2082N

MONITORING OF EMISSIONS FROM THE ANIMAL FEED PROCESS

20 & 21 October, 2009

For Sundown Products Ltd

Prepared for:

Sundown Products Ltd
Station Road
Tilbrook
Huntingdon, Cambs.
PE28 0JY

Prepared by:

REC Ltd
Unit 19 Bordesley Trading Estate
Bordesley Green Road
Birmingham
B8 1BZ
Tel : 0121 326 7007
Fax : 0121 328 1689
E-mail : sales@recltd.co.uk

Issued : 6 November, 2009
Reference : 71135p1r0

Prepared by : ________________________________
G Quirk Team Leader MM05 603 L2 TE1

Reviewed by : ______________________________

CONTENTS

Page No.

TABLES

APPENDICES

EXECUTIVE SUMMARY

Resource & Environmental Consultants (REC) Ltd was commissioned by Sundown Products Ltd to monitor emissions of pollutants from their animal feed manufacturing process at their site in Huntingdon.

In accordance with the requirements of their site authorisation, monitoring has been undertaken for the following:-

- Combustion Gases including O_2
- Total Particulate Matter

The following results were obtained from the emission monitoring survey:-

Species	**Accreditation Status**	**Average Emission Concentration (mg/Nm^3)**		
		Cooler	**BBF**	**Dryer**
Particulate Matter	A	<1	-	107.8
Particulate Matter	C	-	9.4	-

NOTE 1: All data are expressed in mg/Nm^3 at 273K, 101.3kPa unless otherwise stated. Emissions from the Dryer are further expressed at 17% O_2 content.

NOTE 2: UKAS status:- (A) REC Ltd accredited for sampling and analysis. (B) REC Ltd accredited for sampling only, UKAS accredited analysis conducted by SAL Ltd. (C) REC Ltd not accredited for sampling, UKAS accredited analysis conducted by REC Ltd. (D) REC Ltd not accredited for sampling, analysis not UKAS accredited.

1. INTRODUCTION

1.1 Background

Sundown Products Ltd commissioned REC Ltd to conduct an emission monitoring survey on various process emission stacks from their animal feed manufacturing process at their site in Huntingdon.

1.2 Scope of the Survey

An emission monitoring survey was required to determine the release concentrations of particulate matter from the process emission points.

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

Results were to be reported at 273K, 101.3kPa, without correction for moisture and oxygen content. Results from the Dryer were to be further referenced to 17% oxygen content.

1.3 Sampling Personnel

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

- Gary Quirk - Team Leader, MM05 603, Level 2, TE1
- Patrick Kinsey - Assistant, , Level 1,

2. METHODOLOGY

2.1 Species and Techniques

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

Species	Accreditation Status	Method	Uncertainty ±%	Limit of Detection
Moisture	A	In house method MM0010 based on BS EN 14790.	20	0.1%
Particulate Matter	A	In house method MM0009 based on BS ISO 9096	10	1
Particulate Matter	C	In house method based on BS 3405	25	1

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. (C) REC Ltd not accredited for sampling, UKAS accredited analysis conducted by REC Ltd. (D) REC Ltd not accredited for sampling, analysis not UKAS accredited.

2.2 Sampling & Analytical Methodology

Total Particulate Matter

To determine the concentration of particulate matter in the emissions from the dryer and cooler, isokinetic stack sampling equipment satisfying the requirements of BS ISO 9096 was utilised and In house method MM0009 was 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 contained in a heated oven compartment. The temperature of the probe and filter box were maintained at 160ºC i.e. above the dew point of the stack gases, to ensure moisture did not condense on the filter

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 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 MM00010).

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.

On the BBF stack, due to access restrictions REC could not conduct particulate sampling in accordance with BS ISO 9096. To determine the concentration of particulate matter in the emissions, stack sampling equipment satisfying the requirements of BS 3405 was used. REC is not accredited for particulate sampling to this standard.

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 flow rate through the sampling nozzle is adjusted to equal the flow rate in the duct at the sampling positions.

A sample of the exhaust stream was removed from the stack via a stainless steel nozzle and filter housing. The filter housing is deployed in stack, so the filter is at the temperature of the stack gas to ensure moisture did not condense on the filter. The gas then passed through an impinger that 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.

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. 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 MM0009) and digital manometer.

3. SAMPLING AND OPERATIONAL DETAILS

3.1 Process Description

The operation of the processes at Sundown Products Ltd, Huntingdon are to be classified as a Part B process under the Pollution Prevention and Control Regulations. The process will be under Local Authority regulation and must demonstrate compliance with the standards published.

The site manufactures a wide range of animal feeds mainly for the equine and poultry markets.

3.2 Sampling Positions

BBF – 1 x 4" BSP provided on a small platform that did not meet EA TGN M1 requirements and would not allow safe sampling to BS ISO 9096. Sampling to BS 3405 was therefore undertaken outside our scope of accreditation.
Cooler - 1 x 4"BSP provided on small platform (not to EA TGN M1), sampling to BS ISO 9096 was possible at limited points.
Dryer - 1 x 4"BSP provided on small platform (not to EA TGN M1), sampling to BS ISO 9096 was possible at limited points.

3.3 Uncertainty

Sampling on the Cooler and Dryer was only possible on a single sampling plane and at limited points and this will increase the measurement uncertainty from ±10% to no better than ±25%.
Sampling on the BBF was conducted using an unaccredited method therefore the uncertainty is estimated to be no better than ±25%.

3.4 Emission Monitoring Survey Details

The emission monitoring survey was carried out on the process stacks on 20 & 21 October, 2009. The table below summarises the actual sampling periods.

SAMPLING PERIODS

Stack	Parameter	Sample Time & Date
Dryer	Particulates	15:30 - 16:30 (20/09/09)
BBF	Particulates	10:19 - 10:59 (21/09/09)
Cooler	Particulates	09:51 - 10:41 (21/09/09)

4. RESULTS AND DISCUSSION

4.1 Initial Velocity and Temperature Traverse

An initial pitot-static pressure and temperature traverse was carried out across the single sampling plane. 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 to 4.

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 and O_2 content.

====== End of Report Text ======

TABLES

TABLE 1

FLOW DATA

Stack Ref	Stack Temp	Av Pitot delta P	Duct diam	X-Sect. Area	Velocity (actual)	Volume Flow (m^3/hr)	
	(^{0}C)	(Pa)	(cm)	(m^2)	(m/s)	(actual)	(@ ntp)
Dryer	57	51	100	0.785	9.6	27,285	22,588
Cooler	19	87	70	0.385	11.9	16,426	15,368
BBF	16	39	50	0.196	7.9	5,566	5,261

TABLE 2

PARTICULATE EMISSION DATA – DRYER

JOB NUMBER: 71135 **15:30-16:30**

Sampling Data	
Run Time (min)	60
Total mass H_2O collected (g)	150.8
Pitot tube constant, Cp	0.84
Dry gas meter (DGM) volume (litres)	1.63
Temperature DGM (^oC)	13
Temperature stack (^oC)	55
Mean pitot tube pressure drop, delta P (cm H_2O)	9.54
Orifice meter pressure drop, delta H (cm H_2O)	65.64
Barometric Pressure (kPa)	101.3
X-sectional area of stack (m^2)	0.785
Nozzle size (mm)	8.84
Flow Data	
Velocity, actual (m/s)	11.3
Velocity, ntp (m/s)	9.4
Vol. Flow, actual (m^3/hr)	32,016
Vol. Flow, ntp (m^3/hr)	26,621
Volume sampled, ntp, dry gas (m^3)	1.700
Volume sampled, ntp, wet gas (m^3)	1.888
Analytical Data	
Filter Weight Gain (mg)	117.3
Acetone Wash Residue Weight (mg)	14.3
Total Particulates (mg)	131.6
Partics Field Blank (mg)	0.3
Emission Data	
O_2 (%vol)	18.1
H_2O (% vol)	9.9
Percentage Isokinetic	90.8
Particulates (mg/m^3 at ref O_2)	107.8
Uncertainty (± mg/m^3)	9.5

TABLE 3

PARTICULATE EMISSION DATA – BBF

Sampling Data	**BBF**
DGM Start (m^3)	1925.696
DGM End (m^3)	1926.120
Volume Sampled (m^3)	0.424
Ambient Temp (^oC)	16
Ambient Press (kPa)	101.3
Volume Sampled, 273K, 101.3kPa (m^3)	0.401
Analytical Data	
Filter Weight Gain (mg)	3.8
Acetone Wash Residue (mg)	0.0
Total Particulate Matter (mg)	3.8
Emission Concentration Data	
Total Particulate Matter (mg/m^3)	9.4

TABLE 4

PARTICULATE EMISSION DATA – COOLER

JOB NUMBER: **09:51-10:41**

Sampling Data	
Run Time (min)	50
Total mass H_2O collected (g)	9.9
Pitot tube constant, Cp	0.84
Dry gas meter (DGM) volume (litres)	1.03
Temperature DGM (^oC)	17
Temperature stack (^oC)	23
Mean pitot tube pressure drop, delta P (cm H_2O)	4.15
Orifice meter pressure drop, delta H (cm H_2O)	51.42
Barometric Pressure (kPa)	101.3
X-sectional area of stack (m^2)	0.385
Nozzle size (mm)	8.80
Flow Data	
Velocity, actual (m/s)	7.0
Velocity, ntp (m/s)	6.4
Vol. Flow, actual (m^3/hr)	9,660
Vol. Flow, ntp (m^3/hr)	8,910
Volume sampled, ntp, dry gas (m^3)	1.058
Volume sampled, ntp, wet gas (m^3)	1.071
Analytical Data	
Filter Weight Gain (mg)	0.6
Acetone Wash Residue Weight (mg)	0.2
Total Particulates (mg)	0.8
Partics Field Blank (mg)	0.3
Emission Data	
H_2O (% vol)	1.2
Percentage Isokinetic	91.2
Particulates (mg/m^3)	0.7
Uncertainty (± mg/m^3)	2.2

APPENDIX 1

Calculations

Conversion Factors

ppm ® mg/Nm^3 (at 273K, 101.3kPa: STP)

CO	X	1.25	
SO_2	X	2.86	
VOC's	X	0.53	(as total Carbon)
NO_X	X	2.05	(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/Nm^3

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/Nm^3 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/Nm^3 (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)