DATA VALIDATION REPORT

June 2017 Groundwater Sampling Event
Four Corners Power Plant, Arizona Public Service
Farmington, New Mexico

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ACRONYMS

%	percent
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
APS	Arizona Public Service
CCR	coal combustion residual
CLP	Contract Laboratory Program
COC	chain of custody
EPA	United States Environmental Protection Agency
ID	identification
LCS	laboratory control sample
LCSD	laboratory control sample
MCL	maximum contaminant level
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
QC	quality control
RL	reporting limit
RPD	relative percent difference
SAP	sampling and analysis plan
SDG	sample delivery group
SM	Standard Method
SU	standard units (pH)
TestAmerica	TestAmerica Laboratories, Inc.
TDS	total dissolved solids

DATA VALIDATION REPORT
Four Corners Power Plant, Arizona Public Service
Farmington, New Mexico

1.0 INTRODUCTION

Arizona Public Service (APS) collected 20 water samples, including two field duplicates, between June 21st and 22nd, 2017, from the Four Corners Power Plant, located in Farmington, New Mexico. APS submitted the samples to TestAmerica Laboratories, Inc. (TestAmerica) in Phoenix, Arizona. The samples were assigned to sample delivery groups (SDGs) J84943-1, J84943-2, and J84945-1. TestAmerica analyzed the samples for total metals and mercury by United States Environmental Protection Agency (EPA) Methods 200.7, 200.8, and 245.1; anions by EPA Method 300.0; total dissolved solids (TDS) by Standard Method (SM) 2540C; alkalinity by SM 2320B; and pH by SM 4500B. TestAmerica subcontracted the samples to Radiation Safety Engineering, Inc., where they were analyzed for radium 226/228 using GammaRay HPGE. A list of these samples by field sample identification (ID), sample collection date, and the laboratory sample IDs is presented in Table 1.

2.0 DATA VALIDATION METHODOLOGY

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) performed an EPA Stage 2A validation on these samples, which is equivalent to a Level I data evaluation as defined in the project sampling and analysis plan (SAP). The Stage 2A validation includes review of the quality control (QC) results in the laboratory's analytical report and does not include review or validation of the raw analytical data. This data validation has been performed in general accordance with:

- AECOM, Inc., 2015. Final Sampling and Analysis Plan Coal Combustion Residual (CCR) Groundwater Monitoring, Four Corners Power Plant, Arizona Public Service, Farmington, New Mexico, December 2015.
- EPA, 2004. SW 846 Test Methods for Evaluating Solid Wastes, Update IIIB.
- EPA, 2014. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Superfund Data Review, EPA-540 R 013 001.

The CLP guidelines were written specifically for the CLP, and have been modified for the purposes of this data review where they differ from method-specific QC requirements.

The laboratory's certified analytical report and supporting documentation were reviewed to assess the following:

- Data package and electronic data deliverable completeness;
- Chain of custody (COC) compliance;
- Holding time compliance;
- Presence or absence of laboratory contamination as demonstrated by laboratory blanks;
- Accuracy and bias as demonstrated by recovery of laboratory control sample (LCS) and matrix spike (MS) samples;
- Analytical precision as relative percent difference (RPD) of analyte concentration between laboratory duplicates, LCS/LCS duplicates (LCSDs), or MSs/MS duplicates (MSDs);
- Insofar as possible, the degree of conformance to method requirements and good laboratory practices.

In general, it is important to recognize that no analytical data are guaranteed to be correct, even if all QC audits are passed. Strict QC serves to increase confidence in data, but any reported value may potentially contain error.

3.0 EXPLANATION OF DATA QUALITY INDICATORS

Summary explanations of the specific data quality indicators reviewed during data validation are presented below.

3.1 LABORATORY CONTROL SAMPLE RECOVERIES

LCSs are aliquots of analyte free matrices that are spiked with the analytes of interest for an analytical method, or a representative subset of those analytes. The spiked matrix is then processed through the same analytical procedures as the samples they accompany. LCS recovery is an indication of a laboratory’s ability to successfully perform an analytical method in an interference free matrix.

3.2 MATRIX SPIKE RECOVERIES

MSs and MSDs are prepared by adding known amounts of the analytes of interest for an analytical method, or a representative subset of those analytes, to an aliquot of sample. The spiked sample is then processed through the same extraction, concentration, cleanup, and analytical procedures as the unspiked samples in an analytical batch.

MS recovery and precision are an indication of a laboratory's ability to successfully recover an analyte in the matrix of a specific sample or closely related sample matrices. It is important not to apply MS results for any specific sample to other samples without understanding how the sample matrices are related.

3.3 BLANK CONCENTRATIONS

Blank samples are aliquots of analyte free matrix that are used as negative controls to verify that the sample collection, storage, preparation, and analysis system does not produce false positive results.

Laboratory blanks are processed by the laboratory using exactly the same procedures as the field samples. Target analytes should not be found in laboratory blanks.

When target analytes are detected in blanks, analyte concentrations in associated samples less than five times the concentration detected in the blank will be U qualified as being not detected.

3.4 LABORATORY DUPLICATES

Laboratory duplicate analysis verifies acceptable method precision by the laboratory at the time of preparation and analysis and/or sampling precision at the time of collection.

4.0 DEFINITIONS OF QUALIFIERS THAT MAY BE ADDED DURING DATA VALIDATION

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

R The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

5.0 QUALIFICATION REASON CODE

The following reason code was applied to the data during data validation:

HT Holding time exceeded.

6.0 CHAIN OF CUSTODY AND SAMPLE RECEIPT CONDITION DOCUMENTATION

The samples were received at the laboratories under proper COC, intact, properly preserved, and at temperatures less than the SAP-specified maximum of 6 degrees Celsius.

7.0 SPECIFIC DATA VALIDATION FINDINGS

Results from these samples may be considered usable with the limitations and exceptions described in Sections 7.1 through 8.0.

7.1 METALS BY EPA METHODS 200.7, 200.8, AND 245.1

Total metals and mercury results generated by TestAmerica may be considered usable with the limitations described in Sections 7.1.1 through 7.1.6.

7.1.1 Holding Times

All samples were analyzed for metals within the SAP-specified holding time of 28 days for mercury and 180 days for the additional metals.

7.1.2 Laboratory Blanks

Target analytes were not detected in the laboratory blanks associated with the analysis of these samples with the following exception:

- Barium was detected at a concentration of 0.000842 milligrams per liter (mg/L) in the laboratory blank associated with the analysis of samples FC-CCR-MW7-62217, FC-CCR-MW49A-62217, FC-CCR-MW60-62217, FC-CCR-MW61-62217, FC-CCR-MW62-62117, FC-CCR-MW63-62117, FC-CCR-MW64-62117, FC-CCR-MW65-62117, FC-CCR-FD01-62117, and FC-CCR-MW66-62117. Barium was detected in all of these samples at concentrations greater than four times the blank detection, and data usability is not adversely affected.

7.1.3 Laboratory Control Sample Accuracy and Precision

LCS and LCSD recoveries were within the SAP-specified 80 to 120 percent (%) limits and RPDs between the LCS and LCSD results were less than the laboratory-specified maximum of 20%.

7.1.4 Matrix Spikes/Matrix Spike Duplicates

TestAmerica performed MS and MSD analyses on sample FC-CCR-MW60-62217 for beryllium, boron, calcium, lithium, magnesium, potassium, and sodium; FC-CCR-MW64-62117 for antimony, arsenic, barium, cadmium, chromium, cobalt, lead, molybdenum, selenium, and thallium; and FC-CCR-MW63-62117 for mercury. MS/MSD recoveries were within laboratory-specified limits, and RPDs between MS and MSD results were less than the laboratory-specified maximum of 20%, with the following exceptions:

- Boron (-233%,-65%), calcium (-34%), magnesium (-20%, 67%), and sodium (-56%, 62%) recoveries were low in the MS and/or MSD performed on sample FC-CCR-MW60-62217. However, boron, calcium, magnesium, and sodium were detected in the unspiked sample at concentrations greater than four times the spike concentrations and per CLP guidelins it is not possible to evaluate data usability based on the MS/MSD performance of these analytes in this sample.

MS and MSD analyses for other metals were performed on batch samples not related to this project. It is not possible to evaluate data usability based on the MS/MSD performance of unrelated samples.

7.1.5 Analytical Sensitivity

Amec Foster Wheeler compared RLs for antimony, arsenic, barium, beryllium, cadmium, chromium, selenium, thallium, lead and mercury against applicable MCLs to confirm that the RLs were sufficiently low to meet the MCLs. Non-detect results were reported at RLs less than the applicable MCLs.

Boron, calcium, cobalt, lithium, magnesium, molybdenum, potassium, and sodium are not EPA-regulated analytes in groundwater and it is not possible to evaluate the RLs for these analytes against the National Primary Drinking Water Regulation MCLs.

7.1.6 Data Reporting and Analytical Procedures

There were no data reporting or analytical issues with the data groups associated with this validation.

7.2 ANIONS BY EPA METHOD 300.0

Fluoride, chloride, and sulfate results generated by TestAmerica may be considered usable with the limitations described in Sections 7.2.1 through 7.2.7.

7.2.1 Holding Times

Samples were analyzed for anions within the SAP-specified holding time of 28 days.

7.2.2 Laboratory Blanks

Fluoride, chloride, and sulfate were not detected in the laboratory blanks associated with the analysis of these samples.

7.2.3 Laboratory Control Samples

LCS and LCSD recoveries were within the laboratory-specified 90 to 110% limits and RPDs between the LCS and LCSD results were less than the laboratory-specified maximum values.

7.2.4 Matrix Spikes/Matrix Spike Duplicates

TestAmerica did not perform any matrix spike analysis on the samples from these groups, and data cannot be evaluated based on matrix spike analysis of sample from unrelated sample batches.

7.2.5 Laboratory Duplicates

TestAmerica did not perform duplicate analyses of any of the samples covered in this report.

7.2.6 Analytical Sensitivity

Amec Foster Wheeler compared RLs for fluoride against the MCL of 4 mg/L, and confirmed that the RLs were sufficiently low to meet the MCL.

Chloride and sulfate are not EPA-regulated analytes in groundwater and it is not possible to evaluate the RLs for these analytes against the Primary Drinking Water Regulation MCLs.

7.2.7 Data Reporting and Analytical Procedures

There were no data reporting or analytical issues with the data groups associated with this validation.

TestAmerica reported fluoride results in SDGs J84943-1 and J84943-2. Each sample was analyzed for fluoride once and the same fluoride results are reported in both SDGs.

7.3 TOTAL DISSOLVED SOLIDS BY SM 2540C

TDS results generated by TestAmerica may be considered fully usable without qualification.

7.3.1 Holding Times

All samples were analyzed for TDS within the SAP-specified holding time of 7 days.

7.3.2 Laboratory Blanks

TDS was not detected in the laboratory blanks at concentrations above the reporting limit.

7.3.3 Laboratory Control Sample Accuracy and Precision

LCS and LCSD recoveries were within the laboratory-specified 90 to 110% limits and RPDs between the LCS and LCSD results were less than the laboratory-specified maximum of 10%.

7.3.4 Laboratory Duplicates

TestAmerica performed duplicate analysis on sample FC-CCR-MW69-62117. RPDs between primary sample and laboratory duplicate results were less than the laboratory-specified 10% limit.

7.3.5 Data Reporting and Analytical Procedures

There were no data reporting or analytical issues with the data groups associated with this validation.

7.4 ALKALINITY BY SM 2320B

Alkalinity results generated by TestAmerica may be considered usable with the limitations described in Sections 7.4.1 through 7.4.4.

7.4.1 Holding Times

All samples were analyzed for alkalinity within the SAP specified holding time of 14 days.

7.4.2 Laboratory Blanks

Alkalinity was not detected in the laboratory blanks at concentrations above the reporting limit.

7.4.3 Laboratory Control Sample Accuracy

LCS and LCSD recoveries were within the laboratory-specified 90 to 110% limits and RPDs between the LCS and LCSD results were less than the laboratory-specified maximum of 20%.

7.4.4 Laboratory Duplicates

TestAmerica performed duplicate analysis for alkalinity on samples FC-CCR-MW7-62217 and FC-CCR-MW67-62117. RPDs between primary sample and laboratory duplicate results were less than the laboratory-specified 20% limit.

7.4.5 Data Reporting and Analytical Procedures

There were no data reporting or analytical issues with the data groups associated with this validation.

7.5 pH BY SM 4500B

pH results generated by TestAmerica may be considered usable with the limitations described in Sections 7.5.1 through 7.5.4.

7.5.1 Holding Times

All samples were analyzed for pH after the method-specified 15 minute hold time had passed. Amec Foster Wheeler J qualified the pH results from these samples because of the missed hold time. (J-HT)

7.5.2 Laboratory Control Sample Accuracy

LCS recovery was within the laboratory-specified 98.5 to 101.5% limits.

7.5.3 Laboratory Duplicates

TestAmerica performed duplicate analysis for pH on samples FC-CCR-MW7-62217 and FC-CCR-MW67-62117. RPDs between primary sample and laboratory duplicate results were less than the laboratory-specified 5% limit.

7.5.4 Data Reporting and Analytical Procedures

There were no data anomalies associated with the pH analysis of these samples.

7.6 RADIOCHEMICAL ANALYSES

It was not possible to evaluate data usability for the radiochemical analyses due to a lack of reported laboratory QC.

7.6.1 Analytical Sensitivity

Amec Foster Wheeler compared RLs for total radium analysis against the MCL to confirm that the RLs were sufficiently low to meet the MCL. Non-detect results were reported to RLs less than the applicable MCL.

8.0 FIELD DUPLICATES

APS collected samples FC-CCR-FD01-62117 and FC-CCR-FD02-62217 as field duplicates of samples FC-CCR-MW65-62117 and FC-CCR-MW72-62217, respectively. Target analyte detections are summarized in Table 2. Precision values were less than the SAP-specified maximum of 20%, or the differences between the detected concentrations were less than the RLs.

9.0 SUMMARY AND CONCLUSIONS

Amec Foster Wheeler reviewed 580 data records from field samples during this validation. All of the data generated are usable and of acceptable quality with the addition of qualifiers presented in Table 3. Qualifier definitions are summarized in Section 4.0, reason codes are summarized in Section 5.0, and qualified data are summarized below.

- Amec Foster Wheeler J qualified 20 records (3.4%) as being estimated concentrations due to hold time exceedances.

The data should be considered valid with the addition of the qualifiers presented in Table 3.

REFERENCES

AECOM, 2015. Sampling and Analysis Plan CCR Groundwater Monitoring Four Corners Power Plant Arizona Public Service, Farmington, New Mexico, December 2015.

EPA, 2014. EPA CLP National Functional Guidelines for Inorganic Superfund Data Review, EPA-540 R 013 001.

EPA, 2004. SW 846 Test Methods for Evaluating Solid Wastes, Update IIIB.

LIMITATIONS

This report was prepared exclusively for Arizona Public Service by Amec Foster Wheeler Environment & Infrastructure, Inc. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in Amec Foster Wheeler services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions, and qualifications set forth in this report. This data validation report is intended to be used by Arizona Public Service, Four Corners Power Plant site only, subject to the terms and conditions of its contract with Amec Foster Wheeler. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

TABLES

TABLE 1
Field Samples Submitted to Test America Laboratories, Inc.
Four Corners Power Plant, Arizona Public Service
Farmington, New Mexico
June 2017 Data

Field Sample ID	Collection Date	Test America Sample ID	Notes
FC-CCR-MW7-62217	6/22/2017	550-84943-1	
FC-CCR-MW49A-62217	6/22/2017	550-84943-2	
FC-CCR-MW60-62217	6/22/2017	550-84943-3	
FC-CCR-MW61-62217	6/22/2017	550-84943-4	
FC-CCR-MW62-62117	6/21/2017	550-84943-5	
FC-CCR-MW63-62117	6/21/2017	550-84943-6	
FC-CCR-MW64-62117	6/21/2017	550-84943-7	
FC-CCR-MW65-62117	6/21/2017	550-84943-8	
FC-CCR-FD01-62117	6/21/2017	550-84943-9	Field duplicate of FC-CCR-MW65-62117
FC-CCR-MW66-62117	6/21/2017	550-84943-10	
FC-CCR-MW67-62117	6/21/2017	550-84943-11	
FC-CCR-MW68-62117	6/21/2017	550-84943-12	
FC-CCR-MW69-62117	6/21/2017	550-84943-13	
FC-CCR-MW70-62117	6/21/2017	550-84943-14	
FC-CCR-MW71-62217	6/22/2017	550-84943-15	
FC-CCR-MW72-62217	6/22/2017	550-84943-16	
FC-CCR-FD02-62217	6/22/2017	550-84943-17	Field duplicate of FC-CCR-MW72-62217
FC-CCR-MW73-62217	6/22/2017	550-84943-18	
FC-CCR-MW74-62217	6/22/2017	550-84943-19	
FC-CCR-MW75-62217	6/22/2017	550-84943-20	
FC-CCR-MW7-62217	6/22/2017	550-84945-1	
FC-CCR-MW49A-62217	6/22/2017	550-84945-2	
FC-CCR-MW60-62217	6/22/2017	550-84945-3	
FC-CCR-MW61-62217	6/22/2017	550-84945-4	
FC-CCR-MW62-62117	6/21/2017	550-84945-5	
FC-CCR-MW63-62117	6/21/2017	550-84945-6	
FC-CCR-MW64-62117	6/21/2017	550-84945-7	
FC-CCR-MW65-62117	6/21/2017	550-84945-8	
FC-CCR-FD01-62117	6/21/2017	550-84945-9	Field duplicate of FC-CCR-MW65-62117
FC-CCR-MW66-62117	6/21/2017	550-84945-10	
FC-CCR-MW67-62117	6/21/2017	550-84945-11	
FC-CCR-MW68-62117	6/21/2017	550-84945-12	
FC-CCR-MW69-62117	6/21/2017	550-84945-13	
FC-CCR-MW70-62117	6/21/2017	550-84945-14	
FC-CCR-MW71-62217	6/22/2017	550-84945-15	
FC-CCR-MW72-62217	6/22/2017	550-84945-16	
FC-CCR-FD02-62217	6/22/2017	550-84945-17	Field duplicate of FC-CCR-MW72-62217
FC-CCR-MW73-62217	6/22/2017	550-84945-18	
FC-CCR-MW74-62217	6/22/2017	550-84945-19	
FC-CCR-MW75-62217	6/22/2017	550-84945-20	

TABLE 2
Field Duplicate Detections
Four Corners Power Plant, Arizona Public Service
Farmington, New Mexico
June 2017 Data

Method	Analyte	RL	Primary Sample Result	Field Duplicate Result	RPD	Notes
Samples FC-CCR-MW65-62117 and FC-CCR-FD01-62117						
EPA 300.0	Chloride	2 mg/L	68	68	0.0%	
EPA 300.0	Fluoride	0.40 mg/L	1.9	2	5.1%	
EPA 300.0	Sulfate	70 mg/L	710	720	1.4%	
EPA 200.7	Boron	0.05 mg/L	0.92	0.96	4.3%	
EPA 200.7	Calcium	2.0 mg/L	140	140	0.0%	
EPA 200.7	Magnesium	2.0 mg/L	73	76	4.0%	
EPA 200.7	Potassium	0.50 mg/L	3.9	4	2.5%	
EPA 200.7	Sodium	0.50 mg/L	190	200	5.1%	
EPA 200.8	Barium	0.00050 mg/L	0.018	0.019	5.4%	
EPA 200.8	Cobalt	0.00050 mg/L	0.0011	0.0011	0.0%	
EPA 200.8	Molybdenum	0.00050 mg/L	0.0097	0.0098	1.0%	
SM 2320B	Alkalinity as CaCO3	6.0 mg/L	320	330	3.1%	
SM 2320B	Bicarbonate Alkalinity as CaCO3	6.0 mg/L	320	330	3.1%	
SM 2540C	Total Dissolved Solids	20 mg/L	1,400	1,300	7.4%	
SM 4500 H+ B	pH	1.7 SU	7.6	7.6	0.0%	
Samples FC-CCR-MW72-62217 and FC-CCR-FD02-62217						
EPA 300.0	Chloride	10.0 mg/L	450	450	0%	
EPA 300.0	Sulfate	400 mg/L	11000	11000	0.0%	
EPA 200.7	Boron	0.050 mg/L	0.23	0.22	4.4%	
EPA 200.7	Calcium	2.0 mg/L	450	440	2.2%	
EPA 200.7	Magnesium	20.0 mg/L	2400	2500	4.1%	
EPA 200.7	Potassium	0.50 mg/L	29	30	3.4%	
EPA 200.7	Sodium	0.50 mg/L	760	770	1.3%	
EPA 200.8	Lithium	0.20 mg/L	0.39	0.40	2.5%	
EPA 200.8	Barium	0.0013 mg/L	0.0077	0.0086	11.0%	
EPA 200.8	Cobalt	0.0020 mg/L	0.0025	0.0025	0.0%	
EPA 200.8	Selenium	0.0020 mg/L	0.1	0.099	1.0%	
EPA 200.8	Thallium	0.0004 mg/L	0.001	0.0011	9.5%	
EPA 245.1	Mercury	0.0002 mg/L	0.0002 U	0.0002	NC	± RL
SM 2320B	Alkalinity as CaCO3	6.0 mg/L	600	610	1.7%	
SM 2320B	Bicarbonate Alkalinity as CaCO3	6.0 mg/L	600	610	1.7%	
SM 2540C	Total Dissolved Solids	100 mg/L	17000	17000	0.0%	
SM 4500 H+ B	pH	1.7 SU	7.1	7	1.4%	

Notes:
SU=standard units (for pH)
mg/L = milligrams per liter
RL = reporting limit
RPD = relative percent difference

Methods:
EPA 300.0 = Ions
EPA 200.7 = Metals
EPA 200.8 = Low Level Metals
SM2540C = Total Dissolved Solids
SM4500 = pH

TABLE 3
Qualifiers Added During Data Validation
Four Corners Power Plant, Arizona Public Service
Farmington, New Mexico
June 2017 Data

Sample IDs	Analytes	Concentrations	Qualifiers and Reason Codes
FC-CCR-MW7-62217	pH	7.5 SU	J HT
FC-CCR-MW49A-62217	pH	7.5 SU	J HT
FC-CCR-MW60-62217	pH	7.7 SU	J HT
FC-CCR-MW61-62217	pH	8.6 SU	J HT
FC-CCR-MW62-62117	pH	7.0 SU	J HT
FC-CCR-MW63-62117	pH	7.2 SU	J HT
FC-CCR-MW64-62117	pH	7.8 SU	J HT
FC-CCR-MW65-62117	pH	7.6 SU	J HT
FC-CCR-FD01-62117	pH	7.6 SU	J HT
FC-CCR-MW66-62117	pH	7.3 SU	J HT
FC-CCR-MW67-62117	pH	7.3 SU	J HT
FC-CCR-MW68-62117	pH	7.1 SU	J HT
FC-CCR-MW69-62117	pH	7.5 SU	J HT
FC-CCR-MW70-62117	pH	7.1 SU	J HT
FC-CCR-MW71-62217	pH	7.2 SU	J HT
FC-CCR-MW72-62217	pH	7.1 SU	J HT
FC-CCR-FD02-62217	pH	7.0 SU	J HT
FC-CCR-MW73-62217	pH	7.0 SU	J HT
FC-CCR-MW74-62217	pH	7.8 SU	J HT
FC-CCR-MW75-62217	pH	8.3 SU	J HT

Qualifier Definition:
J = The analyte was positively identified; the associated numerical value is approximate.

Reason Code:
HT = Holding time exceeded