Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	Red Mills
Facility Name	Goresbridge, Co Kilkenny
Contact Person	Mr John Rea
EPA Licence Number	-
Licence Holder	Red Mills, FGEF1
Stack Reference Number	FGEF1
Dates of the Monitoring Campaign	19/01/2017
Job Reference Number	REMITL1190117 / 2017521
Report Written By	Dr. John Casey
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. Brian Sheridan, Dr. John Casey
Report Date	10/02/2017
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Brian Sheridan Technical Manager

Contents

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1. Executive Summary

I. Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter (TPM)
Stack Gas Temperature
Volume ($m^3.h^{-1}$)

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	$mg.m^{-3}$	$kg.h^{-1}$
TPM	-	-
Stack Gas Temperature	-	-
Volume ($m^3.h^{-1}$)	-	-

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	No Oxygen Ref
Temperature ^oC	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

	Concentration					Mass Emission	
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**	**Units**	**Result**
Total Particulate Matter (TPM)	$mg.m^{-3}$	67.46	1.25	-	N/A	$kg.h^{-1}$	0.449
Water Vapour (%)	% v/v	7.80	-	-	N/A	-	-
Stack Gas Temperature	K	339.15	-	-	N/A	-	-
Stack Gas Velocity	$m.s^{-1}$	15.43	1.16	-	N/A	-	-
Volumetric Flow Rate	$m^3.h^{-1}$	6649	-	-	N/A	-	-

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	UKAS1549
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Total Particulate Matter (TPM)	Run 1	FGEF1	19/01/2017	10:18:00	10:48:00	00:30:00
	Run 2					
	Run 3					

Executive Summary

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	N/a
Continuous or Batch Process	Continuous
Feedstock	Process Air
Abatement System	Yes
Abatement Systems Running Status	Normal
Fuel	N/A
Plume Appearance	No
Other information	None

Executive Summary

Monitoring, Equipment & Analytical Methods

	Monitoring				Analysis	
Parameter	**Standard**	**Technical Procedure**	**Accredited Testing**	**Testing Lab**	**Analytical Technique**	**Analysis Lab**
Total Particulate Matter (TPM)	EN13284-1:2002	SOP 2000	Yes	AirSci	Gravimetric	SAL
Water Vapour (%)	EN14790:2005	SOP 2007	Yes	AirSci	Impingers	AirSci
Stack Gas Temperature	EN16911:2013	SOP 2005	Yes	AirSci	Thermocouple	AirSci
Stack Gas Velocity	EN16911:2013	SOP 2005	Yes	AirSci	Pitot tubes	AirSci

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ517	Testo 400 Gas Pressure Vacumn and Flow	Testo	00828828/305
ASLTM13EQ506	S TYPE PITOT TUBE	Tecora	O710
ASLTM14EQ505	Stanley 5m Measuring Tape	Stanley	30-696
ASLTM14EQ512	GemRed Electronic Level 0 to 180 Degrees	GemRed	8088
ASLTM14EQ516	6" Digital Calliper	Stanley	052013w
ASLTM15EQ510	Evo ST5	Dadolab	ST5 4A 62015 0143
ASLTM16EQ500	K type thermocouple	TC Direct	12-K-1700-114-3.0-2l-3p2ld-600mm c20kx/ssb

Sampling Deviations

Parameter	Deviation
Standard ID	EN16911 - flow in accordance with MID6911-1
Standard ID	EN16911 - Required number of ports not accessible
Standard ID	EN16911 - angle of swirl >15degrees
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Permanent
Inside/ Outside	Inside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack
E.g. Select Option **1: There is no requirement to perform a BSEN15259 Homogeneity Test on this stack** **2: Test results were obtained from previous Homogeneity test carried out by ASL** **3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor** **4: Other: Enter Description**

Stack diagram

FGEF1 - Flaker 1

APPENDICES

II. Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Air Scientific Limited Approved
		-
Team Leader	**Name**	Brian Sheridan
	Qualifications	PhD. (Eng.), MSc. (Agr.), BSc. (Hons.)
	System approval	Air Scientific Limited Approved
		-

III. Appendix II Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	**Units**	**Value**
Date of survey		19/01/2017
Time of survey		09:15
Type		Rectangular
Stack Diameter / Depth, D	m	0.35
Stack Width, W	m	0.35
Average Stack Gas Temp., Ta	C	66
Average Static Pressure, P static	kPa	0.1
Average Barometric Pressure, Pb	kPa	103.6
Type of Pitot		S
Are Water Droplets Present ?		No
Average Pitot Tube Calibration Coeff, Cp		0.85
Negative flow		No
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	125
Initial Pitot Leak Check	Pa	700
Final Pitot Leak Check	Pa	730
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		1
Number of Lines Used		1

Sampling Line A						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	0.06	180	66	15.8	-	>15
2	0.12	210	66	17.1	-	<15
3	0.18	220	66	17.5	-	<15
4	0.23	160	66	14.9	-	>15
5	0.29	100	66	11.8	-	<15
6	0.35	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	174.00	66	15.43	-	>15
Min	-	100	66	11.80	-	>15
Max	-	220	66	17.50	-	>15

Sampling Line B						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO_2	-	0.1	-	44.01
Oxygen O_2	-	20.9	-	32
Nitrogen N_2	-	79	-	28.1
Moisture (H_2O)	-	-	7.8	18.02

Reference Conditions	Units	Numbers
Temperature	^oC	273.15
Total Pressure	kPa	101.3
Moisture	%	-
Oxygen (Dry)	%	No Oxygen Ref

Stack Gas Composition & Molecular Weights								
Component	**Molar Mass M**	**Density Kg/m^3 p**	**Conc. Dry % v/v**	**Dry Volume Fraction r**	**Dry Conc. kg/m^3 pi**	**Conc. wet % v/v**	**Wet Volume Fraction r**	**Wet Conc.kg/m^3 pi**
Carbon Dioxide CO_2	44.01	1.96	0.1	0.001	0.00	0.09	0.00	0.00
Oxygen O_2	32	1.43	20.9	0.209	0.30	19.27	0.19	0.28
Nitrogen N_2	28.1	1.25	79	0.79	0.99	72.84	0.73	0.91
Moisture (H_2O)	18.02	0.80	-	-	-	7.8	0.08	0.06
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

Calculation of Stack Gas Densities		
Determinand	**Units**	**Result**
Dry Density (STP), P STD	$kg.m^{-3}$	1.291
Wet Density (STP), P STW	$kg.m^{-3}$	1.256
Dry Density (Actual), P Actual	$kg.m^{-3}$	1.063
Average wet Density (Actual), P ActualW	$kg.m^{-3}$	1.034
Where		
P STD = sum of component concentrations, kg/m3 (excluding water vapour)	-	-
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))	-	-
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)	-	-
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)	-	-

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	100	Pa	>5 Pa	Yes	EN16911:2013
Lowest Gas Velocity	11.80	m/s	-	N/A	-
Highest Gas Velocity	17.50	m/s	-	N/A	-
Ratio of Above	1.48	:1	<3:1	Yes	EN16911:2013
Mean Velocity	15.43	m/s	-	N/A	-
Angle of flow with regard to duct axis	>15	degrees	< 15	No	EN16911:2013
No local negative flow	No	-	-	Yes	-
Homogeneous flow stream/gas velocity	Yes	-	-	Yes	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density)	-
Where	
Kpt = Pitot tube calibration coefficient	0.85
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m^3.h^{-1}$	8747
Gas Volumetric Flow Rate (STP, Wet)	$m^3. h^{-1}$	7212
Gas Volumetric Flowrate (STP, Dry)	$m^3. h^{-1}$	6649
Gas Volumetric Flowrate REF to Oxygen	$m^3. h^{-1}$	-

IV. Appendix III Individual parameter sampling details and results

Total Particulate Matter : Sampling details and results

Run 1			**Time On**	10:18:00	-
Stack ID	FGEF1	-	**Time Off**	10:48:00	-
Filter ID	FGEF1	-	**Uncertainty Data**	-	-
Start Dry Gas Meter	-	Nm3	**Temperature at Pump**	14.25	Deg C
Finish Dry Gas Meter	-	Nm3	**Pressure at Pump**	92.24	kPa
Average Stack Temperature	66	degrees	**Air Volume at Pump**	0.7721	m^3
Moisture Content	7.80	%	**Humidity at Pumps**	0.1	%
Stack Flow Rate STP, Dry	6649	$m^3.h^{-1}$	**Filter Weight**	48	mg
Volume of Air Sampled	0.6615	m^3 (VgN)	**Front End Weight**	0.4	mg
Balance Calibration	**Weight**				
300.0	-	g	-	-	-
500.0	-	g	-	-	-
1000.0	-	g	-	-	-
Inpinger Weights	**Initial**	**Final**	**Difference**		
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
Volume of Air Sampled	-	Nm3	0	-	-
Moisture Content (EN 14790)	-	%	-	-	-
Leak Check Results	**Result**	-	**% Leak**		
Before Blank	0.1	l/min	0.4	-	-
After Blank	0.18	l/min	0.8	-	-
Before Sample 1	0.1	l/min	0.4	-	-
After Sample 1	0.12	l/min	0.5	-	-
Average Flow Rate	23	l/min	0.8	-	-
Standard Maximum	0.46	l/min	2%	-	-
Back Pressure	-	bar	-	-	-
Leak check acceptable	Yes	-	Yes/No	-	-
Water droplets present	No	-	Yes/No	-	-
Standard Criteria to be Met	**Result**	**Standard Requirement**			
Angle of Flow	>15	<15 Degrees			
Negative Flow in the Stack	None	None			
Pitot Pressure Difference	>5Pa	>5Pa			
Ratio of Flow Measurement	<3:1	<3:1			
Pitot Tube Leak Check	**Result**				
Positive Pressure	Pass	-			
Negative Pressure	Pass	-			

Number of Ports	1	2			
Straight length before sample point	< 5	> 5 Hydraulic Diameters			
Straight length after sample point	< 5	> 5 Hydraulic Diameters			
Sample Calculations	-	-			
Blank (Filter and Front Wash Combined)	<0.35	mg			
Sample 1 (Filter and Front Combined)	48.4	mg			
Volume of Air Sampled	0.72	m^3			
Blank Result	<0.49	$mg.m^{-3}$			
Sample Result	67.46	$mg.m^{-3}$			
Emission Limit Value	-	$mg.m^{-3}$			
Blank as Percentage of ELV	0.0	%	**Standard Requirement**	**<10% ELV**	-
Isokinetic Criterion Compliance					
Isokinetic Variation	%	0	-	-	-
Allowable IsoKinetic Range	%	95-115	-	-	-
Iso Kineticity Acceptable	-	Yes	-	-	-

Total Particulates Quality Assurance

Stack ID	FGEF1	-
Parameter	**Units**	**Run 1**
Sampling Times	-	10:18:00
Sampling dates	-	19/01/2017
Sampling Device	-	ST5
Volume Sampled (REF.)	m3	0.6615
Filter ID Number	-	FGEF1
Probe rinse ID	-	FGEF1 W
Total Filter Mass	mg	48
Probe Rinse Solids Mass	mg	0.4
Total Mass Collected	mg	48.4
General information		
Standard	ISEN13284-1	**Run 1**
Technical Procedure	-	2000
Probe Material		SS
Filter Housing		SS
Positioning of Filter	-	In-stack
Filter Size and Material	-	47mm filter, 6mm nozzle
Number of Sampling lines used	-	1
Number of Sampling Points used	-	5