




<b>Report Title</b>	Air Emissions Compliance Monitoring Emissions Report
<b>Company address</b>	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
<b>Stack Emissions Testing Report Commissioned by</b>	Red Mills
<b>Facility Name</b>	Goresbridge, Co Kilkenny
<b>Contact Person</b>	Mr John Rea
<b>EPA Licence Number</b>	-
<b>Licence Holder</b>	Red Mills, Cubing
<b>Stack Reference Number</b>	Cubing
<b>Dates of the Monitoring Campaign</b>	19/01/2017
<b>Job Reference Number</b>	REMITL1190117 / 2017521
<b>Report Written By</b>	Dr. John Casey
<b>Report Approved by</b>	Dr. Brian Sheridan
<b>Stack Testing Team</b>	Dr. Brian Sheridan, Dr. John Casey
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<b>Signature of Approver</b>	 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 <sup>3</sup> .h <sup>-1</sup> )

#### Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	mg.m <sup>-3</sup>	kg.h <sup>-1</sup>
TPM	-	-
Stack Gas Temperature	-	-
Volume (m <sup>3</sup> .h <sup>-1</sup> )	-	-

#### 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 <sup>-3</sup>	12.90	0.32	-	N/A	kg.h <sup>-1</sup>	0.128
Water Vapour (%)	% v/v	6.50	-	-	N/A	-	-
Stack Gas Temperature	K	326.15	-	-	N/A	-	-
Stack Gas Velocity	m.s <sup>-1</sup>	15.68	1.18	-	N/A	-	-
Volumetric Flow Rate	m <sup>3</sup> .h <sup>-1</sup>	9953	-	-	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	Cubing	19/01/2017	12:25:00	12:55:00	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**

<b>ID</b>	<b>Item of Equipment</b>	<b>Manufacturer</b>	<b>Serial No.</b>
ASLTM12EQ517	Testo 400 Gas Pressure Vacuum and Flow	Testo	00828828/305
ASLTM13EQ506	S TYPE PITOT TUBE	Tecora	0710
ASLTM14EQ505	Stanley 5m Measuring Tape	Stanley	30-696
ASLTM14EQ512	GemRed Electronic Level 0 to 180 Degrees	GemRed	8088
ASLTM14EQ516	6" Digital Calliper	Stanley	052013w
ASLTM16EQ500	Thermocouple	TC Direct	--
ASLTM15EQ510	Evo ST5	Dadolab	ST5 4A 62015 0143

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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
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
<b>E.g. Select Option</b>
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 Cubing – Press Line 2



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**APPENDICES**

**II. Appendix I Monitoring Personnel & Equipment**

**Stack Emissions Monitoring Personnel**

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

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**III. Appendix II Stack Details & flow characteristics**

**Preliminary stack survey calculations**

<b>General Stack Details</b>		
<b>Stack details</b>	<b>Units</b>	<b>Value</b>
Date of survey		19/01/2017
Time of survey		12:10
Type		Rectangular
Stack Diameter / Depth, D	m	0.40
Stack Width, W	m	0.4
Average Stack Gas Temp., Ta	C	53
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	810
Final Pitot Leak Check	Pa	835
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		1
Number of Lines Used		1

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

Sampling Line A						
Point	Distance to duct (m)	Pa	Temp °C	Velocity (m/s)	Oxygen (%)	Angle of Swirl
1	0.07	140	55	13.7	-	<15
2	0.13	210	55	16.7	-	>15
3	0.2	205	55	16.5	-	<15
4	0.27	241	55	17.9	-	<15
5	0.33	138	55	13.6	-	<15
6	0.4	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	186.80	55	15.68	-	>15
Min	-	138	55	13.56	-	>15
Max	-	241	55	17.92	-	>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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Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO <sub>2</sub>	-	0.1	-	44.01
Oxygen O <sub>2</sub>	-	20.9	-	32
Nitrogen N <sub>2</sub>	-	79	-	28.1
Moisture (H <sub>2</sub> O)	-	-	6.5	18.02
<b>Reference Conditions</b>				
	<b>Units</b>	<b>Numbers</b>		
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 <sup>3</sup> p	Conc. Dry % v/v	Dry Volume Fraction r	Dry Conc. kg/m <sup>3</sup> pi	Conc. wet % v/v	Wet Volume Fraction r	Wet Conc.kg/m <sup>3</sup> pi
Carbon Dioxide CO <sub>2</sub>	44.01	1.96	0.1	0.001	0.00	0.09	0.00	0.00
Oxygen O <sub>2</sub>	32	1.43	20.9	0.209	0.30	19.54	0.20	0.28
Nitrogen N <sub>2</sub>	28.1	1.25	79	0.79	0.99	73.87	0.74	0.93
Moisture (H <sub>2</sub> O)	18.02	0.80	-	-	-	6.5	0.07	0.05
	-	-	-	-	-	-	-	-
where p=M/22.41	-	-	-	-	-	-	-	-
pi = r x p	-	-	-	-	-	-	-	-

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<b>Calculation of Stack Gas Densities</b>		
<b>Determinand</b>	<b>Units</b>	<b>Result</b>
Dry Density (STP), P STD	kg.m <sup>-3</sup>	1.291
Wet Density (STP), P STW	kg.m <sup>-3</sup>	1.261
Dry Density (Actual), P Actual	kg.m <sup>-3</sup>	1.106
Average wet Density (Actual), P ActualW	kg.m <sup>-3</sup>	1.080
<b>Where</b>		
P STD = sum of component concentrations, kg/m <sup>3</sup> (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	138	Pa	>5 Pa	Yes	EN16911:2013
Lowest Gas Velocity	13.56	m/s	-	N/A	-
Highest Gas Velocity	17.92	m/s	-	N/A	-
Ratio of Above	1.32	:1	<3:1	Yes	EN16911:2013
Mean Velocity	15.68	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, $V = K_{cp} \cdot \sqrt{(2 \cdot DP) / \text{Density}}$	-
<b>Where</b>	
K <sub>pt</sub> = 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 <sup>3</sup> .h <sup>-1</sup>	12417
Gas Volumetric Flow Rate (STP, Wet)	m <sup>3</sup> .h <sup>-1</sup>	10645
Gas Volumetric Flowrate (STP, Dry)	m <sup>3</sup> .h <sup>-1</sup>	9953
Gas Volumetric Flowrate REF to Oxygen	m <sup>3</sup> .h <sup>-1</sup>	-

IV. Appendix III Individual parameter sampling details and results

Total Particulate Matter : Sampling details and results

<b>Run 1</b>			<b>Time On</b>	12:25:00	-
<b>Stack ID</b>	Cubing	-	<b>Time Off</b>	12:55:00	-
<b>Filter ID</b>	Cubing	-	<b>Uncertainty Data</b>	-	-
<b>Start Dry Gas Meter</b>	-	Nm3	<b>Temperature at Pump</b>	25.49	Deg C
<b>Finish Dry Gas Meter</b>	-	Nm3	<b>Pressure at Pump</b>	81.41	kPa
<b>Average Stack Temperature</b>	55	degrees	<b>Air Volume at Pump</b>	1.325	m <sup>3</sup>
<b>Moisture Content</b>	6.50	%	<b>Humidity at Pumps</b>	0.1	%
<b>Stack Flow Rate STP, Dry</b>	9953	m <sup>3</sup> h <sup>-1</sup>	<b>Filter Weight</b>	13	mg
<b>Volume of Air Sampled</b>	0.9643	m <sup>3</sup> (VgN)	<b>Front End Weight</b>	<0.3	mg
<b>Balance Calibration</b>	<b>Weight</b>				
300.0	-	g	-	-	-
500.0	-	g	-	-	-
1000.0	-	g	-	-	-
<b>Inpinger Weights</b>	<b>Initial</b>	<b>Final</b>	<b>Difference</b>		
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
<b>Volume of Air Sampled</b>	0.9643	Nm3	0	-	-
<b>Moisture Content (EN 14790)</b>	-	%	-	-	-
<b>Leak Check Results</b>	<b>Result</b>	-	<b>% Leak</b>		
<b>Before Blank</b>	-	l/min	-	-	-
<b>After Blank</b>	-	l/min	-	-	-
<b>Before Sample 1</b>	0.1	l/min	0.3	-	-
<b>After Sample 1</b>	0.1	l/min	0.3	-	-
<b>Average Flow Rate</b>	33	l/min	0.3	-	-
<b>Standard Maximum</b>	0.66	l/min	2%	-	-
<b>Back Pressure</b>	-	bar	-	-	-
<b>Leak check acceptable</b>	Yes	-	Yes/No	-	-
<b>Water droplets present</b>	No	-	Yes/No	-	-
<b>Standard Criteria to be Met</b>	<b>Result</b>	<b>Standard Requirement</b>			
<b>Angle of Flow</b>	>15	<15 Degrees			
<b>Negative Flow in the Stack</b>	None	None			
<b>Pitot Pressure Difference</b>	>5Pa	>5Pa			
<b>Ratio of Flow Measurement</b>	<3:1	<3:1			
<b>Pitot Tube Leak Check</b>	<b>Result</b>				
<b>Positive Pressure</b>	Pass	-			
<b>Negative Pressure</b>	Pass	-			

<b>Number of Ports</b>	1	2			
<b>Straight length before sample point</b>	< 5	> 5 Hydraulic Diameters			
<b>Straight length after sample point</b>	< 5	> 5 Hydraulic Diameters			
<b>Sample Calculations</b>	-	-			
<b>Blank (Filter and Front Wash Combined)</b>	<0.35	mg			
<b>Sample 1 (Filter and Front Combined)</b>	13.3	mg			
<b>Volume of Air Sampled</b>	1.03	m <sup>3</sup>			
<b>Blank Result</b>	<0.34	mg.m <sup>-3</sup>			
<b>Sample Result</b>	12.90	mg.m <sup>-3</sup>			
<b>Emission Limit Value</b>	-	mg.m <sup>-3</sup>			
<b>Blank as Percentage of ELV</b>	0.0	%	<b>Standard Requirement</b>	<b>&lt;10% ELV</b>	-
<b>Isokinetic Criterion Compliance</b>					
Isokinetic Variation	%	0	-	-	-
Allowable IsoKinetic Range	%	95-115	-	-	-
Iso Kineticity Acceptable	-	Yes	-	-	-

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**Total Particulates Quality Assurance**

Stack ID	Cubing	-
Parameter	Units	Run 1
Sampling Times	-	12:25:00
Sampling dates	-	19/01/2017
Sampling Device	-	ST5
Volume Sampled (REF.)	m3	0.9643
Filter ID Number	-	Cubing
Probe rinse ID	-	Cubing W
Total Filter Mass	mg	13
Probe Rinse Solids Mass	mg	<0.3
Total Mass Collected	mg	13.3
<b>General information</b>		
Standard	ISEN13284-1	<b>Run 1</b>
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