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EMISSIONS TESTING REPORT #15002
Text and Appendices

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AIR QUALITY DIV.

Detroit Renewable Power
Detroit, Michigan

at the

Detroit Renewable Power
Detroit, Michigan
Unit 11 Stack

February 2015

by

TESTAR Engineering, P.C.
7424-108 ACC Boulevard
Raleigh, North Carolina 27617
License Number C-3896
919/957-9500

1 INTRODUCTION

1.1 General

Detroit Renewable Power operates the Detroit Renewable Power facility in Detroit, Michigan. Detroit Renewable Power contracted TESTAR Engineering, P. C. to conduct an air emissions testing program to quantify specific emissions from Unit for determining compliance status. The testing program was conducted between February 05 and 07, 2015 by TESTAR Engineering under the supervision of Mr. Bill Alexander of Detroit Renewable Power.

1.2 Test Personnel

Table 1-1 presents the personnel that were involved in the testing program.

Table 1-1
Test Personnel

Affiliation	Personnel Responsibility
Detroit Renewable Power	Bill Alexander Test Coordinator
Michigan Department of Environmental Quality	Joyce Zuh Test Observer
	David Patterson Test Observer
TESTAR Engineering, P. C.	Herbert Dixon, Jr., PE Project Director
	Matt Winkeler Field Laboratory Technician
	Will Snipes CEM Engineer
	Jeff Aims Test Engineer
	Charles Nahrebecki Test Engineer

1.3 Test Parameters and Run Numbers

Tables 1-2, 1-3, and 1-4 present the test dates, sampling locations, flue gas parameters, sampling methods, and run numbers for reference.

Table 1-2
Ash System & Unit 11 Test Sequence

Test Location	Sampling Method	Flue Gas Parameter	Run Date	Run Time	Run Number
Unit 11 Stack	EPA M23	Dioxins/Furans	02/05/15	1022-1533	11-S-M23-1
			02/06/15	0748-1215	11-S-M23-2
			02/06/15	1331-1800	11-S-M23-3
	EPA MM26	Hydrogen Chloride	02/05/15	1046-1146	11-S-MM26-1
			02/05/15	1239-1339	11-S-MM26-2
			02/05/15	1402-1502	11-S-MM26-3
	EPA 29	Particulate and Metals	02/05/15	0901-1121	11-S-M29-1
			02/05/15	1227-1433	11-S-M29-2
			02/05/15	1455-1700	11-S-M29-3
	EPA 13B/ CARB 425	Total Fluorides as HF and Hexavalent Chromium	02/06/15	0800-1008	11-S-M13B/425-1
			02/06/15	1125-1337	11-S-M13B/425-2
			02/06/15	1450-1700	11-S-M13B/425-3
	EPA 25A	Total Hydrocarbons	02/07/15	0949-1115	11-S-CEM-2,3,4
			02/07/15	1126-1253	11-S-CEM-5,6,7
			02/07/15	1305-1431	11-S-CEM-8,9,10
	Facility CEMS	Sulfur Dioxide, Nitrogen Oxides, and Carbon Monoxide	02/05/15	Various	11-S-CEM
	Facility COMS	Opacity	02/05/15	1000-1100	11-S-COM-1
			02/05/15	1300-1400	11-S-COM-2
			02/05/15	1500-1600	11-S-COM-3
Ash Handling System	EPA M22	Fugitive Emissions	02/06/15	0750-0900	M22-1
			02/06/15	1455-1605	M22-2
			02/06/15	1630-1740	M22-3

Table 1-3
Utilization of EPA Method 2 and 3 Data

Runs Requiring Additional Information	Runs Providing Air Flow Rate Data	Runs Providing Flue Gas Composition Data
11-S-MM26-1	NA	11-S-M23-1
11-S-MM26-2	NA	11-S-M23-1
11-S-MM26-3	NA	11-S-M23-1
11-S-CEM-2,3,4	11-S-M2-2,3,4	11-S-CEM-2,3,4
11-S-CEM-5,6,7	11-S-M2-5,6,7	11-S-CEM-5,6,7
11-S-CEM-8,9,10	11-S-M2-8,9,10	11-S-CEM-8,9,10

2 SUMMARY OF RESULTS

2.1 Report Organization

The results of the testing project are summarized in Section 2. The process tested is discussed in Section 3. The sampling and analytical methods utilized are discussed in Section 4 while the Quality Assurance/Quality Control results are presented in Section 5. Appendix A contains detailed results of the testing program. Appendix B contains the field data that was collected and Appendix C contains the analytical results. Appendix D contains all pertinent testing equipment calibration data. Refer to the Table of Contents and the List of Tables and Figures for a complete reference with appropriate page numbers.

2.2 Presentation of Results

Table 2-1 presents the results of the emissions testing project for Unit 11. A more detailed summary of the sampling gas parameters is presented in Appendix A.

2.3 Total Hydrocarbon Data

Continuous Emissions Monitoring (CEM) data for total hydrocarbons was provided by the reference method CEMS. Three 21-minute test runs were combined to represent one 60-minute THC test run.

2.4 Dioxins/Furans Results and EMPC Values

In accordance with EPA Method 23, Section 9.9, all dioxins/furans results that were below the minimum detection limit (ND) were treated as zero when averaging or totaling the results. All dioxins/furans results that were an estimated maximum possible concentration (EMPC) are presented using the EMPC value as a positive catch when calculating the results.

2.5 Metals Reagent Blank Corrections

Chromium was detected at low levels in the reagent blank. In accordance with EPA Method 29, Sections 12.6 and 12.7, the test run catch weights were corrected for the blank values. Chromium results are presented in Appendix A.

Table 2-1
Unit 11 Summary of Emissions

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limit
Unit 11 Stack Concentrations, @ 7%O2					
Carbon monoxide, ppm [1]	93	- - -	- - -	93	200
Carbon monoxide, ppm [2]	131	100	79	103	267
Dioxins/Furans, ng/DSCM	10.7	7.67	15.3	11.2	30
Hex. Chromium, ug/DSCM	< 0.0908	0.189	0.186	< 0.155	4.2
Hydrogen Chloride, ppm	2.25	2.87	2.89	2.67	25
Mercury, ug/DSCM	2.00	1.04	0.964	1.33	50
Metals					
Cadmium, ug/DSCM	0.505	0.469	0.536	0.503	35
Chromium, ug/DSCM	2.92	2.70	4.39	3.34	200
Lead, mg/DSCM	0.0162	0.0181	0.0201	0.0181	0.400
Nitrogen oxides, ppm [2]	198	206	212	205	247
Particulate, Gr/DSCF	0.00587	0.00496	0.00716	0.00600	0.010
Sulfur dioxide, ppm [3]	19	- - -	- - -	19	29
Total Fluorides as HF, ppm	< 0.0815	0.106	< 0.0797	< 0.0891	5
Total Hydrocarbons, ppm	3.40	4.67	5.72	4.59	65
Unit 11 Stack					
Opacity, %	1.3	1.3	1.4	1.3	10

[1] – 24 hour average.
[2] – Three 1 hour averages.
[3] – 24 hour geometric mean.

2.6 Fugitive Emissions Results

Three EPA Method 22 test runs were performed for fugitive emissions on the ash handling system. No fugitive emissions results are presented in Appendix A because all values were zero. The field data sheets are located in Appendix B.

2.7 Opacity Results

Opacity was quantified utilizing the facility's Continuous Opacity Monitoring (COM) monitors per 40CFR 60.11 (e) (5) on each stack. The facility COMS data is located in Appendix B.

2.8 Facility CEM Data

The facility CEMS were utilized for the sulfur dioxide, nitrogen oxides, and carbon monoxide concentrations. The facility data was provided in 1 hour and 24 hour averages as necessary. This data is contained in Appendix B.

2.9 Duplicate Analyses

Runs 11-S-M29-2 was analyzed in duplicate for metals. All samples for mercury were analyzed in duplicate. All samples for hydrogen chloride were analyzed in duplicate. The average of the duplicate analyses were used for reporting purposes.

2.10 Non-detected Values

The results are presented using a worst-case scenario. All non-detected results were used as values for calculation purposes and the result is preceded by a "<" symbol. All non-detected results were used as a zero when calculating total catch weights for samples that had both a positive catch weight for one or more fractions and also non-detected fraction(s). When averaging across a set of three test runs, non-detected results were treated as values. Any average result that includes a non-detected value includes a "<" symbol in front of the result.

3 PROCESS DESCRIPTION AND OPERATION

Refuse is prepared and cleaned of non-processible and non-combustible materials through a series of conveyors and shredders. Waste is then combusted in furnaces at temperatures exceeding 1,800 degrees Fahrenheit and reduced to an inert ash residue

The Detroit Renewable Power facility processes up to 3300 tons of refuse derived fuel each day. Each of the three furnaces processes up to 1100 tons of waste per day. Waste is combusted at furnace temperatures exceeding 1,800 degrees Fahrenheit and reduced to an inert ash residue. Before leaving the facility, combustion air is directed through technologically advanced air pollution control equipment consisting of spray dryer absorbers (SDA) and fabric filter baghouses.

4 SAMPLING AND ANALYTICAL METHODS

This section briefly describes the sampling and analytical procedures that were used and any deviations from the methods. Figure 4-1 depicts cross-sections of the Stack test locations. Figure 4-2 depicts cross-sections of the Primary Shredder Stack test locations while Figure 4-3 depicts cross-sections of the Secondary Shredder Stack test locations.

4.1 EPA Methods 1-4 – Air Flow Rate and Moisture

EPA Methods 1 through 4 were utilized in conjunction with each isokinetic test method. EPA Method 1 was used to determine the location of the sampling points. EPA Method 2 was used to measure the flue gas flow rate. EPA Method 3 was used to determine the flue gas molecular weight. EPA Method 4 was used to determine the flue gas moisture content. The information provided by these methods was used in determining isokinetics, parameter concentrations, and parameter emission rates.

4.2 EPA M13B/CARB M425 – Total Fluorides and Hexavalent Chromium

Total fluorides as hydrogen fluoride and hexavalent chromium concentrations and emission rates were determined utilizing a combined EPA Method 13B and CARB Method 425 sampling train. The sampling train consisted of a glass nozzle, a heated glass probe, a heated Whatman 541 filter, two chilled impingers each with 100mL of 0.5N NaOH, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 13B and CARB Method 425 with no exceptions.

At the end of each test run, the contents of the first three impingers were poured back into the original reagent jar. The moisture catch was then determined gravimetrically. The nozzle, probe, filter holder, impingers, and connecting glassware were rinsed with DI into the sample jar. The filter was placed into the sample jar.

The samples were analyzed in accordance with EPA Method 13B for total fluorides as hydrogen fluoride. The samples were analyzed in accordance with CARB Method 425 for hexavalent chromium.

4.3 EPA Method 22 – Fugitive Emissions

The accumulated emissions time of fugitive emissions was determined by observing the process area(s) during normal operations for a pre-determined observation period (one hour). This method does not require that the opacity of emissions be determined, but rather the length of time

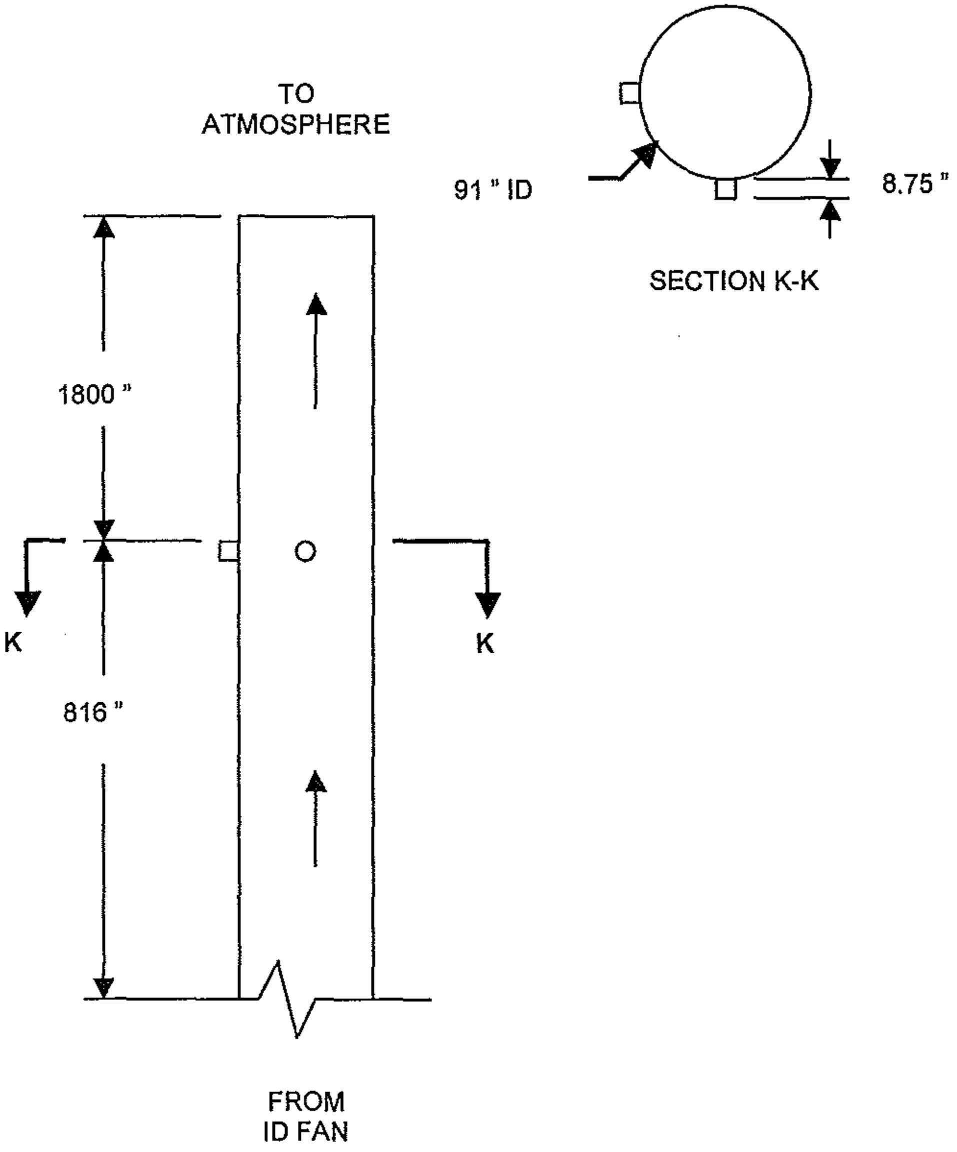

**Figure 4-1. Stack Sampling Location
(Units 11, 12, and 13 are identical)**

that any fugitive emissions are visible. Fugitive emissions include emissions that escape capture by exhaust hoods, that are emitted during material transfer, that are emitted from buildings housing material processing or handling equipment, or that are emitted directly from process equipment. If any fugitive emissions are observed during the observation period, the length of time that the emissions are visible is quantified using a stopwatch. This total accumulated time of fugitive emissions is then used to determine compliance with the subpart or permit.

4.4 EPA Method 23/Alternate Method 052 – Dioxins/Furans

The concentrations and emissions rates of polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDF or dioxins/furans) were determined utilizing EPA 23. The EPA Method 23 sampling train consisted of a glass nozzle, a heated glass probe, a heated glassmat filter, a condenser, an XAD resin trap, an empty impinger, two chilled impingers each with 100mL of DI water, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 23 with no exceptions.

At the end of each test run, the nozzle, probe, and filter fronthalf were rinsed with acetone into a sample jar. The filter was recovered dry into a glass petri dish. The filter backhalf, and condenser were rinsed with acetone into the same sample jar. All of the components listed above up to the XAD resin trap were rinsed again with toluene into another sample jar. The XAD resin trap was sealed and placed into a chilled ice chest. The contents of the first three impingers were poured back into the original reagent jar. The silica gel was poured back into its original container. The moisture catch was then determined gravimetrically.

The samples were analyzed in accordance with EPA Method 23 for dioxins/furans.

4.5 EPA Methods 3A and 25A – CEM Parameters

Oxygen, carbon dioxide, and total hydrocarbon concentrations were determined utilizing a continuous emissions monitoring (CEM) system as per EPA Methods 3A and 25A. This section presents the sample system description and operation. No deviations from EPA Methods were performed.

The CEM system consisted of an in stack probe, heated out of stack filter, heated transfer lines, condenser, unheated Teflon sample lines, sample pump, distribution manifold board, analyzers, and calibration gases. All components of the sampling system that are in contact with the sample are constructed of Teflon, glass, or stainless steel (316). Flue gas was extracted from the source through a three-point stainless steel probe. Flue gas was then passed through a heated Teflon sample line to a tee where the sample was split. Part of the sample remained heated to the hydrocarbon analyzer while the remainder of the sample was diverted into a condenser. This filtering system removes interferences such as particulate and moisture. Conditioned flue gas was then transported via Teflon tubing to a Teflon lined sample pump, through a distribution manifold, and on to various analyzers.

The integrity of this sampling system was verified (as per EPA Methods) using EPA Protocol 1 calibration gases. The design of this sampling system allows the operator to introduce calibration gases at the outlet of the probe, prior to the heated out of Fabric Filter Outlet filter (for the system bias check and calibration drift check), and directly into the analyzers (for linearity checks).

A California Analytical Instruments, Inc. (CAI) Model 300 HFID Heated Hydrocarbon Analyzer was utilized for quantifying THC. This model analyzer uses Flame Ionization Detection (FID) to determine the total hydrocarbon concentration (on a wet basis) within a gaseous sample. The analyzer has an adjustable heated oven which contains a heated pump and a burner in which a small flame is elevated and sustained by regulated flows of air and a mixture of hydrogen and helium. The burner jet is used as an electrode and is connected to the negative side of a precision power supply. An additional electrode, known as the 'collector', is connected to a high impedance, low noise electronic amplifier. The two electrodes establish an electrostatic field. When a gaseous sample is introduced to the burner, it is ionized in the flame and the electrostatic field causes the charged particles (ions) to migrate to their respective electrodes. The migration creates a small current between the electrodes. This current is measured by the precision electrometer amplified and is directly proportional to the hydrocarbon concentration of the sample.

4.6 EPA Modified Method 26 – Hydrogen Chloride

Hydrogen chloride concentrations and emission rates were determined utilizing EPA Method 26 modified to use large impingers. The EPA Method 26 sampling train consisted of a heated glass probe, a heated quartz filter, two chilled impingers each with 100mL of 0.1N H_2SO_4, one empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 26 except that large impingers were used for sample collection.

At the end of each test run, the contents of the first three impingers were poured back into the original H_2SO_4 reagent jar. The silica gel was returned to its original container. The moisture catch in the components was determined gravimetrically. The filter backhalf and first three impingers were rinsed with DI water into the H_2SO_4 reagent jar.

The H_2SO_4 portion of the samples were analyzed in accordance with EPA Method 26 for hydrogen chloride.

4.7 EPA Method 29 – Particulate and Metals

Particulate and metals concentrations and emission rates were determined utilizing EPA Method 29. The EPA Method 29 sampling train consisted of a glass nozzle, a heated glass probe, a heated tared quartz filter, two chilled impingers each with 100mL of 5%HNO_3/10%H_2O_2, an empty impinger, two chilled impingers each with 100mL of 4%$KMnO_4$/10%H_2SO_4, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 29 with no exceptions.

At the end of each test run, the nozzle, probe, and filter fronthalf were rinsed with acetone into a sample bottle. The nozzle, probe, and filter fronthalf were rinsed again with 100 mL of 0.1N nitric acid into a sample jar. The filter was recovered dry into another sample bottle. The contents of the 5%HNO_3/10%H_2O_2 impingers were poured back into the original reagent jar. Any condensate in the empty impinger was poured into a sample bottle. The 4%$KMnO_4$/10%H_2SO_4 impingers were recovered into another sample jar.

The moisture catch was then determined gravimetrically. The filter backhalf and 5%HNO_3/10%H_2O_2 impingers were rinsed with 100 mL of 0.1N nitric acid into the reagent jar. The empty impinger was rinsed with 100 mL of 0.1N nitric acid into a sample jar. The 4%$KMnO_4$/10%H_2SO_4 impingers were rinsed with 100 mL of 4%$KMnO_4$/10%H_2SO_4 and 100 mL of DI water into the jar containing the 4%$KMnO_4$/10%H_2SO_4 reagent. The 4%$KMnO_4$/10%H_2SO_4 impingers and connecting glassware were rinsed with 25mL of 8N HCl if any brown residue remained. This HCl rinse was added to a jar containing 200mL of DI water.

The filter and acetone rinses were desiccated and analyzed gravimetrically following EPA Method 5 techniques. The samples were analyzed in accordance with EPA Method 29 for mercury.

5 QA/QC RESULTS

5.1 QA/QC Policy Procedures

TESTAR Engineering, P. C. is committed to adhering to Quality Assurance/Quality Control (QA/QC) procedures and objectives that meet or exceed the relevant EPA guidance. Our procedures include calibration of equipment as appropriate, proper glassware pre-cleaning to prevent contamination of samples, proper sample recovery, documented sample custody, blank samples, duplicate analyses, matrix spike recovery, and validated computer generated results. We also adhere to other method specific criteria such as maintaining isokinetic conditions during particulate type testing and posttest leak checks.

TESTAR Engineering uses oil manometers to determine velocity differential pressures thus eliminating potential errors from magnehelic gauges. The manometers are leveled and zeroed prior to taking any measurements. All equipment used onsite undergoes a pretest audit and operational check for accuracy. Dry gas meters are checked by using an orifice to determine the meter gamma. The audit gamma must be within 3% of the full test gamma for the meter to be acceptable. Likewise, all thermocouples are checked at ambient temperature versus an ASTM reference thermometer or a thermometer that has been checked against an ASTM reference thermometer. The reading must agree within 2°F. Additionally, the barometer is checked against a reference barometer prior to each project and must agree within 0.1" Hg.

After each testing project, the dry gas meter undergoes a posttest audit following the guidelines of Alternate Method 009. Alternate Method 009 utilizes a mathematical calculation to check the dry gas meter calibration factor (gamma) versus the full test calibration factor. The gamma must agree within ±5% of the full test gamma.

5.2 Sample Custody and Preservation

Proper sample custody and preservation techniques ensure that the samples collected and analyzed are the same, that the sample did not change in concentration prior to analysis, and that the sample was not tampered with prior to analysis. To ensure accurate results, TESTAR Engineering collects and transports samples in clean containers that are inert to the matrix enclosed, that will not contaminate the sample, and that prevent photochemical reactions when appropriate. All samples contain unique identifiers that include the client name, facility name, project number, collection date, unique run number, sample fraction, and matrix. Liquid levels are marked in order to determine if any leakage occurred during transport. Samples are accompanied by sample custody forms identifying the client, facility, project number, sample, fractions, collection date, etc. When custody is relinquished to the laboratory, the receiving sample custodian signs the form.

5.3 Sample Blanks, Duplicates, and Matrix Spikes

Several types of blanks are utilized depending upon the project QA objectives. Typical blanks include field blanks, reagent blanks, and trip blanks. Blanks help to identify the source of contamination if contamination is suspected based upon the result validation procedure. Trip blanks are typically not analyzed unless the field blank shows significant contamination. Field blanks and reagent blanks are analyzed during most testing programs involving metals unless requested not to do so by the client. Field blanks are analyzed during most programs involving organics such as dioxins/furans.

Duplicates and matrix spikes are analyzed for projects involving metals testing. At least 10% of the samples are analyzed in duplicate for metals and at least one matrix spike is performed. All mercury analyses are performed in duplicate.

Breakthrough analyses are performed for projects involving organics utilizing adsorbent tubes. Adsorbent tubes are desorbed and analyzed separately to determine if any breakthrough occurred. Breakthrough is said to have occurred if the organic catch weight on the last fraction (generally the backhalf of the last adsorbent tube) is more than 10% of the total train organic catch.

5.4 Data Validation and Presentation

The field test engineer is responsible for reviewing and validating data as it is obtained. Additionally the onsite project manager reviews data for consistency, completeness, and accuracy prior to leaving the site. This validation procedure is based upon their knowledge of the process being tested and/or similar sources as well as checks built into the software being utilized. This allows for error correction or for the testing to be repeated immediately rather than at a later undetermined date. The data undergoes another review by a Project Director upon return to headquarters. Analytical data is reviewed by the QA Director upon submittal by the analytical laboratory to resolve any conflicts or concerns as soon as possible rather than after the results have been calculated.

Data is collected using computerized spreadsheets in the field and the results are calculated using validated computer programs to prevent erroneous calculations.

5.5 QA/QC Results

This section presents QA/QC results from measures taken during the testing program. The results are summarized in the following tables for easy reference.

Table 5-1
Summary of QA/QC Procedures

Test Method	QA/QC Procedure	QA/QC Objective	QA/QC Results	Status of QA/QC
EPA M13B	HF Reagent Blank	ND	0.074 mg	Acceptable
	Duplicate RPD	≤ 20 %	< 1.8 %	Acceptable
	Spike Recovery	90 - 110%	95 %	Acceptable
CARB M425	Duplicate RPD	≤ 20 %	0.9 %	Acceptable
	NaOH Reagent Blank	ND	0.0.074ug	Acceptable
	Spike Recovery	90 - 110%	105 %	Acceptable
EPA M23	Internal Standard Recoveries (4-6)	40 – 130 %	73.5 – 106 %	Acceptable
	Internal Standard Recoveries (7-8)	25 – 130 %	65.1 – 113 %	Acceptable
	Surrogate Standard Recoveries	70 – 130 %	77.1 – 111 %	Acceptable
EPA MM26	HCl Reagent Blank	ND	< 0.021 mg	Acceptable
	HCl Spike	90 – 110 %	100.2 %	Acceptable
	HCl Internal Audit	≤ 10 %	- 1.57 %	Acceptable
EPA M5/29	Acetone Blank	< 1.0E-05 mg/mg	4.03E-06 mg/mg	Acceptable, no blank correction
EPA M29	Duplicate RPD	≤ 20 %	0 – 4.9 %	Acceptable
Cadmium	Reagent Blank	NA	< 0.2 ug	Acceptable
Chromium	Reagent Blank	NA	1.20 ug	Acceptable, blank correction
Lead	Reagent Blank	NA	< 0.2 ug	Acceptable
Metals	Spike Recoveries	75 – 125 %	91 – 108 %	Acceptable
Mercury	Reagent Blank	NA	< 0.5 ug	Acceptable
Mercury	Duplicate RPD	≤ 20 %	0 – 5.1 %	Acceptable
Mercury	Spike Recoveries	75 – 125 %	91 – 114 %	Acceptable