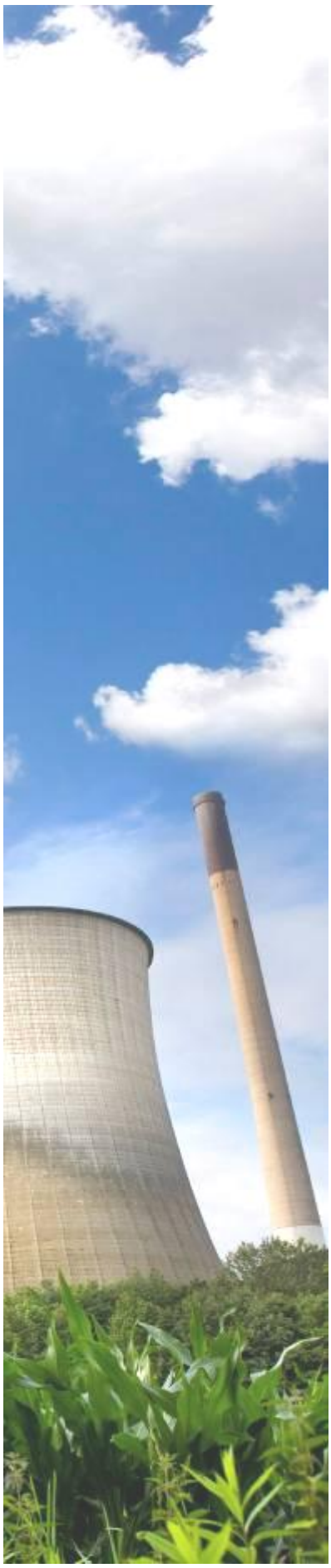
REC
Resource & Environmental Consultants Ltd

UKAS TESTING 2082



MONITORING OF EMISSIONS FROM THE TUB 1 FILTER PROCESS

25 May 2012

Prepared for Sundown Products Ltd

REC Report 71402p2r0

Issued: 21 June 2012

REC Air Quality

GREEN ACHIEVER

SAFEcontractor APPROVED

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Issued : 21 June, 2012
Reference : 71402p2r0

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CONTENTS **Page No.**

EXECUTIVE SUMMARY

Resource & Environmental Consultants (REC) Ltd was commissioned by Sundown Products Ltd to monitor emissions of particulate matter released from Tub 1 Filter process at their site in Huntingdon.

The following results were obtained from the emission monitoring survey and are compared with the current permit limit:

Species	Accreditation Status	Emission Concentration (mg/Nm^3)	Permit Limit (mg/Nm^3)
Particulate Matter	B	5.2	20

NOTE 1: All data are expressed in mg/Nm^3 at 273K, 101.3kPa, without correction for moisture and oxygen content unless otherwise stated.
NOTE: UKAS Status:- (B) REC Ltd accredited for sampling only, UKAS accredited analysis conducted by SAL Ltd .

INTRODUCTION

1.1 Background

Sundown Products Ltd commissioned REC Ltd to conduct an emission monitoring survey on the Tub 1 Filter process at their site in Huntingdon.

1.2 Scope of the Survey

An emission monitoring survey was required to determine the release of particulate matter released from the Tub 1 Filter process.

Ancillary measurements of stack dimensions, temperature and velocity were also made.

All results were to be reported at 273K, 101.3kPa, wet gas without correction for oxygen content.

1.3 Sampling Personnel

Monitoring was conducted by the following REC Ltd permanent staff:-

- David Burns - Team Leader, MM05 579, MCERTS Level 2, TE1-4
- Michelle Edwards - Assistant, MM05 659, MCERTS Level 1, TE1 & 2

2. METHODOLOGY

2.1 Species & Techniques

The following table shows the reference methods used for the emission monitoring survey:

Species	UKAS Status	Method	Uncertainty (±%)	Limit of Detection
Moisture	A	In house method MM0010 based on BS EN 14790	20	0.1%vol
Particulate Matter	B	In house method MM0004 based on BS ISO 9096	10	1 mg/m^3

NOTE: UKAS Status:- (A) REC Ltd accredited for sampling and analysis. (B) REC Ltd accredited for sampling only, UKAS accredited analysis conducted by SAL Ltd.

2.2 Sampling & Analytical Methodology

Total Particulate Matter

To determine the concentration of particulate matter in emissions, Isokinetic stack sampling equipment satisfying the requirements of BS ISO 9096 was utilised and in-house method MM0004 followed.

The Standard describes the methodology for measuring particulate matter under defined conditions and at discrete locations in the duct. Sampling is carried out under isokinetic sampling conditions i.e. the flowrate through the sampling nozzle is adjusted to equal the flowrate in the duct at the sampling positions. Velocity pressures were recorded throughout the monitoring period by means of an 'S' type pitot integral to the sampling probe and nozzle assembly.

A sample of the exhaust stream was removed from the stack via a titanium nozzle and titanium lined heated probe. It was then passed through a quartz fibre filter. The temperature of the probe was maintained at 160ºC. Each filter used complied with the requirements of Section 6.2.7 of BS EN 13284-1:2001 in that the efficiency was better than 99.5% for particles of 0.3µm diameter (or 99.9% for particles of 0.6µm diameter).

The impinger train was seated in a water bath to cool the gas stream and condense out less volatile gases and water vapour.

The first two impingers encountered by the gas stream contained deionised water. The third impinger was left empty and the fourth contained anhydrous silica gel which was used to dry the gas stream before passing it through a dry gas meter (DGM) to measure the volume of gas sampled.

All the impingers were weighed before and after the sampling run in order to determine the mass of water condensed by the impinger train (in house Method MM0010).

The sample volume collected was in excess of the minimum requirement stated in MM0004. The minimum sample volume ensures the results would be representative of normal plant operating conditions.

Upon completion of sampling, the filter was removed to a clean petri dish, labelled and sealed. The probe and filter housing were rinsed with acetone and water. The washings were collected in a container and submitted for analysis along with the filter.

Stack Temperature and Velocity

To determine the stack temperature, a calibrated thermocouple and digital indicator were employed. The exhaust gas velocity was investigated using a pitot static probe (to MM0004) and digital manometer.

3. SAMPLING AND OPERATIONAL DETAILS

3.1 Process Description

The operations at Sundown Products Ltd are authorised under a Part B permit issued by the Local Authority under the Environmental Permitting Regulations, 2007.

The process is therefore under Local Authority regulation and must demonstrate compliance with the emission limits stipulated in the site permit: B03/94

The Tub 1 Filter process involves the filtration of air from various processes, which are utilised in the manufacture animal feed products. Once removed from the various processes the air is passed through a bag filter, before being discharged out to atmosphere.

The process is classified as a batch process which is fuelled primarily by and electric fan.

3.2 Sampling Positions

On the Tub 1 Filter stack, 1 x 4" BSP sampling port was installed on a horizontal plane. The sampling point provided was 5 x hydraulic diameters from any flow disturbance both upstream and downstream from the sampling plane.

Due to not meeting the flow criteria requirements of TGN M1, sampling was only carried out across a single sampling plane at a limited number sampling points.

The sample port size does not fully comply with the positional requirements of Environment Agency Technical Guidance Note M1 (EA TGN M1). TGN M1 requires 2 x 5"BSP sockets to be fitted, at least 5 hydraulic diameters from bends.

Diagrams detailing the sampling positions and taken from Site Worksheets are provided in Appendix 1

3.3 Uncertainty

Sampling could only be conducted across a single sample plane at a limited number of sampling points. This will increase the measurement uncertainty from the standard ±10%.

The blank result for the test was greater than 10% of the ELV at 20.7%.

REC has calculated uncertainty budgets for all of the pollutants listed in the Method Details Table in Section 2.1 above in accordance with calculations and methodology supplied by the Source Testing Association (STA). These uncertainties are quoted in the Tables section of this report.

Emission Monitoring Survey Details

The emission monitoring survey was carried out on the Tub 1 Filter process on the 25 May, 2012. The table below summarises the actual sampling periods.

SAMPLING PERIODS

Stack	Parameter	Sample Time (& Date)
Tub 1 Filter	Particulates	10:23 - 11:03 (25/05/12)

4. RESULTS AND DISCUSSION

4.1 Initial Velocity and Temperature Traverse

An initial pitot-static pressure and temperature traverse was carried out. From these data stack velocity, expressed in metres per second (m/s), and volumetric flowrates expressed in cubic metre per hour (m^3/hr) have been calculated.

The results are reported at actual stack conditions and the volumetric flowrate is further expressed at the standard reference conditions of 273K, 101.3kPa i.e. standard temperature and pressure (STP). The results are summarised in Table 1.

4.2 Particulate Matter

The results of the particulate sampling runs are summarised in Tables 2. From the mass of particulate matter on the filter and in the acetone/water wash residue and volume sampled an emission concentration was calculated.

The results are expressed in mg/m^3 at 273K, 101.3kPa, without correction for water vapour content.

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TABLES

TABLE 1

FLOW DATA

Stack Ref.	Stack Temp	Av Pitot ΔP	Duct Diam	X-Sect. Area	Velocity (actual)	Volume Flow (m^3/hr)	
	(^{0}C)	(Pa)	(cm)	(m^2)	(m/s)	(actual)	(@ ntp)
Tub 1 Filter	34	121	43	0.145	14.5	7,570	6,736

TABLE 2

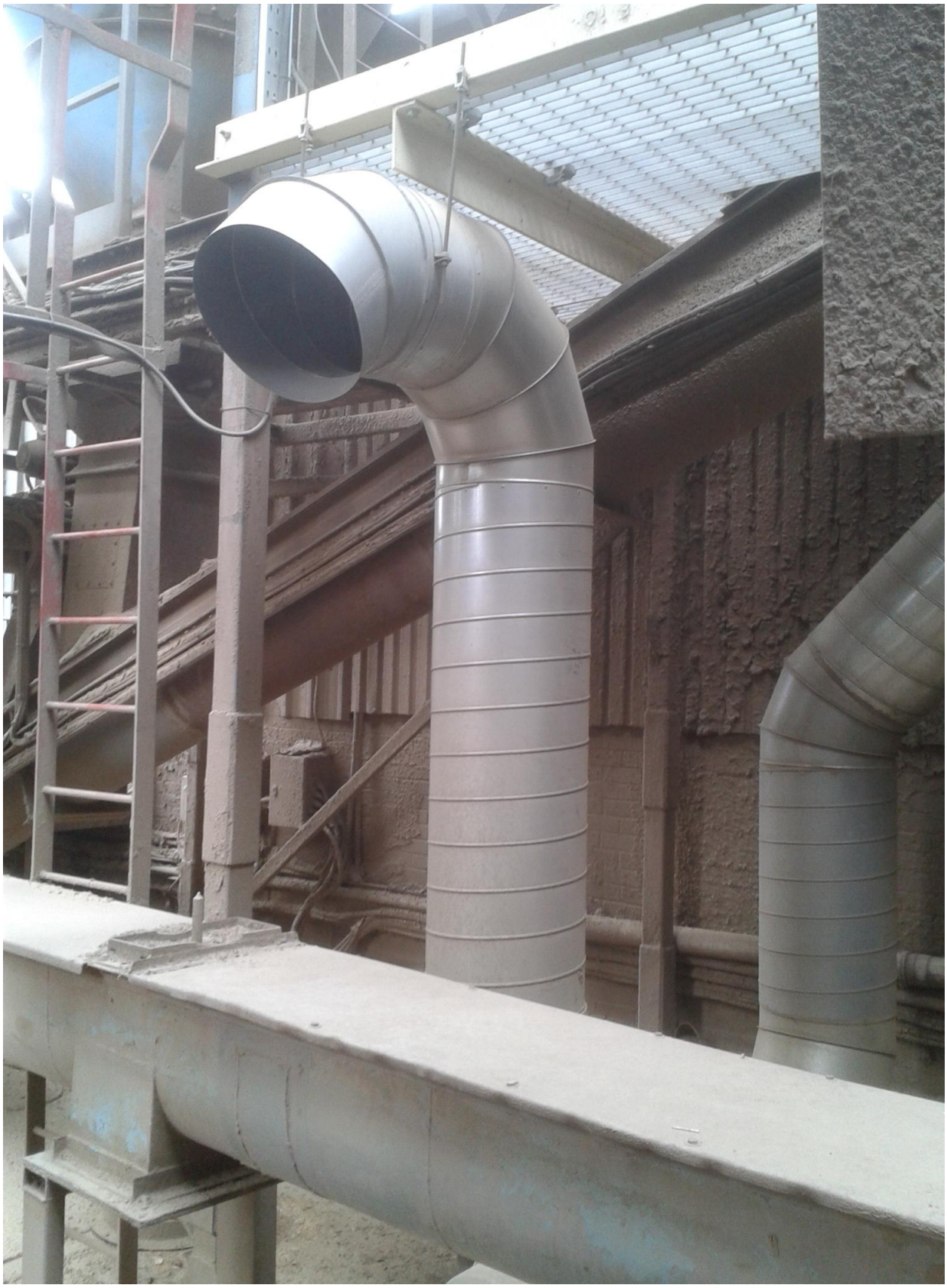
PARTICULATE EMISSION DATA SUMMARY – TUB 1 FILTER

DATE: 25/05/12 **10:23 - 11:03**

Sampling Data	
Run Time (min)	**40**
Total mass H_2O collected (g)	**8.9**
Pitot tube constant, Cp	**0.82**
Dry gas meter (DGM) volume (m^3)	**0.780**
Temperature DGM (^oC)	**26**
Temperature stack (^oC)	**34**
Mean pitot tube pressure drop, delta P (mm H_2O)	**13.7**
Orifice meter pressure drop, delta H (mm H_2O)	**26.5**
Barometric Pressure (kPa)	**101.5**
X-sectional area of stack (m^2)	**0.145**
Nozzle size (mm)	**6.00**
Flow Data	
Velocity, actual (m/s)	**12.6**
Velocity, ntp (m/s)	**11.2**
Vol. Flow, actual (m^3/hr)	**6,599**
Vol. Flow, ntp (m^3/hr)	**5,874**
Volume sampled, ntp, dry gas (m^3)	**0.797**
Volume sampled, ntp, wet gas (m^3)	**0.809**
Analytical Data	
Filter Weight Gain (mg)	**2.6**
Acetone Wash Residue Weight (mg)	**1.6**
Total Particulates (mg)	**4.2**
Partics Field Blank (mg)	**3.2**
Blank % of ELV	**20.1**
Emission Data	
H_2O (% vol)	**1.4**
Percentage Isokinetic	**105.9**
Particulates (mg/m^3)	**5.2**
Uncertainty (± mg/m^3)	**>0.7**

APPENDIX 1

Photograph of Sampling Point



APPENDIX 2

Calculations

Conversion Factors

ppm ® mg/Nm³ (at 273K, 101.3kPa: STP)

CO	x	1.25	
SO_2	x	2.86	
VOC's	x	1.61	(ppm as C_3H_8 to mg/Nm^3 as C)
NO_X	x	2.05	(ppm NO + NO_2 to mg/m^3 as NO_2)

Oxygen Correction to Reference Value

Concentration at (STP) -> Concentration at 273K, 101.3kPa, reference O_2 and Dry Gas, i.e.

Concentration X ((20.9-O_2 ref)/(20.9-O_2 measured)) = Concentration at ref Oxygen state.

Example Calculation

SO_2 concentration at STP	=	170.7 mg/Nm³
Oxygen percentage in gas stream	=	13.8%
Reference Oxygen	=	11%

SO_2 concentration at reference O_2 conditions	=	170.7 ((20.9-11)/(20.9-13.8))
	=	238 mg/Nm³ at 273K, 101.3kPa, 11% O_2 and Dry Gas

Moisture Correction (Wet to Dry)

Concentration of Gas Dry = Concentration of x 100/100-Bws Gas Wet

Concentration of Gas Wet = Concentration of x 100-Bws/100 Gas Dry

Where Bws = moisture content of gas stream in percent (Vol/Vol).

Example

VOC concentration	=	25 mg/Nm³ (Wet)
Moisture Content	=	27.1%
Concentration of VOC	=	25 (100/(100-27.1))

Carbon (C) to Trichloethylene (TCE)

ppm TCE = ppm C x 0.6715

TCE in mg/m^3 = TCE ppm x 5.864 (Mol Wt/22.4)