




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, EX4
Stack Reference Number	EX4
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
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Signature of Approver	 Brian Sheridan Technical Manager

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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 °C	273.15
Total Pressure kPa	101.3
Moisture %	Yes

Executive Summary

Overall Results

Parameter	Concentration	Result	MU +/-	Limit	Compliant	Mass Emission	Result
	Units					Units	
Total Particulate Matter (TPM)	mg.m ⁻³	54.45	1.31	-	N/A	kg.h ⁻¹	0.676
Water Vapour (%)	% v/v	3.00	-	-	N/A	-	-
Stack Gas Temperature	K	303.15	-	-	N/A	-	-
Stack Gas Velocity	m.s ⁻¹	8.75	0.75	-	N/A	-	-
Volumetric Flow Rate	m ³ .h ⁻¹	12406	-	-	N/A	-	-

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	UKAS1549
Other	-

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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	EX4	19/01/2017	11:45:00	12:15:00	00:30:00
	Run 2					
	Run 3					

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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

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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

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List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ517	Testo 400 Gas Pressure Vacuum and Flow	Testo	00828828/305
ASLTM14EQ505	Stanley 5m Measuring Tape	Stanley	30-696
ASLTM14EQ512	GemRed Electronic Level 0 to 180 Degrees	GemRed	8088
ASLTM14EQ513	ISO Stack Sampling Machine and associated equipment	TCR Tecora	070205976 & 049039P
ASLTM14EQ516	6" Digital Calliper	Stanley	052013w
ASLTM14EQ522	S TYPE PITOT TUBE	TRC Tecora	323

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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, Local negative flow
Standard ID	-

Reference Documents

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

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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 Homogeneity 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

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Executive Summary

Stack diagram EX4 - Extruder 4



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
		-

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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		11:38
Type		Rectangular
Stack Diameter / Depth, D	m	0.80
Stack Width, W	m	0.8
Average Stack Gas Temp., Ta	C	30
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	830
Final Pitot Leak Check	Pa	820
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	0.13	75	30	9.6	-	>15
2	0.27	-60	30	-	-	>15
3	0.4	81	30	10.0	-	<15
4	0.53	50	30	7.8	-	>15
5	0.67	48	30	7.7	-	<15
6	0.8	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	38.80	30	8.75	-	>15
Min	-	-60	30	7.66	-	>15
Max	-	81	30	9.95	-	>15

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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	-	-	-	-	-	-

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 Visit No: 1
 Year: 2017
 Office: Trim

IPPC Licence No.: -
 Licence Holder: Red Mills, EX4
 Facility Location: Goresbridge, Co Kilkenny
 Rev.No: 1

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 ₂ O)	-	-	3	18.02
Reference Conditions				
	Units	Numbers		
Temperature	°C	273.15		
Total Pressure	kPa	101.3		
Moisture	%	-		
Oxygen (Dry)	%	No Oxygen Ref		

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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	0.10	0.00	0.00
Oxygen O ₂	32	1.43	20.9	0.209	0.30	20.27	0.20	0.29
Nitrogen N ₂	28.1	1.25	79	0.79	0.99	76.63	0.77	0.96
Moisture (H ₂ O)	18.02	0.80	-	-	-	3	0.03	0.02
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

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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	1.277
Dry Density (Actual), P Actual	kg.m ⁻³	1.190
Average wet Density (Actual), P ActualW	kg.m ⁻³	1.177
Where		
P STD = sum of component concentrations, kg/m ³ (excluding water vapour)	-	-
$P_{STW} = (P_{STD} + p_{i \text{ of } H_2O}) / (1 + (p_{i \text{ of } H_2O} / 0.8036))$	-	-
$P_{actual} = P_{STD} \times (T_{STP} / (P_{STP})) \times (P_a / T_a)$	-	-
$P_{actual \ W} \text{ (at each sampling point)} = P_{STW} \times (T_s / P_s) \times (P_a / T_a)$	-	-

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Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	-60	Pa	>5 Pa	Yes	EN16911:2013
Lowest Gas Velocity	7.66	m/s	-	N/A	-
Highest Gas Velocity	9.95	m/s	-	N/A	-
Ratio of Above	1.30	:1	<3:1	Yes	EN16911:2013
Mean Velocity	8.75	m/s	-	N/A	-
Angle of flow with regard to duct axis	>15	degrees	< 15	No	EN16911:2013
No local negative flow	No	-	-	No	-
Homogeneous flow stream/gas velocity	Yes	-	-	Yes	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, $V = K_{cp} * \text{Sqrt}((2 * DP) / \text{Density})$	-
Where	
K _{pt} = 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	13866
Gas Volumetric Flow Rate (STP, Wet)	m ³ .h ⁻¹	12790
Gas Volumetric Flowrate (STP, Dry)	m ³ .h ⁻¹	12406
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	11:45:00	-
Stack ID	EX4	-	Time Off	12:15:00	-
Filter ID	EX4	-	Uncertainty Data	-	-
Start Dry Gas Meter	-	Nm3	Temperature at Pump	20	Deg C
Finish Dry Gas Meter	-	Nm3	Pressure at Pump	103.2	kPa
Average Stack Temperature	30	degrees	Air Volume at Pump	0.46	m ³
Moisture Content	3.00	%	Humidity at Pumps	0.1	%
Stack Flow Rate STP, Dry	12406	m ³ h ⁻¹	Filter Weight	24	mg
Volume of Air Sampled	0.44	m ³ (VgN)	Front End Weight	0.7	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	0.44	Nm3	0	-	-
Moisture Content (EN 14790)	-	%	-	-	-
Leak Check Results	Result	-	% Leak		
Before Blank	-	l/min	-	-	-
After Blank	-	l/min	-	-	-
Before Sample 1	0.1	l/min	0.3	-	-
After Sample 1	0.1	l/min	0.3	-	-
Average Flow Rate	30	l/min	0.3	-	-
Standard Maximum	0.6	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)	24.7	mg			
Volume of Air Sampled	0.45	m ³			
Blank Result	<0.77	mg.m ⁻³			
Sample Result	54.45	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	-	-	-

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Total Particulates Quality Assurance

Stack ID	EX4	-
Parameter	Units	Run 1
Sampling Times	-	11:45:00
Sampling dates	-	19/01/2017
Sampling Device	-	Basic
Volume Sampled (REF.)	m3	0.44
Filter ID Number	-	EX4
Probe rinse ID	-	EX4 W
Total Filter Mass	mg	24
Probe Rinse Solids Mass	mg	0.7
Total Mass Collected	mg	24.7
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