



MONITORING OF EMISSIONS FROM THE ALUMINIUM CASTING PROCESS

9 JULY & 18 AUGUST, 2014

Prepared for Sarginsons Industries Ltd

REC Report 71892p1r0

Issued: 1 September, 2014



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Sampling identified as UKAS accredited was conducted in accordance with REC Ltd accredited Monitoring Methods.
Analyses identified as UKAS accredited were conducted by REC or approved sub-contractors in accordance with their SOPs

Prepared for:

Sarginsons Industries Ltd
Torrington Avenue
Coventry
CV4 9AG

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
Web :www.recltd.co.uk

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Prepared by : _____

Michelle Edwards, Team Leader
MM05 659, MCERTS Level 2, TE1-3

Reviewed by : _____

Paul Furmston, Director

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EXECUTIVE SUMMARY

Resource & Environmental Consultants (REC) Ltd was commissioned by Sarginsons Industries Ltd to monitor emissions of particulate matter released from process vents from the Aluminium casting process at their site in Coventry.

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

Species	UKAS Accreditation Status	Emission Concentration (mg/Nm ³)	Permit Limit (mg/Nm ³)
Wet Arrestor Stack	B	8.0	50
Dry Arrestor Stack	B	6.9	50

NOTE 1: All data are expressed in mg/Nm³ 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

1. INTRODUCTION

1.1 Background

Sarginsons Industries Ltd commissioned REC Ltd to conduct an emission monitoring survey on the Aluminium Casting process stacks at their site in Coventry.

1.2 Scope of the Survey

An emission monitoring survey was required to determine the release concentrations of particulate matter from two process stacks:

- Wet Arrestor Stack
- Dry Arrestor Stack

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:-

9 July, 2014

- Aidan Wryne - Team Leader, MM08 918, MCERTS Level 2, TE1,3 & 4
- Craig Mcdonald - Assistant, MM11 1130, MCERTS Trainee

18 August, 2014

- Michelle Edwards - Team Leader, MM05 659, MCERTS Level 2, TE1 - 3
- Aidan Wryne - Team Leader, MM08 918, MCERTS Level 2, TE1,3 & 4

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 EN 13284	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 EN 13284 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 contained in a heated oven compartment. The temperature of the probe and filter box were maintained at 160°C i.e. above the dew point of the stack gases, to ensure moisture did not condense on the filter. 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.

2.3 Laboratory Analysis

An approved UKAS accredited sub-contractor, SAL Ltd, undertook the sample analysis for total particulate matter

Copies of their Certificates of Analysis are enclosed in Appendix 1.

3. SAMPLING AND OPERATIONAL DETAILS

3.1 Process Description

The operations at Sarginsons Industries Ltd are authorised under a Part B permit issued by the Local Authority under the Environmental Permitting Regulations, 2010.

The process is therefore under Local Authority regulation and must demonstrate compliance with the emission limits stipulated in the site permit: PPC/020

The site is involved in the production of complex aluminium casts using both low pressure sand and gravity die-casting processes. Both wet and dry arrestors are installed on such processes, assisting in the filtration of fine sand and aluminium particles before they are released out to atmosphere.

These continuous processes operate independently, and are fuelled primarily by electricity. The wet arrestor process utilises a wet scrubber method of abatement, whilst the dry arrestor utilises a bag filter system.

3.2 Sampling Positions

On both the Wet and Dry Arrestor stacks, 2 x 4" BSP sampling ports were installed on a rectangular duct. However due to access restrictions caused by the platforms provided, only one sampling port provided reasonable access for monitoring on each stack. The sampling points provided were at least 4 x hydraulic diameters upstream and less than 4 x hydraulic diameters downstream from any flow disturbance.

The platform and sample port size do not fully comply with the positional requirements of Environment Agency Technical Guidance Note M1 (EA TGN M1). EA TGN M1 requires 5" BSP sockets to be fitted.

The initial temperature and velocity traverses conducted along the sample planes showed that the flow requirements of EA TGN M1 were however met.

Diagrams detailing the sampling positions and taken from Site Worksheets are provided in Appendix 2.

3.3 Uncertainty

Due to the small size of the platforms provided on both the wet and dry arrestor stacks only a single sample plane could be utilised, achieving only a limited number of sample points. This will increase the measurement uncertainty from the standard $\pm 10\%$

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.

3.4 Emission Monitoring Survey Details

The emission monitoring survey was carried out on the Aluminium casting process on 9 July, and 18 August, 2014. The table below summarises the actual sampling periods.

SAMPLING PERIODS

Stack Ref.	Parameter	Sample Time (& Date)
Wet Arrestor Stack	Particulates	09:36 - 10:16 (09/07/14)
Dry Arrestor Stack		10:16 - 10:56 (18/08/14)

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 (m³/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 and 3. 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/m³ at 273K, 101.3kPa, without correction for water vapour content

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

TABLES

TABLE 1
FLOW DATA

Stack Ref.	Stack Temp	Av Pitot ΔP	Duct Diam	X-Sect. Area	Velocity (actual)	Volume Flow m^3/hr	
	($^{\circ}C$)	(Pa)	(cm)	(m^2)	(m/s)	(actual)	(@ ntp)
Wet Arrestor	24	98	48 x 46	0.221	12.8	10,219	9,406
Dry Arrestor	27	473	90 x 90	0.810	28.6	83,390	75,936

TABLE 2

PARTICULATE EMISSION DATA SUMMARY – WET ARRESTOR

DATE: 09/07/14

09:36 - 10:16

Sampling Data	
Run Time (min)	40
Total mass H ₂ O collected (g)	6.2
Pitot tube constant, C _p	0.84
Dry gas meter (DGM) volume (m ³)	1.134
Temperature DGM (°C)	20
Temperature stack (°C)	25
Mean pitot tube pressure drop, delta P (mm H ₂ O)	21.8
Orifice meter pressure drop, delta H (mm H ₂ O)	75.0
Barometric Pressure (kPa)	100.7
X-sectional area of stack (m ²)	0.221
Nozzle size (mm)	6.03
Flow Data	
Velocity, actual (m/s)	16.0
Velocity, ntp (m/s)	14.6
Vol. Flow, actual (m ³ /hr)	12,729
Vol. Flow, ntp (m ³ /hr)	11,627
Volume sampled, ntp, dry gas (m ³)	1.030
Volume sampled, ntp, wet gas (m ³)	1.038
Analytical Data	
Filter Weight Gain (mg)	7.1
Acetone Wash Residue Weight (mg)	1.2
Total Particulates (mg)	8.3
Partics Field Blank (mg)	0.4
Blank % of ELV	0.8
Emission Data	
H ₂ O (% vol)	0.7
Percentage Isokinetic	103.6
Particulates (mg/m ³)	8.0
Uncertainty (± mg/m ³)	0.5

TABLE 3

PARTICULATE EMISSION DATA SUMMARY – DRY ARRESTOR

DATE: 18/08/14

10:16 - 10:56

Sampling Data	
Run Time (min)	40
Total mass H ₂ O collected (g)	1.8
Pitot tube constant, C _p	0.82
Dry gas meter (DGM) volume (m ³)	1.627
Temperature DGM (°C)	22
Temperature stack (°C)	25
Mean pitot tube pressure drop, delta P (mm H ₂ O)	49.3
Orifice meter pressure drop, delta H (mm H ₂ O)	151.2
Barometric Pressure (kPa)	99.6
X-sectional area of stack (m ²)	0.221
Nozzle size (mm)	6.04
Flow Data	
Velocity, actual (m/s)	23.8
Velocity, ntp (m/s)	21.6
Vol. Flow, actual (m ³ /hr)	18,917
Vol. Flow, ntp (m ³ /hr)	17,184
Volume sampled, ntp, dry gas (m ³)	1.456
Volume sampled, ntp, wet gas (m ³)	1.458
Analytical Data	
Filter Weight Gain (mg)	<0.10
Acetone Wash Residue Weight (mg)	10.0
Total Particulates (mg)	10.0
Partics Field Blank (mg)	0.4
Blank % of ELV	0.5
Emission Data	
H ₂ O (% vol)	0.1
Percentage Isokinetic	98.2
Particulates (mg/m ³)	6.9
Uncertainty (± mg/m ³)	0.4

APPENDIX 1

Certificates of Analysis



Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2404

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 409025-1

Date of Report: 23-Jul-2014

Customer: Resource Environmental Consultants Ltd
Unit 19
Bordesley Trading Estate
Bordesley Green Road
Birmingham
B8 1BZ

Customer Contact: Mr Aidan Wrynn

Customer Job Reference: 71892

Customer Site Reference: Date Collected: 9/7/14

Date Job Received at SAL: 16-Jul-2014

Date Analysis Started: 17-Jul-2014

Date Analysis Completed: 23-Jul-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
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Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
Kayleigh McCann
Project Manager

Issued by :
Kayleigh McCann
Project Manager

Signature valid

Digitally signed by Kayleigh
McCann
Date: 2014.07.23 17:06:44 BST
Reason: Issue
Location: SAL

SAL Reference: 409025						
Project Site: Date Collected: 9/7/14						
Customer Reference: 71892						
Filter Quartz 110mm Analysed as Filter Quartz 110mm						
Miscellaneous						
			SAL Reference		409025 001	409025 003
			Customer Sample Reference		71892/1	71892/3
			Test Sample		AR	AR
			Filter Reference		193	192
Determinand	Method	LOD	Units	Symbol		
Particulates (Total)	Grav (5 Dec)	0.10	mg	U	7.1	<0.10

SAL Reference: 409025						
Project Site: Date Collected: 9/7/14						
Customer Reference: 71892						
Wash(Acetone) Analysed as Wash(Acetone)						
Miscellaneous						
			SAL Reference		409025 002	409025 004
			Customer Sample Reference		71892/2	71892/4
			Test Sample		AR	AR
Determinand	Method	LOD	Units	Symbol		
Particulates (Total)	Grav	0.3	mg	U	1.2	<0.3

Index to symbols used in 409025-1

Value	Description
AR	As Received
U	Analysis is UKAS accredited



Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2404

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limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 416739-1

Date of Report: 28-Aug-2014

Customer: Resource Environmental Consultants Ltd
Unit 19
Bordesley Trading Estate
Bordesley Green Road
Birmingham
B8 1BZ

Customer Contact: Ms Michelle Edwards

Customer Job Reference: 2p71892

Customer Site Reference: Date Collected: 18/8/14

Date Job Received at SAL: 20-Aug-2014

Date Analysis Started: 20-Aug-2014

Date Analysis Completed: 28-Aug-2014

The results reported relate to samples received in the laboratory
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Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



Report checked
and authorised by :
James Allan
Project Manager

Issued by :
James Allan
Project Manager

Signature valid

Digitally signed by James Allan
Date: 2014.08.28 17:17:24 BST
Reason: Issue
Location: SAL

SAL Reference: 416739						
Project Site: Date Collected: 18/8/14						
Customer Reference: 2p71892						
Wash(Acetone) Analysed as Wash(Acetone)						
Miscellaneous						
SAL Reference			416739 002	416739 004		
Customer Sample Reference			71842/2	71892/4		
Test Sample			AR	AR		
Determinand	Method	LOD	Units	Symbol		
Particulates (Total)	Grav	0.3	mg	U	<0.3	10

SAL Reference: 416739						
Project Site: Date Collected: 18/8/14						
Customer Reference: 2p71892						
Filter Quartz 85mm Analysed as Filter Quartz 85mm						
Miscellaneous						
SAL Reference			416739 001	416739 003		
Customer Sample Reference			71892/1	71892/3		
Test Sample			AR	AR		
Filter Reference			86	88		
Determinand	Method	LOD	Units	Symbol		
Particulates (Total)	Grav (5 Dec)	0.10	mg	U	<0.10	<0.10

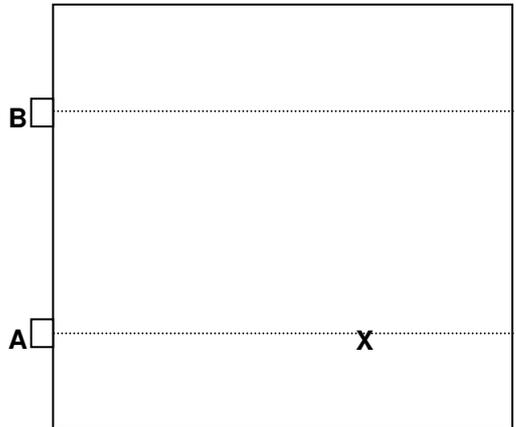
Index to symbols used in 416739-1

Value	Description
AR	As Received
U	Analysis is UKAS accredited

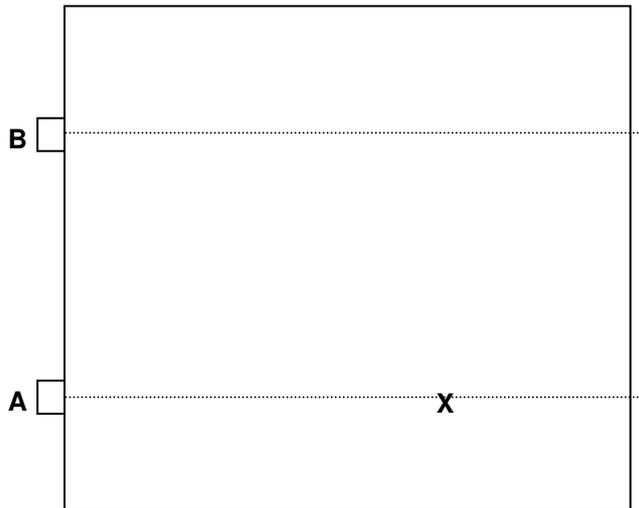
APPENDIX 2

Diagrams of Sampling Points

WET ARRESTOR



DRY ARRESTOR



APPENDIX 3

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 ₃ H 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 O₂ and Dry Gas, i.e.

Concentration X ((20.9-O₂ ref)/(20.9-O₂ 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/m³ = TCE ppm x 5.864 (Mol Wt/22.4)