Source Test Report

Real Alloy Recycling, LLC
Coldwater South
267 N. Fillmore Road
Coldwater, MI 49036

Source Tested: Reverberatory Furnace
7S Baghouse
Test Date: August 22, 2019

AST Project No. 2019-1213

Prepared By
Alliance Source Testing, LLC
1201 Parkway View Drive
Pittsburgh, PA 15205

MAIN OFFICE
255 Grant Street SE
Suite 600
Decatur, AL 35601
(256) 351-0121

stacktest.com

REGIONAL OFFICES
Anchorage, AK
Baton Rouge, LA
Birmingham, AL
Cedar Rapids, IA
Decatur, AL
Denver, CO
Houston, TX
Lewisville, TX
Little Rock, AR
Philadelphia, PA
Pittsburgh, PA
Roanoke, VA
Salt Lake City, UT

The Alliance Advantage

Regulatory Information

Permit No.	MDEQ Permit No. MI-ROP-N5957-2012e
Regulatory Citation	40 CFR 63, Subpart RRR

Source Information

Source Name	*Source ID*	*Target Parameter*
Reverberatory Furnace 7S / Reverberatory Furnace Baghouse	EUALFURN7 / EUIMREVERBFURN-S2	D/F

Contact Information

Test Location
Real Alloy Recycling, LLC
Coldwater South
267 N. Fillmore Road
Coldwater, MI 49036

Brady Myers
brady.myers@realalloy.com
(517) 279-4036

Janine Caldwell
janine.caldwell@realalloy.com
(517) 462-1542

Jeff Ferg
jeff.ferg@realalloy.com
(216) 556-3835

Test Company
Alliance Source Testing, LLC
1201 Parkway View Drive
Pittsburgh, PA 15205

Project Manager
Adam Robinson
adam.robinson@stacktest.com
(412) 668-4040

QA/QC Manager
Heather Morgan
heather.morgan@stacktest.com
(256) 260-3972

Report Coordinator
Alyssa Trujillo
alyssa.trujillo@stacktest.com
(801) 269-0550

Analytical Laboratory
SGS Analytical Perspectives
2714 Exchange Drive
Wilmington, NC 28405
Amy Boehm
amy.boehm@sgs.com
(910) 794-1613, ext. 110

Alliance Source Testing, LLC (AST) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and AST is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections on the test report.

This report is only considered valid once an authorized representative of AST has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.

Adam Robinson, QSTI **Alliance Source Testing, LLC**	9/18/2019 Date

CERTIFICATION OF DATA ACCURACY

I certify based upon review and reasonable inquiry that the statements made and the information contained in this report is true, accurate, complete, and representative of conditions encountered at the time of testing.

Signature:	
Date:	9/18/19
Responsible Official or Authorized Representative	
Name and Title:	Michael Chenoweth, Plant Manager

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

Introduction

1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Real Alloy Recycling, LLC (RAR) to conduct compliance testing at the Coldwater, Michigan (South) facility. Portions of the facility are subject to the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Secondary Aluminum Production, 40 CFR 63, Subpart RRR. The facility operates under the Michigan Department of Environmental Quality (MDEQ) Permit No. MI-PTI-N5957-2012e. Testing was conducted to determine the emission rate of dioxins and furans (D/F) at the baghouse exhaust (EUIMREVERBFURN-S2) serving Reverberatory Furnace 7S (EUALFURN7). The purpose of the test was to demonstrate compliance against the NESHAP while setting a new maximum baghouse inlet temperature.

1.1 Source and Control System Descriptions

The 9,000 lb/hr reverberatory melting furnace is used to melt aluminum scrap that has been processed by the existing drying system or directly charged toll or purchased scrap. The furnace is designed as a sidewell melter/holder unit to allow for continuous operation. The toll, purchased, and preprocessed scrap is charged to the sidewell of the furnace along with solid flux material, Cl_2 gas and any alloying agents that are required for the production order. Once the materials are molten, the metal flows through a submerged opening to the hearth. Once properly alloyed, the furnace is tapped, and the molten aluminum is transferred to refractory lined crucibles for delivery or transferred to sow or DeOx molds. Only clean charge materials are fed to the main hearth, and no reactive flux materials are used in this section of the furnace.

All emissions from the reverberatory furnace sidewell are captured and directed to a lime injected baghouse system for control of the regulated pollutants. Hydrated lime is injected into the baghouse system to reduce the concentrations of acidic and halogenated pollutants present in the exhaust gas. The baghouse then captures the reacted lime and other particulate matter evolved from the melting process. Emissions from the reverberatory furnace flue exhaust directly to the atmosphere and were not quantified as part of this test.

1.2 Project Team

Personnel involved in this project are identified in the following table.

Table 1-1
Project Team

RAR Personnel	Janine Caldwell Jeff Ferg
Regulatory Personnel	Tom Gasloli Amanda Chapel Chance Collins
AST Personnel	Adam Robinson Brendan Price

1.3 Site Specific Test Plan & Notification

Testing was conducted in accordance with the Site-Specific Test Plan (SSTP) submitted to MDEQ on July 23, 2019.

Summary of Results

2.0 Summary of Results

AST conducted compliance testing at the RAR Coldwater, Michigan (South) facility on August 22, 2019. Testing consisted of determining the emission rates of D/F at the baghouse exhaust (EUIMREVERBFURN-S2) serving Reverberatory Furnace 7S (EUALFURN7).

Table 2-1 provides a summary of the emission testing results with comparisons to the applicable 40 CFR 63, Subpart RRR limits. This table also provides a summary of the process operating and control system data collected during testing. Any difference between the summary results listed in the following table and the detailed results contained in appendices is due to rounding for presentation.

Table 2-1
Summary of Results

Emissions Data – EUIMREVERBFURN-S2				
Run Number	**Run 1**	**Run 2**	**Run 3**	**Average**
Date	**8/22/19**	**8/22/19**	**8/22/19**	**--**
Dioxin/Furan Data				
Emission Factor, ug TEQ/MG [1]	0.20	0.53	0.41	0.38
NESHAP Limit, ug TEQ/MG	--	--	--	15.0
Percent of Limit, %	--	--	--	**3**
Process Operating / Control System Data				
Run Number	**Run 1**	**Run 2**	**Run 3**	**Average**
Date	**8/22/19**	**8/22/19**	**8/22/19**	**--**
Feed Rate, lb/hr	11,022	12,389	12,011	11,807
Baghouse Inlet Temperature, °F	147	157	155	153

[1] D/F TEQ values were calculated using 1989 NATO TEFs.

Testing Methodology

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

Table 3-1
Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen / Carbon Dioxide	3/3A	Integrated Bag / Instrumental Analysis
Moisture Content	4	Gravimetric Analysis
Dioxins and Furans	23 / ALT-034	Isokinetic Sampling

3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

3.2 U.S. EPA Reference Test Method 3/3A – Oxygen/Carbon Dioxide

The oxygen (O_2) and carbon dioxide (CO_2) testing was conducted in accordance with U.S. EPA Reference Test Method 3/3A. One (1) integrated Tedlar bag sample was collected during each test run. The bag samples were analyzed on site with a gas analyzer. The remaining stack gas constituent was assumed to be nitrogen for the stack gas molecular weight determination. The quality control measures are described in Section 3.5.

3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.4 U.S. EPA Reference Test Method 23/Alternative Method 034 – Dioxins/Furans

The dioxins and furans (D/F) testing was conducted in accordance with U.S. EPA Reference Test Method 23 with guidance from Alternative Method 034. The sampling system consisted of a Teflon nozzle, heated glass-lined probe, glass filter holder with pre-cleaned heated glass-fiber filter, condenser coil, XAD sorbent module, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning system consisted of five (5) chilled impingers. The first impinger was empty. The next two (2) impingers each contained 100 mL of water. The fourth impinger was empty while the fifth impinger was charged with 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at a temperature of 120 ± 14°C (248 ±25°F), and the impinger temperature was maintained at 20°C (68°F) or less throughout testing.

All glassware leading to the XAD adsorbing resin trap was cleaned and sealed before mobilizing to the site. Glassware cleaning consisted of washing with warm soapy water and rinsing with distilled water and acetone. The sampling train was assembled in the sample recovery area. The glass-fiber filter was placed in a glass filter holder with a Teflon filter support and connected to the condenser coil. All open ends of the sampling train were sealed with Teflon tape prior to complete assembly at the sampling location.

Following the completion of each test run, the sampling train was leak checked at vacuum pressure greater than or equal to the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The XAD sorbent module was sealed on both ends and placed on ice. The filter was removed from the filter holder and placed in sample container 1. The nozzle, probe liner, filter holder, condenser and all connecting glassware were triple-rinsed and brushed with acetone, and these rinses were recovered in sample container 2. All glassware cleaned for sample container 2 was also triple-rinsed with toluene and recovered into sample container 3. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

A field blank was collected after the first test run. A complete sampling system was placed at the sampling location and multiple leak checks were performed on the system similar to an actual testing scenario. The sample train was then moved to the mobile laboratory for recovery. A full set of regent blanks including a filter and a trap were also submitted to the laboratory.

3.5 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 3/3A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low-Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High-Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv absolute difference.

Appendix A

Alliance
SOURCE TESTING

Location:	**Real Alloy Recycling, Inc. - Coldwater South**
Source:	**Reverberatory Furnace Baghouse**
Project No.:	**2019-1213**
Run No.:	**1**
Parameter:	**DF**

Meter Pressure (Pm), in. Hg

$$Pm = Pb + \frac{\Delta H}{13.6}$$

where,

Pb	29.01	= barometric pressure, in. Hg
ΔH	0.619	= pressure differential of orifice, in H_2O
Pm	29.06	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$Ps = Pb + \frac{Pg}{13.6}$$

where,

Pb	29.01	= barometric pressure, in. Hg
Pg	-0.13	= static pressure, in. H_2O
Ps	29.00	= in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.647 \times Y \times Vm \times Pm}{Tm}$$

where,

Y	1.003	= meter correction factor
Vm	68.575	= meter volume, cf
Pm	29.06	= absolute meter pressure, in. Hg
Tm	532.8	= absolute meter temperature, °R
Vmstd	66.186	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04707 \times Vlc$$

where,

Vlc	41.5	= volume of H_2O collected, ml
Vwstd	1.957	= scf

Moisture Fraction (BWSsat), dimensionless (theoretical at saturated conditions)

$$BWSsat = \frac{10^{6.37 - \left(\frac{2,827}{Ts + 365}\right)}}{Ps}$$

where,

Ts	125.8	= stack temperature, °F
Ps	29.00	= absolute stack gas pressure, in. Hg
BWSsat	0.140	= dimensionless

Moisture Fraction (BWS), dimensionless (measured)

$$BWS = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where,

Vwstd	1.957	= standard wet volume, scf
Vmstd	66.186	= standard meter volume, dscf
BWS	0.029	= dimensionless

Alliance Source Testing

Location: Real Alloy Recycling, Inc. - Coldwater South
Source: Reverberatory Furnace Baghouse
Project No.: 2019-1213
Run No.: 1
Parameter: DF

Moisture Fraction (BWS), dimensionless

$$BWS = BWSmsd \ \ unless \ \ BWSsat < BWSmsd$$

where,

BWSsat	0.140	= moisture fraction (theoretical at saturated conditions)
BWSmsd	0.029	= moisture fraction (measured)
BWS	0.029	

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O_2) + (0.28 \ (100 - \% CO_2 - \% O_2))$$

where,

CO_2	0.2	= carbon dioxide concentration, %
O_2	20.3	= oxygen concentration, %
Md	28.84	= lb/lb mol

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md \ (1 - BWS) + 18 \ (BWS)$$

where,

Md	28.84	= molecular weight (DRY), lb/lb mol
BWS	0.029	= moisture fraction, dimensionless
Ms	28.53	= lb/lb mol

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \times Cp \times (\Delta P^{1/2})avg \times \sqrt{\frac{Ts}{Ps \ x \ Ms}}$$

where,

Cp	0.840	= pitot tube coefficient
$\Delta P^{1/2}$	0.583	= velocity head of stack gas, (in. $H_2O)^{1/2}$
Ts	585.8	= absolute stack temperature, °R
Ps	29.00	= absolute stack gas pressure, in. Hg
Ms	28.53	= molecular weight of stack gas, lb/lb mol
Vs	35.2	= ft/sec

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60 \times Vs \times As$$

where,

Vs	35.2	= stack gas velocity, ft/sec
As	27.88	= cross-sectional area of stack, ft^2
Qa	58,917	= acfm

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.647 \times Qa \times (1 - BWS) \times \frac{Ps}{Ts}$$

where,

Qa	58,917	= average stack gas flow at stack conditions, acfm
BWS	0.029	= moisture fraction, dimensionless
Ps	29.00	= absolute stack gas pressure, in. Hg
Ts	585.8	= absolute stack temperature, °R
Qs	49,990	= dscfm

Location: Real Alloy Recycling, Inc. - Coldwater South
Source: Reverberatory Furnace Baghouse
Project No.: 2019-1213
Run No.: 1
Parameter: DF

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Yqa = \frac{Y - \left(\frac{\Theta}{Vm} \sqrt{\frac{0.0319 \times Tm \times 29}{\Delta H@ \times \left(Pb + \frac{\Delta H\ avg.}{13.6} \right) \times Md}} \sqrt{\Delta H}\ avg. \right)}{Y} \times 100$$

where,

Y	1.003	= meter correction factor, dimensionless
Θ	153	= run time, min.
Vm	68.575	= total meter volume, dcf
Tm	532.8	= absolute meter temperature, °R
ΔH@	1.833	= orifice meter calibration coefficient, in. H_2O
Pb	29.01	= barometric pressure, in. Hg
ΔH avg	0.619	= average pressure differential of orifice, in H_2O
Md	28.84	= molecular weight (DRY), lb/lb mol
$(\Delta H)^{1/2}$	0.786	= average squareroot pressure differential of orifice, $(\text{in. H2O})^{1/2}$
Yqa	1.0	= dimensionless

Volume of Nozzle (Vn), ft^3

$$Vn = \frac{Ts}{Ps}\left(0.002669 \times Vlc + \frac{Vm \times Pm \times Y}{Tm} \right)$$

where,

Ts	585.8	= absolute stack temperature, °R
Ps	29.00	= absolute stack gas pressure, in. Hg
Vlc	41.5	= volume of H_2O collected, ml
Vm	68.575	= meter volume, cf
Pm	29.06	= absolute meter pressure, in. Hg
Y	1.003	= meter correction factor, unitless
Tm	532.8	= absolute meter temperature, °R
Vn	78.003	= volume of nozzle, ft^3

Isokinetic Sampling Rate (I), %

$$I = \left(\frac{Vn}{\theta \times 60 \times An \times Vs} \right) \times 100$$

where,

Vn	78.003	= nozzle volume, ft^3
θ	153.0	= run time, minutes
An	0.00024	= area of nozzle, ft^2
Vs	35.2	= average velocity, ft/sec
I	101.3	= %

D/F TEQ Concentration ($C_{D/F}$), grain TEQ/dscf

$$C_{D/F} = \frac{M_{D/F} \times 1.54E-11}{Vmstd}$$

where,

$M_{D/F}$	23	= D/F TEQ mass, pg
Vmstd	66.186	= standard meter volume, dscf
$C_{D/F}$	5.2E-12	= grain TEQ/dscf

Location: Real Alloy Recycling, Inc. - Coldwater South
Source: Reverberatory Furnace Baghouse
Project No.: 2019-1213
Run No.: 1
Parameter: DF

D/F TEQ Emission Rate (ER_{DF}), lb TEQ/hr

$$ER_{DF} = \frac{C_{D/F} \times Q_s \times 60}{4.54E+11}$$

where,

$C_{D/F}$ 3.4E-04 = D/F TEQ concentration, ng/ft^3
Qs 49,990 = average stack gas flow at standard conditions, dscfm
ER_{DF} 2.2E-09 = lb TEQ/hr

D/F TEQ Emission Factor (EF_{DF}), ug TEQ/MG

$$EF_{DF} = \frac{ER_{DF} \times 1.0E+12}{FR}$$

where,

ER_{DF} 2.2E-09 = D/F TEQ emission rate, lb TEQ /hr
FR 11,022 = process feed rate, lb/hr
EF_{DF} 0.20 = ug TEQ/MG

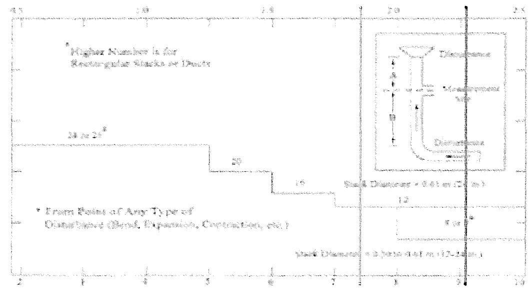
Appendix B

Method 1 Data

Location Real Alloy Recycling, Inc. - Coldwater South
Source Reverberatory Furnace Baghouse
Project No. 2019-1213
Date: 08/21/19

Stack Parameters

Duct Orientation:	Vertical	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	76.00	in
Nipple Length:	4.50	in
Depth of Duct:	71.50	in
Cross Sectional Area of Duct:	27.88	ft^2
No. of Test Ports:	2	
Distance A:	13.5	ft
Distance A Duct Diameters:	2.3	(must be > 0.5)
Distance B:	44.0	ft
Distance B Duct Diameters:	7.4	(must be > 2)
Minimum Number of Traverse Points:	12	
Actual Number of Traverse Points:	12	
Number of Readings per Point:	1	



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

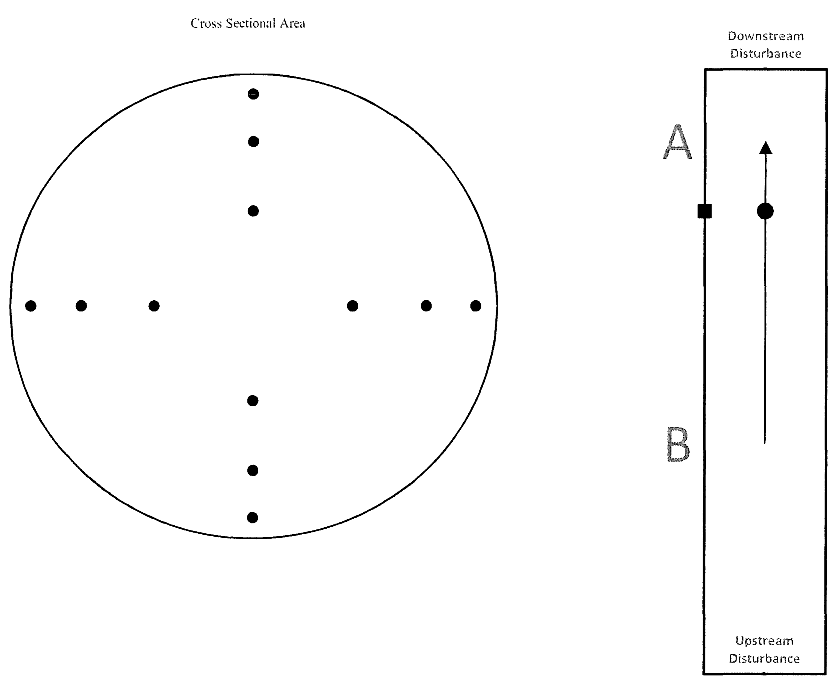
Number of traverse points on a diameter

	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

*Percent of stack diameter from inside wall to traverse point.

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	4.4	3.15	7.65
2	14.6	10.44	14.94
3	29.6	21.16	25.66
4	70.4	50.34	54.84
5	85.4	61.06	65.56
6	95.6	68.35	72.85
7	--	--	--
8	--	--	--
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

Stack Diagram
A = 13.5 ft.
B = 44 ft.
Depth of Duct = 71.5 in.



Cyclonic Flow Check

Location Real Alloy Recycling, Inc. - Coldwater South
Source Reverberatory Furnace Baghouse
Project No. 2019-1213
Date 08/21/19

Sample Point	Angle (ΔP=0)
1	0
2	5
3	0
4	0
5	5
6	5
7	5
8	0
9	5
10	5
11	5
12	5
Average	3

Location Real Alloy Recycling, Inc. - Coldwater South
Source Reverberatory Furnace Baghouse
Project No. 2019-1213
Parameter DF

Run Number		Run 1	Run 2	Run 3	Average
Date		8/22/19	8/22/19	8/22/19	--
Start Time		8:15	11:30	14:25	--
Stop Time		10:55	14:00	16:55	--
Run Time, min	(θ)	153.0	144.0	144.0	147.0
INPUT DATA					
Feed Rate, lb/hr	(FR)	11,022	12,389	12,011	11,807
Barometric Pressure, in. Hg	(Pb)	29.01	29.01	29.01	29.01
Meter Correction Factor	(Y)	1.003	1.003	1.003	1.003
Orifice Calibration Value	(ΔH @)	1.833	1.833	1.833	1.833
Meter Volume, ft^3	(Vm)	68.575	60.213	61.778	63.522
Meter Temperature, °F	(Tm)	72.8	72.6	77.5	74.3
Meter Temperature, °R	(Tm)	532.8	532.6	537.5	534.3
Meter Orifice Pressure, in. WC	(ΔH)	0.619	0.538	0.560	0.572
Volume H_2O Collected, mL	(Vlc)	41.5	34.0	33.8	36.4
Nozzle Diameter, in	(Dn)	0.209	0.206	0.209	0.208
Area of Nozzle, ft^2	(An)	0.0002	0.0002	0.0002	0.0002
D/F TEQ Mass, pg	($M_{D/F}$)	22.5	60.2	46.5	43.1
ISOKINETIC DATA					
Standard Meter Volume, ft^3	(Vmstd)	66.186	58.132	59.100	61.139
Standard Water Volume, ft^3	(Vwstd)	1.957	1.603	1.594	1.718
Moisture Fraction Measured	(BWSmsd)	0.029	0.027	0.026	0.027
Moisture Fraction @ Saturation	(BWSsat)	0.140	0.233	0.268	0.214
Moisture Fraction	(BWS)	0.029	0.027	0.026	0.027
Meter Pressure, in Hg	(Pm)	29.06	29.05	29.05	29.05
Volume at Nozzle, ft^3	(Vn)	78.003	70.665	72.484	73.717
Isokinetic Sampling Rate, (%)	(I)	101.3	100.9	100.5	100.9
DGM Calibration Check Value, (+/- 5%)	(Y_{qa})	1.0	1.1	1.2	1.1
EMISSION CALCULATIONS					
D/F TEQ Concentration, grain/dscf	(C_{DF})	5.2E-12	1.6E-11	1.2E-11	1.1E-11
D/F TEQ Emission Rate, lb/hr	($ER_{D/F}$)	2.2E-09	6.6E-09	5.0E-09	4.6E-09
D/F TEQ Emission Factor, ug/MG	($EF_{D/F}$)	0.20	0.53	0.41	0.38

Location Real Alloy Recycling, Inc. - Coldwater South
Source Reverberatory Furnace Baghouse
Project No. 2019-1213
Parameter DF

Run Number		Run 1	Run 2	Run 3	Average
Date		8/22/19	8/22/19	8/22/19	--
Start Time		8:15	11:30	14:25	--
Stop Time		10:55	14:00	16:55	--
Run Time, min		153.0	144.0	144.0	147.0
VELOCITY HEAD, in. WC					
Point 1		0.38	0.37	0.39	0.38
Point 2		0.40	0.35	0.38	0.38
Point 3		0.39	0.34	0.35	0.36
Point 4		0.36	0.31	0.30	0.32
Point 5		0.32	0.32	0.30	0.31
Point 6		0.30	0.28	0.29	0.29
Point 7		0.31	0.34	0.31	0.32
Point 8		0.37	0.34	0.32	0.34
Point 9		0.34	0.34	0.34	0.34
Point 10		0.35	0.32	0.31	0.33
Point 11		0.35	0.30	0.30	0.32
Point 12		0.28	0.30	0.29	0.29
Point 13		0.28	--	--	0.28
CALCULATED DATA					
Square Root of ΔP, $(\text{in. WC})^{1/2}$	(ΔP)	0.583	0.570	0.568	0.574
Pitot Tube Coefficient	(Cp)	0.84	0.84	0.84	0.84
Barometric Pressure, in. Hg	(Pb)	29.01	29.01	29.01	29.01
Static Pressure, in. WC	(Pg)	-0.13	-0.14	-0.15	-0.14
Stack Pressure, in. Hg	(Ps)	29.00	29.00	29.00	29.00
Stack Cross-sectional Area, ft^2	(As)	27.88	27.88	27.88	27.88
Temperature, °F	(Ts)	125.8	145.4	151.2	140.8
Temperature, °R	(Ts)	585.8	605.4	611.2	600.8
Moisture Fraction Measured	(BWSmsd)	0.029	0.027	0.026	0.027
Moisture Fraction @ Saturation	(BWSsat)	0.140	0.233	0.268	0.214
Moisture Fraction	(BWS)	0.029	0.027	0.026	0.027
O_2 Concentration, %	(O_2)	20.3	20.2	20.2	20.2
CO_2 Concentration, %	(CO_2)	0.2	0.3	0.3	0.3
Molecular Weight, lb/lb-mole (dry)	(Md)	28.84	28.86	28.86	28.85
Molecular Weight, lb/lb-mole (wet)	(Ms)	28.53	28.56	28.57	28.56
Velocity, ft/sec	(Vs)	35.2	35.0	35.0	35.1
VOLUMETRIC FLOW RATE					
At Stack Conditions, acfm	(Qa)	58,917	58,586	58,601	58,701
At Standard Conditions, dscfm	(Qs)	49,990	48,194	47,779	48,654