EMISSIONS STUDY

Performed At The
Port City Group
Alloy Resources Corporation Facility
Common Lime Injected Baghouse Exhaust (FGFURNACES)
Muskegon, Michigan

Test Dates
January 14 through 16, 2015

Report No.
TRC Environmental Corporation Report 220329A

Report Submittal Date
March 19, 2015

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed an emission test program at the Port City Group's Alloy Resources Corporation (ARC) facility on the Common Lime Injected Baghouse (FGFURNACES) exhaust stack in Muskegon, Michigan on January 14 through 16, 2015. The tests were authorized by and performed for Port City Group.

The purpose of this test program was to determine total particulate matter (PM), hydrogen chloride (HCl), hydrogen fluoride (HF), chlorine (Cl_2) and dioxin/furan emission rates at the Common Lime Injected Baghouse exhaust stack during normal operating conditions.

1.1 Project Contact Information

Participants		
Test Facility	Port City Group Alloy Resources Corporation 1985 East Laketon Ave Muskegon, Michigan 50701	Mr. Jerry Garman, MPH EHS Coordinator (231) 777-8759 (phone) (231) 571-3806 (cell) jgarman@PortCityGroup.com
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 2025 E. Beltline Ave SE Suite 402 Grand Rapids, Michigan 49546 TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Mr. Benjamin Lemley, PE Project Engineer (201) 636-5885 (phone) (616) 975-1098 (fax) BLemley@trcsolutions.com Mr. Paul Coleman Project Manager 312-533-2023 (phone) pcoleman@trcsolutions.com

The tests were conducted by Chris Miller and David Thompson of TRC. Documentation of the on-site ASTM D7036-04 Qualified Individuals (QI) can be located in the appendix to this report.

Messrs. Eric Grinstern and Jeremy Howe of the Michigan Department of Environmental Quality (MDEQ) Air Quality Division observed the test program.

2.0 SUMMARY OF RESULTS

The results of this test program are summarized in the table below. Detailed individual run results are presented in Section 6.0.

Parameter		FGFURNACES	Emission Limit
Filterable Particulate Matter	grains/dscf	0.0004	0.01
	lb/hr	0.16	---
Condensable Particulate Matter	grains/dscf	0.0009	---
	lb/hr	0.39	---
Total Particulate Matter	grains/dscf	0.0012	---
	lb/hr	0.55	3.3
HCl	lb/hr	0.30	---
	lb/ton	0.09	0.34 lb/ton aluminum charge
HF	lb/hr	0.00	---
	lb/ton	0.00	0.34 lb/ton aluminum charge
Cl_2	lb/hr	0.00	0.26
Dioxin, TEQ total	lb/hr	9.92×10^{-9}	3.6×10^{-6}

The table below summarizes the test methods used, as well as the number and duration of each at each test location:

Unit ID/ Sample Location	Parameter Measured	Test Method	No. of Runs	Run Duration
FGFURNACES	Filterable and Total PM	Methods 1, 2, 3, 5, and 202	3	60 min
	Dixon/Furan	Method 23	3	180 min
	HCl, HF and Cl2	Method 26	3	60 min

3.0 DISCUSSION OF RESULTS

Four (4) total PM test runs were performed on January 16, 2015. During the total PM Test Run Number 1, it was noticed that the condensable particulate matter (CPM) filter temperature thermocouple was not reading correctly, voiding the first total PM test run. The thermocouple was replaced, and sampling continued without incident. Source operation appeared normal during the entire test program.

4.0 SAMPLING AND ANALYSIS PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were then located in the center of these areas. The minimum numbers of points were determined from Figure 1-1 (particulate).

4.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head (ΔP) and temperature were measured at traverse points defined by USEPA Method 1. The velocity head was measured with a Type S (Stausscheibe or reverse type) pitot tube and oil-filled manometer; and the gas temperature was measured with a Type K thermocouple. The average gas velocity in the flue was calculated based on: the gas density (as determined by USEPA Methods 3 and 4); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

4.3 CO_2 and O_2 Determination by USEPA Method 3

This method is applicable for the determination of CO_2 and O_2 concentrations and dry molecular weight of a sample from an effluent gas stream of a fossil-fuel combustion process or other process.

A gas sample was extracted from the stack by multi-point, integrated sampling, and the gas samples were analyzed for percent CO_2 and percent O_2 using an Orsat.

4.4 Filterable PM Determination by USEPA Method 5

This method is applicable for the determination of PM emissions from stationary sources. USEPA Methods 2-4 were performed concurrently with, and as an integral part of, these determinations.

Flue gas was withdrawn isokinetically from the source at traverse points determined per USEPA Method 1, and PM was collected in the nozzle, probe liner, and on a glass fiber filter. The probe liner and filter were maintained at a temperature of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The PM mass, which included any material that condensed at or above the filtration temperature, was determined gravimetrically after the removal of uncombined water.

4.5 Condensable PM Determination by USEPA Method 202 (As Revised December, 2010)

This method is applicable for the determination of condensable particulate matter (CPM) from stationary sources. CPM is measured in the emissions after removal from the stack and after passing through a filter.

The CPM was collected in dry impingers after filterable particulate material had been collected on filters maintained above 30°C (85°F) using Method 5 or 17 (Appendix A, 40CFR60) or 201A (Appendix M, 40CFR51) type sampling train. The sample train included a Method 23 type condenser capable of cooling the stack gas to less than 85°F, followed by a water dropout impinger. One modified Greenburg Smith impinger and a CPM filter followed the water dropout impinger. The impinger contents were immediately purged after the run with nitrogen (N2) to remove dissolved sulfur dioxide. The impinger solution was then extracted with hexane, and the CPM filter was extracted with water and hexane. The organic and aqueous fractions were then taken to dryness and the residues weighed. A correction, if necessary, was made for any ammonia present due to laboratory analysis procedures. The total of all fractions represented the CPM.

4.6 Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by USEPA Method 23

This method is applicable for the determination of emissions of Polychlorinated Dibenzo-p-Dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) from stationary sources. USEPA Methods 2-4 were performed concurrently with, and as an integral part of these determinations.

A sample was withdrawn isokinetically from the gas stream. PCDDs and PCDFs were collected in the sample probe, on a glass fiber filter, and on a packed column of adsorbent material. The PCDD and PCDF were extracted from the sample, separated by high-resolution gas chromatography (HRCG), and measured by high-resolution mass spectrometry (HRMS).

4.7 Hydrogen Halide and Halogen Determination by USEPA Method 26

This method is applicable for determining emissions of hydrogen halides (HCl, HBr, and HF) and halogens (Cl_2 and Br_2) from stationary sources when specified by the applicable subpart.

An integrated sample was extracted at a constant rate from the source. The sample flowed through a heated probe and filter, and solutions of dilute sulfuric acid and dilute sodium hydroxide. The filter collected particulate matter including halide salts but was not recovered or analyzed. The liquid solutions were analyzed via ion chromatography (IC).

5.0 QUALITY ASSURANCE PROCEDURES

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- Louisiana Environmental Lab Accreditation Program (LELAP) accreditation;
- Interim accreditation from the Stack Testing Accreditation Council (STAC) that our operations conform with the requirements of ASTM D 7036-04

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.

6.0 TEST RESULTS SUMMARY

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METHOD 5/202 PARTICULATE TEST RESULTS SUMMARY

Company: Port City Group
Plant: ARC Facility
Unit: Common Baghouse Exhaust
Location: Stack

Test Run Number	2	3	4	Average
Source Condition	Normal	Normal	Normal	
Date	1/16/2015	1/16/2015	1/16/2015	
Start Time	11:30	14:15	17:00	
End Time	12:35	15:19	18:04	
Sample Duration (min):	60.0	60.0	60.0	60.0
Average Gas Temp (°F):	103.2	104.1	102.1	103.2
Fractional Gas Moisture Content:	0.014	0.012	0.013	0.013
Gas CO_2 Content (%vol):	0.2	0.2	0.2	0.2
Gas O_2 Content (%vol):	18.4	18.2	18.0	18.2
Gas Wet MW (lb/lbmole-mole):	28.61	28.63	28.61	28.62
Average Gas Vel (ft/sec):	42.76	42.73	42.13	42.54
Measured Volumetric Flow Rate				
Q (actual ft^3/min):	58,220	58,180	57,364	57,922
Q_{std} (std ft^3/min):	53,135	52,957	52,702	52,931
$Q_{std(dry)}$ (dry std ft^3/min):	52,370	52,314	52,018	52,234
Sample Volume (dry std ft^3):	46.475	46.372	45.886	46.244
PM Collected (mg):				
Filterable	1.00	0.80	1.50	1.10
Condensable:	3.90	2.50	1.40	2.60
Total:	4.90	3.30	2.90	3.70
PM Concentration (gr/dscf):				
Filterable	0.0003	0.0003	0.0005	0.0004
Condensable:	0.0013	0.0008	0.0005	0.0009
Total:	0.0016	0.0011	0.0010	0.0012
PM Emission Rate (lb/hr based on measured volumetric flow rate):				
Filterable:	0.15	0.12	0.22	0.16
Condensable:	0.58	0.37	0.21	0.39
Total:	0.73	0.49	0.43	0.55
Isokinetic Variance	100.9	100.8	100.3	100.7

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HYDROGEN HALIDE AND HALOGEN TEST RESULTS SUMMARY (METHOD 26)

Company: Port City Group
Plant: ARC Facility
Unit: Common Baghouse Exhaust
Location: Stack

Test Run Number	1	2	3	Average
Source Condition	Normal	Normal	Normal	
Date	1/14/15	1/15/15	1/15/15	
Start Time	12:15	9:37	14:30	
End Time	13:15	10:37	15:30	
Sample Duration (min):	60.0	60.0	60.0	60.0
Barometric Pressure, P_{bar} ("Hg)	29.23	29.05	28.90	29.06
Flue Pressure, P_s ("Hg)	29.19	29.01	28.86	29.02
Meter Volume, $V_{m(std)}$ (dscf):	4.617	4.417	4.348	4.461
Volumetric Flow Rate, $Q_{std(dry)}$ (dscfm):	54,528	59,981	59,310	57,940
Total Scrap Charge (Tons/hr)	3.45	3.62	2.82	3.30
Hydrogen Chloride (HCl)				
HCl Net Mass Collected (mg):	0.18	0.20	0.15	0.18 ADL
HCl Concentration (lb/dscf):	8.59E-08	9.98E-08	7.61E-08	8.73E-08 ADL
HCl Concentration (ppmvd):	0.91	1.05	0.80	0.92 ADL
HCl Concentration (ppmvw):	0.91	1.05	0.80	0.92 ADL
HCl Emission Rate (lb/hr):	0.28	0.36	0.27	0.30 ADL
HCl Emission Rate (lb/Ton scrap charge):	0.08	0.10	0.10	0.09 ADL
Hydrogen Fluoride (HF)				
HF Net Mass Collected (mg):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
HF Concentration (lb/dscf):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
HF Concentration (ppmvd):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
HF Concentration (ppmvw):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
HF Emission Rate (lb/hr):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
HF Emission Rate (lb/Ton scrap charge):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
Chlorine (Cl_2)				
Cl_2 Net Mass Collected (mg):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
Cl_2 Concentration (lb/dscf):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
Cl_2 Concentration (ppmvd):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
Cl_2 Concentration (ppmvw):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL
Cl_2 Emission Rate (lb/hr):	0.00 [1]	0.00 [1]	0.00 [1]	0.00 DLL

[1] -Sample fractions were below the detection limit, results calculated using a value of 0.0

ADL - all analytical values used to calculate and report an in-stack emissions value are greater than the laboratory's reported detection level(s)

DLL - at least one, but not all values used to calculate and report an in-stack emissions value are greater than the laboratory's reported detection level(s)

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METHOD 23 TEST RESULTS SUMMARY

Company: Port City Goup
Plant: ARC Facility
Unit: Common Baghouse Exhaust
Location: Stack

Test Run Number	1	2	3	Average
Source Condition	Normal	Normal	Normal	
Date	1/14/2015	1/15/2015	1/15/2015	
Start Time	10:50	8:45	13:30	
End Time	13:58	12:25	16:36	
Sample Duration (min):	180.0	180.0	180.0	
Average Gas Temp (°F):	92.3	101.8	102.8	98.9
Fractional Gas Moisture Content:	0.007	0.007	0.009	0.008
Gas CO_2 Content (%vol):	0.2	0.2	0.2	0.2
Gas O_2 Content (%vol):	18.1	18.0	18.1	18.1
Gas Wet MW (lb/lbmole-mole):	28.68	28.67	28.66	28.67
Average Gas Vel (ft/sec):	43.24	48.70	48.58	46.84
Measured Volumetric Flow Rate				
Q (actual ft^3/min):	58,870	66,304	66,134	63,769
Q_{std} (std ft^3/min):	54,904	60,417	59,834	58,385
$Q_{std(dry)}$ (dry std ft^3/min):	54,528	59,981	59,310	57,940
Sample Volume (dry std ft^3):	144.141	158.519	121.625	141.428
Isokinetic Variance	100.2	100.2	99.8	100.1

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PCDD/PCDF TEST RESULTS SUMMARY
Port City Group
ARC Facility
Common Lime Injected Baghouse Exhaust
January 14 and 15, 2015

	Test Run 1				Test 2				Test 3				Average					
	Sample Catch	Conc.	Emissions	Emissions	Sample Catch	Conc.	Emissions	Emissions	Sample Catch	Conc.	Emissions	Emissions	Conc.	Emissions	Emissions	TEQ* Factor Results		
Analytes	(pg)	(ug/dscm)	lb/hr	(g/hr)	(pg)	(ug/dscm)	lb/hr	(g/hr)	(pg)	(ug/dscm)	lb/hr	(g/hr)	(ug/dscm)	lb/hr	(g/hr)	TEF**	lb/hr	(g/hr)
2378-TCDD	9.00	2.21E-06	4.50E-10	2.04E-07	19.00	4.23E-06	9.51E-10	4.31E-07	14.00	4.06E-06	9.03E-10	4.10E-07	2.21E-06	4.50E-10	2.04E-07	1.0	4.50E-10	2.04E-07
12378-PeCDD	10.00	2.45E-06	5.00E-10	2.27E-07	24.30	5.41E-06	1.22E-09	5.52E-07	15.60	4.53E-06	1.01E-09	4.56E-07	2.45E-06	5.00E-10	2.27E-07	1.0	5.00E-10	2.27E-07
123478-HxCDD	<2.10	<5.15E-07	<1.05E-10	<4.77E-08	4.30	9.58E-07	2.15E-10	9.76E-08	3.30	9.58E-07	2.13E-10	9.66E-08	<5.15E-07	<1.05E-10	<4.77E-08	0.1	<1.05E-11	<4.77E-09
123678-HxCDD	4.00	9.80E-07	2.00E-10	9.08E-08	10.80	2.41E-06	5.41E-10	2.45E-07	6.90	2.00E-06	4.45E-10	2.02E-07	9.80E-07	2.00E-10	9.08E-08	0.1	2.00E-11	9.08E-09
123789-HxCDD	5.60	1.37E-06	2.80E-10	1.27E-07	13.30	2.96E-06	6.66E-10	3.02E-07	8.90	2.58E-06	5.74E-10	2.60E-07	1.37E-06	2.80E-10	1.27E-07	0.1	2.80E-11	1.27E-08
1234678-HpCDD	8.80	2.16E-06	4.40E-10	2.00E-07	20.00	4.46E-06	1.00E-09	4.54E-07	11.60	3.37E-06	7.48E-10	3.39E-07	2.16E-06	4.40E-10	2.00E-07	0.01	4.40E-12	2.00E-09
OCDD	20.20	4.95E-06	1.01E-09	4.58E-07	20.40	4.54E-06	1.02E-09	4.63E-07	13.10	3.80E-06	8.45E-10	3.83E-07	4.95E-06	1.01E-09	4.58E-07	0.0003	3.03E-13	1.38E-10
2378-TCDF	<1400.00	<3.43E-04	<7.01E-08	<3.18E-05	<3100.00	<6.91E-04	<1.55E-07	<7.04E-05	<2100.00	<6.10E-04	<1.35E-07	<6.14E-05	<3.43E-04	<7.01E-08	<3.18E-05	0.1	<7.01E-09	<3.18E-06
12378-PeCDF	67.10	1.64E-05	3.36E-09	1.52E-06	162.00	3.61E-05	8.11E-09	3.68E-06	104.00	3.02E-05	6.71E-09	3.04E-06	1.64E-05	3.36E-09	1.52E-06	0.03	1.01E-10	4.57E-08
23478-PeCDF	75.10	1.84E-05	3.76E-09	1.70E-06	170.00	3.79E-05	8.51E-09	3.86E-06	110.00	3.19E-05	7.10E-09	3.22E-06	1.84E-05	3.76E-09	1.70E-06	0.3	1.13E-09	5.11E-07
123478-HxCDF	63.90	2.06E-05	4.20E-09	1.90E-06	217.00	4.83E-05	1.09E-08	4.93E-06	139.00	4.04E-05	8.97E-09	4.07E-06	2.06E-05	4.20E-09	1.90E-06	0.1	4.20E-10	1.90E-07
123678-HxCDF	29.70	7.28E-06	1.49E-09	6.74E-07	78.90	1.76E-05	3.95E-09	1.79E-06	49.50	1.44E-05	3.19E-09	1.45E-06	7.28E-06	1.49E-09	6.74E-07	0.1	1.49E-10	6.74E-08
234678-HxCDF	14.60	3.58E-06	7.31E-10	3.31E-07	35.90	8.00E-06	1.80E-09	8.15E-07	22.40	6.50E-06	1.44E-09	6.55E-07	3.58E-06	7.31E-10	3.31E-07	0.1	7.31E-11	3.31E-08
123789-HxCDF	2.20	5.39E-07	1.10E-10	4.99E-08	3.70	8.24E-07	1.85E-10	8.40E-08	2.40	6.97E-07	1.55E-10	7.02E-08	5.39E-07	1.10E-10	4.99E-08	0.1	<1.10E-11	<4.99E-09
1234678-HpCDF	35.70	8.75E-06	1.79E-09	8.10E-07	87.90	1.96E-05	4.40E-09	2.00E-06	64.80	1.88E-05	4.18E-09	1.90E-06	8.75E-06	1.79E-09	8.10E-07	0.01	1.79E-11	8.10E-09
1234789-HpCDF	3.20	7.84E-07	1.60E-10	7.26E-08	7.30	1.63E-06	3.65E-10	1.66E-07	4.70	1.36E-06	3.03E-10	1.38E-07	7.84E-07	1.60E-10	7.26E-08	0.01	1.60E-12	7.26E-10
OCDF	11.30	2.77E-06	5.65E-10	2.56E-07	30.30	6.75E-06	1.52E-09	6.88E-07	12.90	3.75E-06	8.32E-10	3.77E-07	2.77E-06	5.65E-10	2.56E-07	0.0003	1.70E-13	7.69E-11
Total TCDD	9.00	2.21E-06	4.50E-10	2.04E-07	19.00	4.23E-06	9.51E-10	4.31E-07	14.00	4.06E-06	9.03E-10	4.10E-07	2.21E-06	4.50E-10	2.04E-07			
Total PeCDD	10.00	2.45E-06	5.00E-10	2.27E-07	24.30	5.41E-06	1.22E-09	5.52E-07	15.60	4.53E-06	1.01E-09	4.56E-07	2.45E-06	5.00E-10	2.27E-07			
Total HxCDD	11.70	2.87E-06	5.85E-10	2.66E-07	28.40	6.33E-06	1.42E-09	6.45E-07	19.10	5.55E-06	1.23E-09	5.59E-07	2.87E-06	5.85E-10	2.66E-07			
Total HpCDD	8.80	2.16E-06	4.40E-10	2.00E-07	20.00	4.46E-06	1.00E-09	4.54E-07	11.60	3.37E-06	7.48E-10	3.39E-07	2.16E-06	4.40E-10	2.00E-07			
Total TCDF	1400.00	3.43E-04	7.01E-08	3.18E-05	3100.00	6.91E-04	1.55E-07	7.04E-05	2100.00	6.10E-04	1.35E-07	6.14E-05	3.43E-04	7.01E-08	3.18E-05			
Total PeCDF	142.20	3.48E-05	7.12E-09	3.23E-06	332.00	7.40E-05	1.66E-08	7.54E-06	214.00	6.21E-05	1.38E-08	6.26E-06	3.48E-05	7.12E-09	3.23E-06			
Total HxCDF	130.40	3.19E-05	6.53E-09	2.96E-06	335.50	7.47E-05	1.68E-08	7.62E-06	213.30	6.19E-05	1.38E-08	6.24E-06	3.19E-05	6.53E-09	2.96E-06			
Total HpCDF	38.90	9.53E-06	1.95E-09	8.83E-07	95.20	2.12E-05	4.76E-09	2.16E-06	69.50	2.02E-05	4.48E-09	2.03E-06	9.53E-06	1.95E-09	8.83E-07			
Total PCDD/PCDF	1782.50	4.37E-04	8.92E-08	4.05E-05	4005.10	8.92E-04	2.00E-07	9.09E-05	2683.10	7.79E-04	1.73E-07	7.85E-05	4.37E-04	8.92E-08	4.05E-05			
TEQ Adjusted Total																	9.92E-09	4.50E-06

	Test 1	Test 2	Test 3
Sample volume (Vmstd, dscf)	144.141	158.519	121.625
Volumetric Air Flow (DSCFM)	54,528	59,981	59,310

*TEQ Toxicity Equivalents
**TEF Toxicity Equivalency Factor
TEF Factors from World Health Organization (WHO)