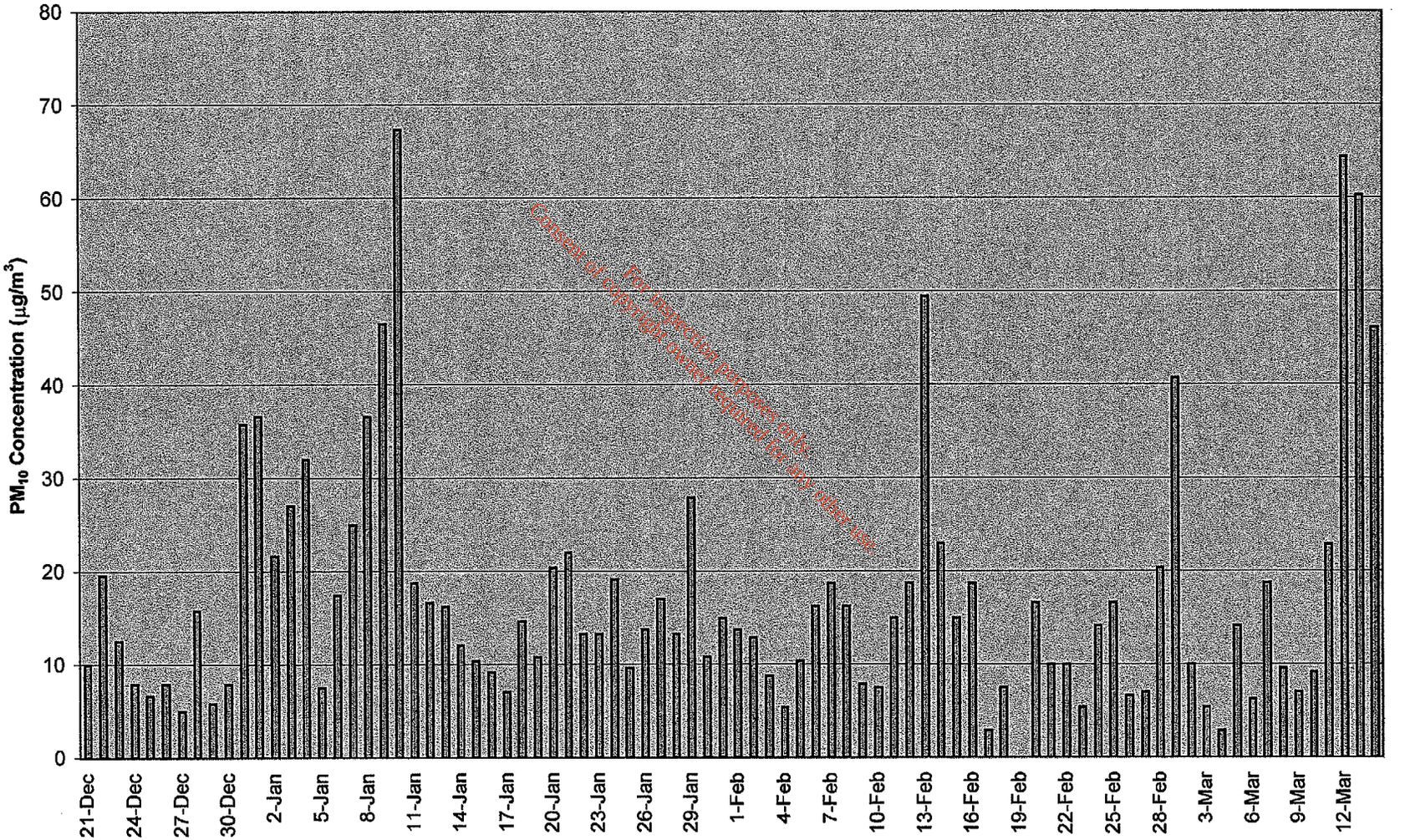


FIGURE 3

Comparison of PM_{10} Monitoring Results With Available Data for Average Daily Wind Speed from Dublin Airport (December 21st 2001 – January 31st 2002)

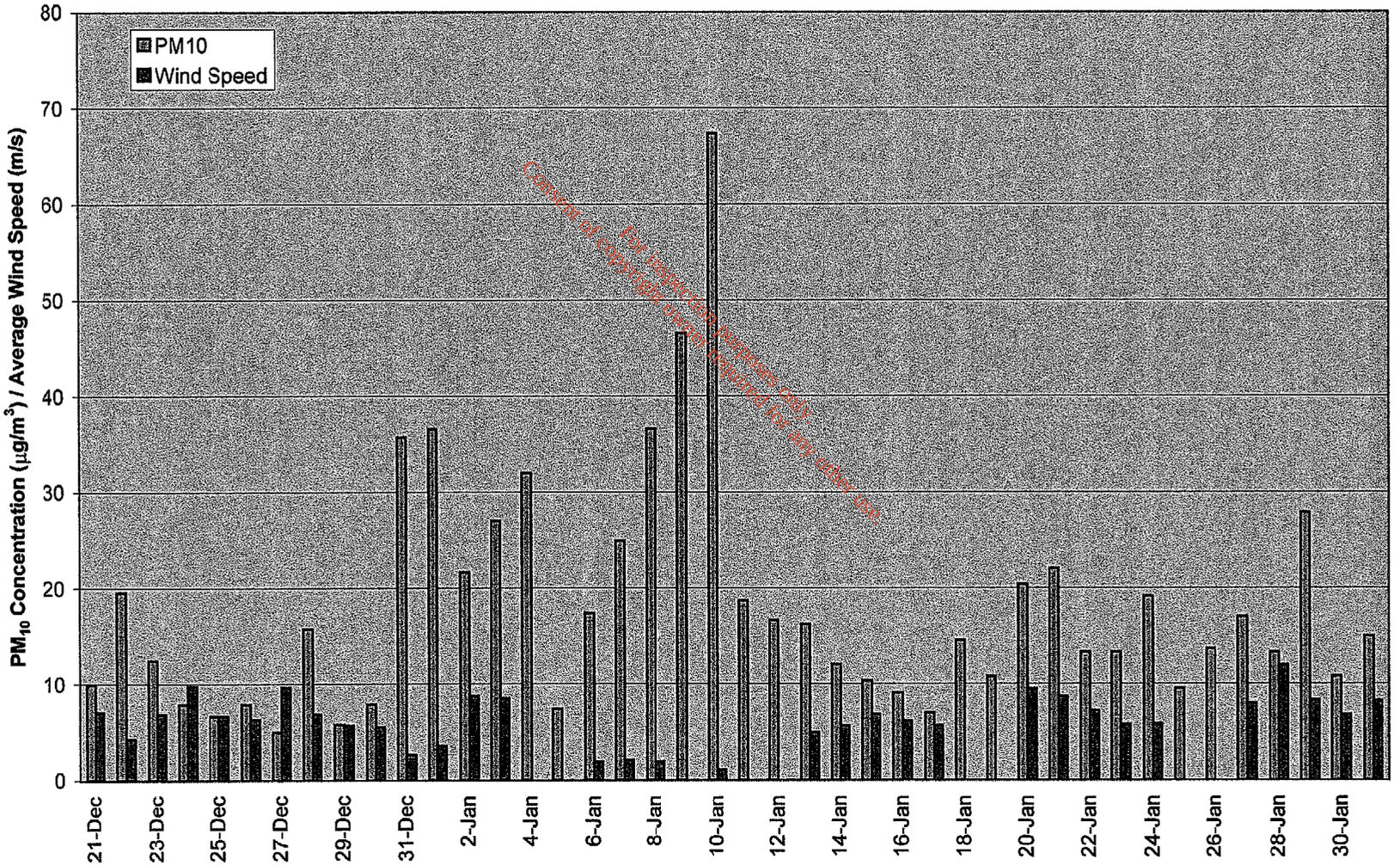


FIGURE 4

Comparison of PM_{10} Monitoring Results With Available Data for Average Daily Wind Speed from Dublin Airport (February 1st 2002 – March 14th 2002)

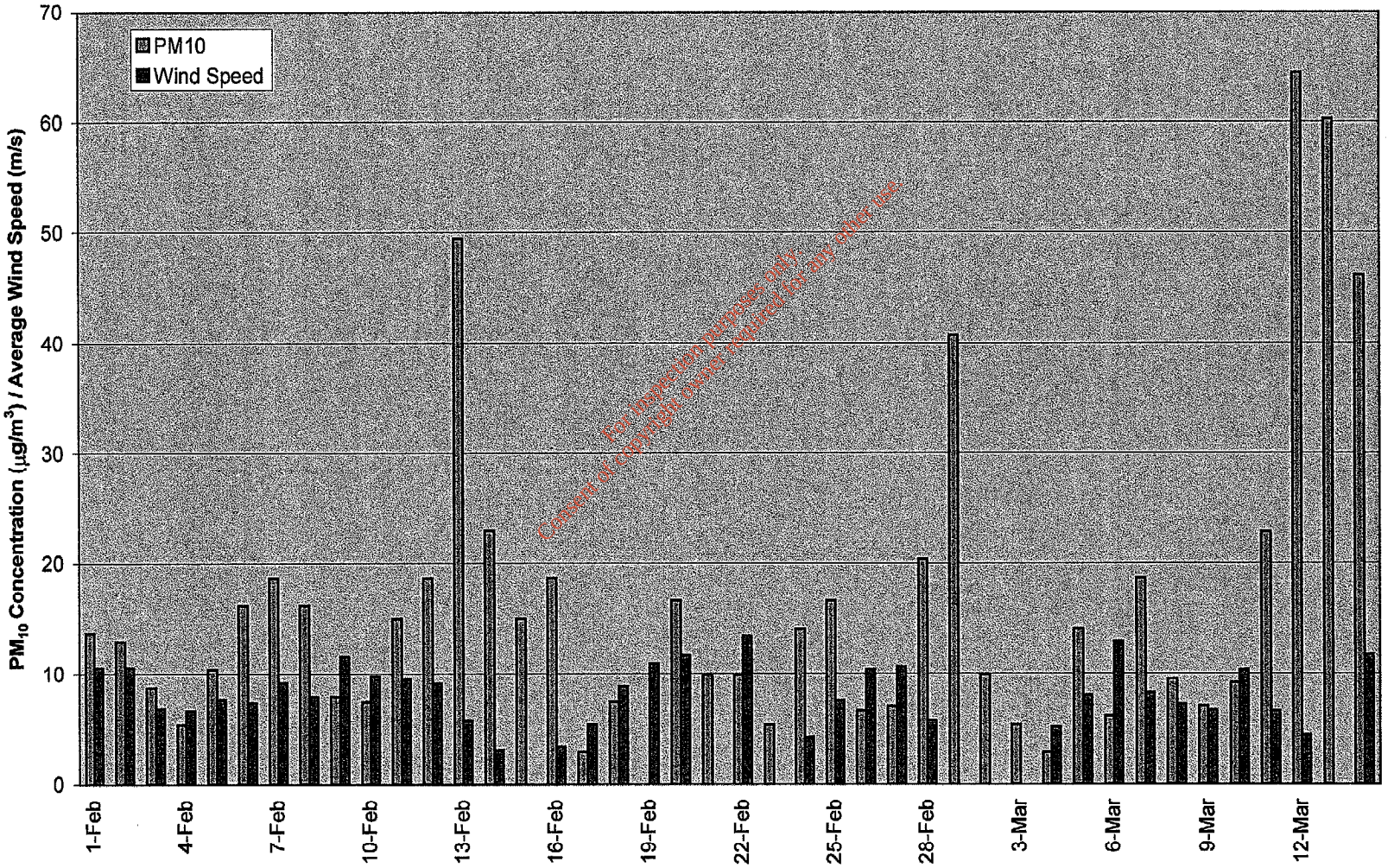
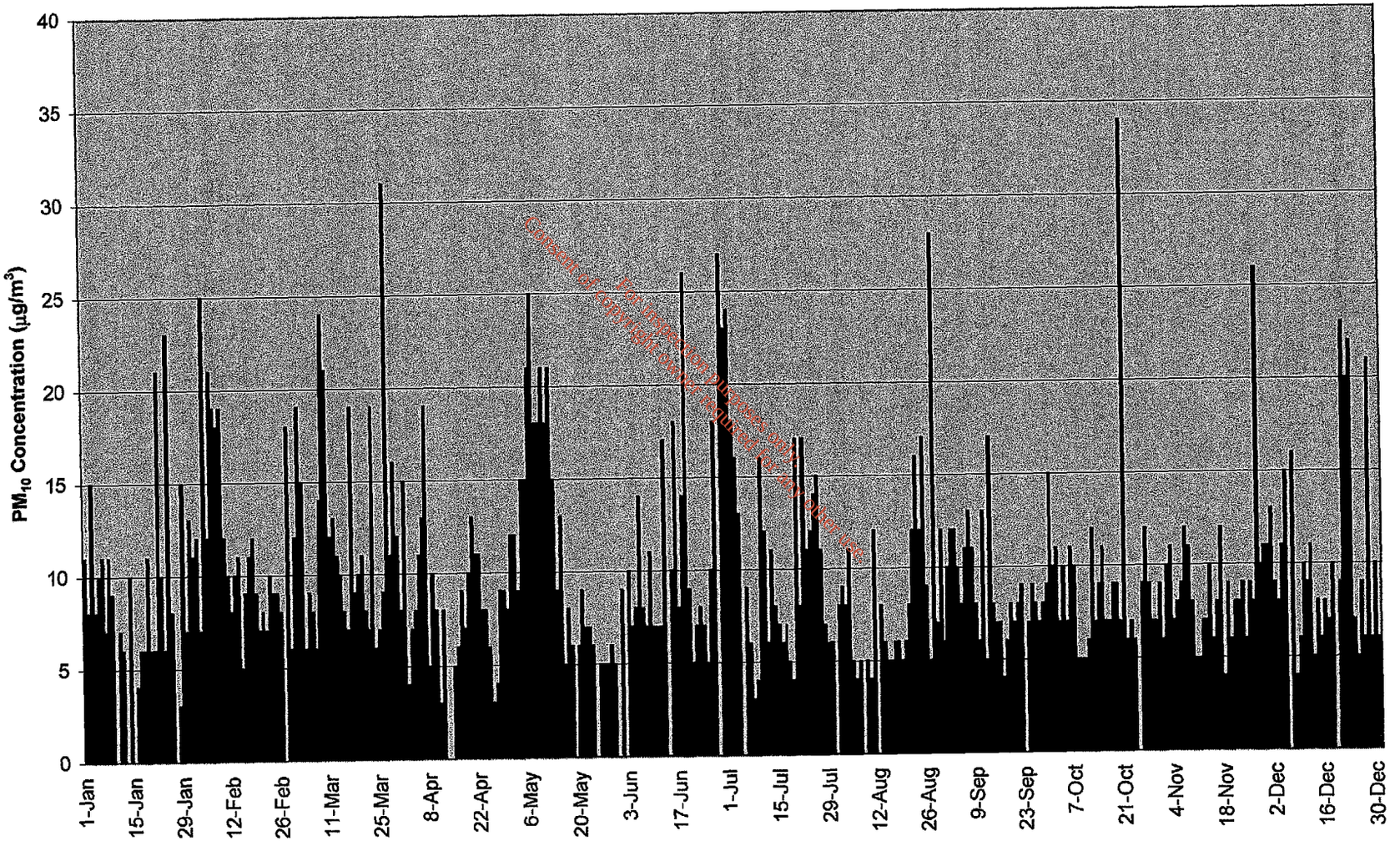


FIGURE 5

PM_{10} Monitoring Results at Lough Navar Forest, Co. Fermanagh in 2000



Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Particulate Matter Stage 1	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50% until 2001 reducing linearly to 0% by 2005	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	20% until 2001 reducing linearly to 0% by 2005	40 $\mu g/m^3$ PM_{10}
Particulate Matter Stage 2(1)	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 7 times/year	To be derived from data and to be equivalent to Stage 1 limit value	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	50% until 2005 reducing linearly to 0% by 2010	20 $\mu g/m^3$ PM_{10}

(1) Indicative limit values to be reviewed in the light of further information on health and environmental effects, technical feasibility and experience in the application of Stage 1 limit values in the Member States

Table 1 EU Ambient Air Standard - Council Directive 1999/30/EC

Sampling Date	PM_{10} ($\mu g/m^3$)	Sampling Date	PM_{10} ($\mu g/m^3$)	Sampling Date	PM_{10} ($\mu g/m^3$)
21-Dec-01	10	18-Jan-02	15	15-Feb-02	15
22-Dec-01	20	19-Jan-02	11	16-Feb-02	19
23-Dec-01	12	20-Jan-02	20	17-Feb-02	3
24-Dec-01	8	21-Jan-02	22	18-Feb-02	7
25-Dec-01	7	22-Jan-02	13	19-Feb-02	(1)
26-Dec-01	8	23-Jan-02	13	20-Feb-02	17
27-Dec-01	5	24-Jan-02	19	21-Feb-02	10
28-Dec-01	16	25-Jan-02	10	22-Feb-02	10
29-Dec-01	6	26-Jan-02	14	23-Feb-02	5
30-Dec-01	8	27-Jan-02	17	24-Feb-02	14
31-Dec-01	36	28-Jan-02	13	25-Feb-02	17
01-Jan-02	37	29-Jan-02	28	26-Feb-02	7
02-Jan-02	22	30-Jan-02	11	27-Feb-02	7
03-Jan-02	27	31-Jan-02	15	28-Feb-02	20
04-Jan-02	32	01-Feb-02	14	01-Mar-02	41
05-Jan-02	7	02-Feb-02	13	02-Mar-02	10
06-Jan-02	17	03-Feb-02	9	03-Mar-02	5
07-Jan-02	25	04-Feb-02	5	04-Mar-02	3
08-Jan-02	37	05-Feb-02	10	05-Mar-02	14
09-Jan-02	47	06-Feb-02	16	06-Mar-02	6
10-Jan-02	67	07-Feb-02	19	07-Mar-02	19
11-Jan-02	19	08-Feb-02	16	08-Mar-02	10
12-Jan-02	17	09-Feb-02	8	09-Mar-02	7
13-Jan-02	16	10-Feb-02	7	10-Mar-02	9
14-Jan-02	12	11-Feb-02	15	11-Mar-02	23
15-Jan-02	10	12-Feb-02	19	12-Mar-02	64
16-Jan-02	9	13-Feb-02	49	13-Mar-02	60
17-Jan-02	7	14-Feb-02	23	14-Mar-02	46
Average			18		
No. Exceedances of 24-hour Limit Value			3		
Limit Values			$40^{(2)}$, $50^{(3)}$		

(1) Filter damaged post sampling.
(2) EU Council Directive 1999/30/EC - Limit value to be enforced in 2005 (as an annual average).
(3) EU Council Directive 1999/30/EC - Limit value to be enforced in 2005 (as a 90.1th percentile of 24 hour averages).

Table 2 Results of PM_{10} monitoring carried out at a roadside location in Carranstown, Co. Meath.

Sampling Date	Wind Speed (m/s)[1]	Sampling Date	Wind Speed (m/s)[2]	Sampling Date	Wind Speed (m/s)[1]
21-Dec-01	13.9	18-Jan-02	n.a.	15-Feb-02	n.a.
22-Dec-01	8.3	19-Jan-02	n.a.	16-Feb-02	n.a.
23-Dec-01	13.4	20-Jan-02	9.5	17-Feb-02	3.4
24-Dec-01	19.0	21-Jan-02	8.7	18-Feb-02	5.4
25-Dec-01	13.0	22-Jan-02	7.3	19-Feb-02	8.8
26-Dec-01	12.3	23-Jan-02	5.8	20-Feb-02	11.0
27-Dec-01	18.8	24-Jan-02	5.9	21-Feb-02	11.7
28-Dec-01	13.4	25-Jan-02	n.a.	22-Feb-02	n.a.
29-Dec-01	11.1	26-Jan-02	n.a.	23-Feb-02	13.4
30-Dec-01	10.7	27-Jan-02	8.0	24-Feb-02	n.a.
31-Dec-01	5.2	28-Jan-02	12.0	25-Feb-02	4.2
01-Jan-02	6.9	29-Jan-02	8.3	26-Feb-02	7.6
02-Jan-02	17.0	30-Jan-02	6.8	27-Feb-02	10.4
03-Jan-02	16.6	31-Jan-02	8.2	28-Feb-02	10.6
04-Jan-02	n.a.	01-Feb-02	10.5	01-Mar-02	5.8
05-Jan-02	n.a.	02-Feb-02	10.5	02-Mar-02	n.a.
06-Jan-02	3.8	03-Feb-02	6.8	03-Mar-02	n.a.
07-Jan-02	4.1	04-Feb-02	6.7	04-Mar-02	n.a.
08-Jan-02	3.8	05-Feb-02	7.7	05-Mar-02	5.2
09-Jan-02	n.a.	06-Feb-02	7.4	06-Mar-02	8.1
10-Jan-02	2.1	07-Feb-02	9.2	07-Mar-02	12.9
11-Jan-02	n.a.	08-Feb-02	7.9	08-Mar-02	8.3
12-Jan-02	n.a.	09-Feb-02	11.6	09-Mar-02	7.2
13-Jan-02	9.6	10-Feb-02	9.8	10-Mar-02	6.7
14-Jan-02	11.0	11-Feb-02	9.5	11-Mar-02	10.3
15-Jan-02	13.3	12-Feb-02	9.1	12-Mar-02	6.6
16-Jan-02	12.0	13-Feb-02	5.7	13-Mar-02	4.4
17-Jan-02	6.0	14-Feb-02	3.1	14-Mar-02	n.a.

(1) Meteorological data recorded by Met Eireann at Dublin Airport (n.a. signifies data not currently available).

Table 3 Wind speed data recorded as daily averages between January 21st 2001 and March 14th 2002.