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**REPORT NO. 00414
MEASUREMENT OF
TOTAL PARTICULATE AND
VOC EMISSIONS
AT
VIP - HEINKE
HUNTINGDON
AUGUST 2000**

Client: VIP - HEINKE.
St Peter's Road
Huntingdon
Cambs.
PE18 7DJ

For the attention of: Mr D Rees

Dates of Field Work: 14,15 & 16 August 2000

Date of Report: 25 August, 2000

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1 INTRODUCTION

At the request of Mr D Rees, various stack emissions were monitored for compliance with EPA requirements, i.e. for compliance with requirements of Process Guidance Note PG6/28 - Rubber Processes.

2 METHODOLOGY UTILISED

2.1 Total Particulate Matter - Stack emissions

The emissions from the exhaust stacks were measured by means of isokinetic sampling, carried out according to the main procedural requirements of BS 3405:1983 as specified in Secretary of State's Guidance Note PG6/28(92) - Rubber Processes.

Wherever possible the procedure followed was as follows. Prior to carrying out the isokinetic sampling it was necessary to establish the airflow and temperature profiles along two sampling lines across the stack.

The airflow profile was established by two six-point traverses arranged at right angles across the stack using a pitot static tube connected to a manometer.

The temperature profile was similarly measured using a digital K-Type thermometer.

All measurements were taken in a straight section of the discharge duct away from any obstructions that might cause disturbances in the airflow pattern etc.

The girth of the stack was measured and the internal diameter of the stack was calculated. The volume air flow was calculated from the velocity measurements obtained above.

Once the airflow and temperature profiles had been established as suitable for isokinetic sampling, the air velocities were then measured at a further four positions located at the centres of four equal areas as required by BS 3405: 1983.

A sample was then taken at each of these four locations by drawing air through a suitably sized nozzle, conforming to the requirements of BS 3405: 1983, and collecting the particulate matter on a pre-weighed glass fibre filter (Whatman GF/A); the flow rates being adjusted to provide isokinetic sampling to match the air velocities already determined at each of these locations in the stack.

This procedure was then repeated to obtain a duplicate sample of the emissions.

After sampling the exposed filters were transported back to the laboratory and allowed to equilibrate for a period of 24 hours to allow time for evaporation of any adsorbed moisture before being re-weighed.

The total particulate matter in the emissions was then calculated from the results obtained.

On some of the stacks the skew pattern of the airflow within the duct made it impossible to obtain an accurate indication of the air velocity. It was found that the airflow was inclined in the region of 15-20° from the vertical indicating a swirling pattern of airflow within the duct. Therefore in these circumstances there was no alternative but to measure the airflow by angling the Pitot tube to the same extent followed by isokinetic sampling with the sampling probe similarly inclined.

2.2 Volatile Organic Compounds (VOC's)

A portable Flame Ionisation Detector (FID), Research Engineers - type GAS-TECH, was used to measure the VOC content of the emissions.

Before use the instrument had been calibrated using methane. The results were calculated using the appropriate response factor for the compound being measured as specified by the manufacturers of the instrument.

In the case of rubber fume, the results are expressed in terms of methane-equivalent as the composition of the fume is unknown.

3 RESULTS

3.1 The results of the various samples are given in the tables.

COMMENTS ON THE RESULTS

The limits set out for the emissions in PG6/28 are as follows:

Total Particulate Matter from the storage, handling or mixing of carbon black (applicable to stacks 43 & 44 only)	10 mg/m ³
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Total Particulate Matter other than from the storage, handling or mixing of carbon black	50 mg/m ³
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Volatile Organic Compounds (as total carbon excluding particulate matter)	50 mg/m ³
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All of the emissions measured were found to be well below the relevant limits in respect to Total Particulate Matter.

All of the rubber fume emissions were found to be well below the VOC emission limit.

On this occasion, whilst spraying lead circles, the spray booth emissions were found to be below the VOC limit; the concentrations being emitted were found to be in the range of 11 - 232 mg C/m³, with an average value of 42 mg C/m³.

However, when spraying the small metal parts which form the major part of the work on this post, the spray booth emissions were found to exceed the VOC limit; the concentrations being emitted were found to be in the range of 11 - 824 mg C/m³, with an average value of 194 mg C/m³.

Also, the emissions from the Mindon oven adjacent to the spray booth were found to exceed the VOC limit; the concentrations being emitted were found to be in the range of 11 - 419 mg C/m³, with an average value of 67 mg C/m³.

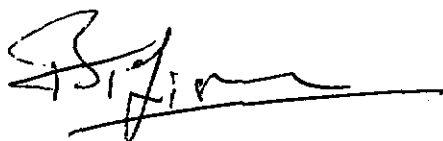
CONCLUSIONS

The results of the Total Particulate Matter measurements have shown that the emissions, from all of the nine stacks measured, comply with the current limits in respect of PG6/28.

On this occasion, the results from the 33 stacks measured for rubber fume VOC's have shown that all of these emissions comply with the current limits in respect of PG6/28.

However, the VOC emissions from the metal preparation posts were once again found to be in excess of the VOC limit whilst spraying the small metal parts. However, we were told that the Local Authority were prepared to allow this to continue as the total annual consumption of solvents is less than 5 tonnes/annum.

I would also repeat my recommendation from last year that a three metre duct extension should be re-fitted to stack 75 to comply with the requirements of PG6/28 and to allow better dispersion of the fumes and prevent any further re-entrainment into the workshop.



B T Fisher MSc, Dip Occ Hyg, MBIOH, ROH
Consultant Occupational Hygienist

TABLE 1A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 15.8.00

STACK No: 27

CIRCULAR DUCT

DUCT DIAMETER: 0.300 m

NUMBER OF POINTS IN TRAVERSE: 6

IN-DUCT TEMPERATURE: 29°C

ATMOSPHERIC PRESSURE: 101.6 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	10	10.4	9.4
2	41	11.0	9.8
3	96	10.8	9.5
4	204	8.2	6.8
5	260	7.5	5.5
6	290	7.5	4.9

RESULTS

AVERAGE VELOCITY 8.44m/s

AVERAGE FLOW 35.8 m³/min

TABLE 1B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 15.8.00

STACK No: 27

SAMPLING NOZZLE SIZE: 3.5 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
First Traverse		
45	11.0	6.4
225	7.5	4.3
Second Traverse		
45	10.0	5.8
225	5.5	3.2

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 60.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.36 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 60.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.18 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **0.27 mg/m³**

TABLE 2A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 15.8.00

STACK No: 25

CIRCULAR DUCT

DUCT DIAMETER: 0.300 m

NUMBER OF POINTS IN TRAVERSE: 6

IN-DUCT TEMPERATURE: 30°C

ATMOSPHERIC PRESSURE: 101.6 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	10	7.5	6.8
2	41	8.5	8.0
3	96	8.2	8.1
4	204	7.0	6.4
5	260	6.9	6.0
6	290	5.8	4.0

RESULTS

AVERAGE VELOCITY 6.93 m/s

AVERAGE FLOW 29.4 m³/min

TABLE 2B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 15.8.00

STACK No: 25

SAMPLING NOZZLE SIZE: 5.0 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
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First Traverse

45	8.5	10.0
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255	7.0	8.2
-----	-----	-----

Second Traverse

45	8.0	9.4
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255	6.0	7.1
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INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 109.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.60 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 108.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.50 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **0.55 mg/m³**

TABLE 3A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P
DATE: 14.8.00
STACK No: 40

CIRCULAR DUCT

DUCT DIAMETER: 0.300 m
NUMBER OF POINTS IN TRAVERSE: 6
IN-DUCT TEMPERATURE: 30°C
ATMOSPHERIC PRESSURE: 100.9 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	10	8.0	8.3
2	41	8.9	8.9
3	96	9.5	9.4
4	204	9.2	9.0
5	260	9.0	8.5
6	290	8.3	7.3

RESULTS

AVERAGE VELOCITY 8.69 m/s
AVERAGE FLOW 36.9 m³/min

TABLE 3B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 14.8.00

STACK No: 40

SAMPLING NOZZLE SIZE: 5.0 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
First Traverse		
45	9.0	10.6
255	9.0	10.6
Second Traverse		
45	9.0	10.6
255	8.5	10.0

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 128.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.60 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 128.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.59 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **0.60 mg/m³**

TABLE 4A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 14.8.00

STACK No: 43

CIRCULAR DUCT

DUCT DIAMETER: 0.525 m

NUMBER OF POINTS IN TRAVERSE: 6

IN-DUCT TEMPERATURE: 28°C

ATMOSPHERIC PRESSURE: 100.9 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	17	5.0	5.0
2	71	9.0	8.0
3	169	8.0	7.5
4	357	7.5	5.5
5	455	7.5	7.5
6	509	4.5	7.5

RESULTS

AVERAGE VELOCITY 6.88 m/s

AVERAGE FLOW 89.4 m³/min

TABLE 4B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 14.8.00

STACK No: 43

SAMPLING NOZZLE SIZE: 5.0 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
First Traverse		
79	9.0	10.6
447	7.5	8.8
Second Traverse		
79	8.0	9.4
447	7.5	8.8

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 118.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 2.04 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 112.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 1.76 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION 1.90 mg/m³

TABLE 5A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P
DATE: 14.8.00
STACK No: 8

CIRCULAR DUCT

DUCT DIAMETER: 0.500 m
NUMBER OF POINTS IN TRAVERSE: 6
IN-DUCT TEMPERATURE: 34°C
ATMOSPHERIC PRESSURE: 100.9 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	16	7.5	11.0
2	68	10.5	13.0
3	161	8.0	10.5
4	340	9.0	12.5
5	433	9.5	13.5
6	484	8.8	10.0

RESULTS

AVERAGE VELOCITY 10.3 m/s

AVERAGE FLOW 121.3 m³/min

TABLE 5B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 14.8.00

STACK No: 8

SAMPLING NOZZLE SIZE: 3.5 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
First Traverse		
75	10.5R	6.1
425	9.5L	5.5
Second Traverse		
75	13.0R	7.5
425	13.5L	7.8

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 83.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.26 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 83.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.39 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **0.33 mg/m³**

TABLE 6A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 14.8.00

STACK No: 28

CIRCULAR DUCT

DUCT DIAMETER: 0.320 m

NUMBER OF POINTS IN TRAVERSE: 6

IN-DUCT TEMPERATURE: 68°C

ATMOSPHERIC PRESSURE: 100.9 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	10	7.2	7.0
2	43	8.8	8.3
3	103	8.8	8.4
4	217	8.1	8.1
5	277	8.5	7.6
6	310	8.5	7.2

RESULTS

AVERAGE VELOCITY 8.04 m/s

AVERAGE FLOW 38.8 m³/min

TABLE 6B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 14.8.00

STACK No: 28

SAMPLING NOZZLE SIZE: 5.0 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
First Traverse		
48	9.0	10.6
272	8.5	10.0
Second Traverse		
48	8.0	9.4
272	7.5	8.8

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 118.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 3.53 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 118.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.92 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **2.23 mg/m³**

TABLE 7A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 15.8.00

STACK No: 12

CIRCULAR DUCT

DUCT DIAMETER: 0.380 m

NUMBER OF POINTS IN TRAVERSE: 6

IN-DUCT TEMPERATURE: 70°C

ATMOSPHERIC PRESSURE: 101.6 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	12	2.0	2.0
2	51	2.5	3.5
3	122	3.0	3.5
4	258	3.0	3.0
5	329	3.0	3.0
6	368	2.0	2.0

RESULTS

AVERAGE VELOCITY 2.71 m/s

AVERAGE FLOW 18.4 m³/min

TABLE 7B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 15.8.00

STACK No: 12

SAMPLING NOZZLE SIZE: 5.0 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
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First Traverse

57	2.5	2.9
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323	3.0	3.5
-----	-----	-----

Second Traverse

57	3.5	4.1
----	-----	-----

323	3.0	3.5
-----	-----	-----

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 49.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 2.43 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 44.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 4.73 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **3.58 mg/m³**

TABLE 8A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 16.8.00

STACK No: 44

CIRCULAR DUCT

DUCT DIAMETER: 0.460 m

NUMBER OF POINTS IN TRAVERSE: 6

IN-DUCT TEMPERATURE: 27°C

ATMOSPHERIC PRESSURE: 101.1 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	15	16.5	18.5
2	62	18.5	19.0
3	148	19.0	18.5
4	313	18.5	18.5
5	399	19.0	19.0
6	447	14.5	13.5

RESULTS

AVERAGE VELOCITY 17.8 m/s

AVERAGE FLOW 177 m³/min

TABLE 8B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 16.8.00

STACK No: 44

SAMPLING NOZZLE SIZE: 3.0 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
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First Traverse

69	18.5	7.8
----	------	-----

392	19.0	8.1
-----	------	-----

Second Traverse

69	19.0	8.1
----	------	-----

392	19.0	8.1
-----	------	-----

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 99.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.32 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 99.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.32 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **0.32 mg/m³**

TABLE 9A

PITOT STATIC TUBE MEASUREMENT RECORD

FACTORY NAME: V I P
DATE: 15.8.00
STACK No: 37

CIRCULAR DUCT

DUCT DIAMETER: 0.300 m
NUMBER OF POINTS IN TRAVERSE: 6
IN-DUCT TEMPERATURE: 27°C
ATMOSPHERIC PRESSURE: 101.6 kPa

VELOCITY MEASUREMENTS:

Location No	Location Position (mm)	First Traverse (m/s)	Second Traverse (m/s)
1	10	8.8	8.2
2	41	8.5	9.5
3	96	8.5	9.0
4	204	9.3	8.0
5	260	8.5	8.0
6	290	7.2	7.8

RESULTS

AVERAGE VELOCITY 8.44m/s

AVERAGE FLOW 35.8m³/min

TABLE 9B

TOTAL PARTICULATE MATTER MEASUREMENT RECORD

FACTORY NAME: V I P

DATE: 15.8.00

STACK No: 37

SAMPLING NOZZLE SIZE: 5.0 mm

LOCATION (mm)	VELOCITY (m/s)	SAMPLING RATE (l/m)
First Traverse		
45	8.5	10.0
255	8.5	10.0
Second Traverse		
45	9.5	11.1
255	8.0	9.4

INITIAL SAMPLE

TOTAL VOLUME SAMPLED: 125.0 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.44 mg/m³

DUPLICATE SAMPLE

TOTAL VOLUME SAMPLED: 125.5 Litres

TOTAL PARTICULATE CONCENTRATION
(REF. CONDITIONS): 0.53 mg/m³

AVERAGE TOTAL PARTICULATE CONCENTRATION **0.48 mg/m³**

TABLE 10

SUMMARY OF RESULTS (TOTAL PARTICULATE MATTER.)

(mg/m³)

<u>STACK No.</u>	<u>SAMPLE 1</u>	<u>SAMPLE 2</u>	<u>AVERAGE VALUE.</u>
27	0.36	0.18	0.27
25	0.60	0.50	0.55
40	0.60	0.59	0.60
43	2.04	1.76	1.90
8	0.26	0.39	0.33
28	3.53	0.92	2.23
12	2.43	4.73	3.58
44	0.32	0.32	0.32
37	0.44	0.53	0.48

Nb All results have been corrected to the standard reference conditions of 101.3 kPa and 273°K

TABLE 11**RUBBER FUME VOC RESULTS**

<u>STACK No</u>	<u>FID READING</u>	<u>VOC RESULT</u>
	<u>(ppm CH₄ Equivalent)</u>	<u>(mg C/m³)</u>
6	1	0.5
7	1	0.5
8	1	0.5
9	1	0.5
10	1	0.5
11	1	0.5
12	1	0.5
14	1	0.5
16	1	0.5
17	1	0.5
18	1	0.5
19	1	0.5
20	1	0.5
21	1	0.5
23	1	0.5
24	1	0.5
25	1	0.5
26	1	0.5
27	1	0.5
28	1	0.5
29	1	0.5
30	1	0.5
32	1	0.5
35	1	0.5
36	1	0.5
37	1	0.5
38	1	0.5
39	1	0.5
40	1	0.5
41	1	0.5
43	1	0.5
60	1	0.5
75	1	0.5

* based on methane equivalents as actual composition unknown

TABLE 12

VOC EMISSIONS FROM METAL PREPARATION DISCHARGES

SPRAY BOOTH

From a survey carried out in January 1999, the solvents being emitted from this spray booth were found to consist of a mixture of methyl isobutyl ketone, xylenes, and toluene. The stack temperature during the measurement was found to be 20°C.

Assuming the same composition for the solvent mixture and correcting to reference conditions, On this occasion, whilst spraying lead circles, the spray booth emissions were found to be below the VOC limit; the concentrations being emitted were found to be in the range of 11 - 232 mg C/m³, with an average value of 42 mg C/m³.

However, when spraying the small metal parts which form the major part of the work on this post, the spray booth emissions were found to exceed the VOC limit; the concentrations being emitted were found to be in the range of 11 - 824 mg C/m³, with an average value of 194 mg C/m³.

MINDEN OVEN

This was assumed to be emitting a similar mixture of solvents. The stack temperature during the measurement was found to be 38°C.

Corrected to reference conditions, the emissions from the Mindon oven adjacent to the spray booth were found to exceed the VOC limit; the concentrations being emitted were found to be in the range of 11 - 419 mg C/m³, with an average value of 67 mg C/m³.