Annual Report
Base Year (2015/2016)
and Option Year 1 (2016/2017)
$PM_{2.5}$ Chemical Speciation Network
Sample Filter Handling, Shipment, and Gravimetric Analysis
Contract # EP-D-15-001

Prepared for:
US Environmental Protection Agency
109 TW Alexander Drive
Research Triangle Park, NC 27709

Prepared by:

Wood Environment & Infrastructure Solutions, Inc.

404 SW 140th Terrace
Newberry, FL 32669

Wood Project No.: 6066150360

September 2018

Table of Contents

Table of Contents (continued)

List of Appendices

List of Tables

Table of Contents (continued)

List of Acronyms and Abbreviations

CSN	$PM_{2.5}$ Chemical Speciation Network
DART	Data Analysis and Reporting Tool
DRI	Desert Research Institute
EC	Elemental Carbon
EPA	United States Environmental Protection Agency
FiSH	Wood Filter Shipping and Handling Unit
FRM	Federal Reference Method
LQL	lower quantifiable limits
MDL	Method Detection Limit
NIST	National Institute of Standards and Technology
OC	Organic Carbon
PM	Particulate Matter
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedure
TC	Total Carbon
TSA	Technical Systems Audit
UC Davis	The University of California at Davis
Wood	Wood Environment & Infrastructure Solutions, Inc.

1.0 Executive Summary

1.1 Introduction

Established by the United States Environmental Protection Agency (EPA) in 1999, the $PM_{2.5}$ Chemical Speciation Network (CSN) operates approximately 160 air monitoring sites throughout the 50 United States, the US Virgin Islands and Puerto Rico. Wood Environment & Infrastructure Solutions, Inc. (Wood) operates the filter handling, shipping, and gravimetric mass portion of the program. Wood was awarded the contract in September of 2015 and took over this portion of the CSN operations on November 16, 2015.

Wood is responsible for scheduling, shipping and receiving filters to/from the field sites in accordance with the EPA sampling schedule; data entry and validation of field and laboratory data; acceptance testing of Nylon and Quartz filters used in CSN network; gravimetric analyses for EPA-selected Teflon filters; and performing denuder refurbishment. In addition to this, Wood ships exposed filter media and their associated sampling event data to analysis laboratories at the University of California at Davis (UC Davis) and Desert Research Institute (DRI) respectively.

This document will discuss network operations for two different contract years, September 3, 2015 (filter handling operations began November 2015) to September 2, 2016 and September 3, 2016 through September 2, 2017. Information reported is for both contract years unless specified.

1.2 Data Quality Overview and Issues

An issue of significance arose early in the first option year regarding the availability of Nylon filter media. The long-term supplier, Pall Corporation, announced in October 2016 that they would no longer produce the Nylasorb filters used for CSN ion sampling. Several replacement candidates were acceptance tested from different vendors. None of them passed as received initially. The leading vendor has been working with Wood to produce a pre-washed product that will pass acceptance testing. This is ongoing as of this writing. Additionally, EPA has contracted with RTI International to wash filters from the leading vendor for use in the network. No final decision has been made.

There were some issues with data transferred to UC Davis for entry into the EPA Data Analysis and Reporting Tool (DART). Corrective actions were initiated to prevent recurrence, chief among them the implementation of automated data validation queries by Wood identical to those used by UC Davis prior to DART processing.

During these periods of performance, the only significant data quality issues related to the gravimetric laboratory or denuder refurbishment were a limited number of samples invalidated due to holding time issues, this was either caused by late or improper shipping from the field, or delayed filter weighing in the gravimetric laboratory. Table 4.1.2 shows that these invalidation percentages have improved through a combination of laboratory training and communicating proper shipping procedures with the field site operators.

Quality issues are discussed in Section 3.0.

2.0 Summary of Field Operation Issues

2.1 Chemical Speciation Site Changes

Changes at each CSN site are detailed in the quarterly metadata reports produced by Wood and provided to EPA. The changes that occurred during the first contract year (contract inception on 9/3/2015 through 9/2/16) are detailed in Table 2-1. Changes occurring during the second contract year (9/3/16 through 9/2/17) are detailed in Table 2-2.

Table 2-1. Site Changes during Base Year (2015-2016) (page 1 of 5)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
11/16/15		Network Wide		Shipping/handling and gravimetric laboratory switched from RTI to Wood	N/A	N/A	N/A	
11/20/15		Network Wide		Teflon filters used in the CSN switched to MTL	N/A	N/A	N/A	
11/30/15	080010006	Commerce City	CO	Site shut down until further notice	Completeness.	ALL or partial.	Yes	
12/14/15	391351001	Dayton National Trail High School	OH	URG Sampler out for repair	Completeness.	ALL or partial.	Yes	
12/18/15	481130069	Hinton	TX	SASS sampler down	Completeness.	ALL or partial.	Yes	
1/12/16	300930005	Butte-Greeley School	MT	Site shut down until further notice	Completeness.	ALL or partial.	Yes	
1/20/16	300930005	Butte-Greeley School	MT	Site operational again	N/A	N/A	N/A	
1/31/16	340070002	Camden-NJ	NJ	URG sampler issue - 1/31/16 sample missed	Completeness.	ALL or partial.	Yes	
2/5/16	391351001	Dayton National Trail High School	OH	URG sampler operational again	Completeness.	ALL or partial.	Yes	

Table 2-1. Site Changes during Base Year (2015-2016) (page 2 of 5)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
2/12/16	720210010	Bayamon Regional Jail	PR	Site initiated sampling	Completeness.	ALL or partial.	No	
3/17/16	540390011	WV - Guthrie Agriculture Center	WV	Site moved to NCore 54-039-0020 in Charleston	N/A	N/A	No	Gravimetric mass no longer measured since move
3/20/16	220150008	Shreveport, La site Q050	LA	Site closed until further notice	Completeness.	ALL or partial.	Yes	
3/25/16	340070002	Camden-NJ	NJ	URG sampler operational again	Completeness.	ALL or partial.	Yes	
4/21/16	380171004	Fargo NW	ND	Sample site relocated from Fargo NW to Bismarck Residential 380150003	Completeness.	ALL or partial.	No	
6/11/16	780100012	Virgin Islands sites	VI	Sampling initiated at VI sites	Completeness.	ALL or partial.	No	Gravimetric mass only
7/5/16	340230006	New Brunswick	NJ	moved to Rutgers (New Brunswick) site	Completeness.	ALL or partial.	No	new aqs id 34-023-0011
7/19/16	132950002	Rossville	GA	Site operator shipping change	Completeness.	ALL or partial.	No	
8/17/16	170434002	Naperville	IL	URG sampler down	Completeness.	ALL or partial.	Yes	
8/28/16	80010008	Adams County	CO	Replacement site for Commerce City initiated sampling	Completeness.	ALL or partial.	Yes	

Table 2-1. Site Changes during Base Year (2015-2016) (page 3 of 5)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
9/3/16	multiple	Washoe 1,2, Navajo, Southern Ute, Manzanita		Sampling shut down at all but one tribal site	N/A	NA	No	
9/23/16	11130001	Phenix City	AL	Site decommissioned due to lease, looking for location	Completeness.	ALL or partial.	Yes	
10/3/16	510870014	Henrico County	VA	Site operator shipping change	N/A	NA	No	Boris Leonoff
10/10/16	060731022	El Cajon	CA	SASS sampler down	Completeness.	ALL or partial.	Yes	
10/13/16	160010010	St. Lukes Meridian (IMS)	ID	Site operator shipping change	NA	NA	No	Matt Garringer
10/20/16	60290014	Bakersfield	CA	Site operator shipping change	NA	NA	No	Patrick Seames
10/27/16	420950025	Freemansburg	PA	Site moved to Lancaster Downwind AQS # 420710012	NA	NA	No	
10/31/16	130690002	Douglas	GA	Site operator shipping change	NA	NA	No	Shipping address changed to Caryn Huffman, 46 John Coffee Rd. Nicholls, GA

Table 2-1. Site Changes during Base Year (2015-2016) (page 4 of 5)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
11/14/16	130890002	South DeKalb	GA	New Super SASS, Site switched to 1-in-3 from 1-in-3 alt schedule	N/A	NA	No	
11/17/16	130890002	South DeKalb	GA	New Super SASS, Site switched to Sequential 1-in-3 from 1-in-3 schedule	N/A	NA	No	
11/11/16	060731022	El Cajon	CA	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	Super SASS now sampling had been down since 10/11
11/16/16	500070012	Burlington	VT	Site operator shipping change	N/A	NA	No	Jean Woodward
11/17/16	202090021	JFK Center	KS	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
11/28/16	060850005	San Jose	CA	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
11/28/16	310550019	Woolworth St.	NE	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	

Table 2-1. Site Changes during Base Year (2015-2016) (page 5 of 5)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
11/29/16	065821010	Morongo Band of Mission Indians		Sampling suspended	Completeness.	ALL or partial.	Yes	
12/19/16	460990008	Sioux Falls School for the Deaf	SD	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
12/28/17	500070012	Burlington	VT	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	

Table 2-2. Site Changes during Option Year 1 (2016-2017) (page 1 of 7)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
1/1/17	390350065	Harvard Yard	OH	Site initiated sampling	N/A	NA	No	
1/3/17	080310026	La Casa	CO	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
1/3/17	390350060	GT Craig	OH	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
1/4/17	421255001	East of Pittsburgh-Florence	PA	Site operator shipping change	N/A	NA	No	Robert Valentich
1/4/17	421290008	Greensburg	PA	Site operator shipping change	N/A	NA	No	Robert Valentich
1/13/17	280490020	Jackson	MS	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
1/19/17	340390004	Elizabeth Lab	NJ	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
1/26/17	390350065	Harvard Yard	OH	Alerted site that shipments postponed due to lack of signed delivery order	N/A	NA	No	
1/31/17	510870014	Henrico	VA	Site operator shipping change	N/A	NA	No	James Biggs

Table 2-2. Site Changes during Option Year 1 (2016-2017) (page 2 of 7)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
2/9/17	60290014	Bakersfield	CA	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
2/8/17	410510080	Portland-SE Lafayette	OR	URG inoperable	N/A	NA	No	
2/8/17	170310057	Springfield Pumping Station	IL	Site operator shipping change	N/A	NA	No	Leo Flores
2/10/17	482011039	Deer Park	TX	Site operator shipping change	N/A	NA	No	Site operator moved to new address 214 Kincourt Way, Huffman, TX 77336
2/13/17	040139997	Phoenix Supersite	AZ	URG runs invalid from 11/21/16 to 1/9/17 due to mfc issue	Completeness	All or partial	Yes	
2/15/17	120110034	Broward	FL	SASS channel 4 down previous week. Installed and operable 2/16	Completeness	All or partial	Yes	
3/8/17	010732003	Wylam	AL	Switched to sequential from 1 in 6 day frequency	N/A	NA	No	

Table 2-2. Site Changes during Option Year 1 (2016-2017) (page 3 of 7)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
3/2/17	510870014	Henrico	VA	New Super SASS, Site switched to sequential from 1-in-3 alt schedule	N/A	NA	No	
3/10/17	391530023	Akron 5 Points	OH	URG inoperable	Completeness	All or partial	Yes	
3/15/17	420010001	Arendtsville	PA	Site operator shipping change	N/A	NA	No	Spurgeon Bingaman
4/1/17		Network Wide		Increased the number of icepacks in speciation packages from 6 to 8 for the warmer months.				
4/1/17	420030008	Lawrenceville	PA	New Super SASS, Site switched to sequential from alt 1-in-3 schedule	N/A	NA	No	
4/1/17	120573002	Sydney	FL	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
4/4/17		Network Wide		New cassette cleaning procedure to deal with chloride contamination				

Table 2-2. Site Changes during Option Year 1 (2016-2017) (page 4 of 7)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
4/7/17	550790026	SER-DNR Headquarters	WI	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
4/7/17	340130003	Newark	NJ	New Super SASS, Site switched to sequential from alt 1-in-3 schedule	N/A	NA	No	
4/19/17	340230011	Rutgers (New Brunswick)	NJ	New Super SASS, Site switched to sequential from alt 1-in-3 schedule	N/A	NA	No	
5/13/17	320030540	Jerome Mack Middle School	NV	New Super SASS, Site switched to sequential from alt 1-in-3 schedule	N/A	NA	No	
5/25/17	120730012	Tallahassee	FL	Site operator shipping change	N/A	NA	No	Pascal Brignone
5/31/17	550270001	Horicon Palmatory	WI	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
6/6/17	390350065	Harvard Yard	OH	Site started sampling after being down due to stalled Delivery Order	N/A	NA	No	

Table 2-2. Site Changes during Option Year 1 (2016-2017) (page 5 of 7)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
6/9/17	020900034	Alaska Ncore	AK	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
6/12/17	11130001	Phenix City	AL	Replacement site for Phenix City initiated sampling	Completeness.	ALL or partial.	Yes	New name is Phenix City - S. Girard School AQS 01-113-0003
6/14/17	360290005	Buffalo	NY	Wood discovered site operator not putting decimal on %CV for SASS since 11/16	Completeness.	ALL or partial.	Yes	
6/21/17	060190011	Fresno	CA	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
6/21/17	211110067	Louisville-Cannons Lane	KY	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
6/26/17	390810017	Steubenville	OH	Site operator shipping change	N/A	NA	No	Eric Haenni
6/29/17	060850005	San Jose	CA	Site operator shipping change	N/A	NA	No	

Table 2-2. Site Changes during Option Year 1 (2016-2017) (page 6 of 7)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
8/5/17	390350076	Southerly WTP	OH	Site started sampling	N/A	NA	No	
8/21/17	081230008	Platteville	CO	Site operator shipping change	N/A	NA	No	Air Program Management
8/23/17	100032004	Wilmington	DE	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
8/23/17	110010043	Washington	DC	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
8/23/17	380150003	Bismarck Residential	ND	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
8/23/17	390610040	Cincinnati Taft	OH	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
8/23/17	410510080	Portland-SE Lafayette	OR	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	

Table 2-2. Site Changes during Option Year 1 (2016-2017) (page 7 of 7)

Date	AQS Site Code	Site Name	State	Description	Effect on Data	Type of Data Affected	Affected Data Flagged	Additional Information
8/23/17	482011039	Deer Park	TX	New Super SASS, Site switched to sequential from 1-in-3 schedule	N/A	NA	No	
8/29/17	482011039	Deer Park	TX	Site down due to Hurricane Harvey	Completeness.	ALL or partial.	Yes	Hurricane Harvey flooding impacts.

3.0 Quality Issues and Corrective Actions

3.1 Data Quality Issues and Corrective Actions

Wood staff perform an array of Quality Assurance / Quality Control (QA/QC) activities to ensure that data provided to EPA and stakeholders are of the highest quality. Wood strives to provide data that can serve as the basis for making important decisions.

Data quality for the CSN has several dimensions, but the primary goal should be usefulness to data users and understanding of the data sets' characteristics. There are several metrics typically considered in assessing the quality of the CSN data set:

- **Accuracy.** Analyses are standardized to reference values that are traceable to the National Institute of Standards and Technology (NIST). For Wood's component of the CSN contract, this applies to gravimetric analyses along with IC and EC/OC acceptance testing.
- **Precision.** Measured through regular QC replicates. Wood does not evaluate results from samplers collocated at the same site since the CSN collocated site locations are not part of Wood's scope of work on the contract.
- **Comparability.** The Wood laboratory participates in performance evaluation studies, which show that Wood's laboratory is consistently highly rated for analytical results, indicating an excellent approach to producing quality data.
- **Completeness.** Excellent completeness (>95%) is demonstrated overall for the Wood Filter Shipping and Handling Unit (FiSH) as measured by evaluating the total number of filters shipped that required pre-weighed filters for gravimetric analysis (either gravimetric mass only or gravimetric mass followed by XRF analysis) compared to the number of filters returned and converted into trip blanks. Some individual sites may have lower completeness, typically due to site maintenance or shipping problems; but overall the completeness for samples shipped to the field and returned is excellent.

3.1.1 Sample Shipping

3.1.2 Sample Handling Laboratory

As mentioned in Section 1.2 of this report, four issues were identified in May 2017 affecting data quality and requiring corrective actions. These issues were:

- Null codes were applied with no associated comment to data entry records. After further investigation, Wood determined that the null code should not have been applied. This resulted in samples being marked as invalid that were valid.
- Filters were not unloaded upon receipt at the FiSH and were then shipped again to the field site. This resulted in samples being marked as invalid due to Lab Error (Null Code = "AR").
- Filters were not loaded into the corresponding sampler type (Teflon/nylon into SASS or quartz into URG) and were then shipped to the field site. This resulted in sample run data being marked as invalid due to Lab Error (Null Code = "AR").

- Data entry errors were encountered when the data file provided with shipped filters to UC Davis was examined. In some instances, this resulted in data being flagged as invalid.

Corrective actions that were implemented as a result of these issues were:

- Data entry personnel have been instructed to enter comments when a Null flag is entered that would result in invalidation of a filter sample. The importance of adding a comment when a flag is entered will be reiterated during future training.
- Wood sought and received additional guidance from EPA defining Wood's responsibility for contacting site operators regarding suspected entry errors on field data sheets beyond correct transcriptions of the data received.
- Automated flagging routines that add comments to the Comment field for parameters that are not self-explanatory were instituted. For example: parameters outside of specification.
- CSN FiSH shipping and handling personnel have received and will continue to receive training to ensure cross-checking of modules and filter IDs (on Teflon filters) with those already shipped.
- Wood personnel began using a QA query that had been used only prior to filter shipments to the analytical laboratory as a tool to identify filters with missing Filter Analysis IDs prior to shipment of subsequent sets assisting in the identification of potential filters that haven't been unloaded.
- Blanks for all sites, URG field blanks for the entire network have been implemented making retrieval of these filters more routine since all sites will now have field blanks. Previously only a small percentage of the network included field blanks.
- CSN shipping and handling personnel have received and will continue to receive training on double-checking modules prior to shipping to ensure that filters are loaded into all sampler holders.
- CSN data entry personnel have received and will continue to receive training on double checking numeric entries at the time of entry and that data are entered into the correct fields.

3.1.3 Gravimetric Mass Laboratory

The only data quality issue associated with the gravimetric mass laboratory was related to holding times for filters based on the receipt temperatures of the samples. A number of Teflon samples were delivered outside of the de minimis 4°C criteria, resulting in shortened handling times. This resulted in a small number of samples receiving TS AQS null codes resulting in invalid samples. As a corrective action, Wood instituted a revised laboratory chain-of-custody form specifically designed to address this issue. In addition, a new model of ice pack was recommended and purchased by EPA to assist in maintaining required temperatures during sample shipment back to Wood.

Additionally, the weighing room had difficulty maintaining temperature and humidity requirements from the start of the contract in November of 2015 to March of 2016. While

this didn't affect data, it did limit the days of operation in the weighing lab, as no weighing could be performed while the lab was out of specification. The air handling system was tuned to provide continuous weighing conditions going forward. Since this change, the temperature and relative humidity have been kept in specification with just a few exceptions that did not affect data.

The Temperature and RH logger was inoperable for the period of February 17-February 19, 2016. This is demonstrated in Figure B-1. No filters were weighed during this time period.

3.1.4 Filter Acceptance Testing

3.1.4.1 Nylon Acceptance Testing

During the period of performance covered by this report, there were no issues related to nylon filter acceptance testing. All nylon filter lots evaluated during this period passed all acceptance testing. However, the supplier did inform us that the Nylasorb filters they supply were no longer going to be available. Replacement filters have not yet shown the same acceptance testing success rates as the Nylasorb filters.

3.1.4.2 Quartz Acceptance Testing

During the period of performance covered by this report, the only issue found for quartz filter acceptance testing was a smaller-than-acceptable number of filters for a few boxes of filters. In some cases, this wasn't related to actual acceptance testing criteria but rather was related to filters not passing visual inspection (pinholes, etc.) or a smaller number of filters in a box than were expected. If the number of filters remaining in a box after acceptance testing resulted in 85 filters or less, then the filter supplier was notified, and a new replacement box of filters was provided by the supplier.

3.1.5 Data Management and Reporting

3.1.5.1 Quality Issues and Corrective Actions

No significant quality issues arose during the period of this report that affected reportable data other than those noted in 3.1.1.

3.1.5.2 Operational Summary

Routine data-processing activities include the following:

- Entering sample ID and event data supplied by the FiSH into the LIMS
- Automated uploading of gravimetric mass and QC data
- Data review
- Submission of data to the CSN Program Manager for subsequent entry to the FiSH-maintained CSN database

3.1.5.3 Operational Changes and Improvements

The laboratory created an internal gravimetric chain-of-custody form to facilitate identification and tracking of received samples requiring gravimetric analysis.

3.1.6 Denuder Refurbishment Laboratory

There were no quality issues or corrective actions associated with the Denuder Refurbishment laboratory.

4.0 Laboratory Quality Control Summaries

4.1 Gravimetric Laboratory

The Gravimetric Laboratory determines mass for filters sent to CSN and other sites that require mass determination either because the site does not have a Federal Reference Method (FRM) device that is currently measuring mass or because $PM_{2.5}$ and/or PM_{10} are the pollutants of interest for the site. This section describes the QA/QC parameters evaluated during the periods covered by this report.

4.1.1 Summary of QC Checks and Statistics

Gravimetric QC checks performed are included in Tables 4-1-1, 4-1-2 and 4-1-3. When test data was determined to be outside of the stated parameters, the laboratory informed the project team for inclusion into the project records.

Table 4-1-1. Gravimetric Analysis Critical Criteria (page 1 of 2)

Criteria	Frequency	Acceptance Limits	Results
CSN Post Sampling Weighing (Hold Time)	All Filters	≤30 days from sample end date if receipt temperature < 4°C, or ≤30 days from sample end date if receipt temperature >4°C but < average ambient temperature during sampling (TT AQS flag also applied), or ≤10 days if receipt temperature > 4°C and > average ambient temperature during sampling (apply TT AQS flag also applied), if these limits are exceeded or if the samples arrive > 25°C apply TS* Null code	See Table 4-1-2
Tribal, FRM and Special Studies Weighing (Hold Time)	All Filters	≤30 days from sample end date if receipt temperature < average ambient temperature during sampling, or ≤30 days from sample end date if receipt temperature > average ambient temperature during sampling but <4°C, or ≤10 days from sample end date if receipt temperature > 4°C and > average ambient temperature during sampling, if these limits are exceeded or if the samples arrive > 25°C apply TS Null code	See Table 4-1-2
Unexposed filter visual defect check	All Filters	Correct type & size; for pinholes, particles or imperfections	All filters are checked on a light table prior to use and rejected if visibly defective.

Table 4-1-1. Gravimetric Analysis Critical Criteria (page 2 of 2)

Criteria	Frequency	Acceptance Limits	Results
Filter equilibration time	All Filters	24 hours minimum	All filters equilibrate for at least 24 hrs.
Filter equilibration temperature range	All Filters	24-hr mean 20.0-23.0°C	See room condition control charts in Appendix B.
Filter equilibration temperature control	All Filters	< 2.1°C Δ over 24 hr	See room condition control charts in Appendix B.
Filter equilibration humidity range	All Filters	24-hr mean 30.0% - 40.0% Relative Humidity (RH) or Within +5.0 % sampling RH but > 20.0%RH	See room condition control charts in Appendix B.
Filter equilibration humidity control	All Filters	< 5.1% Δ per hr	See room condition control charts in Appendix B.
Filter pre/post sampling RH difference	All Filters	Difference in 24-hr means < + 5.1% RH	See room condition control charts in Appendix B.
Microbalance location	All Filters	Located in filter conditioning environment	Microbalance is permanently located in the filter conditioning lab.
Microbalance auto-calibration	Prior to each weighing session	Manufacturer's specification	Calibration verified prior to each session.

*TS Null Code is applied for filters whose holding time or transport temperature is out of specifications.

Table 4-1-2. Gravimetric Samples Receiving TS Null Code

	Flagged CSN Filters	Non CSN Grav Flags	Total Filters Weighed CSN	Total Filters Non CSN Grav	Percentage Flagged CSN Sites
Base Year	32	284	118	1164	27.12%
Option Year	6	16	93	491	6.45%

*TS Null Code is applied for filters whose holding time or transport temperature is out of specifications.

Laboratory analysis operational QC included daily calibration verifications, laboratory blanks, and replicate filter analyses. Results are presented in Appendix B.

Table 4-1-3. Gravimetric Analysis Operational Criteria (page 1 of 2)

Criteria	Frequency	Acceptance Limits	Results
Lab Filter (Batch) Blank	10% or 1 per weighing session	< ±15.1 µg change between weighings	See Lab Blank results - Appendix B.
Balance Check (working standards)	Beginning, 10th sample, end	< ±3.1 µg from certified value	See SRM results - Appendix B.
Routine filter reweighing	1 per weighing session	< ±15.1 µg change between weighings	See Duplicate results - Appendix B.
Microbalance audit	Annually (every 365 days)	< ±0.003 mg or manufacturers specs, whichever is tighter	Audited and calibrated annually in March by Rite-Weight, Inc.
Lab temperature logger check	Every 90 days	< ±2.1°C	Verified using an independently certified hygrometer at least every 90 days.
Lab humidity logger check	Every 90 days	< ±2.1%	Verified using an independently certified hygrometer at least every 90 days.
Microbalance calibration	At installation, and annually (every 365 days)	Manufacturer's specification	Audited and calibrated annually in March by Rite-Weight, Inc.
Lab temperature certification	Annually (every 365 days)	< ±2.1°C of certifying standard	Audited and calibrated annually by Dickson, Inc.*
Lab humidity certification	Annually (every 365 days)	< ±5.1% RH of certifying standard	Audited and calibrated annually by Dickson, Inc.*
Working mass standards certification	Annually (every 365 days)	0.025 mg tolerance (ASTM Class 2)	Certified annually by Troemner, LLC.
Working mass standards comparison to primary standards	Every 90 days	0.025 mg tolerance (ASTM Class 2)	This has been cited as a need to perform during an internal audit in Feb. 2018. Standards are all Class I and have passed annual certifications.

Table 4-1-3. Gravimetric Analysis Operational Criteria (page 2 of 2)

Criteria	Frequency	Acceptance Limits	Results
Primary mass standards certification	Annually (every 365 days)	0.025 mg tolerance (ASTM Class 2)	Certified annually by Troemner, LLC.

*Performed September 2015, February 2016, January 2017, and October 2017.

Nylon Acceptance Testing QC checks performed are included in Table 4-1-4.

Table 4-1-4. Nylon Filter Acceptance Testing Criteria

Criteria	Frequency	Acceptance Limits	Results
Nylon Acceptance Testing	2% of Filters	≤1 µg of cation/anion per filter	Appendix A (Note: data provided represents all referenced tests run during the referenced year)
Reference standard (SRM)	Bracket beginning and ending of sample analysis batch	± 10% of the certified true value	Appendix A (Note: data provided represents all referenced tests run during the referenced year)
Control standard (CCV)	Every 10 samples and bracketing analysis batch	± 10% of the certified true value	Appendix A (Note: data provided represents all referenced tests run during the referenced year)
MB	Daily	≤ 2 times the RL	Appendix A (Note: data provided represents all referenced tests run during the referenced year)

Quartz Acceptance Testing QC checks performed are include in Table 4-1-5.

Table 4-1-5 Quartz Filter Acceptance Testing Criteria

Criteria	Frequency	Acceptance Limits	Results
Quartz Acceptance Testing	2% of Filters	Organic Carbon (OC) <1.5 µg C/cm2 Elemental Carbon (EC) <0.5 µg C/cm2 Total Carbon (TC) <2.0 µg C/cm2	Appendix C
Sucrose Calibration	Thrice per week	17.1 – 18.9 µg C/filter	Appendix C
System Blank	Once per week	<0.2 µg C/cm2	Appendix C

4.1.2 Determination of Uncertainties and Method Detection Limits

The FiSH is evaluated for the uncertainty associated with the gravimetric mass determinations for those sites where mass is determined and the corresponding concentration uncertainties. Uncertainty for mass is determined as [1.414 * standard deviation of replicate weighings] and varies by balance. Total mass uncertainty is calculated by assuming a 5% flow uncertainty (as used by the IMPROVE program - see IMPROVE Standard Operating Procedure (SOP) 351, *Data Processing and Validation*) coupled with the analytical uncertainty according to the following formula:

$$\sigma_{Mi,j} = \sqrt{\sigma_{Ai}^2 + \sigma_{Vk}^2 * M^2}$$

where

$$\text{Total uncertainty} = \sqrt[2]{(Anal.Uncertainty)^2 + (Vol.Uncertainty * Mass)^2}$$

$\sigma_{Mi,j}$ = Std. dev. of mass for analyte *i* for event *j* (micrograms per filter)
σ_{Ai} = Analytical uncertainty
σ_{Vk} = Relative std. dev. of sampler volume (dimensionless) [typically 5%]
M = Analytical mass (micrograms per filter)

Uncertainty values reported with each concentration record are calculated from the mass uncertainty values and include components of both analytical and the volumetric uncertainties. The reported uncertainties are estimated “1-sigma” valued (one standard deviation). No blank corrections are assumed.

4.1.2.1 Gravimetric Mass Uncertainty and MDL Determinations

Gravimetric mass Method Detection Limit (MDL) is currently in the process of being evaluated for the CSN shipping laboratory. Field blanks were sent to 11 different CSN sites on a quarterly basis; but the results for the first round of tests for those samples were not completed for this reporting period. The evaluation of the gravimetric mass MDL will be presented in future annual reports.

Uncertainty for CSN sites that determine gravimetric mass is determined for both mass and concentration. Mass and concentration uncertainties for regular CSN sites (not mass-only sites with FRM samplers such as the Virgin Islands and Tribal sites) are shown for the base year and option year 1 periods in Table 4-1-6.

Table 4-1-6. Average and Standard Deviation of Mass and Concentration Uncertainty by Period

Period	Average Mass Uncertainty (µg)	Standard Deviation of Mass Uncertainty (µg)	Average Concentration Uncertainty (µg /m3)	Standard Deviation of Concentration Uncertainty (µg /m3)
Base Year	6.85	10.6	0.59	0.44
Option Year 1	6.71	9.02	0.60	0.38

4.1.2.2 Ion Acceptance Testing MDL Determinations

Ion acceptance testing MDL determinations for cations and anions were evaluated by measurements made on seven (7) duplicate analyses. The MDL is computed as follows per 40CFR136 Appendix B:

$$MDL = t_{(n-1,1-\alpha = 0.99)} * (S)$$

where:

MDL = the method detection limit

$t_{(n-1,1-\alpha = 0.99)}$ = the students t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom. For n=7 this value is 3.143.

S = standard deviation

The results showed MDLs listed in Table 4-1-7.

Table 4-1-7. Anion and Cation MDLs (µg/ml)

Analyte	Average concentration of 7 replicates	Standard Deviation of 7 replicates	MDL
Anions			
Chloride	0.2030	0.00195	0.0061
Nitrate	0.3968	0.0079	0.0247
Sulfate	0.5020	0.0124	0.0388
Cations			
Sodium	0.0328	0.0006	0.0018
Ammonium	0.0523	0.0033	0.0104
Potassium	0.05210	0.0003	0.0011

4.1.2.3 Quartz Acceptance Testing MDL Determinations

The MDLs represent the best sensitivity of the method and should be less than or equal to the lower quantifiable limits (LQLs). The IMPROVE_A protocol is based on the analyses of pre-fired laboratory blank quartz-fiber filters. The MDL is defined as three times the standard deviation of their measured results (see Table 4-1-8).

Table 4-1-8. EC and OC MDLs

Analyte	MDL (µg/cm^2)	MDL (µg/Filter)
Total OC	0.41	1.43
Total EC	0.11	0.37
TC	0.42	1.48

4.1.3 Audits, Performance Evaluations, Training, and Accreditations

A laboratory audit was performed by Wood in March 2016 for the gravimetric and ion analysis laboratories. This audit included the laboratory facility and high level overview of technical systems. Specific CSN test methods were not reviewed for this audit. The only finding was to update the laboratory organizational chart.

Forms documenting personnel demonstrations of capability are completed as needed. Qualified personnel observe method performance and review the results from analyses of known reference materials to authorize technicians for initial or ongoing performance of the method. Demonstrations of capability were completed for laboratory personnel during the period of reporting as listed in Table 4-1-9.

Table 4-1-9. Demonstrations of Capability

Period	Demonstration of Capability Completion Dates
Base Year	11/6/15, 12/15/15, 8/2/16
Option Year 1	9/26/16, 12/12/16

4.1.4 Summary of Filter Blanks (i.e., lab blanks, lot blanks, and field blanks)

Filter blank results for Nylon filters are presented in Appendix A.

Filter blank results for gravimetric samples are presented in Appendix B.

Filter blank results from Quartz Filters are presented in Appendix C. Failing results for EC and OC analyses were not observed.

4.2 Sample Handling Laboratory

The FiSH prepares and ships appropriate sampling media installed in their associated sampling modules to each state or local agency (or sampling site within the state) as

needed to meet the sampling schedule for each site. This section describes the QA/QC parameters evaluated during the periods covered by this report.

4.2.1 Summary of QC Checks and Statistics

QC checks and statistics for the FiSH relate to the number of filters that were invalidated based on issues created solely by FiSH personnel. These issues include invalidations due to one or more of the following reasons:

- more than one filter loaded into a channel at a time
- no filter loaded into a cassette
- filter loaded into improper channel
- filters dropped or contaminated during unloading.

These statistics are based on the number of filters that receive the "AR" (Lab Error) null code. Table 4-2-1 shows the numbers and percentages for filters receiving the "AR" null code for the base year and option year 1.

Table 4-2-1. Number of Filters Invalidated based on the AR Lab Error Null Code

Period	Total Filters Processed	Number of Filters Receiving the AR Null Code	Percentage
Base Year	31,805	65	0.20%
Option Year 1	42,986	63	0.15%

Table 4-2-2 shows that less than 1% of all filters result in invalidation due to lab errors.

4.2.2 Audits, Performance Evaluations, Trainings, and Accreditations

A management systems audit was performed May 3 and 5, 2016. Follow up reviews were performed June 23, 2016; May 9, 2017; and May 19, 2017. (Appendix D)

Analysis batch reviews were performed for each batch transferred to the analysis laboratories. The May 2016 internal audit cited the need to document these reviews. Since February 2017 analysis batch reviews have been documented and each batch has been reviewed for one hundred percent of data content.

Wood submitted a corrective action plan June 27, 2017 in response to an external audit conducted May 22 – 26, 2017 by EPA. The audit report was received June 22, 2017. Corrective action responses were delivered as show in Table 4-2-2.

Subcontractor audits were not performed during the base year or option year 1. However, audits of MTL and DRI were performed in 2018 and will be discussed in a later report.

Table 4-2-2. Corrective Action to May 2017 Technical Systems Audit (TSA) (page 1 of 2)

Date of Delivery	Finding	Corrective Action
July 21, 2017	1. Independent QA oversight at the program level. 2. There are no documented validation or QA/QC checks for database operations. 3. Inadequate FiSH training documentation.	1. Reassigned QA Manager and QC Specialist. 2. SQL Server migration implemented. 3. Established new training record form.
August 4, 2017	1. SOP GLO-3180-041 does not contain QA/QC procedures. 2. There are no procedures for identifying database errors, including misapplied flags, prior to release of data to UC Davis. 3. Database queries are not documented. 4. Some SOPs do not include referenced checklists and forms and/or checklists/forms observed during procedure demonstrations are not referenced in SOPs. 5. Database queries are not documented. 6. Some SOPs do not include referenced checklists and forms, and/or checklists/forms observed during procedure demonstrations are not referenced in SOPs.	1. QA/QC procedures identified. 2. Implemented SQL Server migration and associated transaction logging. 3. The compiled list of queries was provided to EPA. 4. The compiled list of checklists was provided to EPA. 5. The compiled list of queries was provided to EPA. 6. The compiled list of checklists was provided to EPA.
August 18, 2017	1. There are no documented validation or QA/QC checks for database operations. 2. There are no procedures for identifying database errors, including misapplied flags, prior to release of data to UC Davis. 3. Database queries are not documented. 4. Some procedures observed during the audit are not documented in a SOP.	1. QA/QC checks to evaluate potential database errors database and corrective action procedures for those errors were implemented. 2. Validation and verification steps were reviewed. 3. Query documentation added to SOPs and checklists. 4. Completion of procedural review in preparation for document creation.

Table 4-2-2. Corrective Action to May 2017 Technical Systems Audit (TSA) (page 2 of 2)

Date of Delivery	Finding	Corrective Action
September 1, 2017	1. Independent QA oversight at the program level. 2. SOP GLO-3180-041 does not contain QA/QC procedures. 3. SOP GLO-3180-041 does not contain well documented procedures. 4. There are no documented validation or QA/QC checks for database operations. 5. There are no procedures for identifying database errors, including misapplied flags, prior to release of data to UC Davis. 6. Level 0 Data Validation is not documented or performed as described in EP-D-15-001, ROW I. A. 1 and incorporated reference. 7. Some SOPs do not include referenced checklists and forms, and/or checklists/forms observed during procedure demonstrations are not referenced in SOPs. 8. Some procedures observed during the audit are not documented in a SOP. 9. Inadequate FiSH training documentation.	1. Revised Quality Assurance Project Plan (QAPP) with respect to QA program reorganization. 2. QA/QC procedure subsections added to FiSH SOPs. 3. SOP GLO-3180-041 separated into three SOPs addressing training, field shipping and handling, and batch preparation and shipment. 4. Established software quality assurance plan. 5. Validation and verification procedures documented in SOPs for field shipping and handling, and batch preparation and shipment. 6. Level 0 procedures documented in SOPs for field shipping and handling, and batch preparation and shipment. 7. Checklists and forms documented in SOPs. 8. Procedures documented in SOPs for training, field shipping and handling, and batch preparation and shipment. 9. New Training record documented in the training SOP.

4.2.3 Summary of Sample Filter Receipt Temperature

Table 4-2-3 details the number of filters that arrived at the FiSH at temperatures above 4ºC during both the base year and option year 1. For each period, the percentage of filters that arrived above the acceptable temperature criteria exceeded 40%.

Table 4-2-3. Number of Filters Received Above 4ºC

Period	Total Filters Processed	Number of Filters Received Above Criteria	Percentage
Base Year	31,806	13,914	43.75%
Option Year 1	42,992	20,821	48.43%

Filters received above the 4ºC criteria receive the "TT" Validity flag. The samples are not marked as invalid but are simply outside of the acceptable criteria.

4.2.4 Summary of FiSH Filter Blanks Results

At present there is no existing protocol or contract mechanism for contracted laboratories to routinely process and evaluate shipping and handling blanks.

5.0 Data Management and Reporting

5.1 Number of Records Transferred to Analysis Laboratory

During the base year of the contract (9/3/15-9/2/16), 31,805 data records were delivered to the analysis laboratory (Table 5-1-1). For option year 1 (9/3/16-9/2/17), 42,986 records were transferred to the analysis laboratory.

In addition, 3,037 and 3,923 Null flag records were transferred during the base and option year 1 periods, respectively (Table 5-1-2). 13,607 and 22,172 Validity flag records were transferred during the base year and option year 1.

Table 5-1-1. Base Year Analysis Batch Shipments

Analysis Batch #	Date Range	Date Shipped	# of Submissions	Records
A0000001	11/20-11/23/2015	12/15/2015	2	347
A0000002	11/23-12/14/2015	1/27/2016	2	2409
A0000003	12/17-12/26/2015	2/23/2016	2	52
A0000004	12/17-12/29/2015	3/3/2016	2	1480
A0000005	1/1/-1/13/2016	3/28/2016	2	1680
A0000006	1/16-1/31/2016	4/18/2016	2	1950
A0000007	2/3-2/27/2016	4/26/2016	2	2933
A0000008	3/1-3/19/2016	5/25/2016	3	2683
A0000009	3/22-4/18/2016	6/20/2016	2	3252
A0000010	4/21-5/12/2016	7/21/2016	2	2618
A0000011	5/15-6/17/2016	8/30/2016	2	4080
A0000012	6/20-7/8/2016	9/28/2016	3	2199
A0000013	7/11-7/29/2016	10/20/2016	2	2435
A0000014	8/1-8/19/2018	10/31/16	2	2405
A0000015	8/22-8/31/2016	11/14/16	3	1282

Table 5-1-2. Option Year 1 Analysis Batch Shipments (page 1 of 2)

Analysis Batch #	Date Range	Date Shipped	# of Submissions	Records
A0000016	9/3-9/21/2016	12/1/2016	2	2480
A0000017	9/24-10/12/2016	12/15/2016	2	2192
A0000018	10/15-11/2/2016	12/28/2016	2	2563
A0000019	11/5-11/23/2016	1/12/2017	2	2192
A0000020	11/26-12/14/2016	1/26/2017	2	2481
A0000021	12/17-12/29/2016	2/8/2017	2	1536
A0000022	1/1-1/22/2017	2/21/2017	1	2619
A0000023	1/25-2/15/2017	3/14/2017	1	2665
A0000024	2/18-2/27/2017	3/30/2017	1	1296
A0000025	3/2-3/20/2017	4/25/2017	2	2586

Table 5-1-2. Option Year 1 Analysis Batch Shipments (page 2 of 2)

Analysis Batch #	Date Range	Date Shipped	# of Submissions	Records
A0000026	3/23-4/10/2017	5/10/2017	2	2353
A0000027	4/13-4/16/2017	5/25/2017	1	657
A0000028	4/19-5/10/2017	6/14/2017	1	2998
A0000029	5/13-5/31/2017	7/17/2017	2	2833
A0000030	6/3-6/21/2017	8/2/2017	1	2463
A0000031	6/24-7/12/2017	8/21/2017	1	2823
A0000032	7/15-7/30/2017	9/7/2017	1	2235
A0000033	8/2-8/20/2017	9/27/2017	1	2241
A0000034	8/23-9/13/2017	10/25/2017	2	1773*

*includes only the portion of records before option year 2 began on 9/3/2017

5.2 Acceptance Testing Data Management

5.2.1 Nylon Filter Acceptance

Upon receipt, nylon filter acceptance data is reviewed by the Laboratory Manager and distributed to the project team. The data is authenticated, scanned, and maintained on the project drive. During these performance periods, the data was also periodically checked by the quality specialist as secondary verification of compliance/noncompliance of data with acceptance testing parameters. These checks were performed on a periodic basis.

5.2.2 Quartz Filter Acceptance

Upon receipt, quartz filter acceptance data is checked by the quality specialist for quantity, lot number, and that data is within acceptance testing parameters. The quality specialist indicates her observations with initials and date. Finally, the data is scanned and maintained on the project drive.

6.0 Quality Assurance and Data Validation

6.1 QAPP Revisions

The QAPP for Filter Handling, Acceptance Testing and Gravimetric Analysis for Chemical Speciation Network, Special Studies and State, Local and Tribal Site $PM_{2.5}$ Federal Reference Method Filter Samples was established as revision 0.0 following EPA QA-G6 input and guidance, signed and approved on 1/18/2018. There have been no finalized revisions to this version as of this writing.

6.2 SOP Revisions

Over the course of the first two years of this contract, SOPs were drafted to reflect procedures used in processing of CSN filters. The Draft SOPs from the original proposal were modified based on the USEPA G6 guidance document with input from EPA and Wood personnel to create the current accepted SOPs.

SOPs in use during the period of this report are as follows:

- DRI-SOP #2-107r4 Procedure for Light Transmission Analysis Method Improve A
- DRI-SOP #2-106r6 Pre-firing and Acceptance Testing of Quartz Fiber Filters for Aerosol and Carbonaceous Material Sampling
- GLM3180-009 Determination of Particulate Matter (PM) Gravimetric Mass for the Chemical Speciation Network
- GLM3180-010 Acceptance Testing of Nylon Filters by Ion Chromatography for the Chemical Speciation Network
- GLM3180-011 SOP for Dual-Wavelength Optical Density Analyses
- GLM3180-040 Cleaning and Coating of Aluminum Honeycomb Denuders
- GLO3110-001 Training Chemical Speciation Network Shipping and Handling Personnel
- GLO3110-002 Field Shipping and Handling
- GLO3110-003 Analysis Batch Preparation and Shipment
- GLO3110-004 Corrective and Preventive Action
- GLO3110-005 SOP for Leak Checking the URG 3000N Filter Cassette
- GLO3110-006 Database Operations for the Chemical Speciation Network
- GLO3110-007 Long-Term Archiving of PM Only Teflon Filters

6.3 Summary of Internal QA Activities

For the reporting period, activities were:

- Wood issued 5 working drafts of the QAPP during the reporting period on November 3, 2015; March 30, 2016; March 17, 2017; May 18, 2017; September 1, 2017.
- A management systems audit was performed in March 2016.

  The first technical and quality systems audit reviewing method performance was performed May 3 and 5, 2016. Follow up reviews were performed June 23, 2016; May 9, 2017; and May 19, 2017.
- Analysis batch reviews were performed for each batch transferred to the analysis laboratories. Since February of 2017, these batches have been reviewed for one hundred percent of data content (versus a subset of content).
- Four corrective actions were implemented in response to EPA concerns raised April 25, 2017 for the following:
  - Null codes were applied with no associated comment to data entry records. After further investigation, Wood determined that the code should not have been applied. This resulted in samples being marked as invalid that were valid.
    - Data entry personnel have now been instructed to enter comments whenever a Null flag is entered that would result in invalidation of a filter sample and the importance of adding a comment whenever a flag is entered will be reiterated during future training.
  - Wood sought and received additional guidance from EPA defining Wood's responsibility for contacting site operators regarding suspected entry errors on field data sheets beyond correct transcriptions of the data received.
  - Filters were not unloaded upon receipt at the FiSH and were then shipped again to the field site. This resulted in samples being marked as invalid due to Lab Error (Null Code = "AR").
    - CSN FiSH shipping and handling personnel have received and will continue to receive training to ensure cross-checking of modules and filter IDs (on Teflon filters) with those already shipped.
  - Wood personnel began using a QA query after filter unloading that had previously only been used prior to filter shipments to the analytical laboratory as a tool to identify filters with missing Filter Analysis IDs prior to shipment of subsequent sets assisting in the identification of potential filters that haven't been unloaded.
  - Filters were not loaded into the corresponding sampler type (Teflon/nylon into SASS or quartz into URG) and were then shipped to the field site. This resulted in sample run data being marked as invalid due to Lab Error (Null Code = "AR").
    - CSN shipping and handling personnel have received and will continue to receive training on making sure to double check modules prior to shipping to ensure that filters are loaded into all sampler holders.
    - Monthly, network wide URG field blanks have been implemented, making retrieval of filters more routine since all sites now have field blanks.

  - During quality checking, there were a number of data entry errors encountered when the data file provided with shipped filters to UC Davis was examined. In some cases this resulted in data being flagged as invalid.
    - CSN data entry personnel have received and will continue to receive training on making sure that numeric entries are double checked at the time of entry and that data are entered into the correct fields.
    - Automated flagging routines that add comments to the Comment field for parameters that are not self-explanatory were instituted.
- Wood submitted a corrective action plan June 27, 2017 in response to an external audit conducted May 22 – 26, 2017 by EPA. The audit report was received June 22, 2017. Corrective action responses (shown on Table 4-2-2) were delivered on:
  - July 21. 2017
  - August 4, 2017
  - August 18, 2017
  - September 1, 2017

6.4 Data Validation and Review

6.4.1 Summary of Analysis Batch Data Validation Review

Prior to Analysis Batch shipment to Analysis Labs, the data is run through a number of queries specified in GLO3110-003. Queries are run on field data to apply flags to samples with parameters out of specification, and to ensure that suspected abnormalities in the data are verified to be correct. Starting in 2017 all data sets have had 100% review of data entry, and all queries of analysis batch data since 6/24/17 have been standardized.

6.4.2 Post Shipment Data Investigations

It is Wood's goal to produce zero data errors. As a group, we are continually updating database tools and data entry procedures to limit errors. Since July 18, 2017, Wood has engaged in a weekly phone conference with UC Davis to go over questions on the analysis batch data. A shared online spreadsheet documents questions and resolutions between the two groups. This teamwork has allowed for each group to understand the data issues that each has observed. Since this arrangement has started, the number of errors has gone down and the data going to the end users has been processed more expeditiously.

6.4.3 Checks of Nylon and Quartz acceptance testing data

DRI data is checked by the Quality Specialist. The lot numbers and quantities are checked against the filters shipped. OC/EC/TC blank values and sucrose calibrations are checked to ensure that the values fall within the acceptance criteria. Additionally, OC/EC/TC values for the filters that underwent acceptance testing are checked to ensure acceptance testing criteria were met.

6.5 Collocated Precision Summary Statistics

There are no collocated data to report for the Shipping and Handling operations or gravimetric laboratory because collocated sites are outside of the Wood scope.

7.0 List of References

Guidance for Preparing Standard Operating Procedures (SOPs), EPA QA/G-6, April 2007.

40 CFR Appendix to Part 136 – Definition and Procedure for the Determination of the Method Detection Limit-Revision 1.11, July 1, 2011.

Appendix A

Daily Calibration Verifications, Laboratory Blanks, and Replicate Filter Analyses Charts

Table A-1. Anion SRM Summary Report, Nov 16, 2015 - Sept 2, 2016

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
SRM1	0.9343	0.940	100.6	6.9285	7.000	101.0	10.0961	10.100	100.0	12/7/15
SRM2	0.9498	0.940	99.0	7.0760	7.000	98.9	10.3357	10.100	97.7	12/8/15
SRM1	0.9580	0.940	98.1	7.0089	7.000	99.9	10.1553	10.100	99.5	12/16/15
SRM2	1.0039	0.940	93.6	7.3092	7.000	95.8	10.6518	10.100	94.8	12/16/15
SRM1	0.9373	0.940	100.3	6.9147	7.000	101.2	10.1287	10.100	99.7	4/21/16
SRM2	0.9495	0.940	99.0	6.9915	7.000	100.1	10.2096	10.100	98.9	4/21/16
SRM1	0.9409	0.940	99.9	6.8997	7.000	101.5	10.1398	10.100	99.6	5/5/16
SRM2	1.0064	0.940	93.4	7.0121	7.000	99.8	10.2894	10.100	98.2	5/5/16
SRM1	0.9650	0.940	97.4	6.9169	7.000	101.2	10.1732	10.100	99.3	5/23/16
SRM2	0.9770	0.940	96.2	7.0392	7.000	99.4	10.2867	10.100	98.2	5/24/16
SRM1	0.9564	0.960	100.4	6.8872	7.000	101.6	10.0424	10.100	100.6	8/2/16
SRM2	0.9661	0.960	99.4	7.0272	7.000	99.6	10.2048	10.100	99.0	8/3/16
SRM3	0.9656	0.960	99.4	6.9638	7.000	100.5	10.1487	10.100	99.5	8/4/16
SRM1	0.9412	0.960	102.0	6.7909	7.000	103.1	9.8579	10.100	102.5	8/9/16
SRM2	0.9500	0.960	101.1	6.8700	7.000	101.9	9.9113	10.100	101.9	8/10/16
SRM1	0.9558	0.960	100.4	6.8853	7.000	101.7	10.0359	10.100	100.6	8/15/16
SRM2	0.9633	0.960	99.7	6.9823	7.000	100.3	10.2159	10.100	98.9	8/16/16
SRM1	0.9367	0.960	102.5	6.8721	7.000	101.9	9.9947	10.100	101.1	8/17/16
SRM2	0.9509	0.960	101.0	6.9107	7.000	101.3	10.0922	10.100	100.1	8/18/16

Table A-2. Anion SRM Summary Report, Sept 3, 2016 - Sept 2, 2017

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
SRM1	0.0401	0.040	100.2	0.0408	0.040	102.0	0.0397	0.040	99.3	6/16/17
SRM2	0.0397	0.040	99.4	0.0410	0.040	102.4	0.0393	0.040	98.2	6/16/17
SRM3	0.0399	0.040	99.7	0.0434	0.040	108.6	0.0403	0.040	100.8	6/17/17
SRM1	0.0384	0.040	96.0	0.0415	0.040	103.8	0.0396	0.040	98.9	6/17/17
SRM3	0.0401	0.040	100.3	0.0395	0.040	98.8	0.0402	0.040	100.5	6/18/17
SRM1	0.0418	0.040	104.6	0.0391	0.040	97.8	0.0408	0.040	102.0	6/30/17
SRM2	0.0410	0.040	102.5	0.0402	0.040	100.4	0.0402	0.040	100.5	7/1/17
SRM3	0.0412	0.040	103.0	0.0386	0.040	96.5	0.0396	0.040	99.0	7/1/17
SRM1	0.0405	0.040	101.2	0.0388	0.040	97.0	0.0392	0.040	97.9	7/12/17
SRM2	0.0410	0.040	102.5	0.0401	0.040	100.1	0.0391	0.040	97.6	7/12/17
SRM3	0.0414	0.040	103.4	0.0411	0.040	102.7	0.0391	0.040	97.8	7/12/17

Note: SRM Targets for Chloride, Nitrate and Sulfate were reduced between the first and second contract years in order to limit recalibrations and reruns.

Table A-3. Cation SRM Summary Report, Nov 16, 2015 - Sept 2, 2016

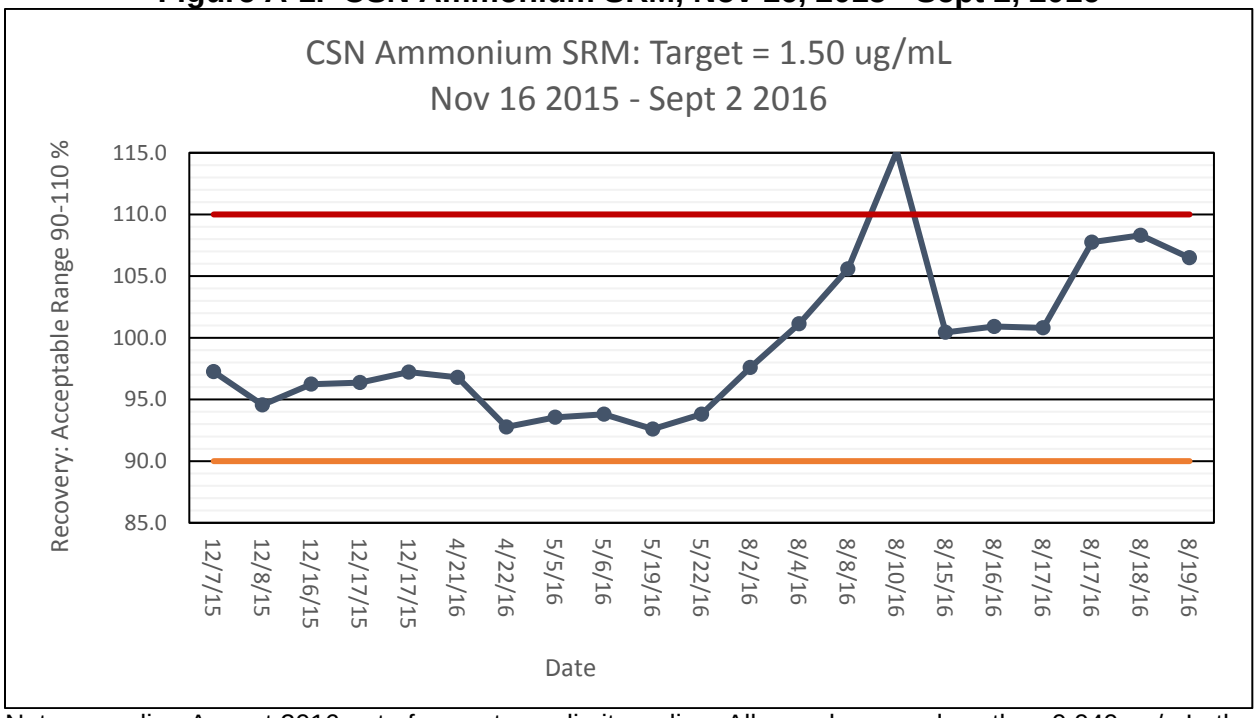
Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	% Recovery Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
SRM1	1.6209	1.50	92.5	1.5424	1.50	97.3	2.6422	2.50	94.6	12/7/15
SRM2	1.6510	1.50	90.9	1.5863	1.50	94.6	2.6922	2.50	92.9	12/8/15
SRM1	1.6803	1.50	112.0	1.4436	1.50	96.2	2.5910	2.50	103.6	12/16/15
SRM1	1.6595	1.50	110.6	1.4455	1.50	96.4	2.5758	2.50	103.0	12/17/15
SRM2	1.6938	1.50	112.9	1.4582	1.50	97.2	2.5915	2.50	103.7	12/17/15
SRM1	1.7053	1.50	113.7	1.4518	1.50	96.8	2.6060	2.50	104.2	4/21/16
SRM2	1.5203	1.50	101.4	1.3916	1.50	92.8	2.2152	2.50	88.6	4/22/16
SRM1	1.4695	1.50	98.0	1.4033	1.50	93.6	2.3687	2.50	94.7	5/5/16
SRM2	1.4763	1.50	98.4	1.4070	1.50	93.8	2.3743	2.50	95.0	5/6/16
SRM1	1.3734	1.50	91.6	1.2889	1.50	92.6	2.3003	2.50	92.0	5/19/16
SRM2	1.3433	1.50	90.0	1.4071	1.50	93.8	2.4242	2.50	97.0	5/22/16
SRM1	1.5502	1.50	103.3	1.4639	1.50	97.6	2.3834	2.50	95.3	8/2/16
SRM2	1.4297	1.50	95.3	1.5171	1.50	101.1	2.3229	2.50	92.9	8/4/16
SRM1	1.3529	1.50	90.2	1.5838	1.50	105.6	2.4509	2.50	98.0	8/8/16
SRM2	1.4921	1.50	99.5	1.7269	1.50	115.1	2.6090	2.50	104.4	8/10/16
SRM1	1.4745	1.50	98.3	1.5067	1.50	100.4	2.3052	2.50	92.2	8/15/16
SRM2	1.4726	1.50	98.2	1.5137	1.50	100.9	2.3065	2.50	92.3	8/16/16
SRM3	1.4718	1.50	98.1	1.5120	1.50	100.8	2.3845	2.50	95.4	8/17/16
SRM1	1.6243	1.50	108.3	1.6162	1.50	107.7	2.5526	2.50	102.1	8/17/16
SRM2	1.6007	1.50	106.7	1.6246	1.50	108.3	2.5503	2.50	102.0	8/18/16
SRM3	1.5917	1.50	106.1	1.5973	1.50	106.5	2.5379	2.50	101.5	8/19/16

Table A-4. Cation SRM Summary Report, Sept 3, 2016 - Sept 2, 2017

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	% Recovery Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
SRM1	0.0293	0.03	97.8	0.0310	0.03	103.4	0.0482	0.05	96.5	6/6/17
SRM2	0.0292	0.03	97.4	0.0297	0.03	99.0	0.0537	0.05	107.4	6/7/17
SRM3	0.0291	0.03	96.9	0.0313	0.03	104.3	0.0512	0.05	102.5	6/8/17
SRM1	0.0278	0.03	92.7	0.0308	0.03	102.7	0.0538	0.05	107.6	6/14/17
SRM2	0.0284	0.03	94.7	0.0324	0.03	107.8	0.0512	0.05	102.5	6/15/17
SRM1	0.0292	0.03	97.3	0.0305	0.03	101.7	0.0494	0.05	98.8	6/22/17
SRM2	0.0316	0.03	105.3	0.0306	0.03	102.0	0.0490	0.05	98.1	6/23/17
SRM3	0.0286	0.03	95.2	0.0320	0.03	106.8	0.0482	0.05	96.4	6/23/17
SRM1	0.0316	0.03	105.3	0.0306	0.03	102.0	0.0490	0.05	98.0	7/10/17
SRM2	0.0292	0.03	97.3	0.0305	0.03	101.7	0.0494	0.05	98.8	7/11/17

Note: SRM Targets for Ammonium, Potassium and Sodium were reduced between the first and second contract years in order to limit recalibrations and reruns.

Figure A-1. CSN Ammonium SRM, Nov 16, 2015 - Sept 2, 2016



Note regarding August 2016 out of acceptance limit reading: All samples were less than 0.040 ug/mL, the reportable limit. Therefore, reported sample data was not affected.

Figure A-2. CSN Ammonium SRM, Sept 3, 2016 - Sept 2, 2017

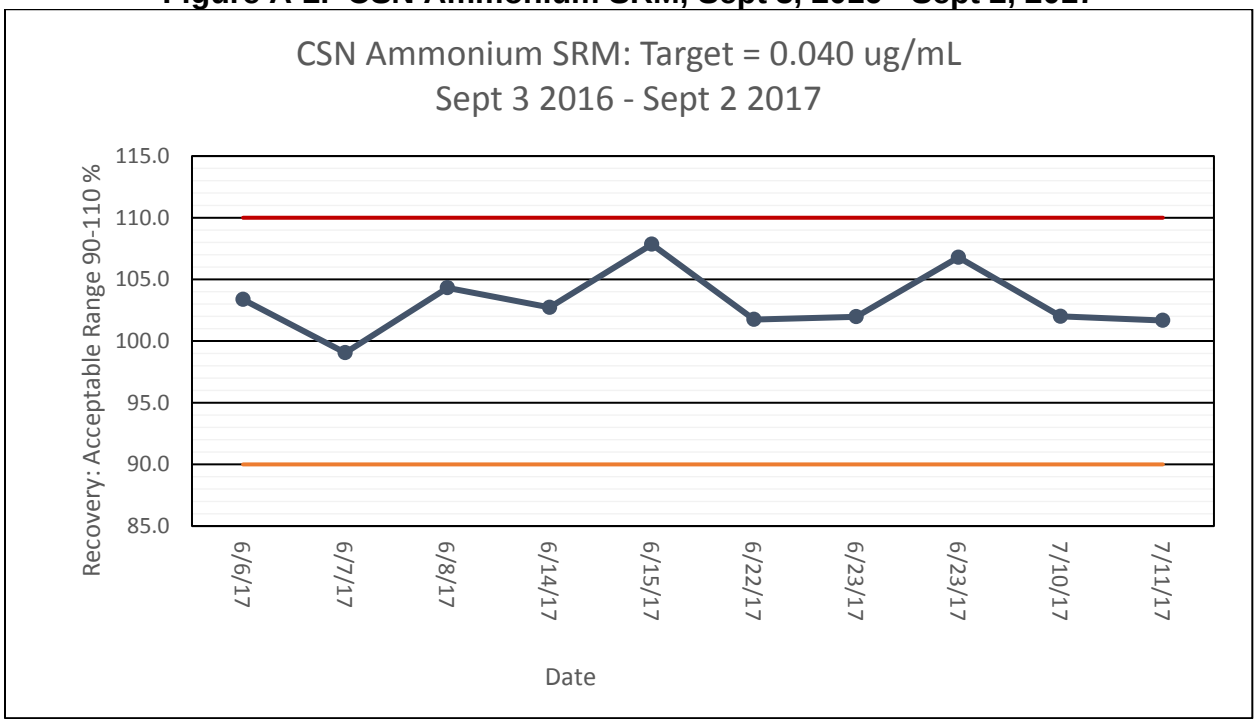


Figure A-3. CSN Chloride SRM, Nov 16, 2015 - Sept 2, 2016

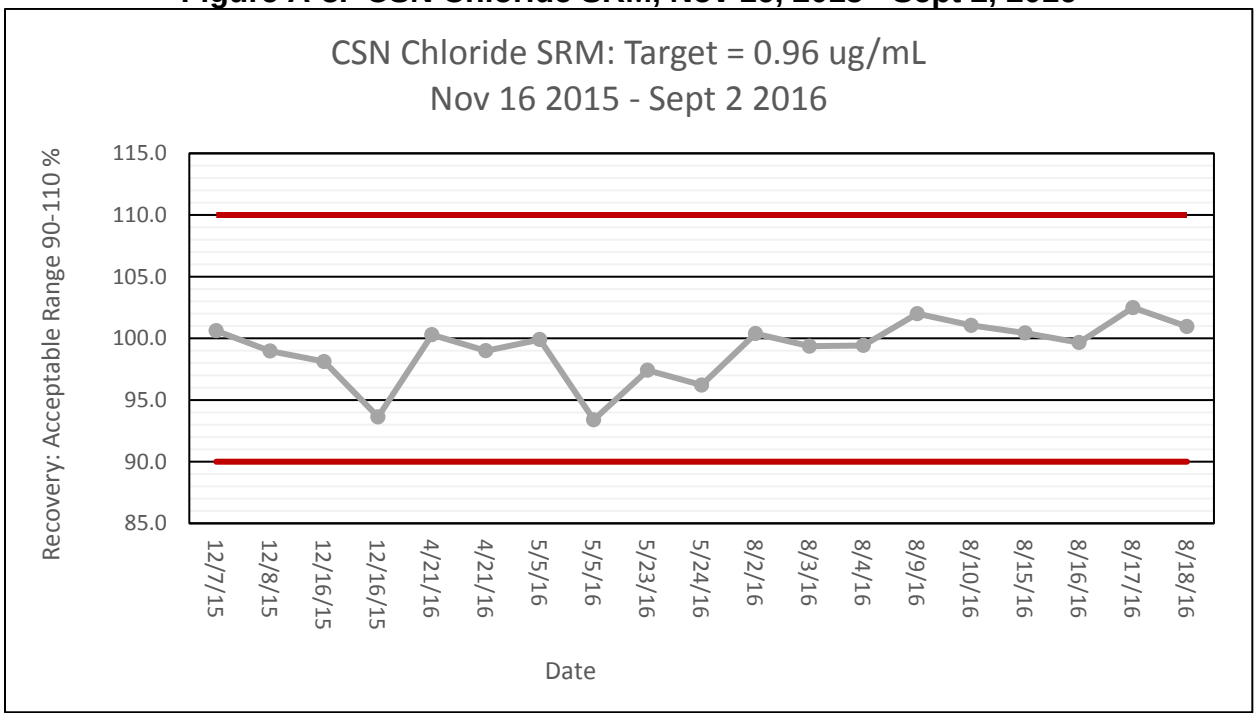


Figure A-4. CSN Chloride SRM, Sept 3, 2016 - Sept 2, 2017

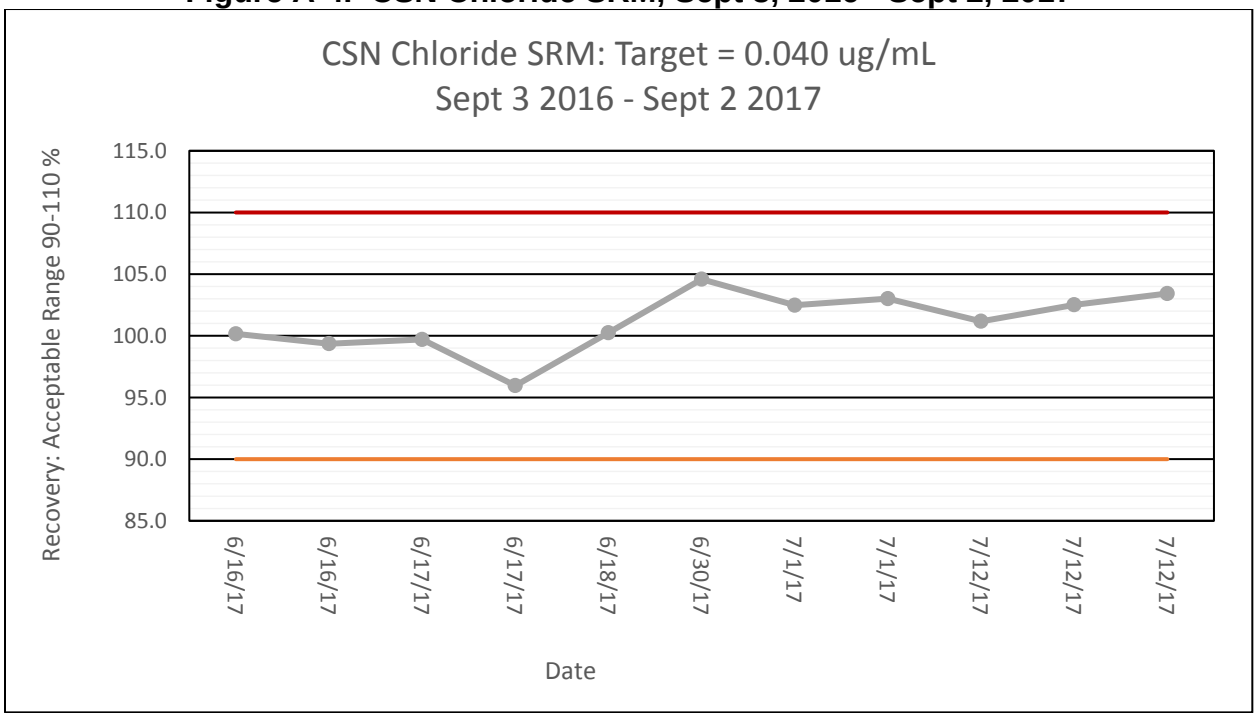


Figure A-5. CSN Nitrate SRM, Nov 16, 2015 - Sept 2, 2016

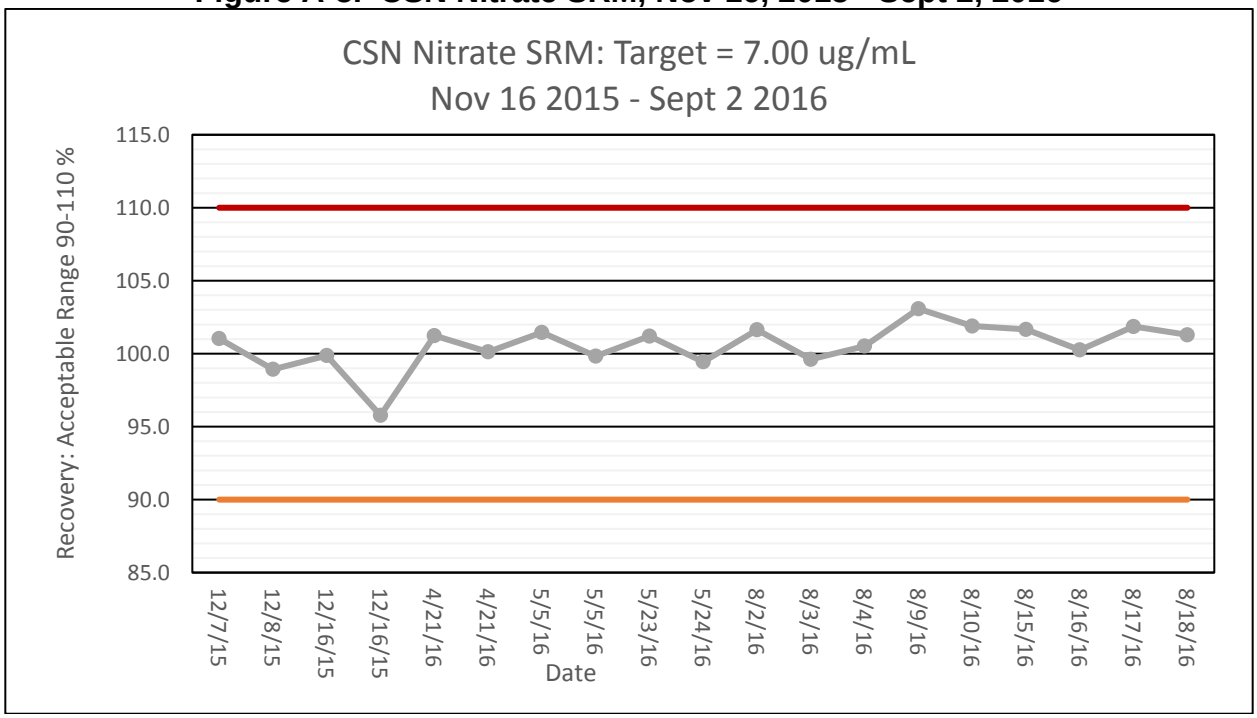


Figure A-6. CSN Nitrate SRM, Sept 3, 2016 - Sept 2, 2017

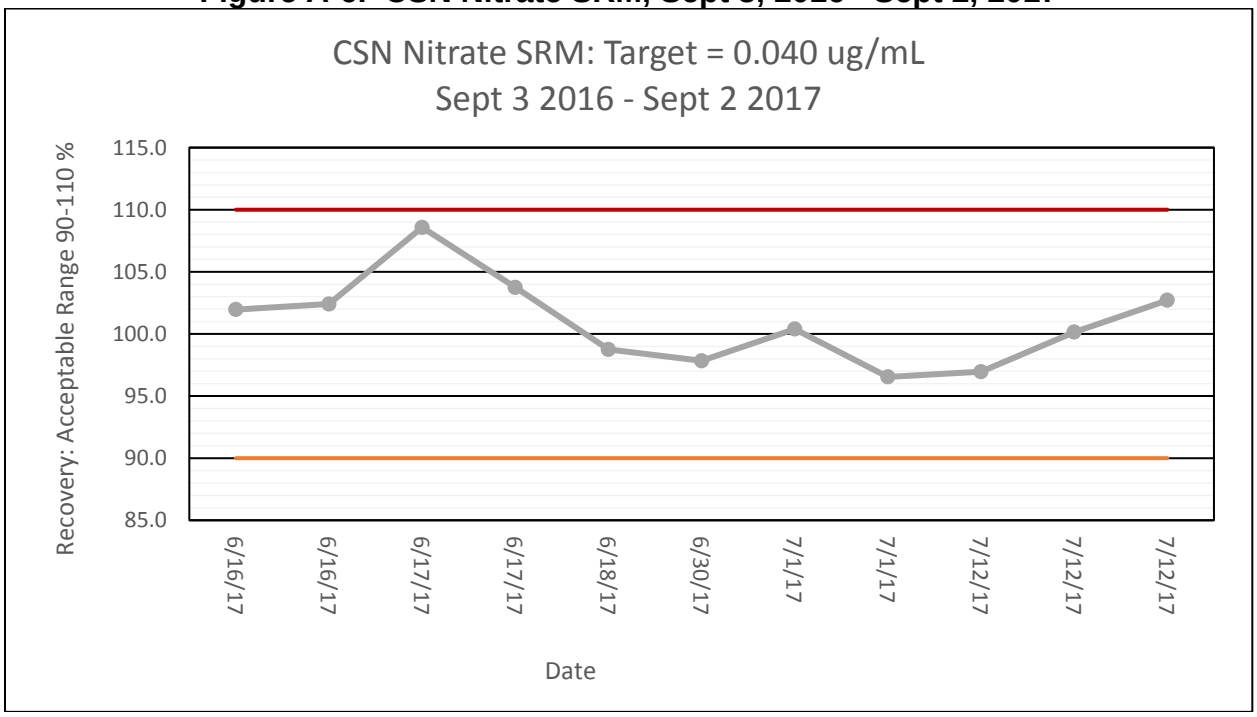
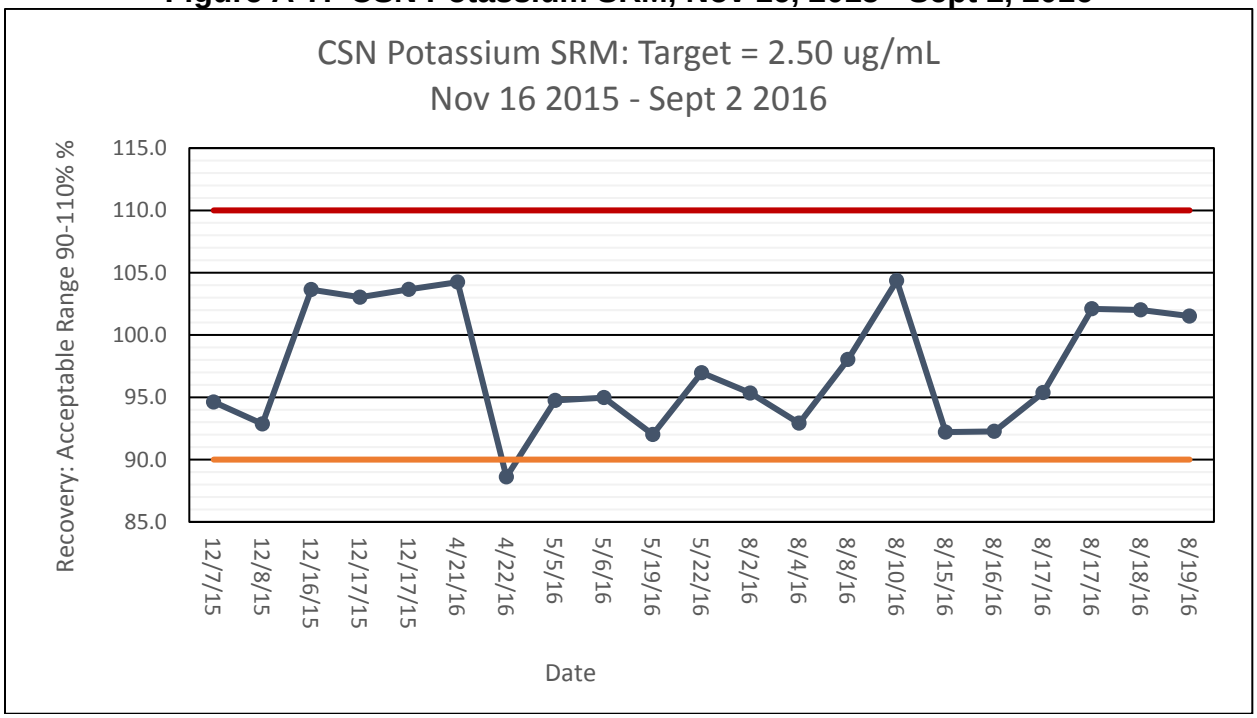


Figure A-7. CSN Potassium SRM, Nov 16, 2015 - Sept 2, 2016



Note regarding April 2016 out of acceptance limit reading: SRM at end of run. CCV = 100% (lower concentration than SRM). Therefore, reported sample data was not affected.

Figure A-8. CSN Potassium SRM, Sept 3, 2016 - Sept 2, 2017

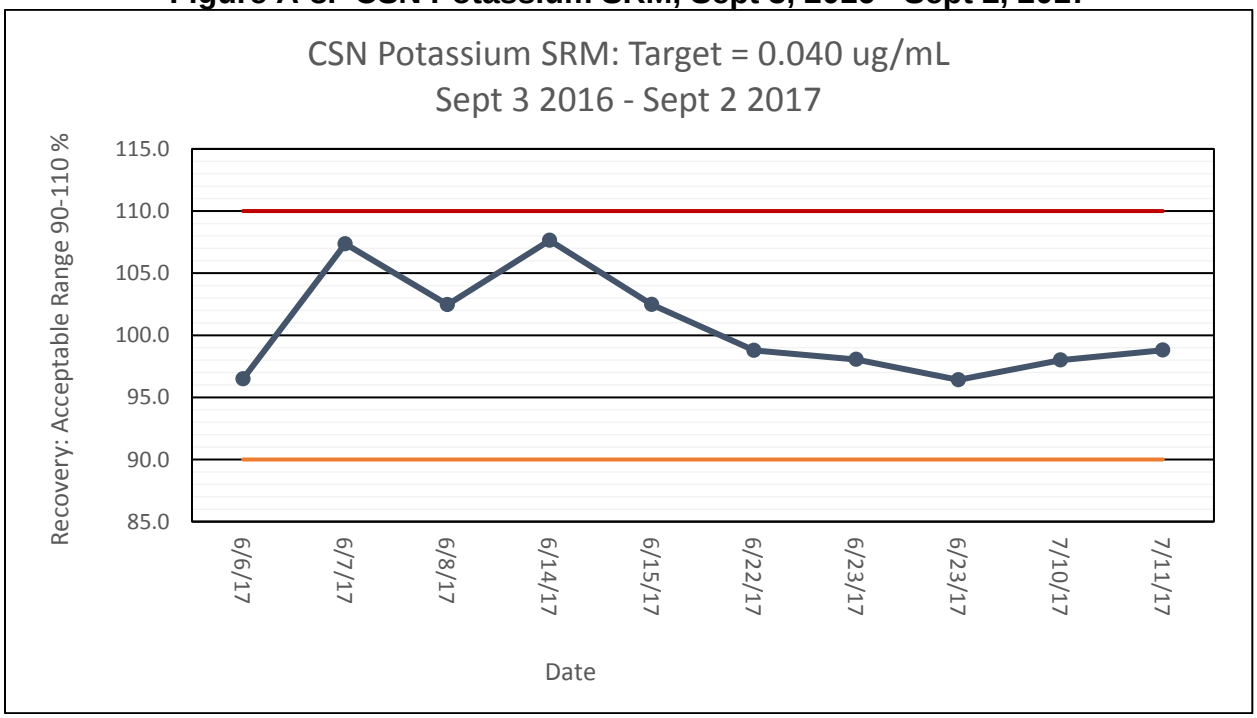
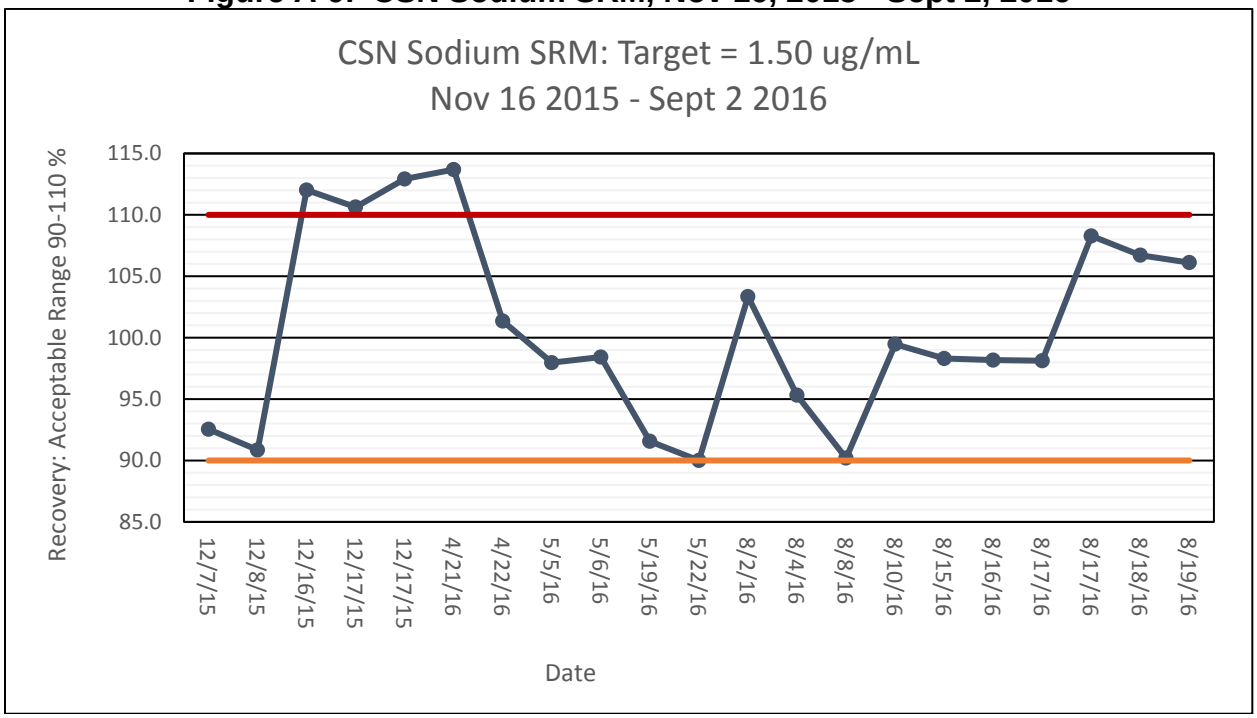


Figure A-9. CSN Sodium SRM, Nov 16, 2015 - Sept 2, 2016



Note regarding December 2015 and April 2016 out of acceptance limit readings: All samples were less than 0.040 ug/mL, the reportable limit. Therefore, reported sample data was not affected.

Figure A-10. CSN Sodium SRM, Sept 3, 2016 - Sept 2, 2017

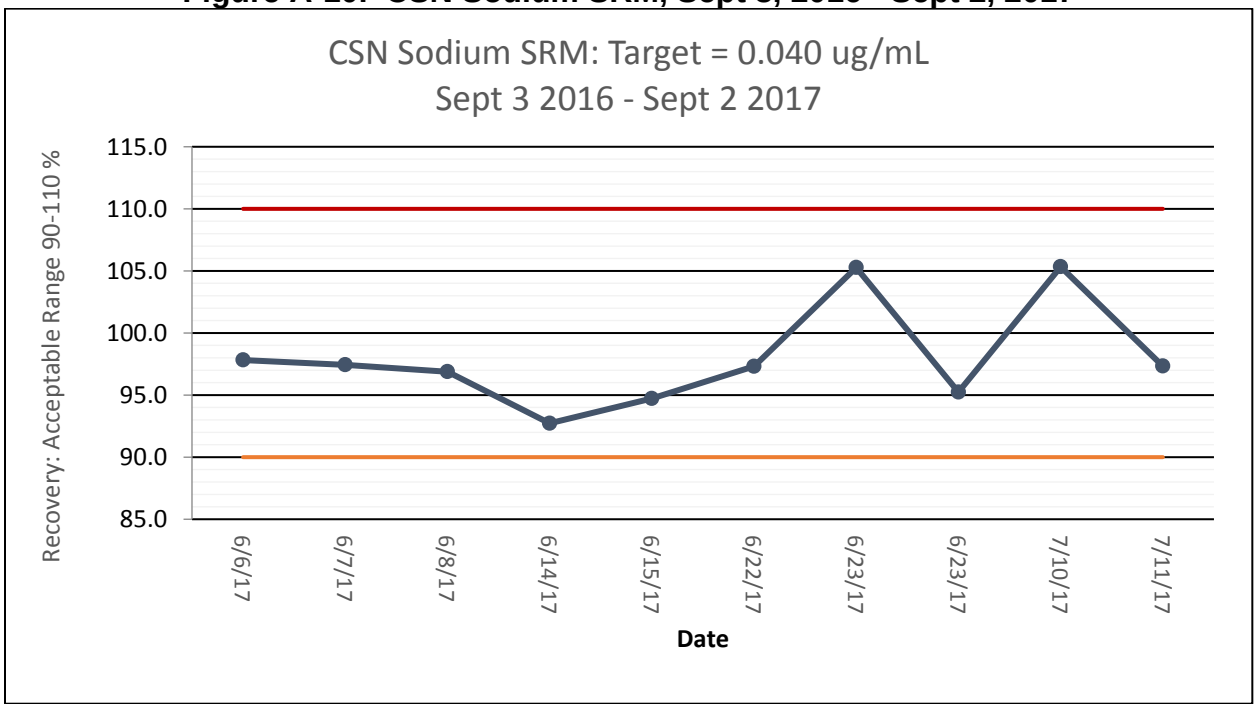


Figure A-11. CSN Sulfate SRM, Nov 16, 2015 - Sept 2, 2016

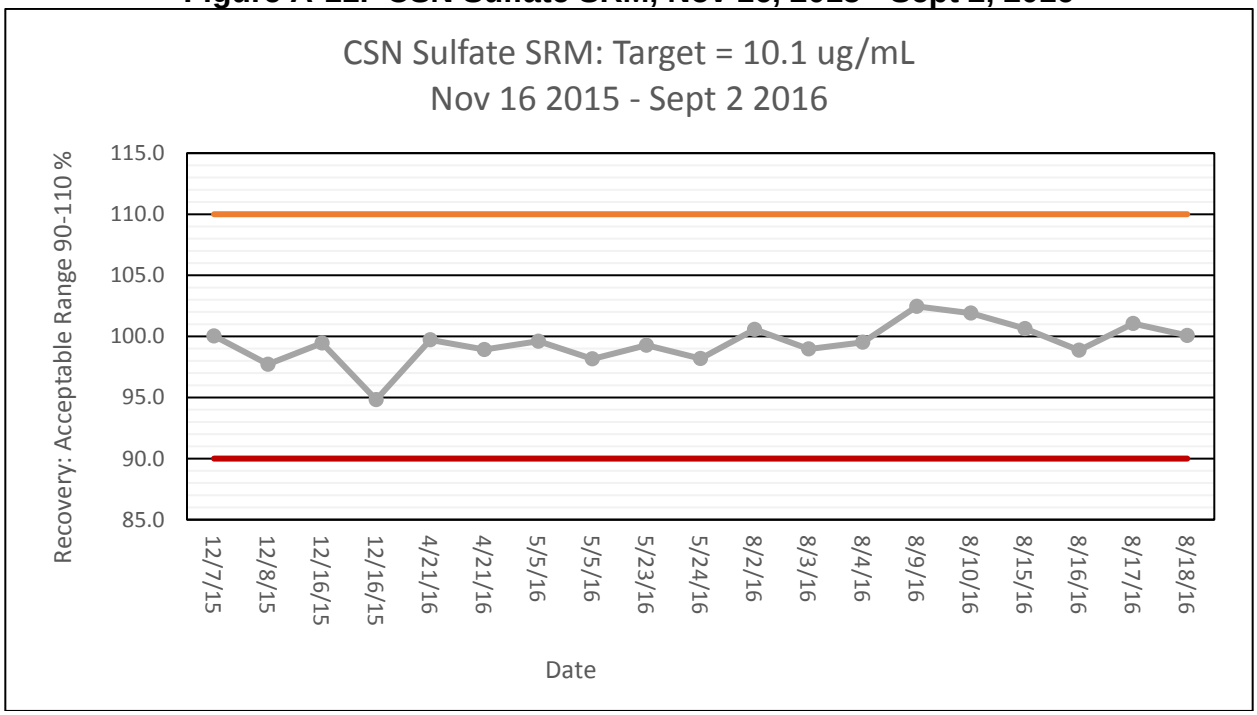


Figure A-12. CSN Sulfate SRM, Sept 3, 2016 - Sept 2, 2017

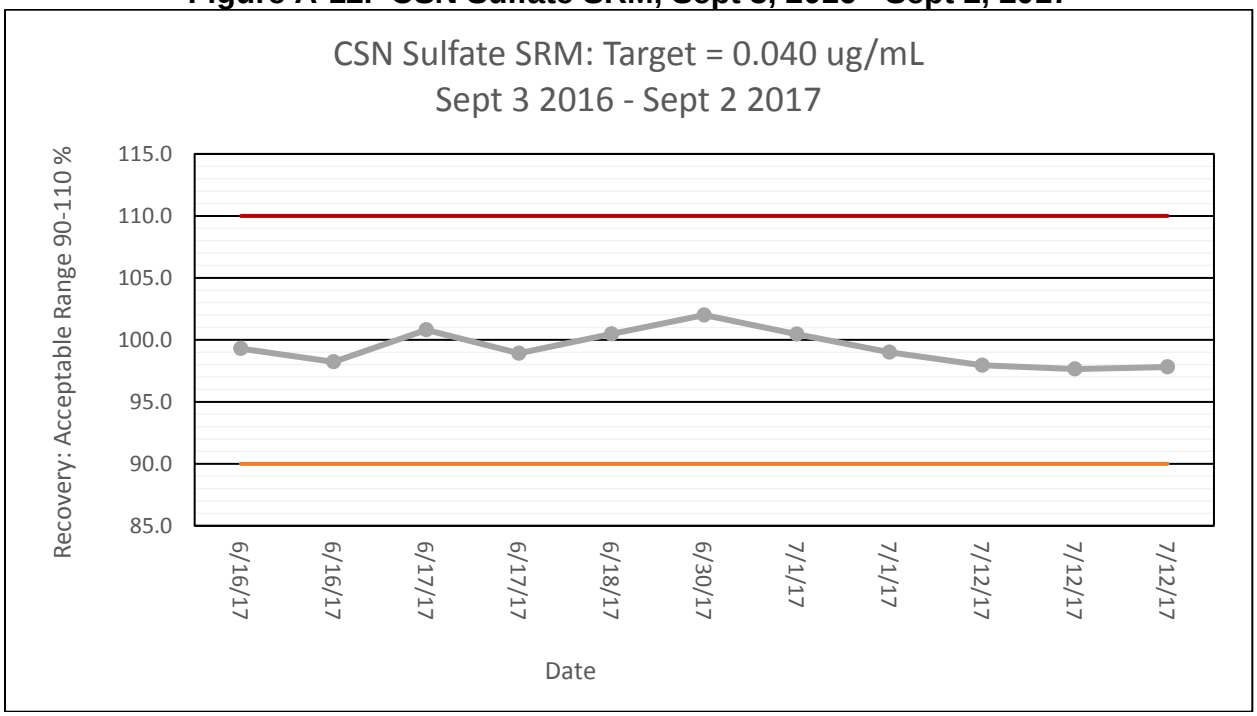


Table A-5. Anion CCV Summary Report, Nov 16, 2015 - Sept 2, 2016 (page 1 of 3)

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
CCV1	0.5125	0.500	97.6	2.2240	2.214	99.5	2.4973	2.500	100.1	12/7/15
CCV2	0.5192	0.500	96.3	2.2109	2.214	100.1	2.5093	2.500	99.6	12/7/15
CCV3	0.5199	0.500	96.2	2.2250	2.214	99.5	2.5140	2.500	99.4	12/7/15
CCV4	0.5262	0.500	95.0	2.2257	2.214	99.5	2.5151	2.500	99.4	12/7/15
CCV5	0.5237	0.500	95.5	2.2462	2.214	98.6	2.5307	2.500	98.8	12/7/15
CCV6	0.5239	0.500	95.4	2.2459	2.214	98.6	2.5246	2.500	99.0	12/7/15
CCV7	0.5308	0.500	94.2	2.2575	2.214	98.1	2.5477	2.500	98.1	12/7/15
CCV1	0.5334	0.500	93.7	2.2347	2.214	99.1	2.5192	2.500	99.2	12/15/15
CCV2	0.5381	0.500	92.9	2.2662	2.214	97.7	2.5737	2.500	97.1	12/15/15
CCV3	0.5493	0.500	91.0	2.2972	2.214	96.4	2.6089	2.500	95.8	12/15/15
CCV4	0.5510	0.500	90.8	2.3207	2.214	95.4	2.6313	2.500	95.0	12/16/15
CCV5	0.5491	0.500	91.1	2.3207	2.214	95.4	2.6262	2.500	95.2	12/16/15
CCV6	0.5524	0.500	90.5	2.3513	2.214	94.2	2.6496	2.500	94.4	12/16/15
CCV7	0.5507	0.500	90.8	2.3334	2.214	94.9	2.6524	2.500	94.3	12/16/15
CCV1	0.5092	0.500	98.2	2.2109	2.214	100.1	2.5122	2.500	99.5	4/21/16
CCV2	0.5081	0.500	98.4	2.2127	2.214	100.1	2.5158	2.500	99.4	4/21/16
CCV3	0.5162	0.500	96.9	2.2163	2.214	99.9	2.5314	2.500	98.8	4/21/16
CCV4	0.5108	0.500	97.9	2.2210	2.214	99.7	2.5315	2.500	98.8	4/21/16
CCV1	0.5191	0.500	96.3	2.1738	2.214	101.8	2.4860	2.500	100.6	5/5/16
CCV2	0.5372	0.500	93.1	2.1708	2.214	102.0	2.4882	2.500	100.5	5/5/16

Table A-5. Anion CCV Summary Report, Nov 16, 2015 - Sept 2, 2016 (page 2 of 3)

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
CCV3	0.5417	0.500	92.3	2.2040	2.214	100.5	2.5191	2.500	99.2	5/5/16
CCV4	0.5272	0.500	94.8	2.1654	2.214	102.2	2.5059	2.500	99.8	5/5/16
CCV1	0.5246	0.500	95.3	2.1811	2.214	101.5	2.4802	2.500	100.8	5/23/16
CCV2	0.5236	0.500	95.5	2.1809	2.214	101.5	2.5138	2.500	99.5	5/23/16
CCV3	0.5205	0.500	96.1	2.1924	2.214	101.0	2.5024	2.500	99.9	5/23/16
CCV4	0.5241	0.500	95.4	2.2036	2.214	100.5	2.5093	2.500	99.6	5/23/16
CCV5	0.5242	0.500	95.4	2.2105	2.214	100.2	2.5240	2.500	99.0	5/23/16
CCV6	0.5230	0.500	95.6	2.1992	2.214	100.7	2.5106	2.500	99.6	5/23/16
CCV7	0.5242	0.500	95.4	2.2074	2.214	100.3	2.5249	2.500	99.0	5/23/16
CCV1	0.5218	0.500	95.8	2.1575	2.214	102.6	2.5560	2.500	97.8	8/2/16
CCV2	0.5281	0.500	94.7	2.1446	2.214	103.2	2.5645	2.500	97.5	8/2/16
CCV3	0.5297	0.500	94.4	2.1527	2.214	102.8	2.5668	2.500	97.4	8/2/16
CCV4	0.5280	0.500	94.7	2.1514	2.214	102.9	2.5609	2.500	97.6	8/2/16
CCV5	0.5441	0.500	91.9	2.1917	2.214	101.0	2.5926	2.500	96.4	8/2/16
CCV6	0.5310	0.500	94.2	2.1482	2.214	103.1	2.5873	2.500	96.6	8/2/16
CCV7	0.5338	0.500	93.7	2.1411	2.214	103.4	2.5930	2.500	96.4	8/2/16
CCV8	0.5217	0.500	95.8	2.1058	2.214	105.1	2.5916	2.500	96.5	8/2/16
CCV9	0.5327	0.500	93.9	2.1144	2.214	104.7	2.5891	2.500	96.6	8/2/16
CCV10	0.5101	0.500	98.0	2.0998	2.214	105.4	2.4572	2.500	101.7	8/2/16
CCV11	0.5274	0.500	94.8	2.1585	2.214	102.6	2.5627	2.500	97.6	8/2/16
CCV12	0.5240	0.500	95.4	2.1792	2.214	101.6	2.5653	2.500	97.5	8/2/16
CCV1	0.5176	0.500	96.6	2.1162	2.214	104.6	2.5393	2.500	98.5	8/9/16
CCV2	0.5191	0.500	96.3	2.0828	2.214	106.3	2.4870	2.500	100.5	8/9/16
CCV3	0.5150	0.500	97.1	2.0974	2.214	105.6	2.5178	2.500	99.3	8/9/16
CCV4	0.5227	0.500	95.7	2.0634	2.214	107.3	2.4813	2.500	100.8	8/9/16

Table A-5. Anion CCV Summary Report, Nov 16, 2015 - Sept 2, 2016 (page 3 of 3)

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
CCV5	0.5189	0.500	96.4	2.0687	2.214	107.0	2.5014	2.500	99.9	8/9/16
CCV6	0.5239	0.500	95.4	2.0618	2.214	107.4	2.5210	2.500	99.2	8/9/16
CCV7	0.5181	0.500	96.5	2.0271	2.214	109.2	2.5190	2.500	99.2	8/9/16
CCV8	0.5281	0.500	94.7	2.0153	2.214	109.9	2.5508	2.500	98.0	8/9/16
CCV9	0.5158	0.500	96.9	2.0309	2.214	109.0	2.5165	2.500	99.3	8/9/16
CCV1	0.5142	0.500	97.2	2.1433	2.214	103.3	2.5350	2.500	98.6	8/15/16
CCV2	0.5288	0.500	94.5	2.1257	2.214	104.2	2.5616	2.500	97.6	8/15/16
CCV3	0.5314	0.500	94.1	2.1613	2.214	102.4	2.5664	2.500	97.4	8/15/16
CCV4	0.5302	0.500	94.3	2.1420	2.214	103.4	2.5663	2.500	97.4	8/15/16
CCV5	0.5322	0.500	94.0	2.1434	2.214	103.3	2.5829	2.500	96.8	8/15/16
CCV6	0.5278	0.500	94.7	2.1223	2.214	104.3	2.5732	2.500	97.2	8/15/16
CCV7	0.5294	0.500	94.4	2.1255	2.214	104.2	2.5731	2.500	97.2	8/15/16
CCV8	0.5280	0.500	94.7	2.0955	2.214	105.7	2.5721	2.500	97.2	8/15/16
CCV9	0.5322	0.500	93.9	2.1095	2.214	105.0	2.5868	2.500	96.6	8/15/16
CCV1	0.5166	0.500	96.8	2.1239	2.214	104.2	2.5203	2.500	99.2	8/17/16
CCV2	0.5084	0.500	98.3	2.1350	2.214	103.7	2.5209	2.500	99.2	8/17/16
CCV3	0.5118	0.500	97.7	2.1355	2.214	103.7	2.5623	2.500	97.6	8/17/16
CCV4	0.5138	0.500	97.3	2.1051	2.214	105.2	2.5429	2.500	98.3	8/17/16
CCV5	0.5318	0.500	94.0	2.1275	2.214	104.1	2.5654	2.500	97.5	8/17/16
CCV6	0.5147	0.500	97.1	2.1880	2.214	101.2	2.5952	2.500	96.3	8/17/16
CCV7	0.5084	0.500	98.3	2.1200	2.214	104.4	2.5489	2.500	98.1	8/17/16
CCV8	0.5007	0.500	99.9	2.1485	2.214	103.0	2.5782	2.500	97.0	8/17/16
CCV9	0.5173	0.500	96.6	2.0756	2.214	106.7	2.5686	2.500	97.3	8/17/16

Table A-6. Anion CCV Summary Report, Sept 3, 2016 - Sept 2, 2017 (page 1 of 2)

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
CCV1	0.5038	0.500	100.8	2.1244	2.214	96.0	2.4426	2.500	97.7	6/16/17
CCV2	0.5405	0.500	108.1	2.2654	2.214	102.3	2.6086	2.500	104.3	6/16/17
CCV3	0.5456	0.500	109.1	2.2443	2.214	101.4	2.6261	2.500	105.0	6/16/17
CCV4	0.5504	0.500	110.1	2.2408	2.214	101.2	2.7152	2.500	108.6	6/17/17
CCV5	0.5492	0.500	109.8	2.2411	2.214	101.2	2.7300	2.500	109.2	6/17/17
CCV6	0.5476	0.500	109.5	2.3205	2.214	104.8	2.7318	2.500	109.3	6/17/17
CCV7	0.5460	0.500	109.2	2.3261	2.214	105.1	2.7343	2.500	109.4	6/17/17
CCV8	0.5519	0.500	110.0	2.3968	2.214	108.3	2.7461	2.500	109.8	6/17/17
CCV1	0.5118	0.500	102.4	2.1686	2.214	97.9	2.4895	2.500	99.6	6/17/17
CCV2	0.5169	0.500	103.4	2.1939	2.214	99.1	2.5450	2.500	101.8	6/17/17
CCV3	0.5260	0.500	105.2	2.2212	2.214	100.3	2.5447	2.500	101.8	6/17/17
CCV4	0.5254	0.500	105.1	2.1937	2.214	99.1	2.5524	2.500	102.1	6/18/17
CCV5	0.5303	0.500	106.1	2.2072	2.214	99.7	2.5504	2.500	102.0	6/18/17
CCV8	0.5202	0.500	104.0	2.1835	2.214	98.6	2.5180	2.500	100.7	6/18/17
CCV1	0.5208	0.500	104.2	2.2867	2.214	103.3	2.6099	2.500	104.4	6/30/17
CCV2	0.5246	0.500	104.9	2.3041	2.214	104.1	2.6194	2.500	104.8	6/30/17
CCV3	0.5243	0.500	104.9	2.3203	2.214	104.8	2.6114	2.500	104.5	6/30/17
CCV4	0.5249	0.500	105.0	2.3198	2.214	104.8	2.6109	2.500	104.4	6/30/17
CCV5	0.5242	0.500	104.8	2.3207	2.214	104.8	2.6170	2.500	104.7	7/1/17
CCV6	0.5205	0.500	104.1	2.2968	2.214	103.7	2.6214	2.500	104.9	7/1/17
CCV7	0.5224	0.500	104.5	2.2969	2.214	103.7	2.6187	2.500	104.7	7/1/17
CCV1	0.5138	0.500	102.8	2.1597	2.214	97.5	2.4912	2.500	99.6	7/12/17
CCV2	0.5224	0.500	104.5	2.2021	2.214	99.5	2.5311	2.500	101.2	7/12/17
CCV3	0.5173	0.500	103.5	2.2115	2.214	99.9	2.5335	2.500	101.3	7/12/17
CCV4	0.5225	0.500	104.5	2.2208	2.214	100.3	2.5384	2.500	101.5	7/12/17

Table A-6. Anion CCV Summary Report, Sept 3, 2016 - Sept 2, 2017 (page 2 of 2)

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
CCV5	0.5213	0.500	104.3	2.2107	2.214	99.9	2.5579	2.500	102.3	7/13/17
CCV6	0.5244	0.500	104.9	2.2264	2.214	100.6	2.5609	2.500	102.4	7/13/17
CCV7	0.5210	0.500	104.2	2.2187	2.214	100.2	2.5691	2.500	102.8	7/13/17
CCV8	0.5238	0.500	104.8	2.2287	2.214	100.7	2.5543	2.500	102.2	7/13/17
CCV9	0.5193	0.500	103.9	2.2405	2.214	101.2	2.5733	2.500	102.9	7/13/17
CCVA	0.5213	0.500	104.3	2.1965	2.214	99.2	2.5619	2.500	102.5	7/13/17

Table A-7. Cation CCV Summary Report, Nov 16, 2015 - Sept 2, 2016 (page 1 of 3)

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	% Recovery Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
CCV1	1.8129	2.01	90.2	3.6978	4.03	91.8	1.9542	2.01	97.2	10/28/15
CCV2	2.1381	2.01	106.4	4.1615	4.03	103.3	2.1137	2.01	105.2	10/28/15
CCV3	2.1463	2.01	106.8	4.1820	4.03	103.8	2.1199	2.01	105.5	10/29/15
CCV4	2.1519	2.01	107.1	4.2217	4.03	104.8	2.1330	2.01	106.1	10/29/15
CCV5	2.2943	2.01	114.1	4.4656	4.03	110.8	2.2364	2.01	111.3	10/29/15
CCV1	2.1526	2.04	94.8	3.8808	4.04	104.1	2.1289	2.04	95.8	12/7/15
CCV2	1.9180	2.04	106.4	3.7386	4.04	108.1	2.0345	2.04	100.3	12/7/15
CCV3	2.0326	2.04	100.4	3.8264	4.04	105.6	2.0912	2.04	97.5	12/8/15
CCV4	1.8891	2.04	108.0	3.6627	4.04	110.3	2.0197	2.04	101.0	12/8/15
CCV5	1.9147	2.04	106.5	3.6190	4.04	111.6	2.0991	2.04	97.2	12/8/15
CCV6	1.9674	2.04	103.7	3.6708	4.04	110.1	1.9704	2.04	103.5	12/8/15
CCV7	1.9540	2.04	104.4	3.7314	4.04	108.3	1.9891	2.04	102.6	12/8/15
CCV1	2.0587	2.04	100.9	3.6547	4.04	90.5	1.8815	2.04	92.2	12/16/15
CCV2	2.2661	2.04	111.1	4.0998	4.04	101.5	2.0636	2.04	101.2	12/16/15
CCV3	2.3066	2.04	113.1	4.1024	4.04	101.5	2.0578	2.04	100.9	12/16/15
CCV4	2.0216	2.04	99.1	3.7057	4.04	91.7	1.8566	2.04	91.0	12/17/15
CCV5	2.0393	2.04	100.0	3.6557	4.04	90.5	1.8389	2.04	90.1	12/17/15
CCV6	2.0213	2.04	99.1	3.6802	4.04	91.1	1.9250	2.04	94.4	12/17/15
CCV7	2.0388	2.04	99.9	3.6688	4.04	90.8	1.8419	2.04	90.3	12/17/15
CCV1	2.0033	2.04	98.2	3.6471	4.04	90.3	1.8547	2.04	90.9	4/21/16
CCV2	2.0648	2.04	101.2	3.8941	4.04	96.4	2.0001	2.04	98.0	4/21/16
CCV3	2.2410	2.04	109.9	4.0703	4.04	100.8	2.0399	2.04	100.0	4/22/16
CCV4	2.3033	2.04	112.9	4.1636	4.04	103.1	2.0840	2.04	102.2	4/22/16
CCV1	1.9902	2.04	97.6	3.6188	4.04	90.0	1.9209	2.04	94.2	5/5/16
CCV2	2.0061	2.04	98.3	3.7077	4.04	91.8	1.9331	2.04	94.8	5/5/16

Table A-7. Cation CCV Summary Report, Nov 16, 2015 - Sept 2, 2016 (page 2 of 3)

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	% Recovery Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
CCV3	2.0408	2.04	100.0	3.7131	4.04	91.9	1.9523	2.04	95.7	5/6/16
CCV4	2.3876	2.04	117.0	4.4269	4.04	109.6	2.2256	2.04	109.1	5/6/16
CCV1	2.0054	2.04	98.3	3.7166	4.04	92.0	2.0197	2.04	99.0	5/19/16
CCV2	1.8399	2.04	90.2	3.6648	4.04	90.7	2.1330	2.04	104.6	5/19/16
CCV3	1.8517	2.04	90.8	3.6631	4.04	90.7	1.9725	2.04	96.7	5/20/16
CCV4	1.8675	2.04	91.5	3.6759	4.04	91.0	2.1048	2.04	103.2	5/20/16
CCV5	2.0236	2.04	99.2	3.7384	4.04	92.5	2.0674	2.04	101.3	5/20/16
CCV6	1.8372	2.04	90.1	3.7671	4.04	93.2	2.1173	2.04	103.8	5/20/16
CCV7	2.0813	2.04	102.0	3.8257	4.04	94.7	2.0808	2.04	102.0	5/20/16
CCV1	2.1714	2.02	107.5	4.3194	4.05	106.7	2.1000	1.98	106.1	8/2/16
CCV2	2.1979	2.02	108.8	4.4396	4.05	109.6	2.1720	1.98	109.7	8/3/16
CCV3	1.9980	2.02	98.9	4.0646	4.05	100.4	1.9955	1.98	100.8	8/3/16
CCV4	1.9393	2.02	96.0	3.9487	4.05	97.5	1.9319	1.98	97.6	8/3/16
CCV5	1.9174	2.02	94.9	3.9377	4.05	97.2	1.9283	1.98	97.4	8/4/16
CCV6	2.1979	2.02	108.8	4.4172	4.05	109.1	2.1739	1.98	109.8	8/4/16
CCV7	1.9064	2.02	94.4	3.9278	4.05	97.0	1.9574	1.98	98.9	8/4/16
CCV8	1.9615	2.02	97.1	4.0005	4.05	98.8	1.9458	1.98	98.3	8/4/16
CCV9	1.9368	2.02	95.9	4.0729	4.05	100.6	1.9449	1.98	98.2	8/4/16
CCV1	2.0256	2.02	100.3	4.1616	4.05	102.8	2.1835	1.98	110.3	8/8/16
CCV2	1.8801	2.02	93.1	4.0944	4.05	101.1	2.1110	1.98	106.6	8/8/16
CCV3	1.8212	2.02	90.2	3.9420	4.05	97.3	2.0099	1.98	101.5	8/9/16
CCV4	1.8338	2.02	90.8	3.9440	4.05	97.4	2.0250	1.98	102.3	8/9/16
CCV5	1.8473	2.02	91.5	3.9872	4.05	98.4	2.0531	1.98	103.7	8/9/16
CCV6	1.8637	2.02	92.3	4.0667	4.05	100.4	2.0944	1.98	105.8	8/9/16
CCV7	1.8418	2.02	91.2	3.9947	4.05	98.6	2.0026	1.98	101.1	8/9/16

Table A-7. Cation CCV Summary Report, Nov 16, 2015 - Sept 2, 2016 (page 3 of 3)

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
CCV8	1.8246	2.02	90.3	4.0351	4.05	99.6	2.1190	1.98	107.0	8/10/16
CCV9	2.0407	2.02	101.0	4.2307	4.05	104.5	2.2515	1.98	113.7	8/10/16
CCV1	2.0115	2.02	99.6	3.7386	4.05	92.3	2.0098	1.98	101.5	8/15/16
CCV2	1.9806	2.02	98.1	3.7668	4.05	93.0	2.0207	1.98	102.1	8/15/16
CCV3	1.9570	2.02	96.9	3.6992	4.05	91.3	2.0196	1.98	102.0	8/15/16
CCV4	1.9525	2.02	96.7	3.7040	4.05	91.5	2.0144	1.98	101.7	8/16/16
CCV5	2.0041	2.02	99.2	3.8456	4.05	95.0	2.0241	1.98	102.2	8/16/16
CCV6	1.9679	2.02	97.4	3.7261	4.05	92.0	2.0298	1.98	102.5	8/16/16
CCV7	1.9798	2.02	98.0	3.7492	4.05	92.6	2.0428	1.98	103.2	8/16/16
CCV1	1.9046	2.02	94.3	3.9280	4.05	97.0	1.9860	1.98	100.3	8/17/16
CCV2	2.1860	2.02	108.2	4.4166	4.05	109.1	2.2017	1.98	111.2	8/17/16
CCV3	2.1410	2.02	106.0	4.4124	4.05	108.9	2.1806	1.98	110.1	8/17/16
CCV7	0.5084	0.500	98.3	2.1200	2.214	104.4	2.5489	2.500	98.1	8/17/16
CCV8	2.2090	2.02	109.4	4.1079	4.05	101.4	2.2146	1.98	111.8	8/17/16
CCV8	0.5007	0.500	99.9	2.1485	2.214	103.0	2.5782	2.500	97.0	8/17/16
CCV9	2.2136	2.0	109.6	4.1036	4.05	101.3	2.1660	1.98	109.4	8/17/16
CCV9	0.5173	0.500	96.6	2.0756	2.214	106.7	2.5686	2.500	97.3	8/17/16
CCV4	2.1422	2.02	106.1	4.3948	4.05	108.5	2.1658	1.98	109.4	8/18/16
CCV5	2.1490	2.02	106.4	4.3624	4.05	107.7	2.1998	1.98	111.1	8/18/16
CCV6	2.1667	2.02	107.3	4.3926	4.05	108.5	2.1754	1.98	109.9	8/18/16
CCV7	2.1764	2.02	107.7	4.4291	4.05	109.4	2.1768	1.98	109.9	8/18/16
CCV8	2.1686	2.02	107.4	4.4188	4.05	109.1	2.1918	1.98	110.7	8/18/16
CCV9	2.1462	2.0	106.2	4.3740	4.05	108.0	2.1707	1.98	109.6	8/19/16

Table A-8. Cation CCV Summary Report, Sept 3, 2016 - Sept 2, 2017 (page 1 of 2)

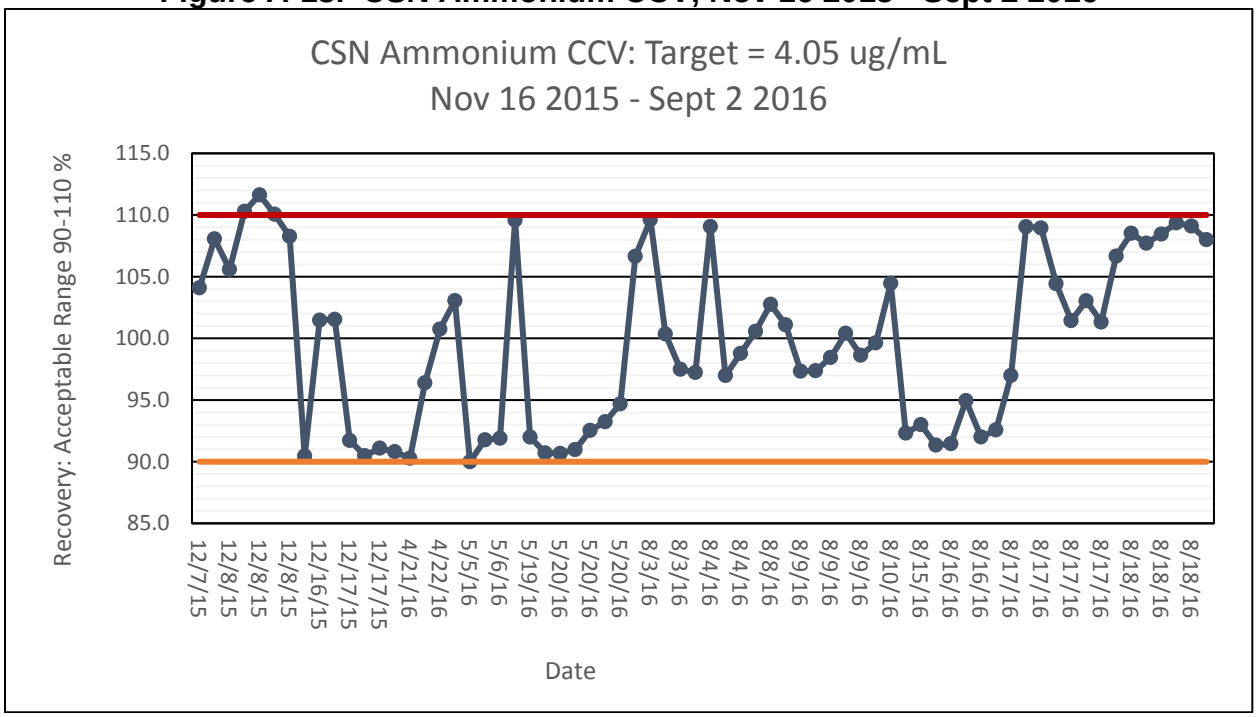
Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	% Recovery Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
CCV1	0.4944	0.50	98.9	0.5043	0.50	100.9	0.5210	0.50	104.2	6/6/17
CCV2	0.5214	0.50	104.3	0.5369	0.50	107.4	0.5488	0.50	109.8	6/6/17
CCV3	0.5235	0.50	104.7	0.5245	0.50	104.9	0.5475	0.50	109.5	6/7/17
CCV4	0.5481	0.50	109.6	0.5437	0.50	108.7	0.5452	0.50	109.0	6/7/17
CCV5	0.5265	0.50	105.3	0.5371	0.50	107.4	0.5492	0.50	109.8	6/7/17
CCV6	0.5249	0.50	105.0	0.5321	0.50	106.4	0.5498	0.50	110.0	6/7/17
CCV7	0.4890	0.50	97.8	0.4869	0.50	97.4	0.5137	0.50	102.7	6/7/17
CCV8	0.5270	0.50	105.4	0.5372	0.50	107.4	0.5496	0.50	109.9	6/8/17
CCV1	0.5484	0.50	109.7	0.5019	0.50	100.4	0.5446	0.50	108.9	6/14/17
CCV2	0.5529	0.50	110.6	0.5104	0.50	102.1	0.5494	0.50	109.9	6/14/17
CCV3	0.5547	0.50	110.9	0.5276	0.50	105.5	0.5753	0.50	115.1	6/14/17
CCV4	0.5157	0.50	103.1	0.4632	0.50	92.6	0.4956	0.50	99.1	6/15/17
CCV5	0.5530	0.50	110.6	0.5301	0.50	106.0	0.5350	0.50	107.0	6/15/17
CCV6	0.5508	0.50	110.2	0.5246	0.50	104.9	0.5446	0.50	108.9	6/15/17
CCV1	0.5008	0.50	100.2	0.5095	0.50	101.9	0.4992	0.50	99.8	6/22/17
CCV2	0.5403	0.50	108.1	0.5366	0.50	107.3	0.5269	0.50	105.4	6/22/17
CCV3	0.5495	0.50	109.9	0.5445	0.50	108.9	0.5431	0.50	108.6	6/22/17
CCV4	0.5500	0.50	110.0	0.5453	0.50	109.1	0.5369	0.50	107.4	6/22/17
CCV5	0.5446	0.50	108.9	0.5365	0.50	107.3	0.5443	0.50	108.9	6/22/17
CCV7	0.5501	0.50	110.0	0.5494	0.50	109.9	0.5412	0.50	108.2	6/22/17
CCV8	0.5473	0.50	109.5	0.5320	0.50	106.4	0.5357	0.50	107.1	6/22/17
CCV9	0.5494	0.50	109.9	0.5453	0.50	109.1	0.5391	0.50	107.8	6/22/17
CCV1	0.5085	0.50	101.7	0.5077	0.50	101.5	0.5011	0.50	100.2	7/10/17
CCV2	0.5088	0.50	101.8	0.5073	0.50	101.5	0.4807	0.50	96.1	7/10/17
CCV3	0.5138	0.50	102.8	0.5124	0.50	102.5	0.4820	0.50	96.4	7/10/17

Table A-8. Cation CCV Summary Report, Sept 3, 2016 - Sept 2, 2017 (page 2 of 2)

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	% Recovery Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
CCV4	0.5164	0.50	103.3	0.5146	0.50	102.9	0.4847	0.50	96.9	7/11/17
CCV5	0.5118	0.50	102.4	0.5092	0.50	101.8	0.4814	0.50	96.3	7/11/17
CCV6	0.5111	0.50	102.2	0.5120	0.50	102.4	0.4863	0.50	97.3	7/11/17

Note: SRM Target for Ammonium, Potassium and Sodium were reduced between the first and second contract years in order to limit recalibrations and reruns.

Figure A-13. CSN Ammonium CCV, Nov 16 2015 - Sept 2 2016



Note regarding December 2015 out of acceptance limit reading: All samples were less than 0.040 ug/mL, the reportable limit. Therefore, reported sample data was not affected.

Figure A-14. CSN Ammonium CCV, Sept 3 2016 - Sept 2 2017

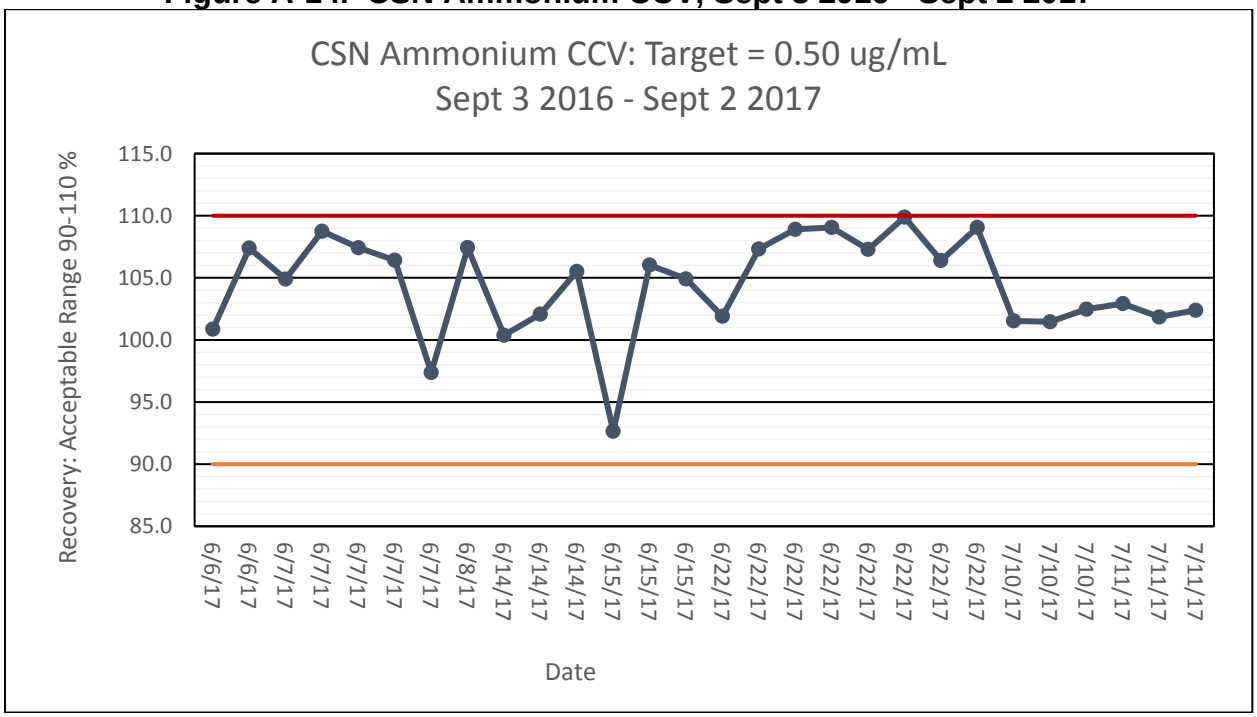


Figure A-15. CSN Chloride CCV, Nov 16 2015 - Sept 2 2016

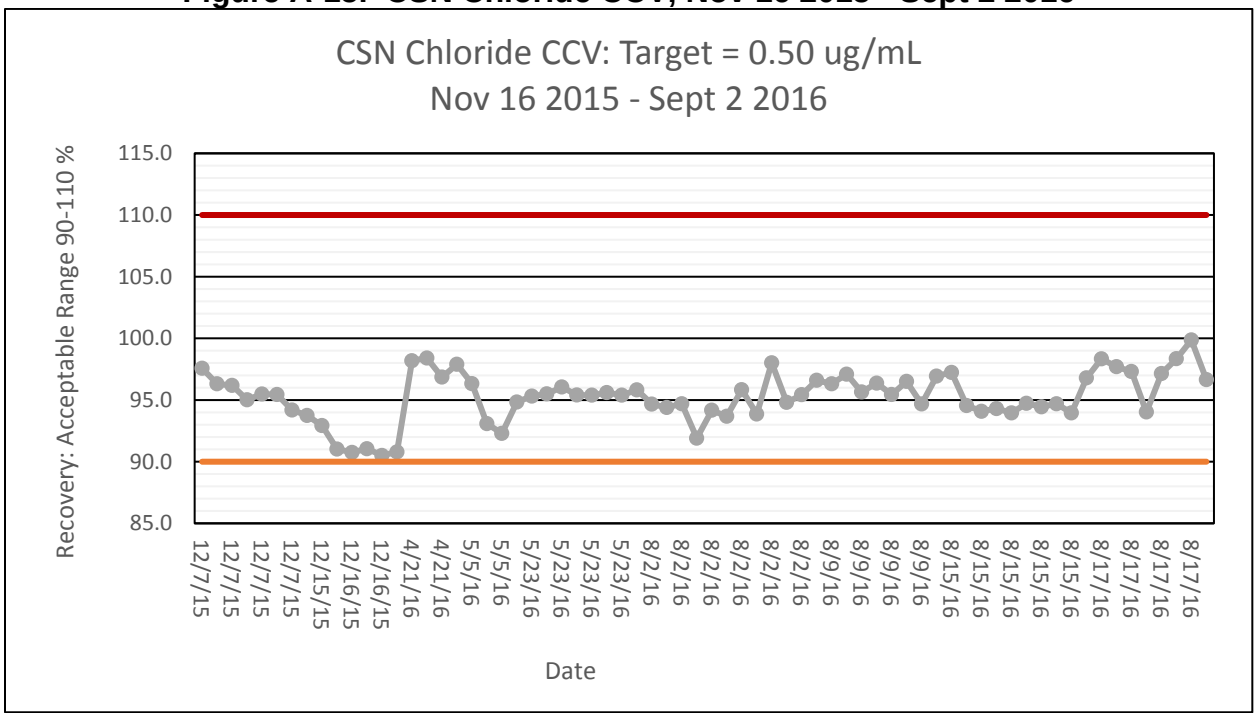


Figure A-16. CSN Chloride CCV, Sept 3 2016 - Sept 2 2017

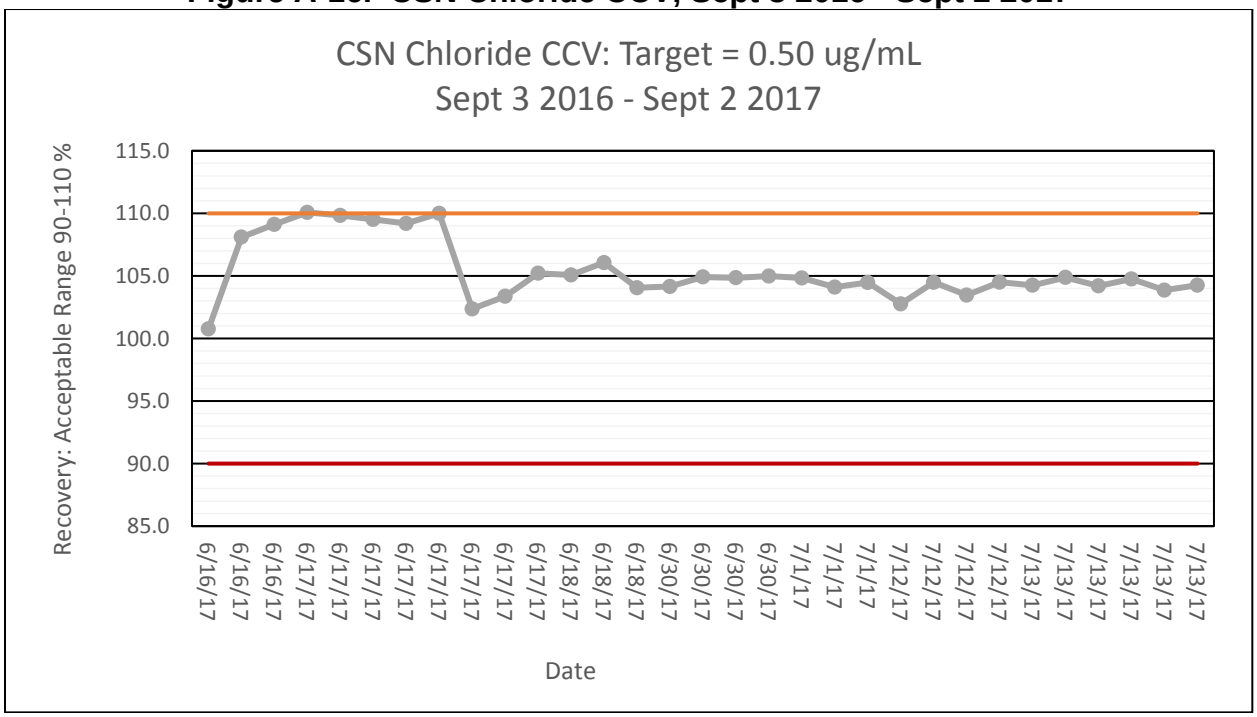


Figure A-17. CSN Nitrate CCV, Nov 16 2015 - Sept 2 2016

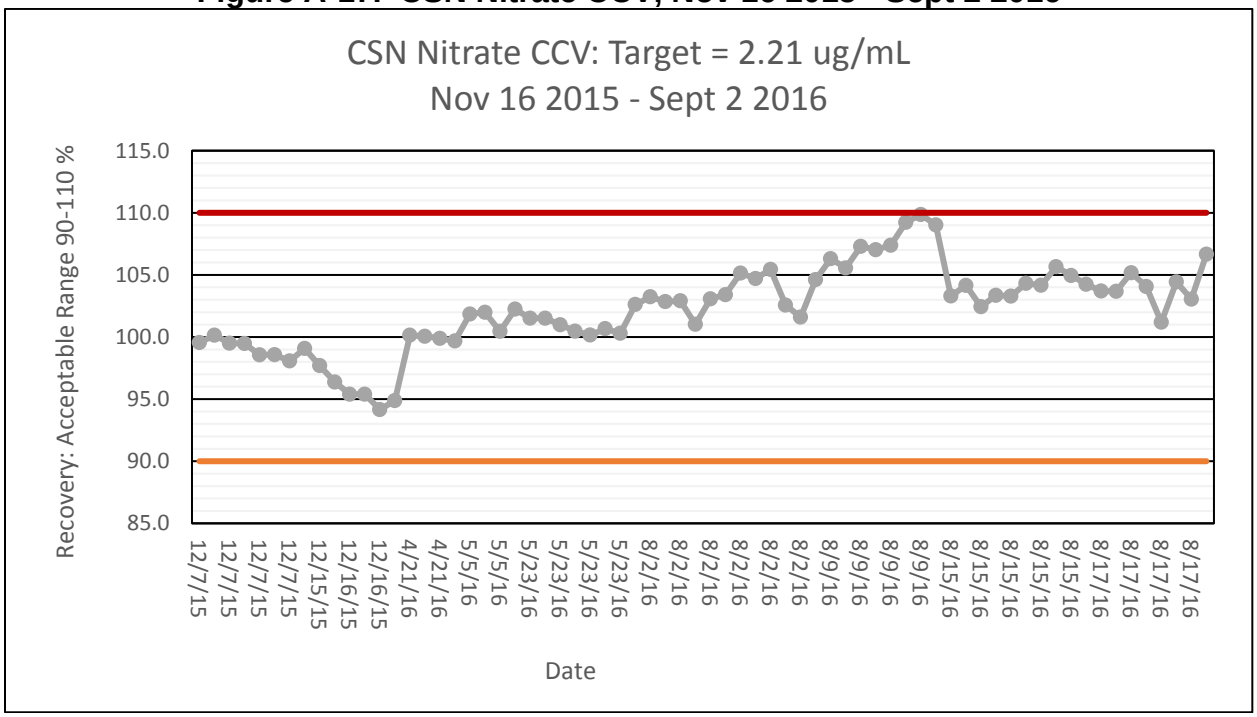


Figure A-18. CSN Nitrate CCV, Sept 3 2016- Sept 2 2017

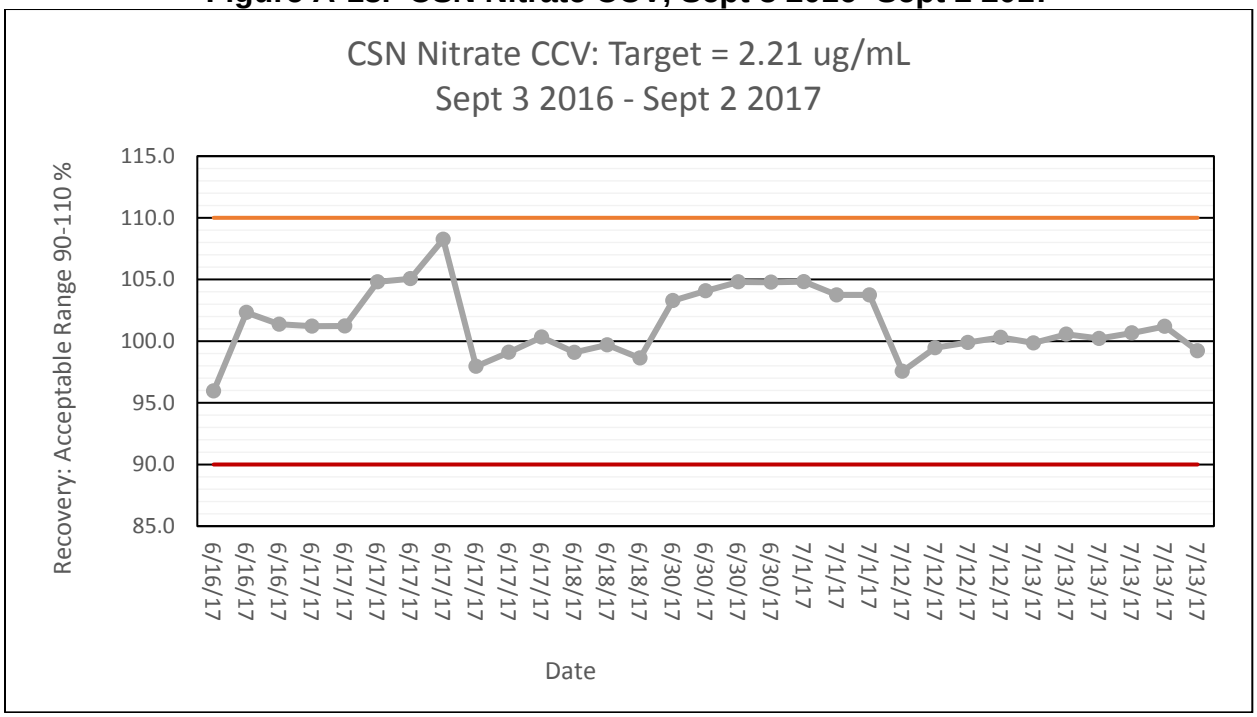
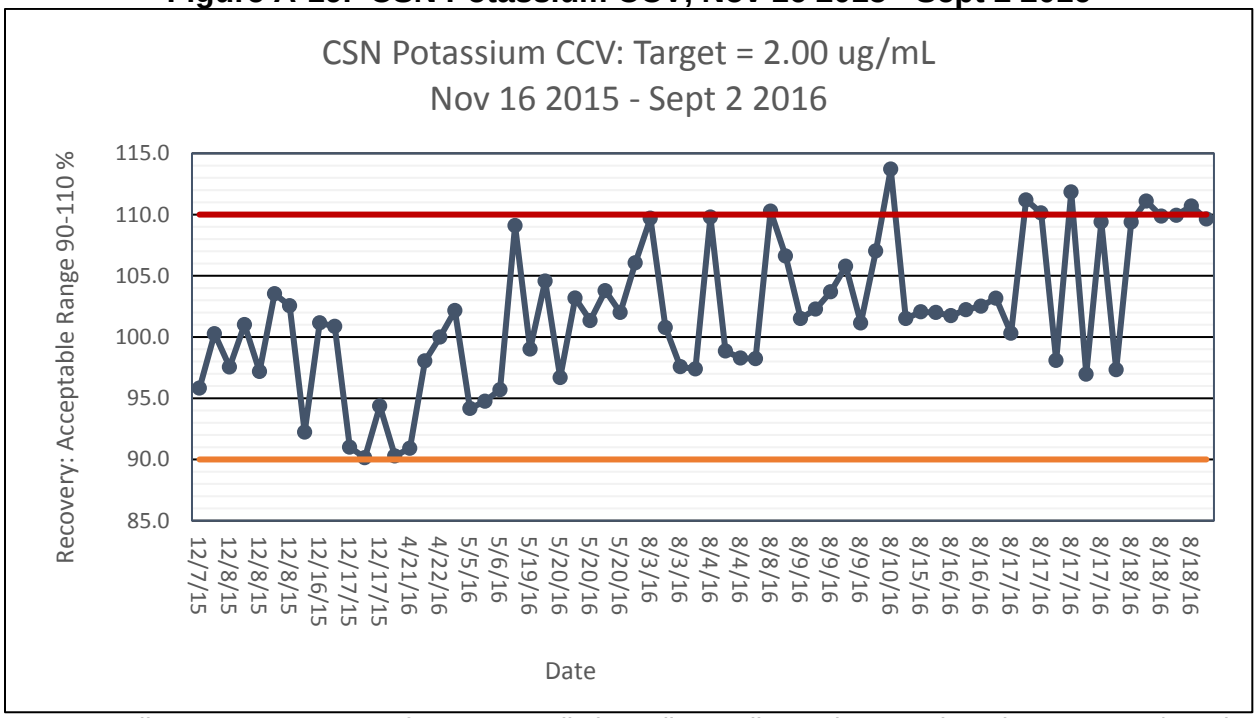
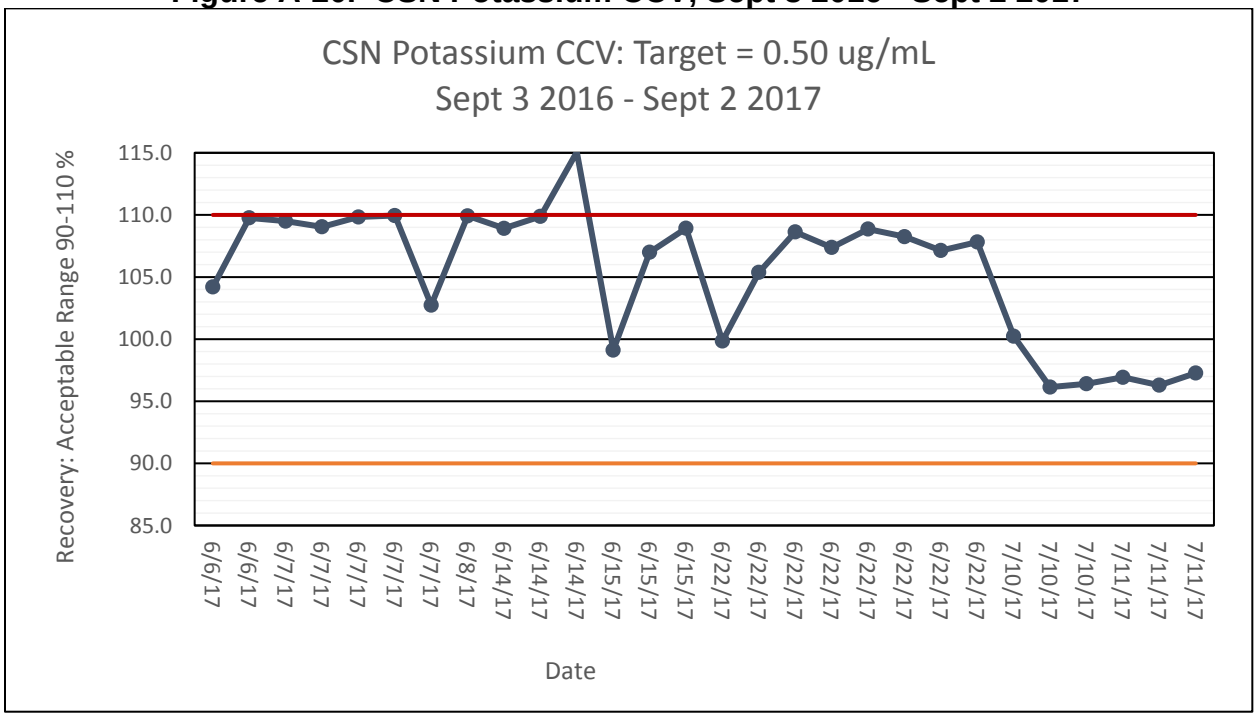


Figure A-19. CSN Potassium CCV, Nov 16 2015 - Sept 2 2016



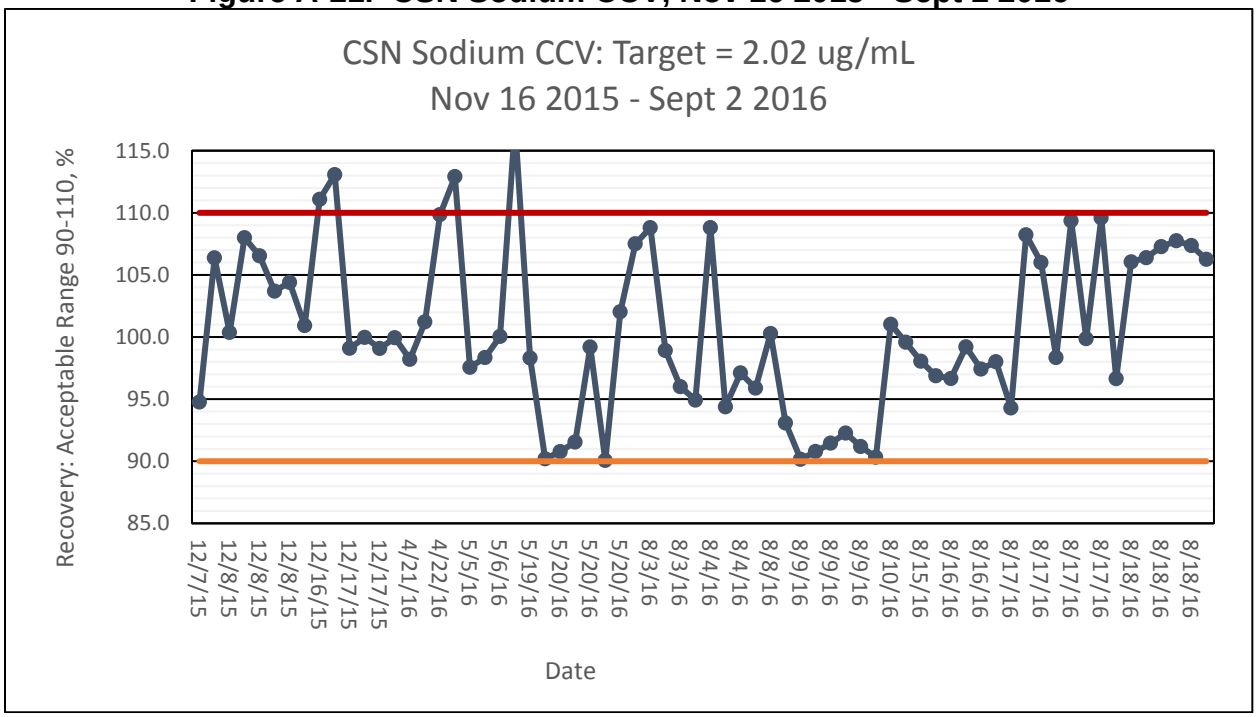
Note regarding August 2016 out of acceptance limit readings: All samples were less than 0.040 ug/mL, the reportable limit. Therefore, reported sample data was not affected.

Figure A-20. CSN Potassium CCV, Sept 3 2016 - Sept 2 2017



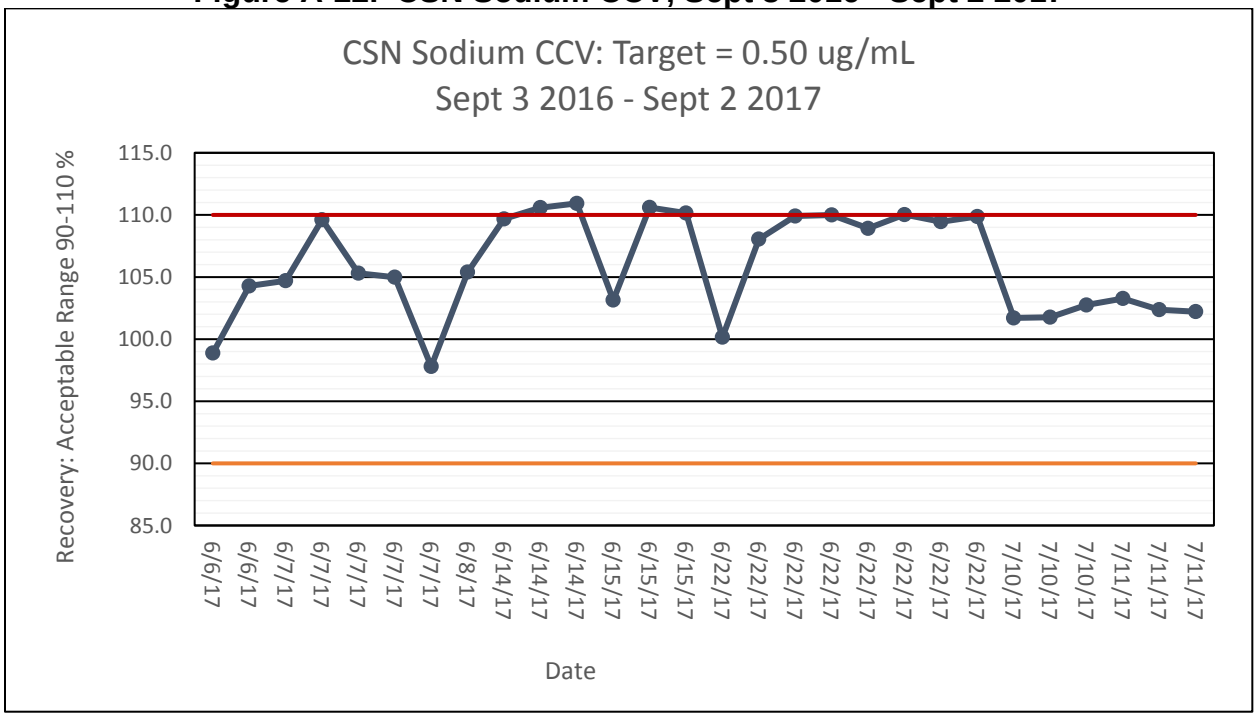
Note regarding June 2017 out of acceptance limit reading: All samples were less than 0.040 ug/mL, the reportable limit. Therefore, reported sample data was not affected.

Figure A-21. CSN Sodium CCV, Nov 16 2015 - Sept 2 2016



Note regarding December 2015, April 2016, and May 2016 out of acceptance limit readings: All samples were less than 0.040 ug/mL, the reportable limit. Therefore reported sample data was not affected.

Figure A-22. CSN Sodium CCV, Sept 3 2016 - Sept 2 2017



Note regarding June 2017 out of acceptance limit readings: All samples were less than 0.040 ug/mL, the reportable limit. Therefore, reported sample data was not affected.

Figure A-23. CSN Sulfate CCV, Nov 16 2015 - Sept 2 2016

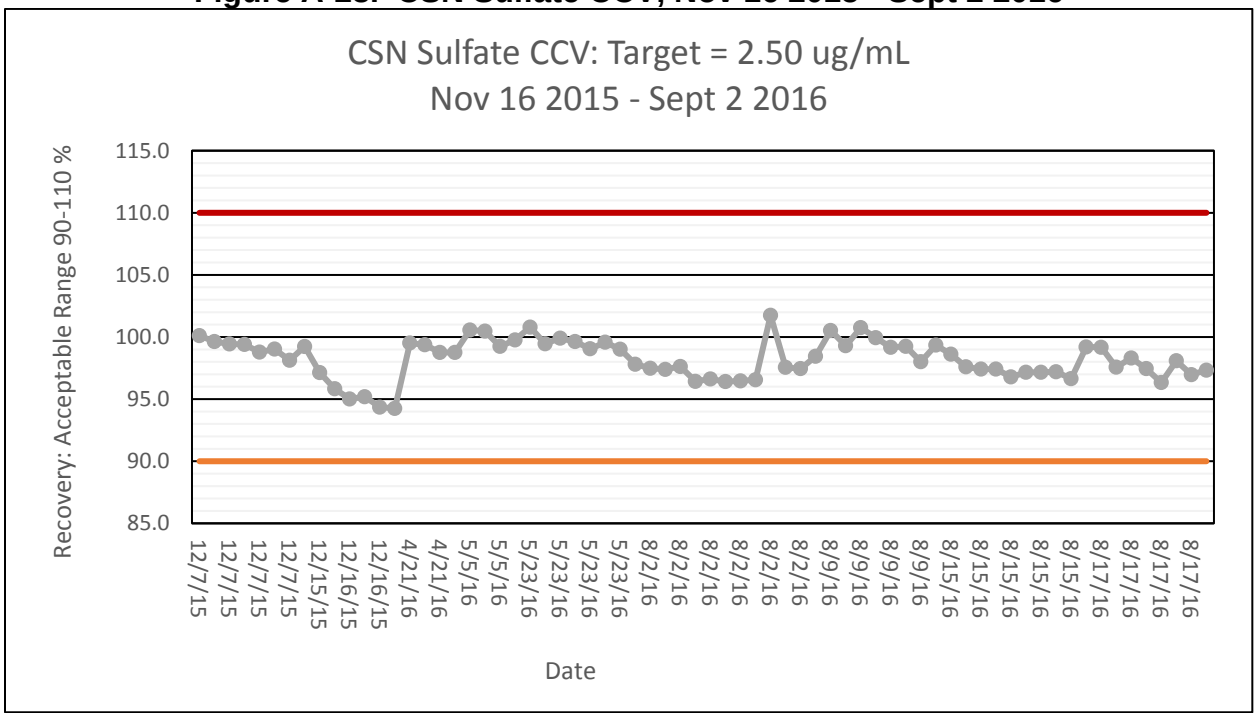


Figure A-24. CSN Sulfate CCV, Sept 3 2016 - Sept 2 2017

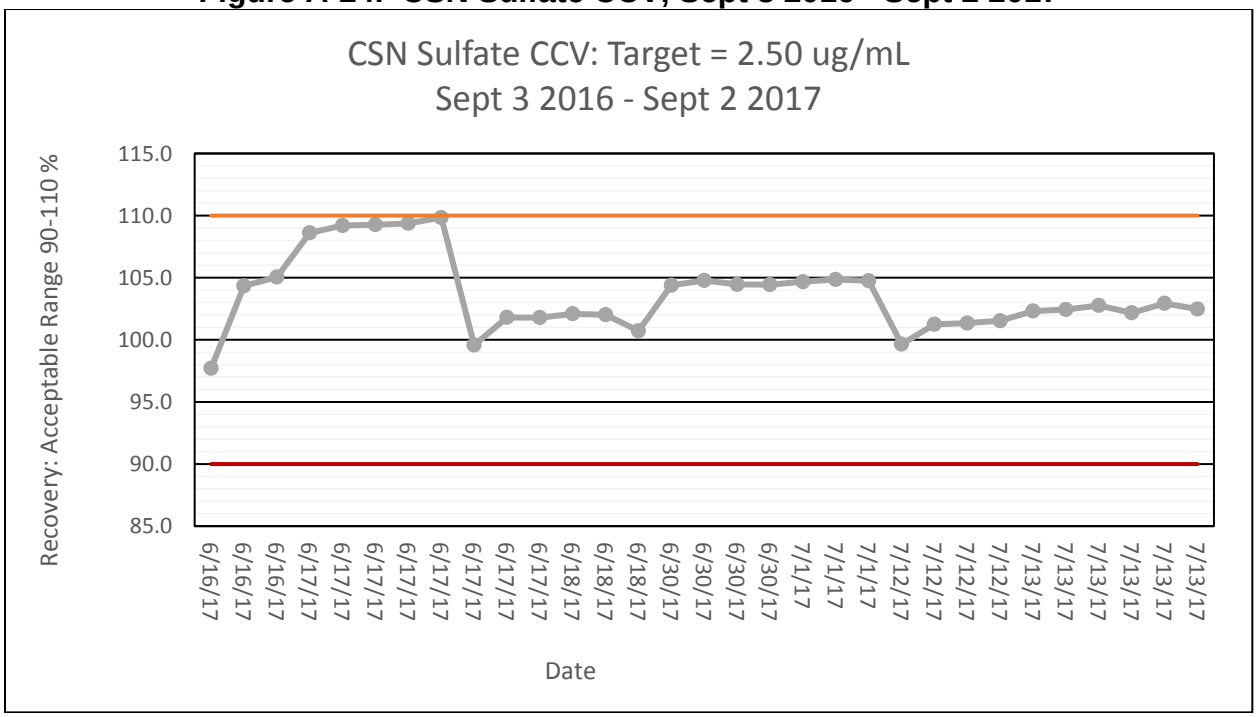


Table A-9. Anion BS Summary Report, Nov 16, 2015 - Sept 2, 2016

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
BS1	0.1999	0.200	100.1	0.4374	0.443	101.3	0.5013	0.500	99.7	12/7/15
BS1	0.2107	0.200	94.9	0.4491	0.443	98.6	0.5150	0.500	97.1	12/15/15
BS1	0.1934	0.200	103.4	0.4331	0.443	102.3	0.5024	0.500	99.5	4/21/16
BS1	0.2025	0.200	98.8	0.4257	0.443	104.1	0.5015	0.500	99.7	5/5/16
BS1	0.2011	0.200	99.4	0.4250	0.443	104.2	0.5021	0.500	99.6	5/23/16
BS1	0.2002	0.200	99.9	0.4340	0.443	102.1	0.5065	0.500	98.7	8/2/16
BS2	0.2064	0.200	96.9	0.4411	0.443	100.4	0.5001	0.500	100.0	8/4/16
BS1	0.1981	0.200	101.0	0.4196	0.443	105.6	0.4954	0.500	100.9	8/9/16
BS1	0.2000	0.200	100.0	0.4278	0.443	103.6	0.5023	0.500	99.5	8/15/16
BS1	0.1954	0.200	102.4	0.4179	0.443	106.0	0.4980	0.500	100.4	8/17/16

Table A-10. Anion BS Summary Report, Sept 3, 2016 - Sept 2, 2017

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	% Recovery Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	% Recovery Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	% Recovery Sulfate	Inject Time
BS1	0.2044	0.200	102.2	0.4318	0.443	97.5	0.5124	0.500	102.5	6/16/17
BS1	0.2004	0.200	100.2	0.4479	0.443	101.1	0.4750	0.500	95.0	6/17/17
BS1	0.2076	0.200	103.8	0.4399	0.443	99.3	0.5061	0.500	101.2	6/30/17
BS1	0.2095	0.200	104.8	0.4082	0.443	92.1	0.4945	0.500	98.9	7/12/17
BS1	0.2131	0.200	106.6	0.4796	0.443	108.3	0.5091	0.500	101.8	9/12/17
BS1	0.2448	0.200	122.4	0.4618	0.443	104.2	0.5006	0.500	100.1	9/18/17
BS1	0.2491	0.200	124.6	0.5048	0.443	113.9	0.5013	0.500	100.3	9/25/17
BS1	0.2069	0.200	103.4	0.4314	0.443	97.4	0.4971	0.500	99.4	12/5/17

Table A-11. Cation BS Summary Report, Nov 16, 2015 - Sept 2, 2016

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	% Recovery Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
BS1	0.0864	0.10	115.7	0.2591	0.26	99.6	0.0992	0.10	100.8	12/7/15
BS1	0.0833	0.10	83.3	0.2412	0.26	93.5	0.0885	0.10	88.5	12/16/15
BS1	0.0822	0.10	82.2	0.2411	0.26	93.4	0.0889	0.10	88.9	4/21/16
BS1	0.0761	0.10	76.1	0.3071	0.26	119.0	0.1141	0.10	114.1	5/5/2016
BS1	0.0798	0.10	79.8	0.2667	0.26	103.4	0.1038	0.10	103.8	5/19/16
BS1	0.0918	0.10	91.8	0.2833	0.26	109.8	0.1061	0.10	106.1	8/2/16
BS1	0.0910	0.10	91.0	0.2777	0.26	107.6	0.0912	0.10	91.2	8/8/16
BS1	0.0817	0.10	81.7	0.2933	0.26	113.7	0.1012	0.10	101.2	8/15/16
BS1	0.0815	0.10	81.5	0.2676	0.26	103.7	0.1017	0.10	101.7	8/17/16

Table A-12. Cation BS Summary Report, Sept 3 2016 - Sept 2 2017

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL SOdium	% Recovery SOdium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	% Recovery Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	% Recovery Potassium	Inject Time
BS1	0.0876	0.10	87.6	0.2587	0.258	100.3	0.0895	0.10	89.5	6/6/17
BS1	0.0893	0.10	89.3	0.2505	0.258	97.1	0.0928	0.10	92.8	6/14/17
BS1	0.0908	0.10	90.8	0.2470	0.258	95.7	0.0923	0.10	92.3	6/22/17
BS1	0.0929	0.10	92.9	0.2498	0.258	96.8	0.0907	0.10	90.7	7/10/17

Figure A-25. CSN Ammonium Blank Spikes, Nov 16 2015 - Sept 2 2016

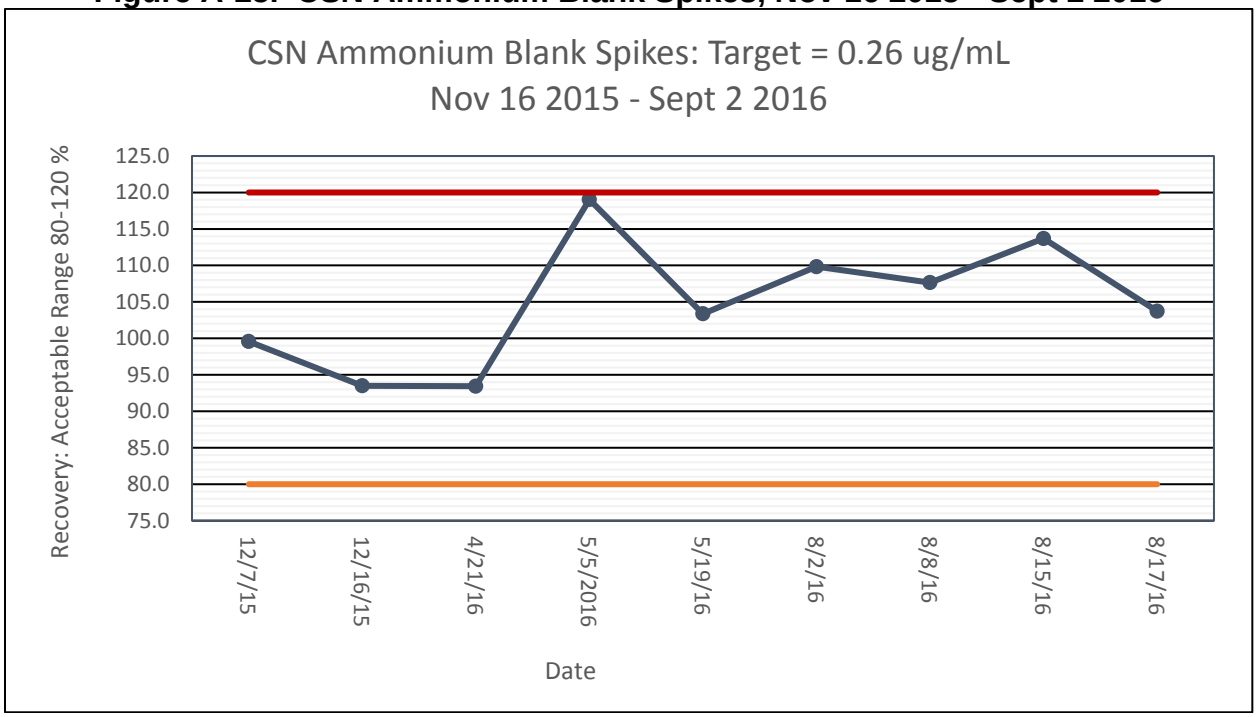


Figure A-26. CSN Ammonium Blank Spikes, Sept 3 2016 - Sept 2 2017

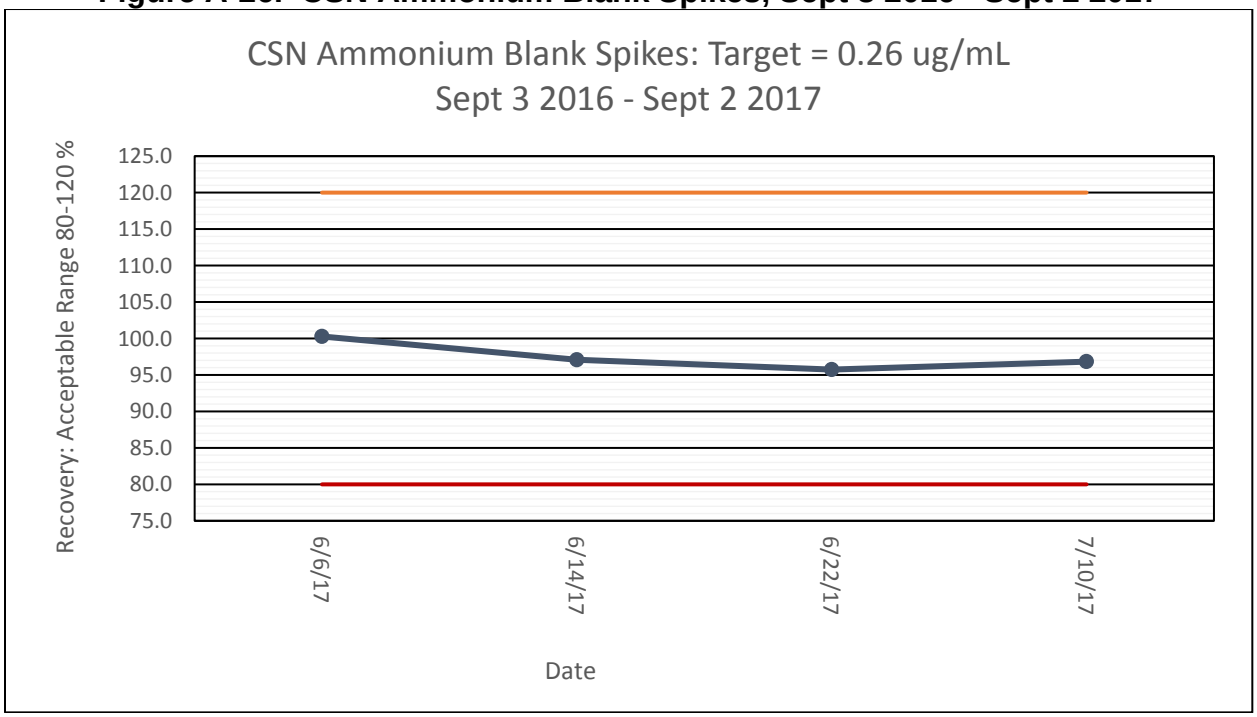


Figure A-27. CSN Chloride Blank Spikes, Nov 16 2015 - Sept 2 2016

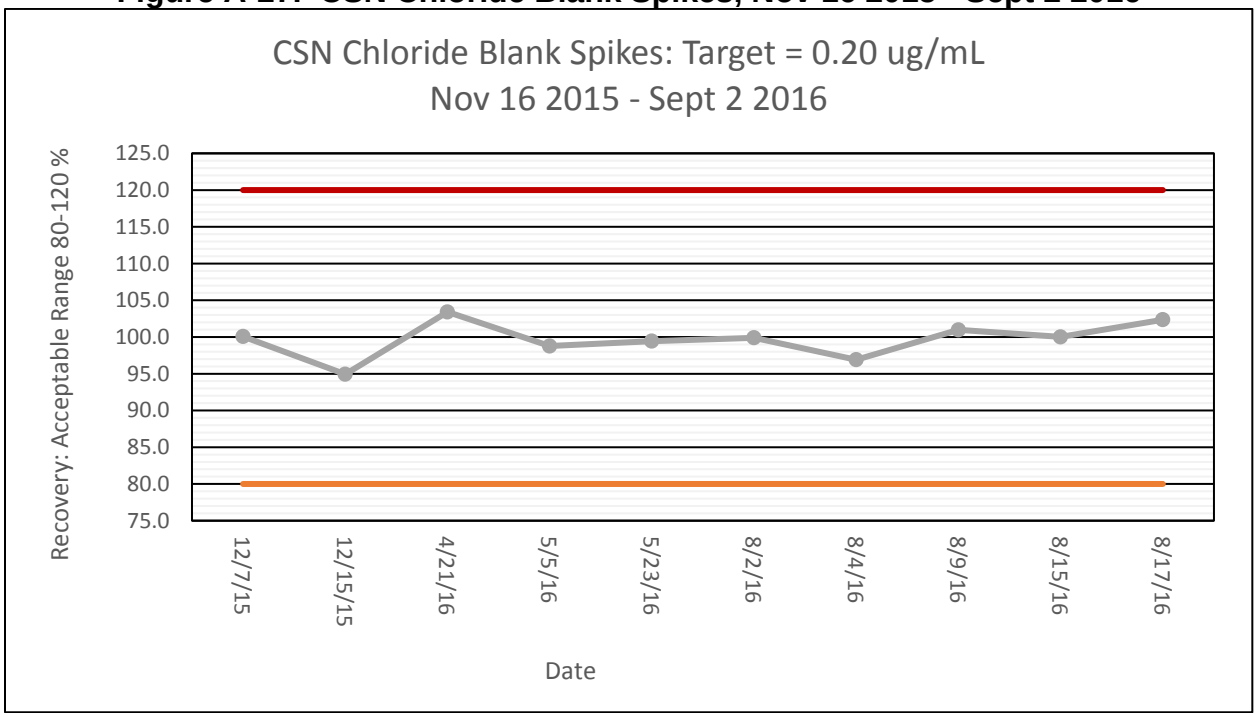


Figure A-28. CSN Chloride Blank Spikes, Sept 3 2016 - Sept 2 2017

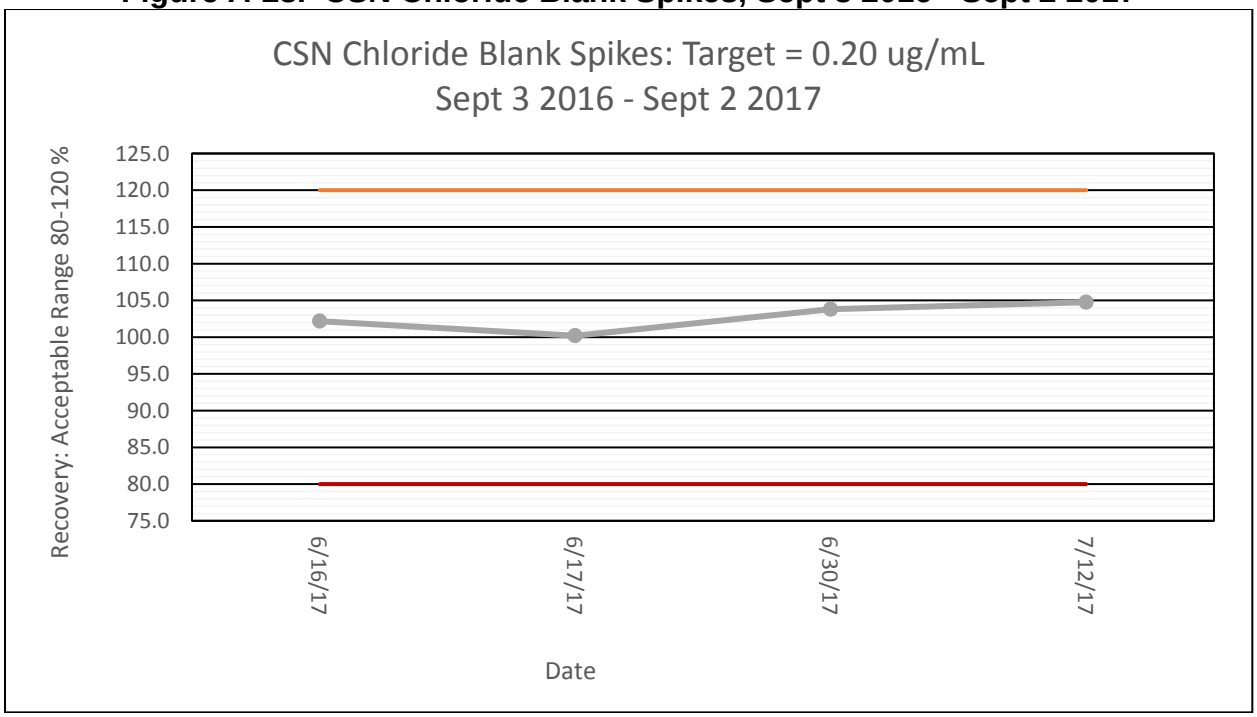


Figure A-29. CSN Nitrate Blank Spikes, Nov 16 2015 - Sept 2 2016

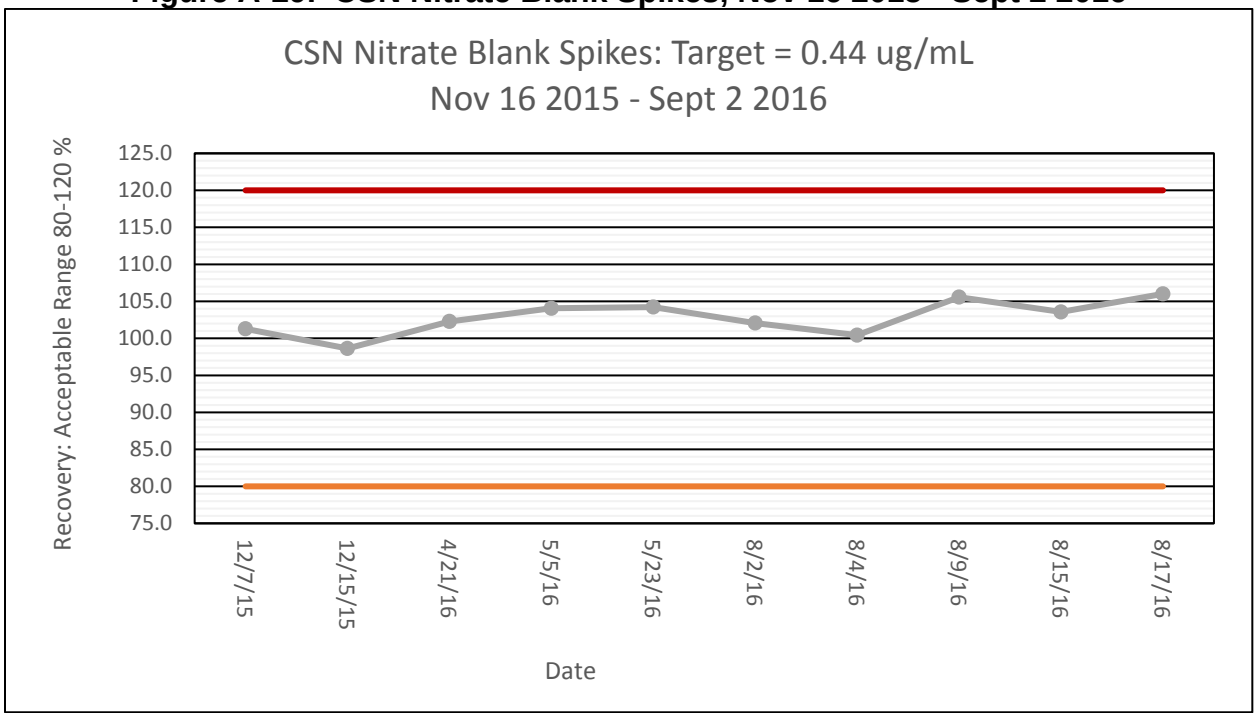


Figure A-30. CSN Nitrate Blank Spikes, Sept 3 2016 - Sept 2 2017

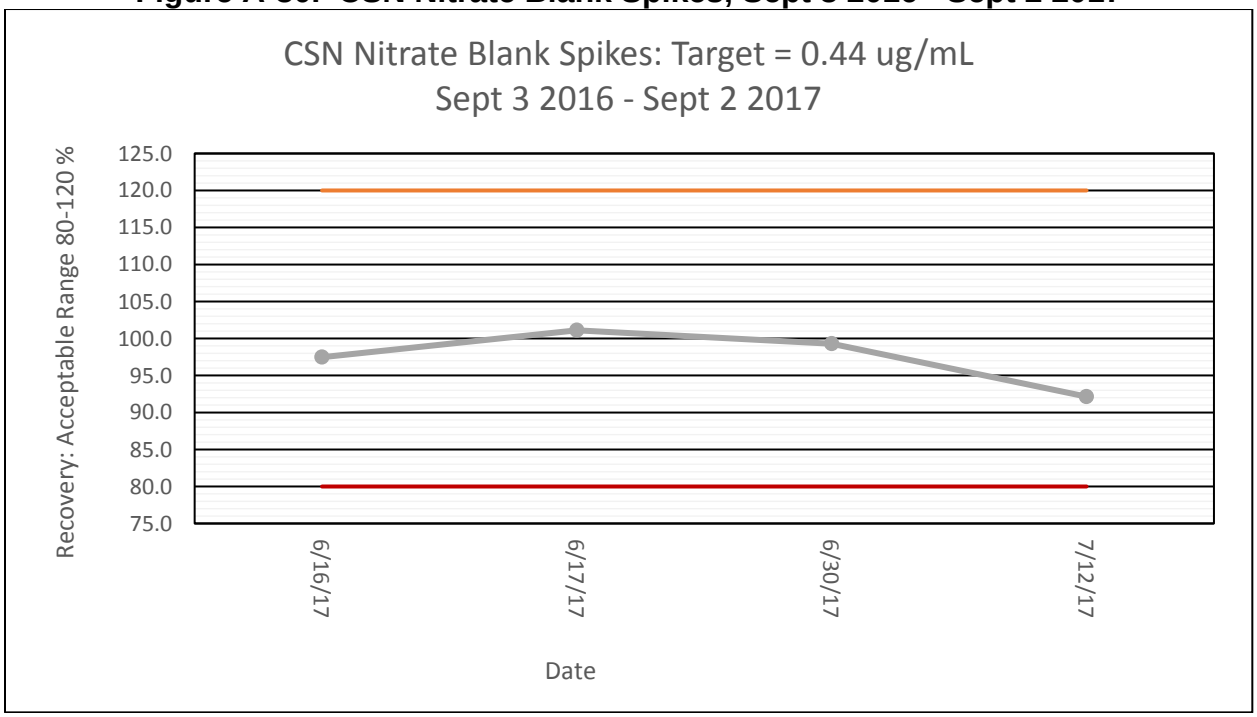


Figure A-31. CSN Potassium Blank Spikes, Nov 16 2015 - Sept 2 2016

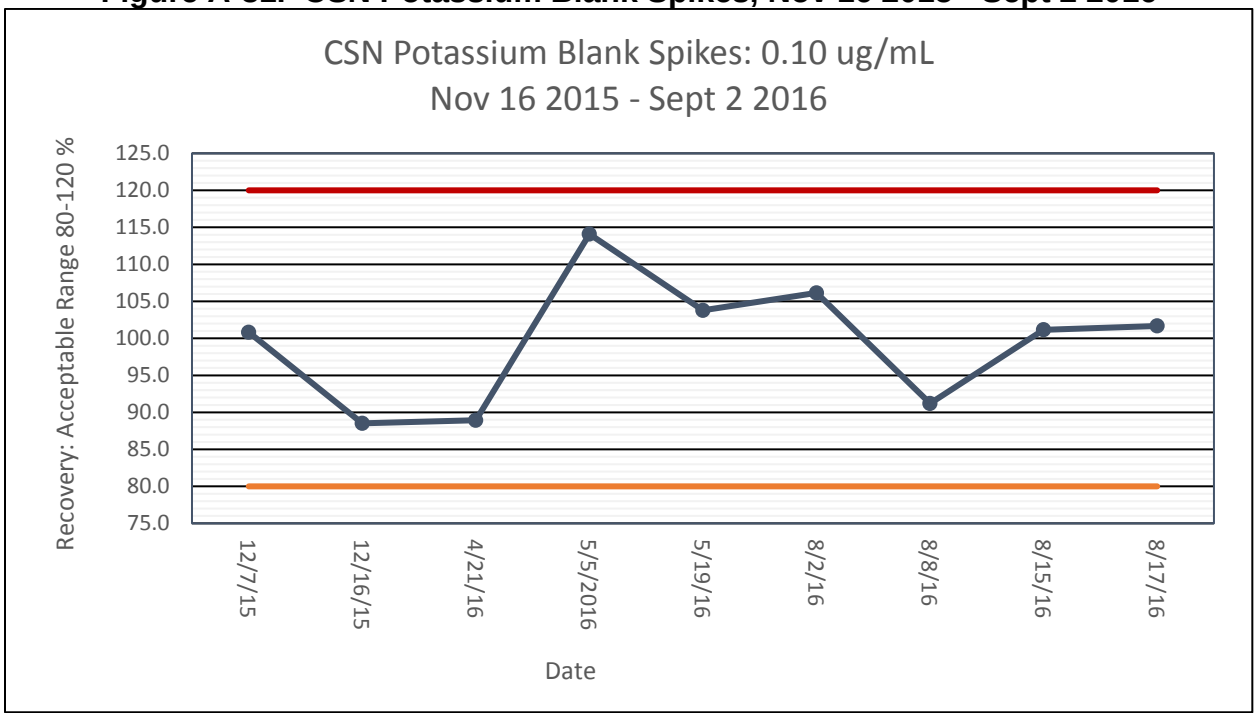


Figure A-32. CSN Potassium Blank Spikes, Sept 3 2016 - Sept 2 2017

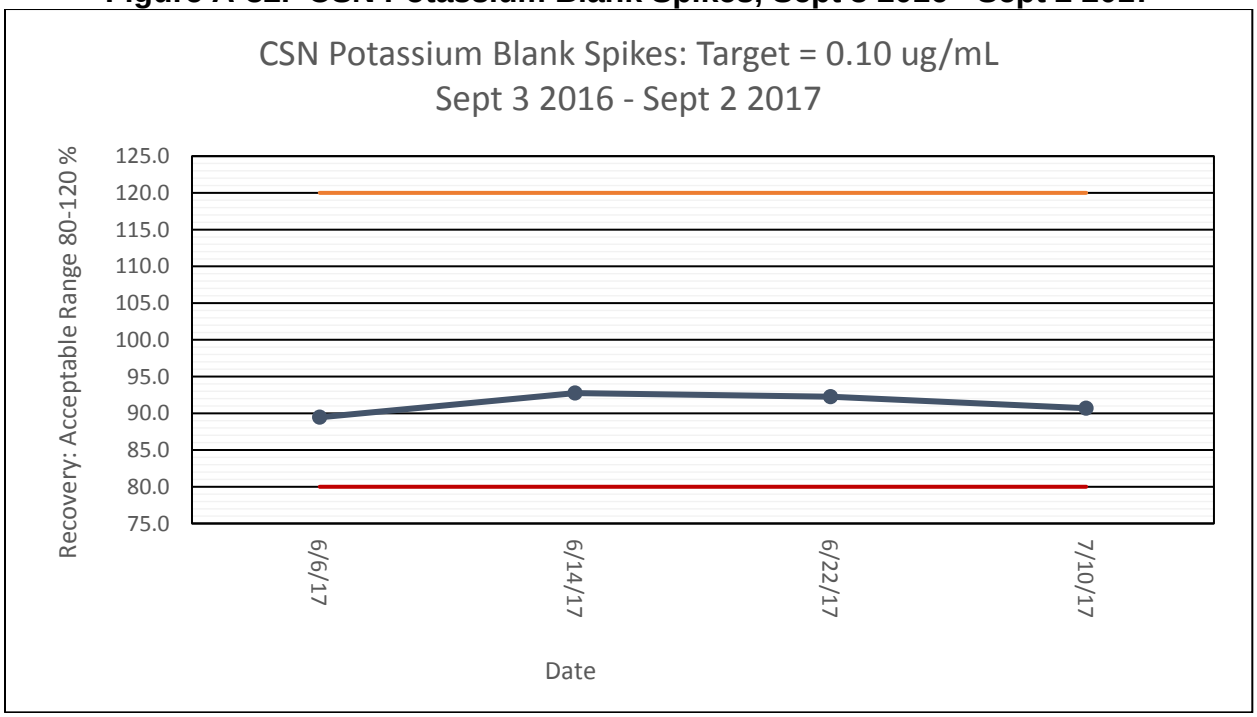


Figure A-33. CSN Sodium Blank Spikes, Nov 16 2015 - Sept 2 2016

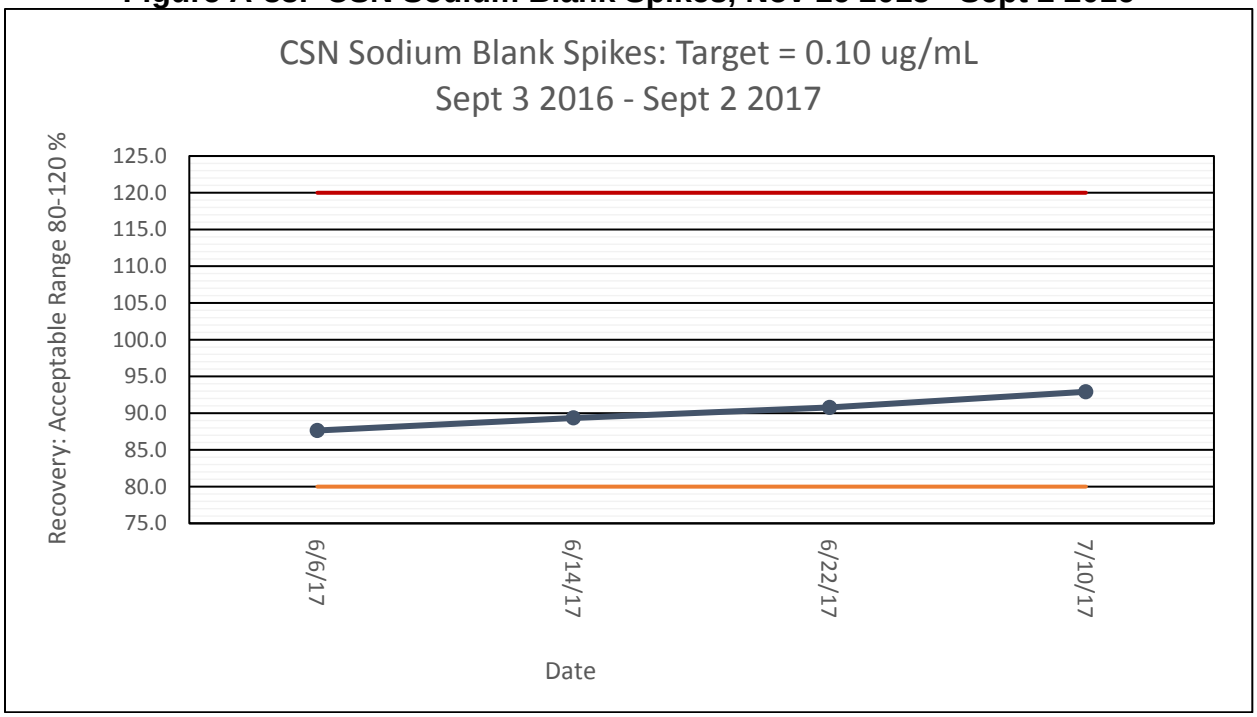
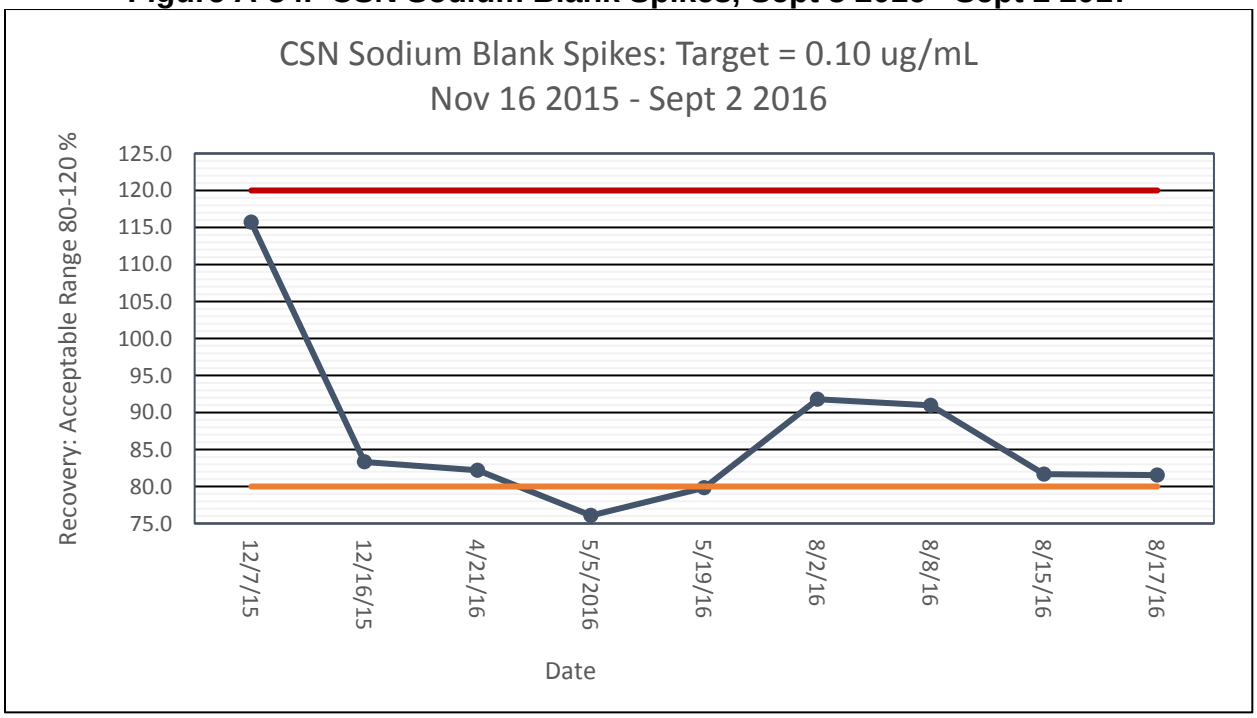


Figure A-34. CSN Sodium Blank Spikes, Sept 3 2016 - Sept 2 2017



Note regarding May 2016 out of acceptance limit reading: Other analytes from same BS solution passed, all other QC passed.

Figure A-35. CSN Sulfate Blank Spikes, Nov 16 2015 - Sept 2 2016

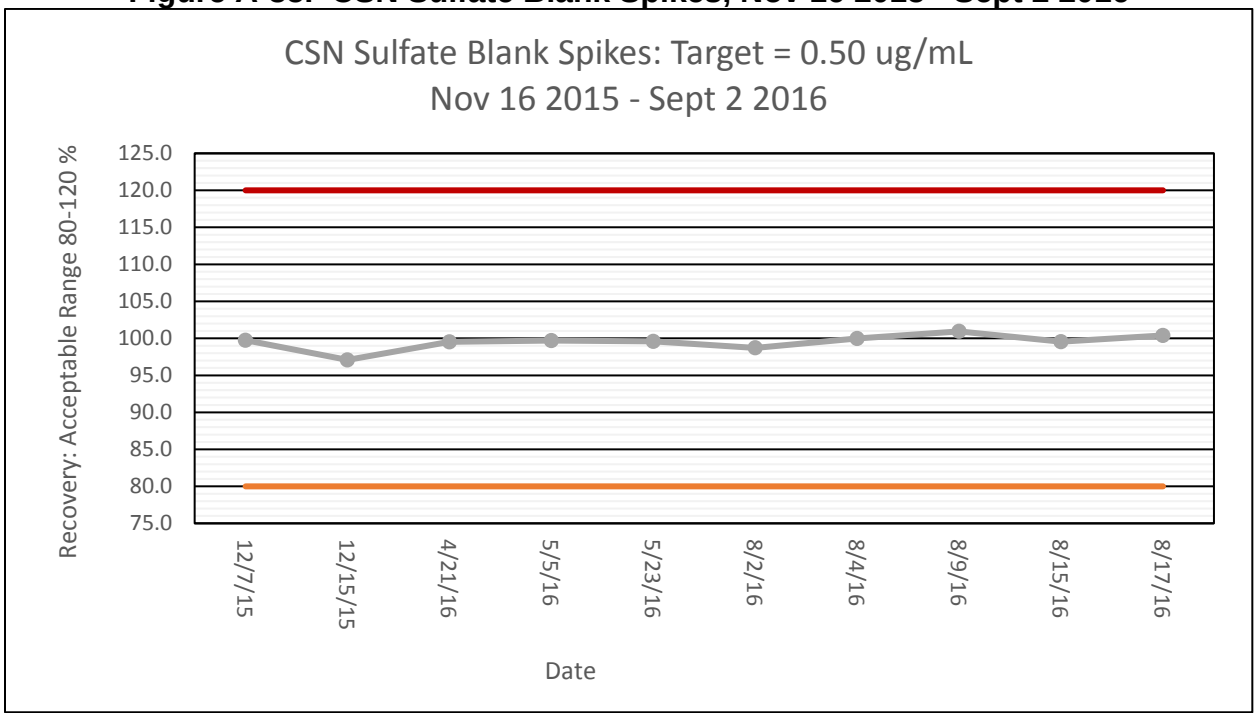


Figure A-36. CSN Sulfate Blank Spikes, Sept 3 2016 - Sept 2 2017

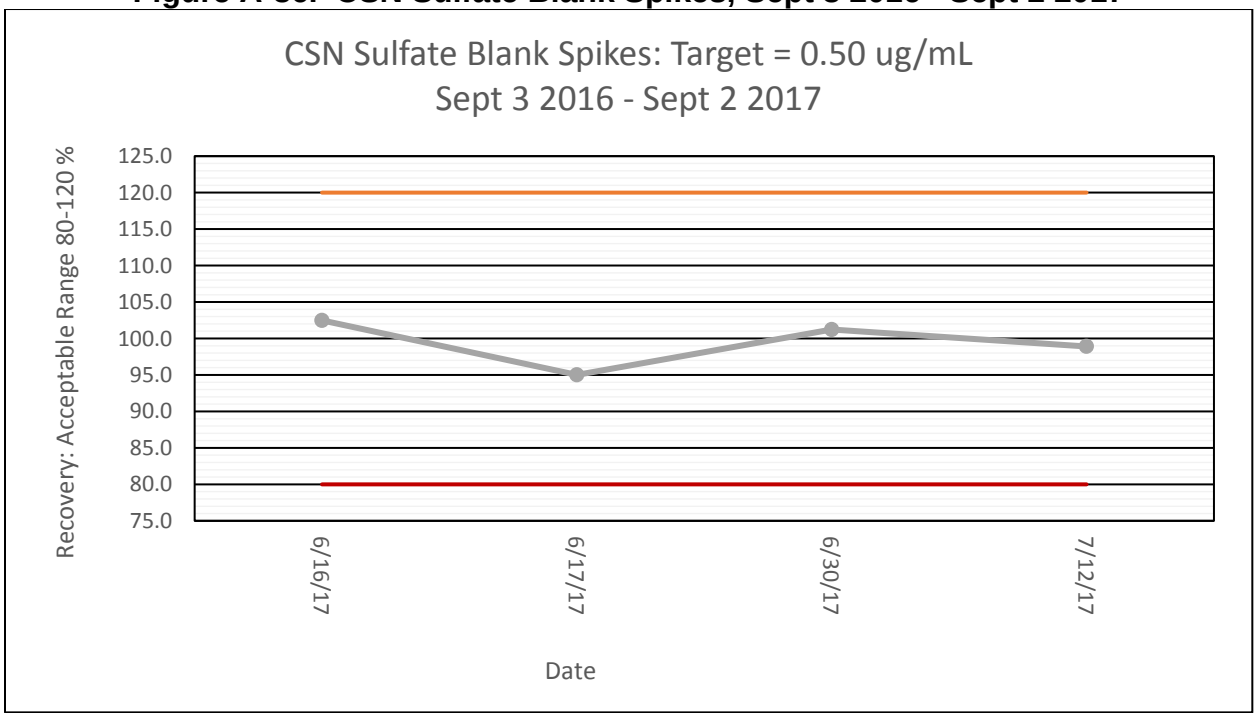


Table A-13. Cation MB Summary Report, Nov 16, 2015 - Sept 2, 2016

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	Inject Time
MB1	0.0000	<0.040	0.0000	<0.040	0.0007	<0.040	12/7/15
MB1	0.0000	<0.040	0.0011	<0.040	0.0089	<0.040	12/16/15
MB1	0.0000	<0.040	0.0000	<0.040	0.0053	<0.040	4/21/16
MB1	0.0000	<0.040	0.0000	<0.040	0.0000	<0.040	5/5/16
MB1	0.0000	<0.040	0.0000	<0.040	0.0052	<0.040	5/19/16
MB1	0.0000	<0.040	0.0037	<0.040	0.0147	<0.040	8/2/16
MB1	0.0077	<0.040	0.0000	<0.040	0.0000	<0.040	8/8/16
MB1	0.0000	<0.040	0.0037	<0.040	0.0018	<0.040	8/15/16
MB1	0.0000	<0.040	0.0001	<0.040	0.0034	<0.040	8/17/16

Table A-14. Anion MB Summary Report, Sept 3, 2016 - Sept 2, 2017

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	Inject Time
MB1	0.0042	<0.040	0.0000	<0.040	0.0000	<0.040	6/16/17
MB1	0.0000	<0.040	0.0000	<0.040	0.0000	<0.040	6/17/17
MB1	0.0041	<0.040	0.0000	<0.040	0.0000	<0.040	6/30/17
MB1	0.0000	<0.040	0.0000	<0.040	0.0000	<0.040	7/12/17

Table A-15. Cation MB Summary Report, Sept 3, 2016 -Sept 2, 2017

Name	Amount µg/mL ECD_1 Sodium	Target µg/mL Sodium	Amount µg/mL ECD_1 Ammonium	Target µg/mL Ammonium	Amount µg/mL ECD_1 Potassium	Target µg/mL Potassium	Inject Time
MB1	0.0000	<0.040	0.0000	<0.040	0.0000	<0.040	6/6/17
MB1	0.0000	<0.040	0.0013	<0.040	0.0031	<0.040	6/14/17
MB1	0.0040	<0.040	0.0016	<0.040	0.0053	<0.040	6/22/17
MB1	0.0000	<0.040	0.0020	<0.040	0.0024	<0.040	7/10/17

Table A-16. Anion MB Summary Report, Nov 16, 2015 - Sept 3, 2016

Name	Amount µg/mL ECD_1 Chloride	Target µg/mL Chloride	Amount µg/mL ECD_1 Nitrate	Target µg/mL Nitrate	Amount µg/mL ECD_1 Sulfate	Target µg/mL Sulfate	Inject Time
MB1	0.0000	<0.040	0.0000	<0.040	0.0007	<0.040	12/7/15
MB1	0.0000	<0.040	0.0011	<0.040	0.0089	<0.040	12/16/15
MB1	0.0000	<0.040	0.0000	<0.040	0.0053	<0.040	4/21/16
MB1	0.0000	<0.040	0.0000	<0.040	0.0000	<0.040	5/5/16
MB1	0.0000	<0.040	0.0000	<0.040	0.0052	<0.040	5/19/16
MB1	0.0000	<0.040	0.0037	<0.040	0.0147	<0.040	8/2/16
MB1	0.0077	<0.040	0.0000	<0.040	0.0000	<0.040	8/8/16
MB1	0.0000	<0.040	0.0037	<0.040	0.0018	<0.040	8/15/16
MB1	0.0000	<0.040	0.0001	<0.040	0.0034	<0.040	8/17/16

Figure A-37. CSN Ammonium Method Blanks, Nov 16 2015 - Sept 2 2016

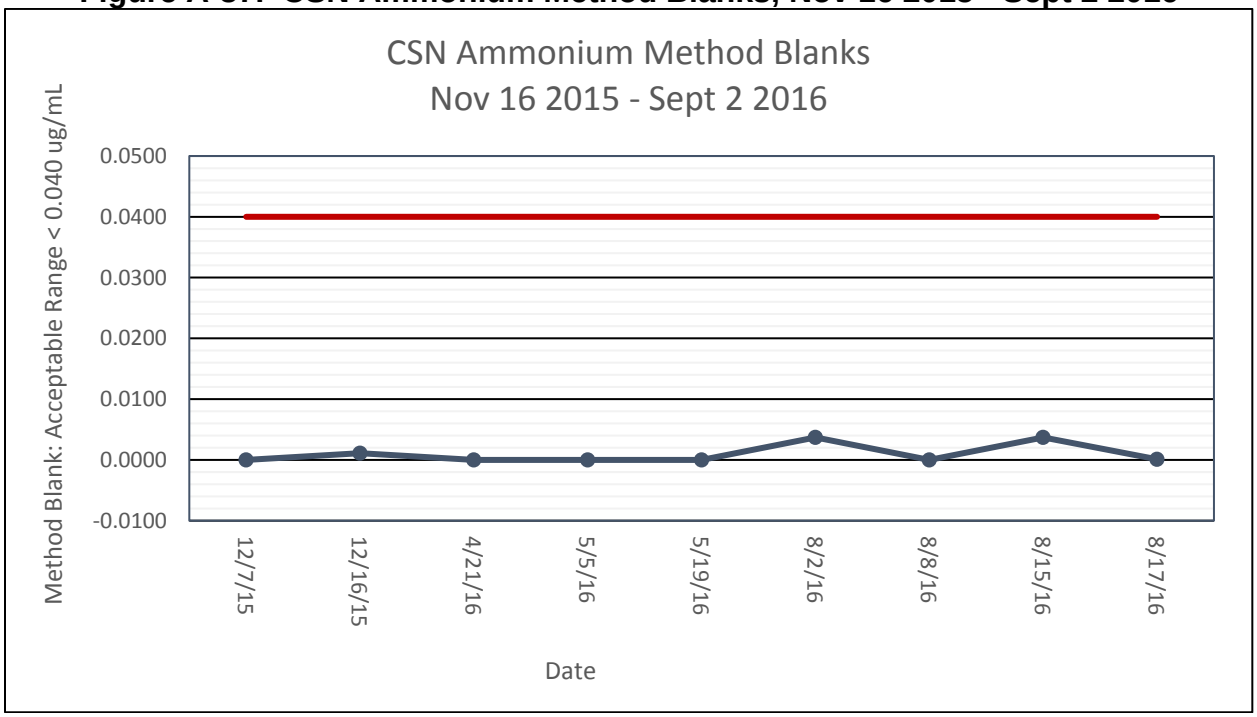


Figure A-38. CSN Ammonium Method Blanks, Sept 3 2016 - Sept 2 2017

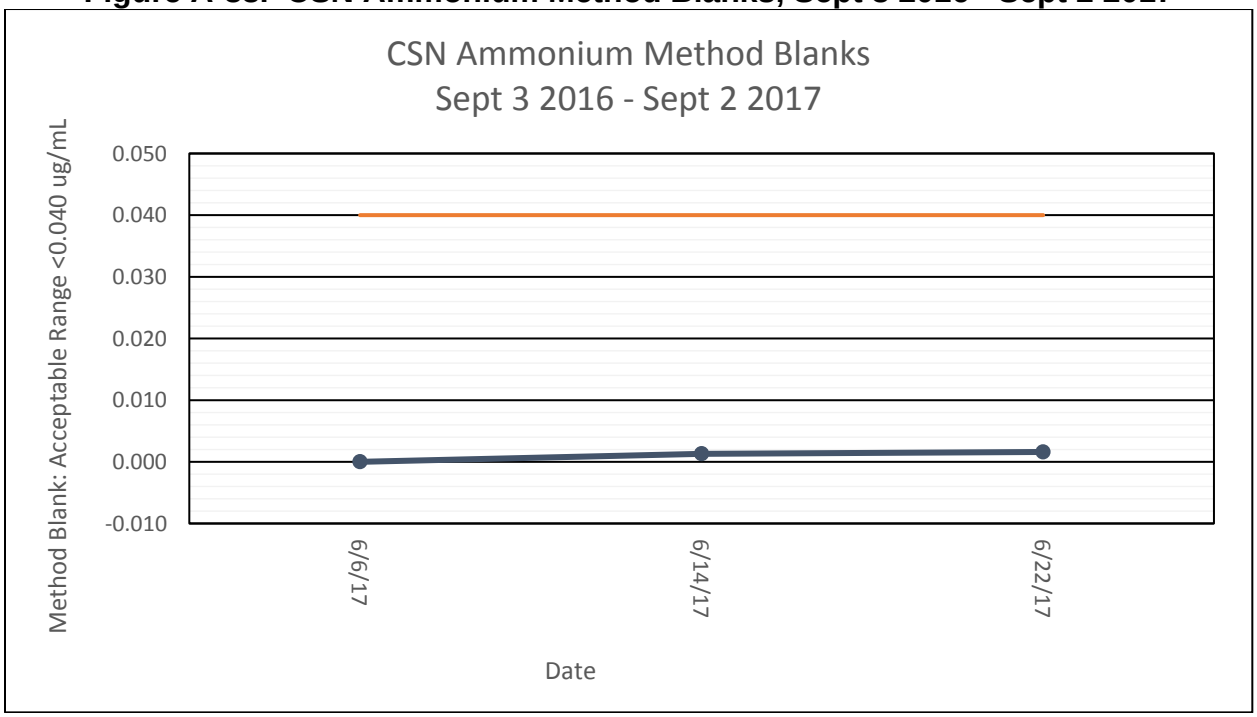


Figure A-39. CSN Chloride Method Blanks, Nov 16 2015 - Sept 2 2016

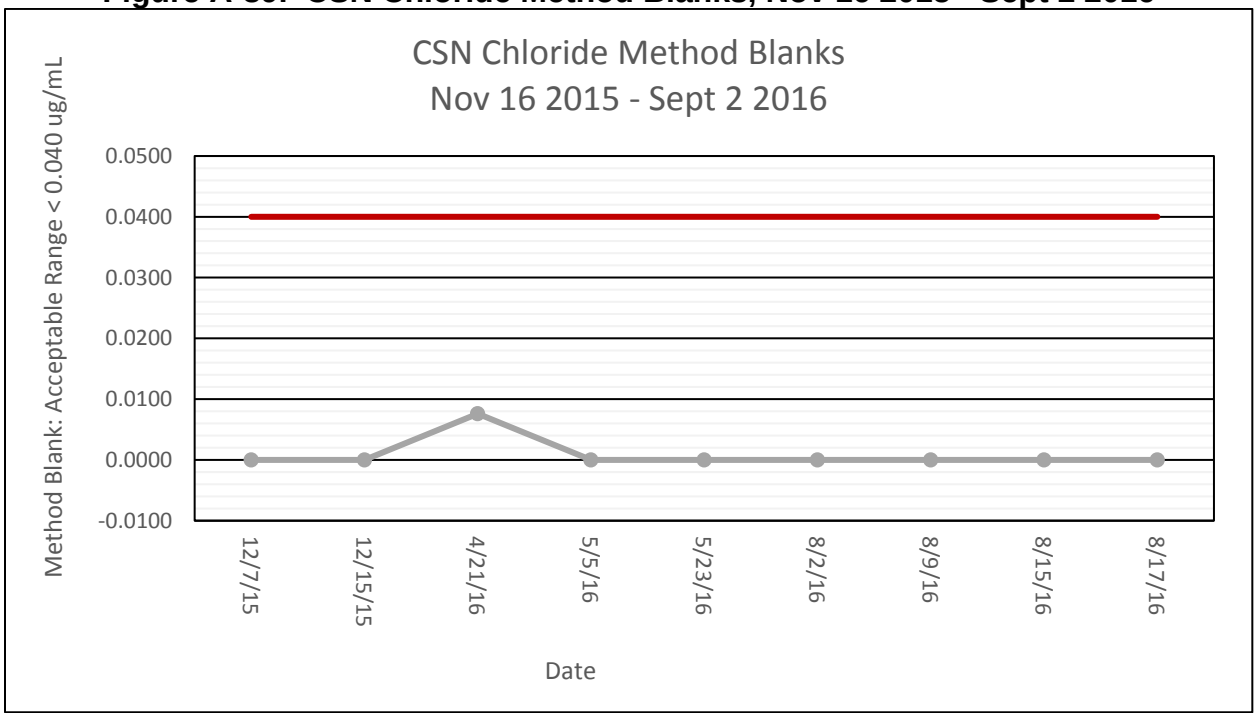


Figure A-40. CSN Chloride Method Blanks, Sept 3 2016 - Sept 2 2017

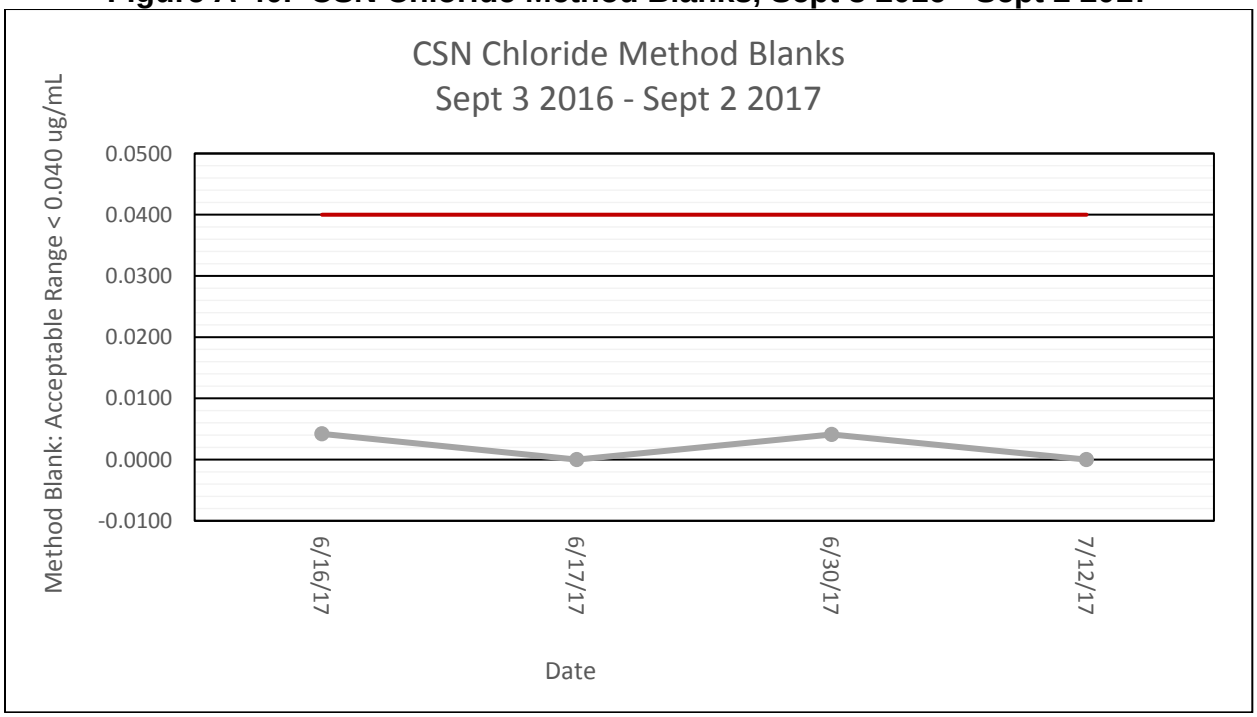


Figure A-41. CSN Nitrate Method Blanks, Nov 16 2015 - Sept 2 2016

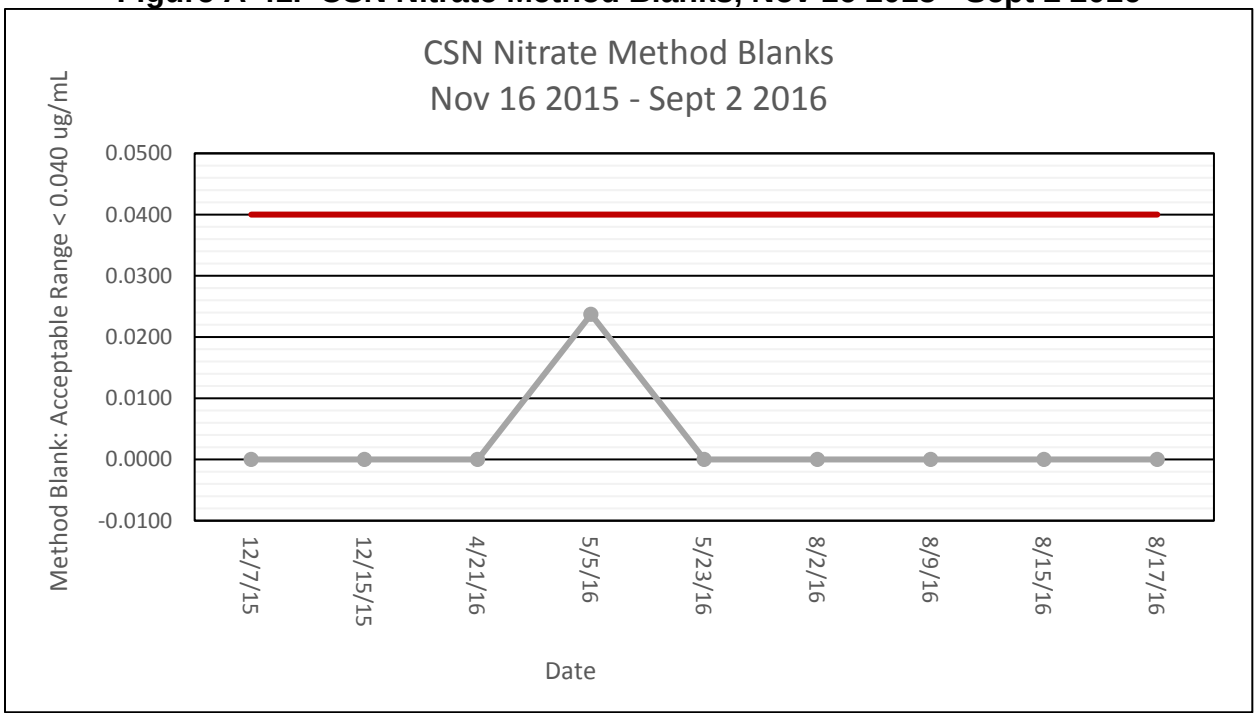


Figure A-42. CSN Nitrate Method Blanks, Sept 3 2016 - Sept 2 2017

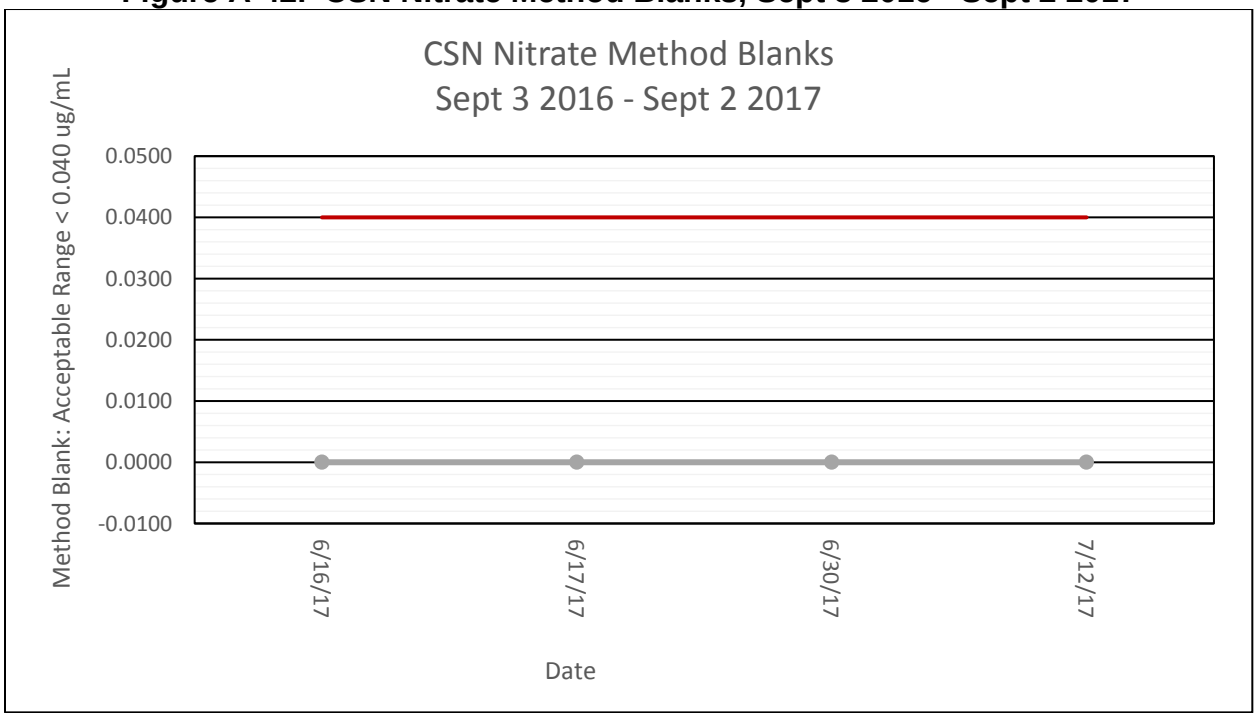


Figure A-43. CSN Potassium Method Blanks, Nov 16 2015 - Sept 2 2016

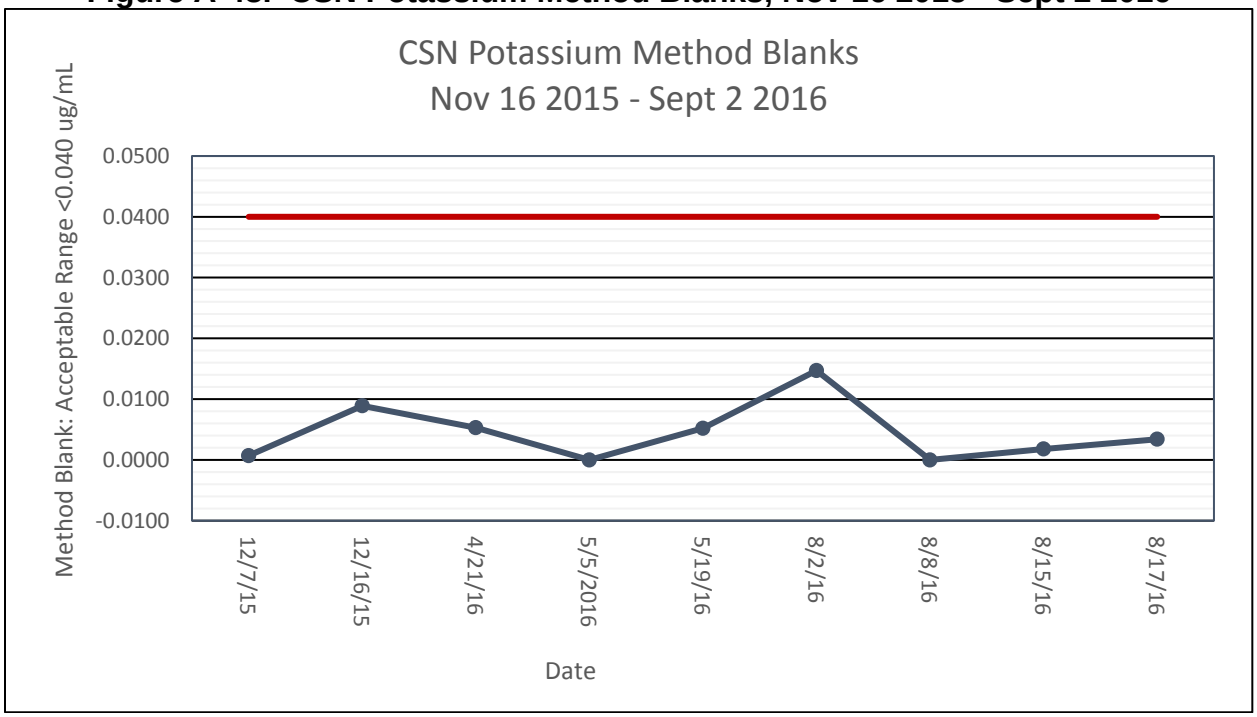


Figure A-44. CSN Potassium Method Blanks, Sept 3 2016 - Sept 2 2017

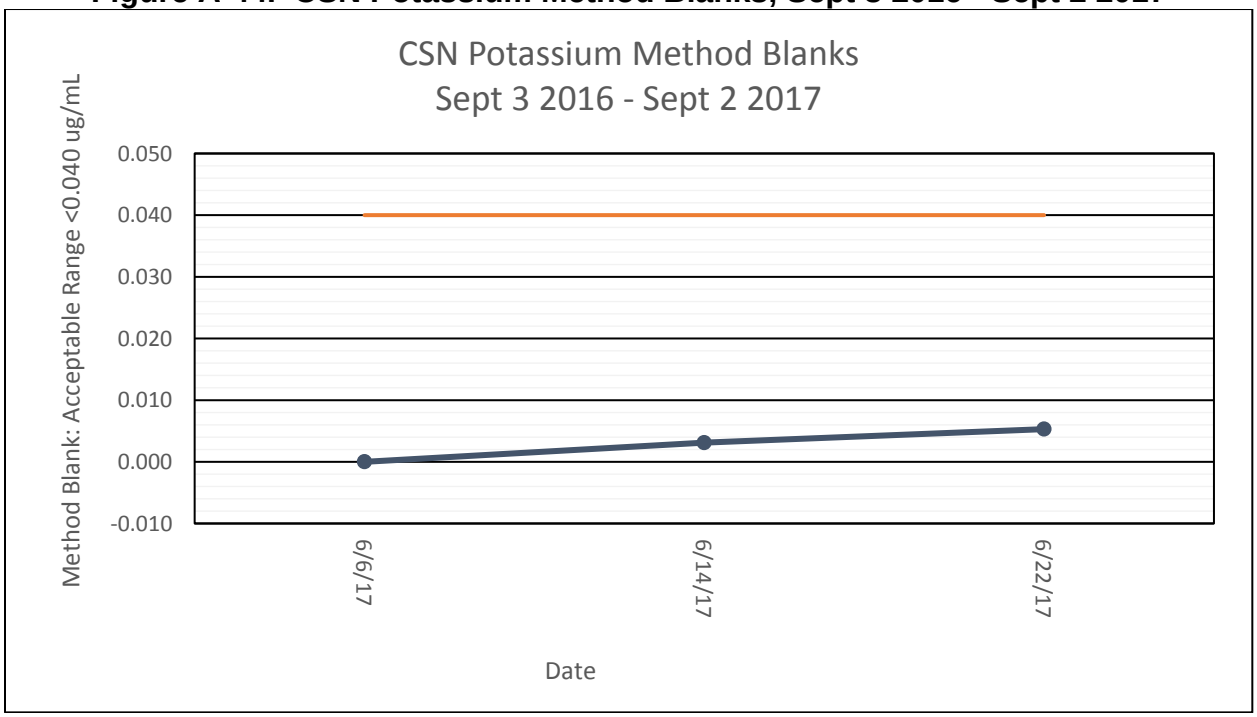


Figure A-45. CSN Sodium Method Blanks, Nov 16 2015 - Sept 2 2016

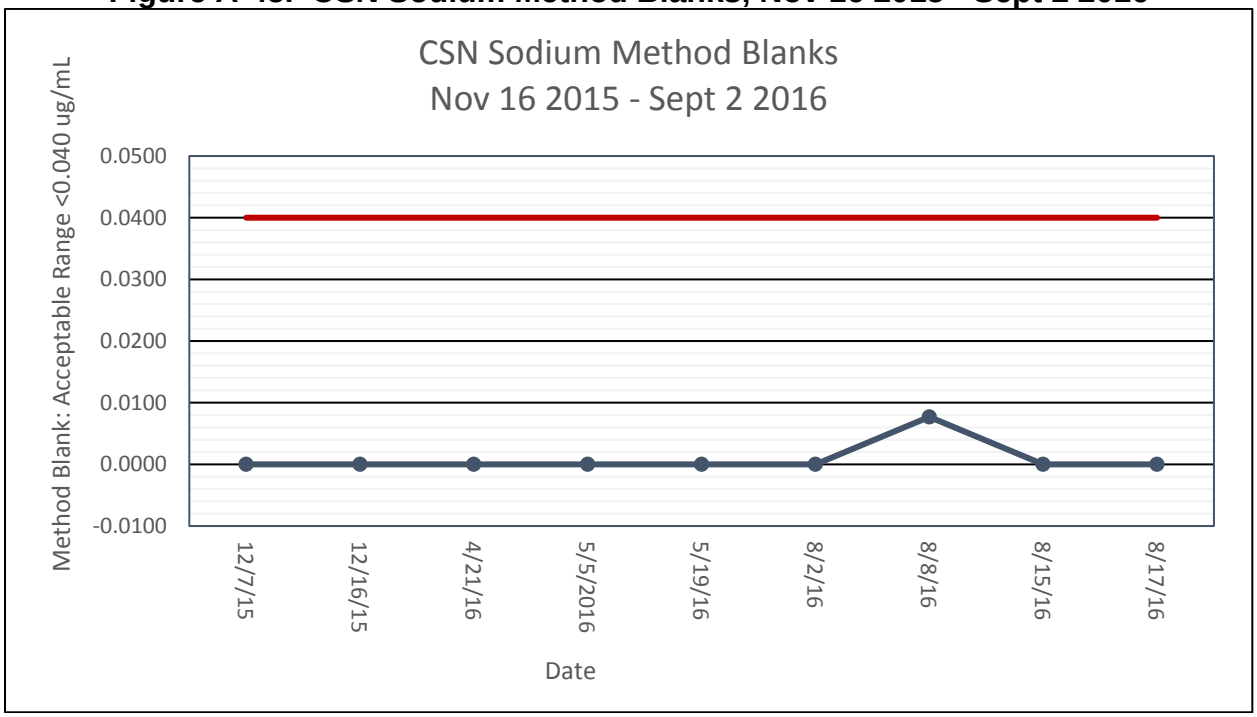


Figure A-46. CSN Sodium Method Blanks, Sept 3 2016 - Sept 2 2017

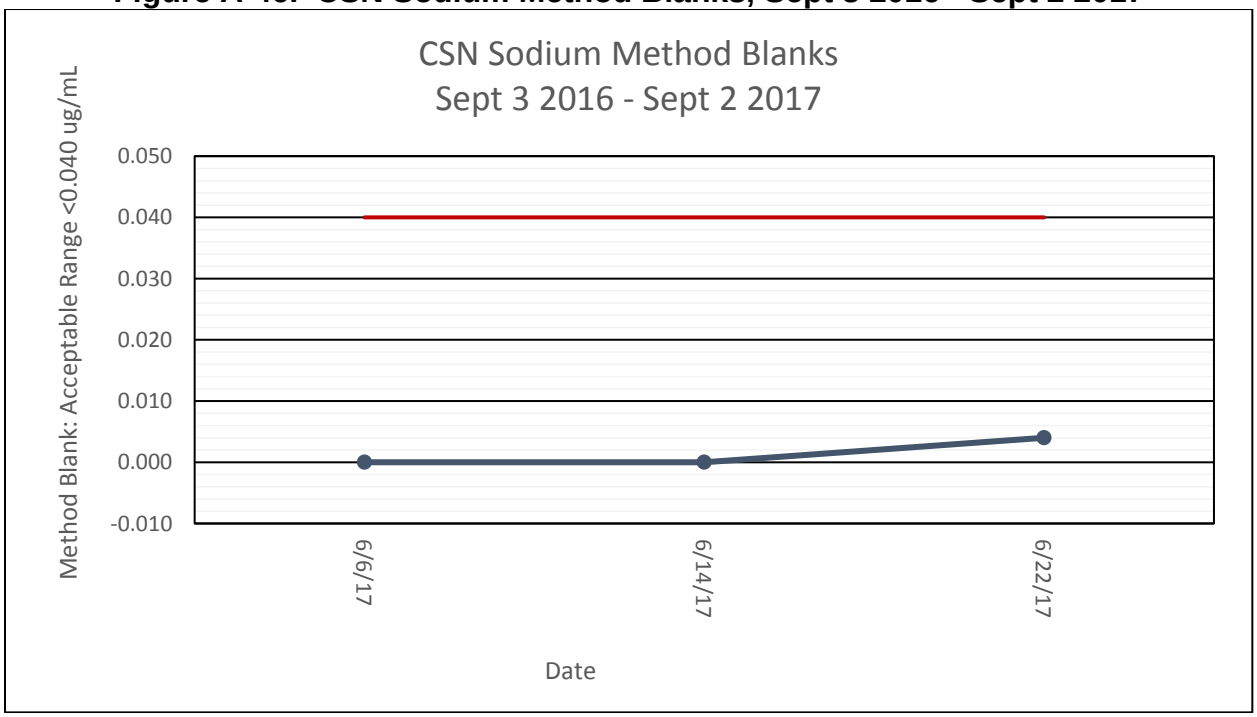


Figure A-47. CSN Sulfate Method Blanks, Nov 16 2015 - Sept 2 2016

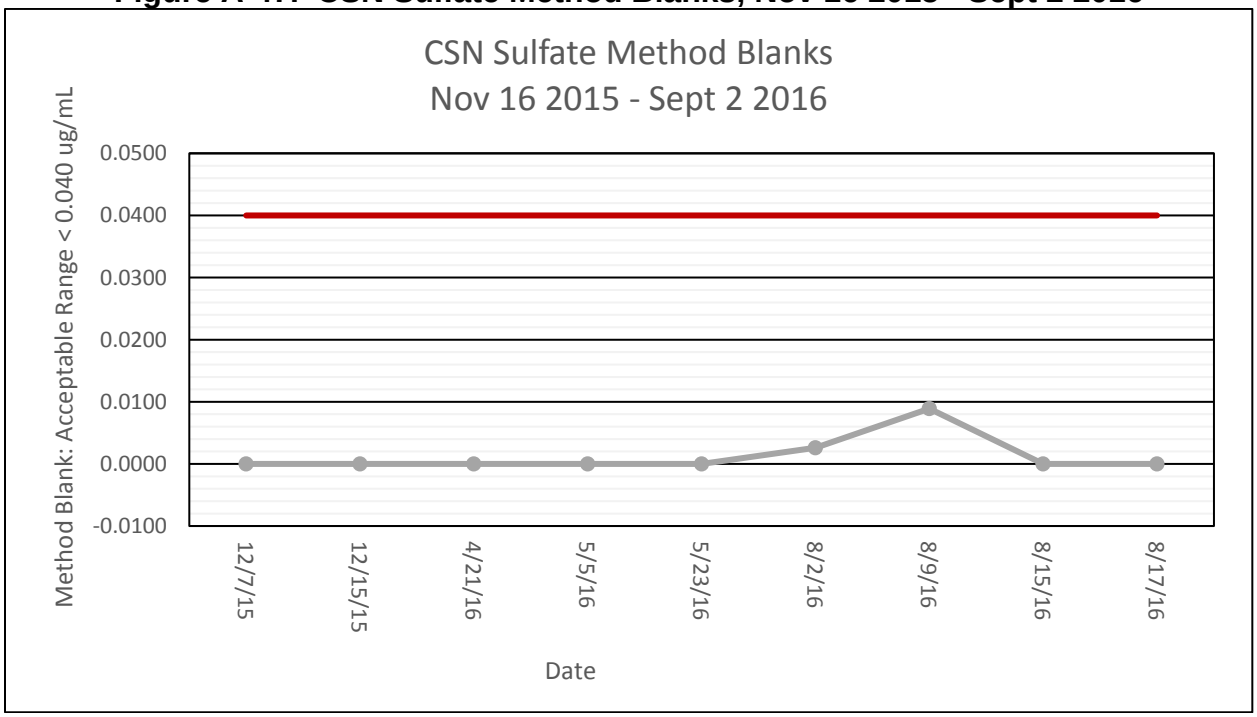
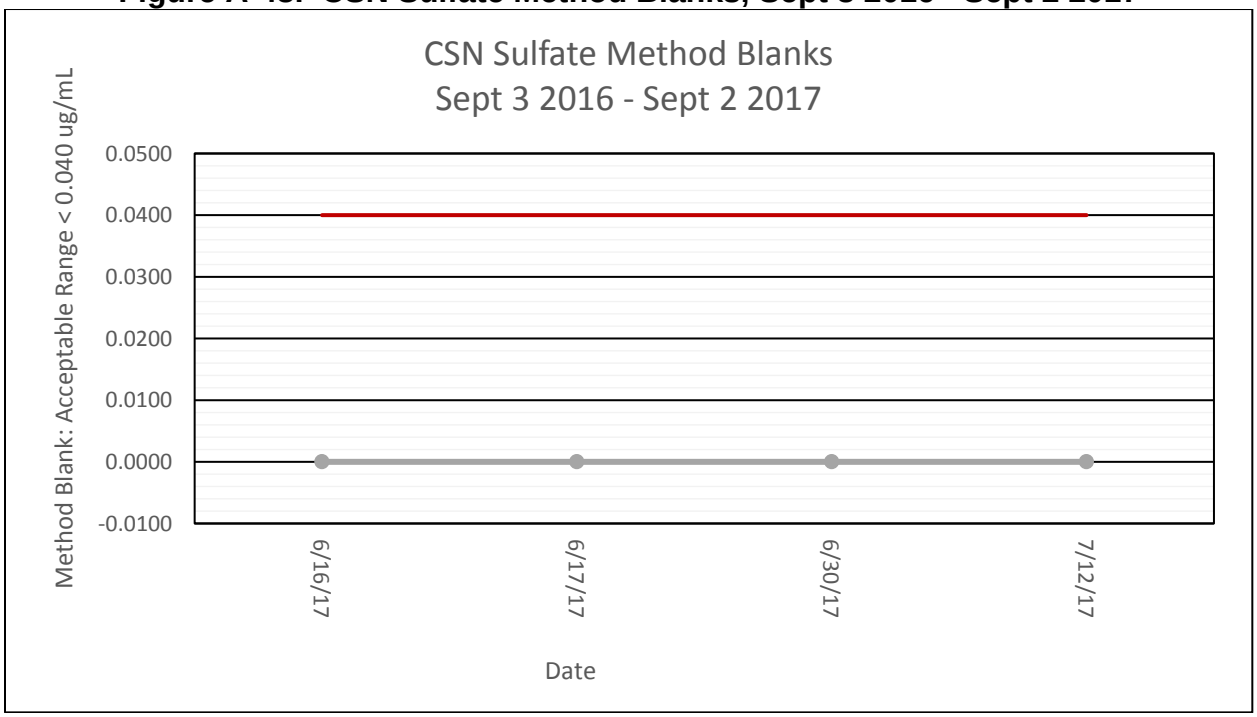


Figure A-48. CSN Sulfate Method Blanks, Sept 3 2016 - Sept 2 2017



Appendix B

Room Condition Control Charts

Figure B-1. Daily Averages, November 16, 2015 to September 2, 2016

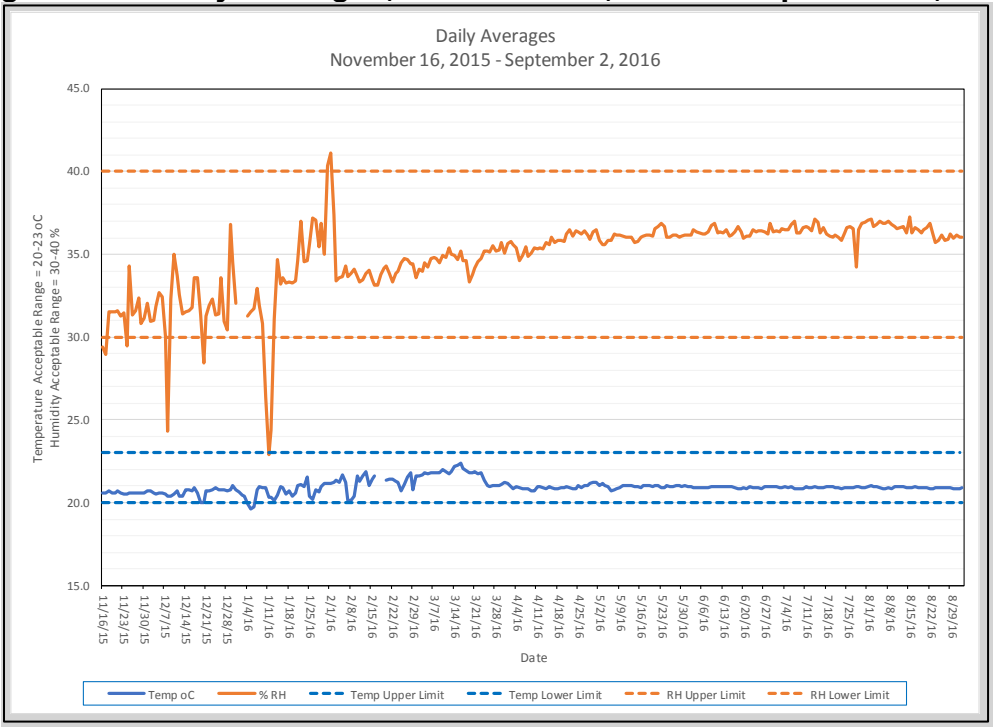


Figure B-2. Daily Averages, September 3, 2016 to September 2, 2017

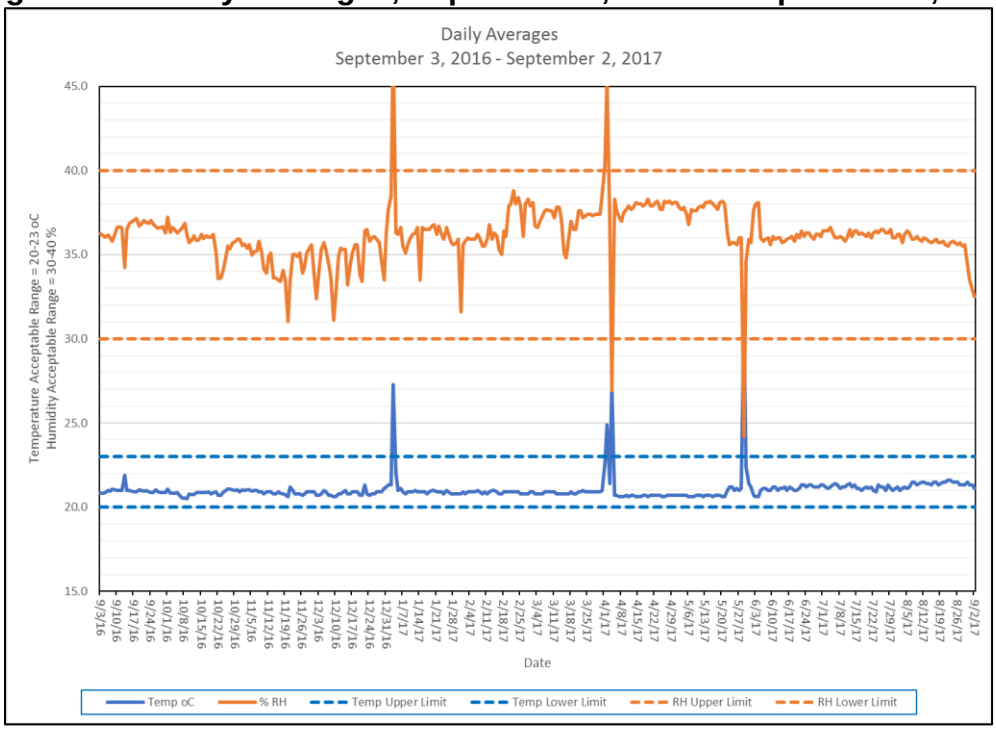


Figure B-3. Mass Duplicates, Nov 16, 2015-September 2, 2016

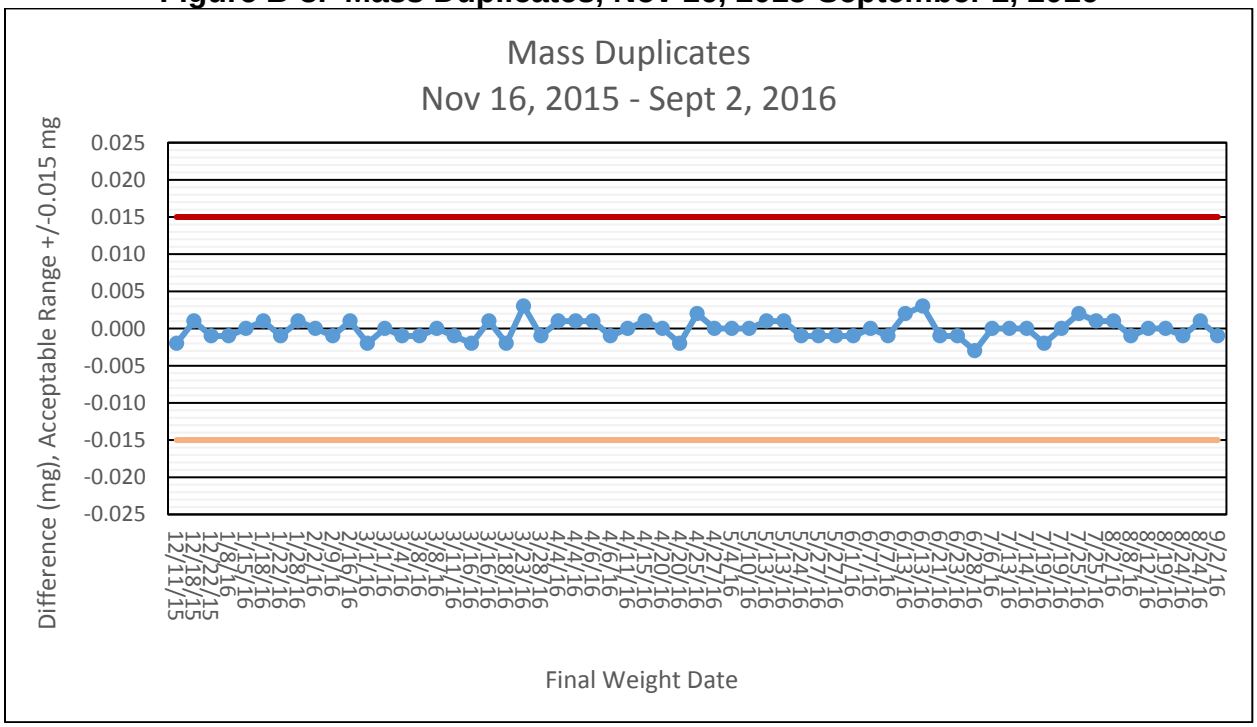


Figure B-4. Mass Duplicates, Sept 3, 2016-Sept 2, 2017

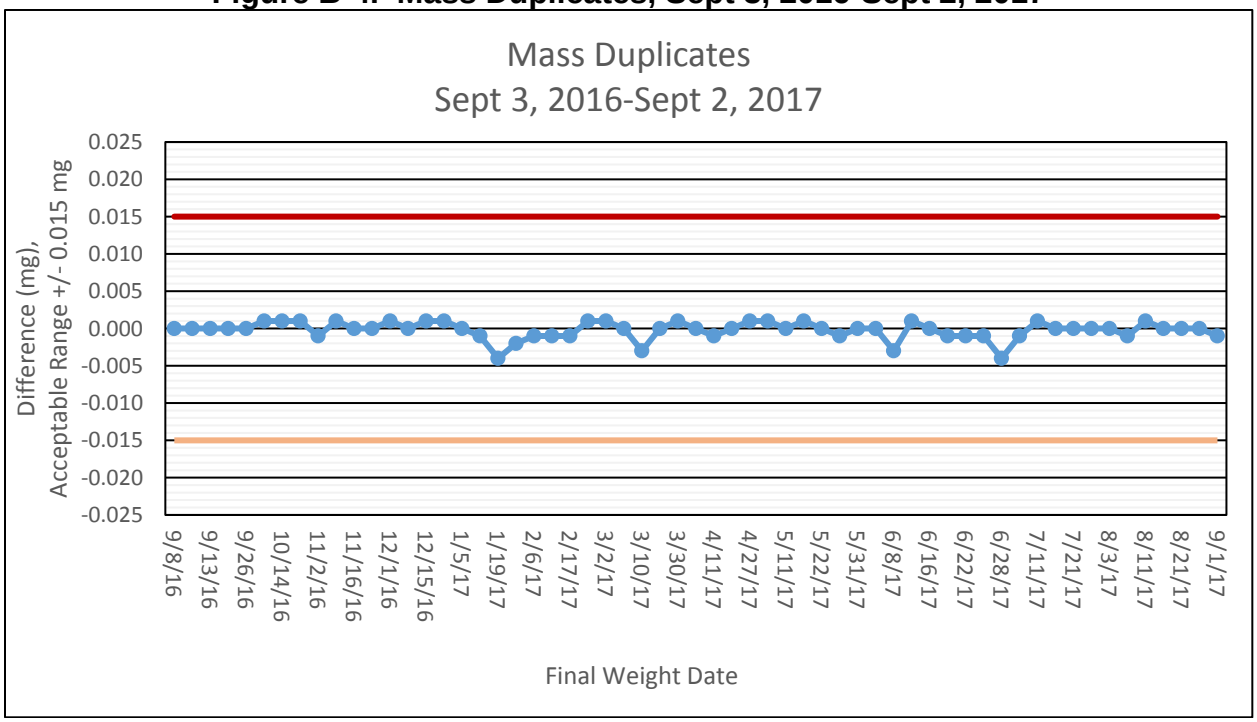


Figure B-5. Mass 300 mg SRM, Nov 16, 2015-Sept 02, 2016

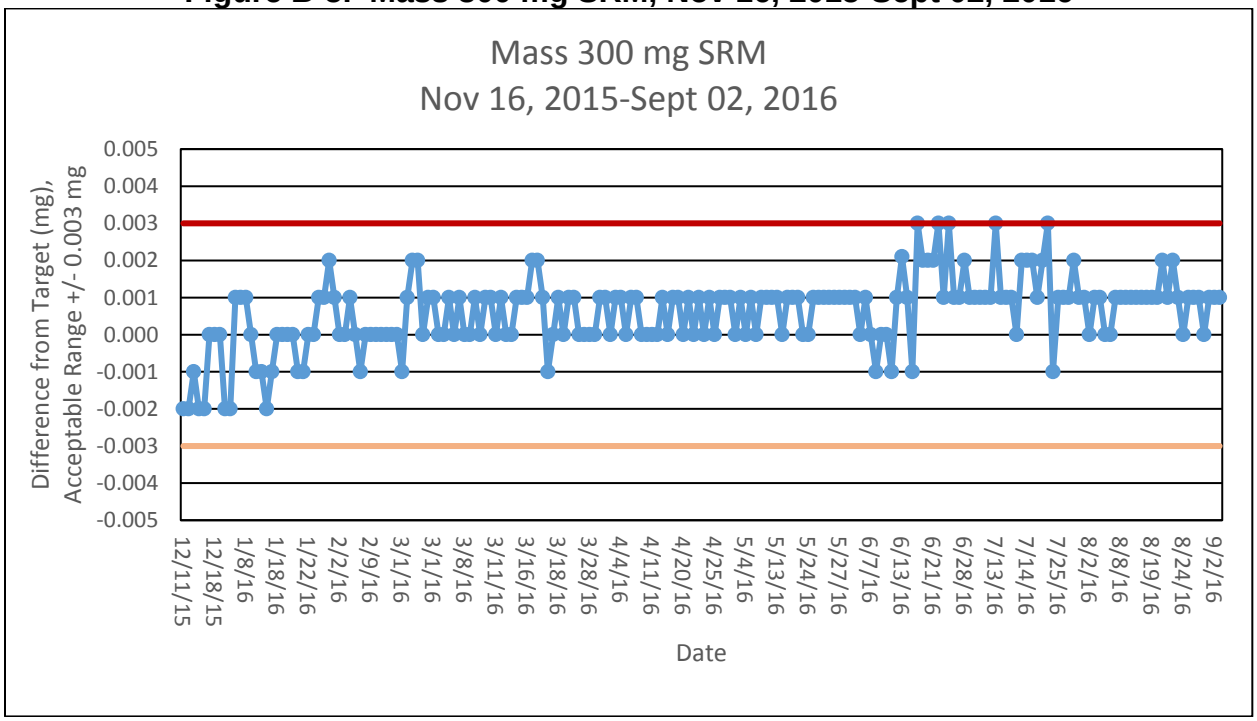


Figure B-6. Mass 300 mg SRM, Sept 3, 2016-Sept 2 2017

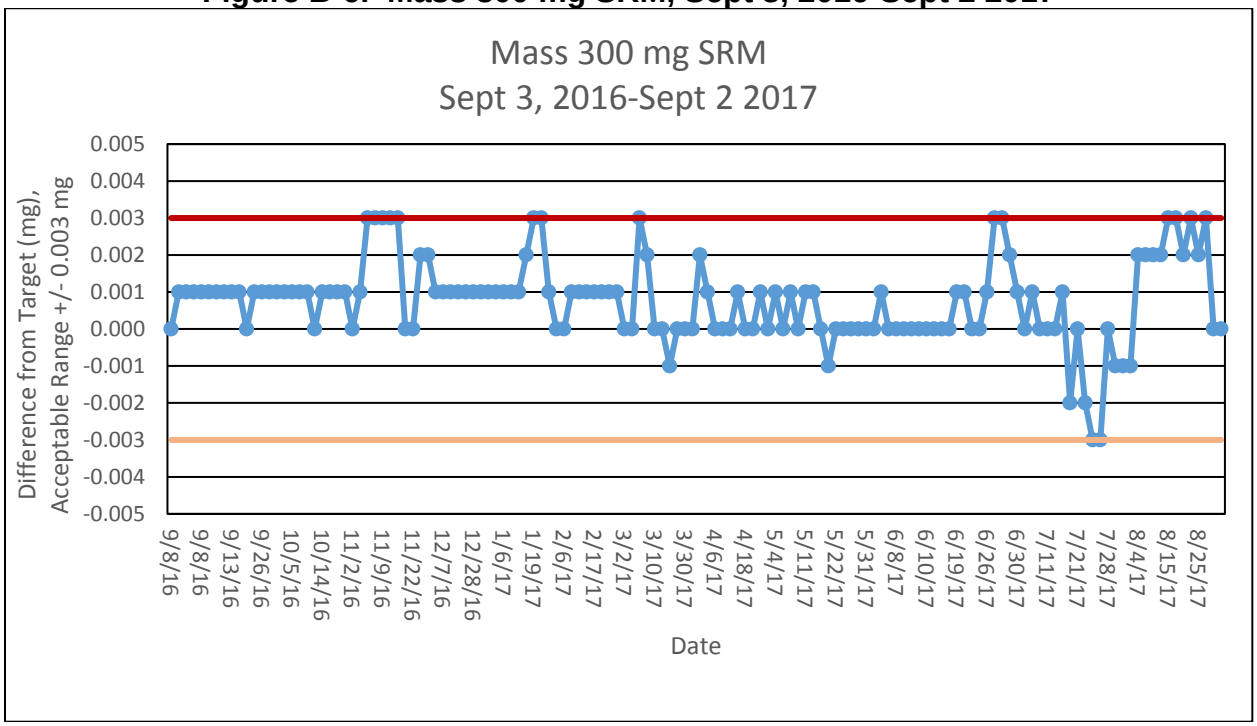


Figure B-7. Mass 500 mg SRM, Nov 16, 2015-Sept 02, 2016

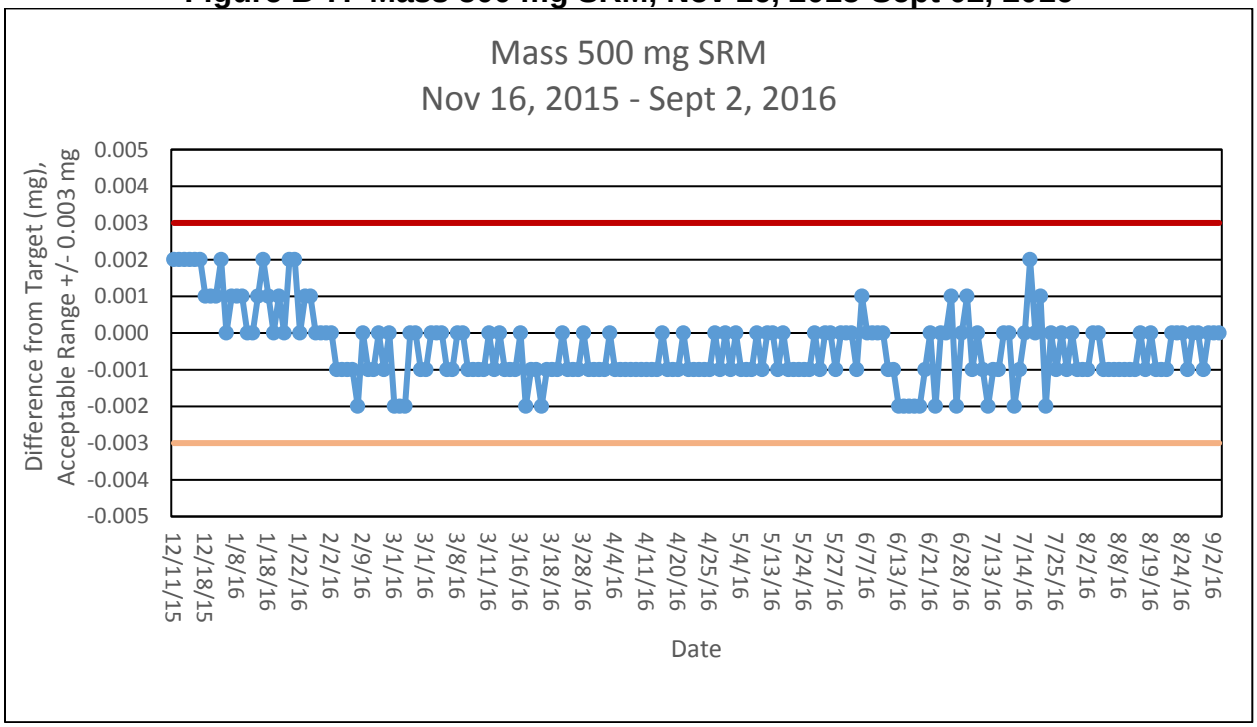
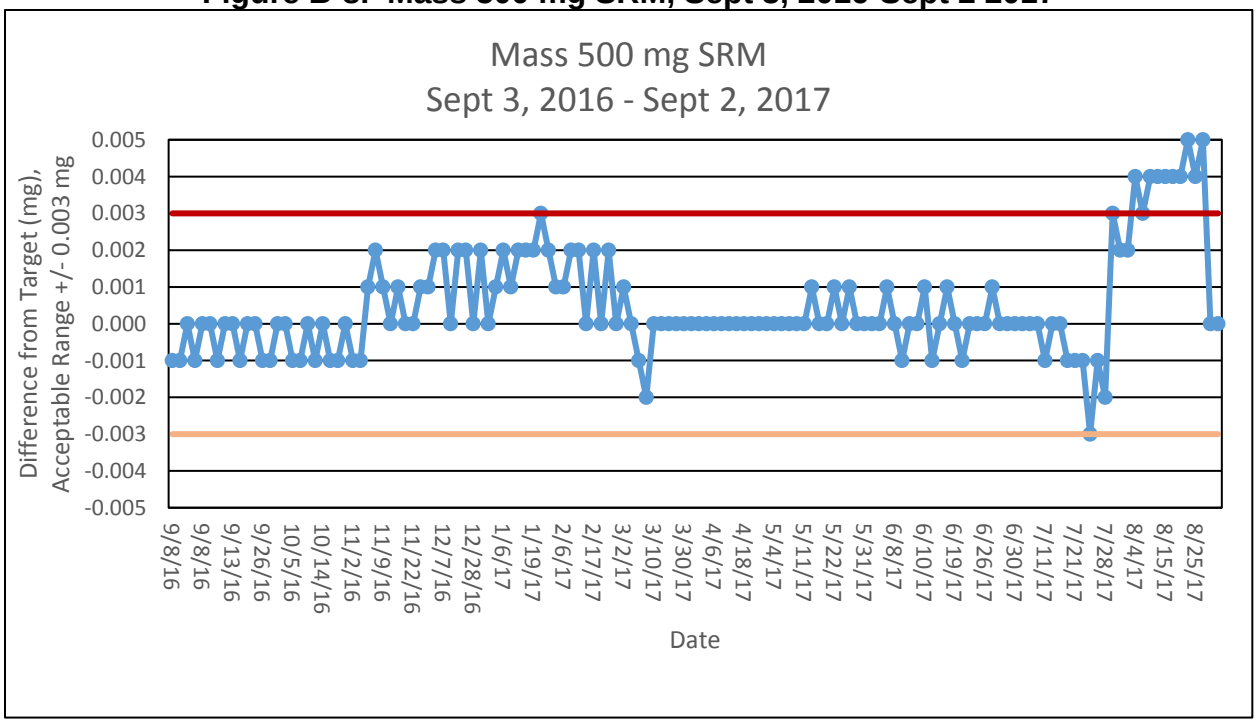


Figure B-8. Mass 500 mg SRM, Sept 3, 2016-Sept 2 2017



Note regarding out of acceptance limit readings in August 2017: 300 mg SRM was acceptable. Masses were sent for recertification. See CA-0074 for additional information.

Figure B-9. Mass Lab Blanks, Nov 16, 2015-September 2, 2016

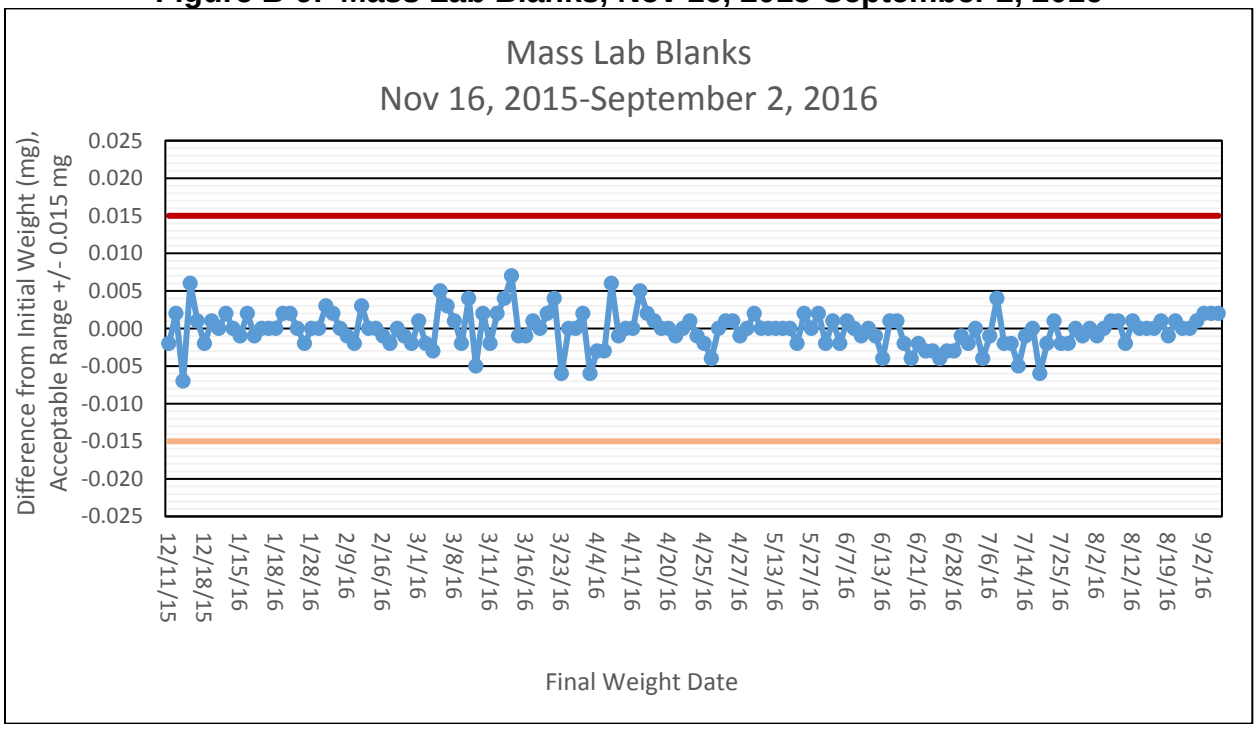


Figure B-10. Mass Lab Blanks, Sept 3, 2016-Sept 2, 2017

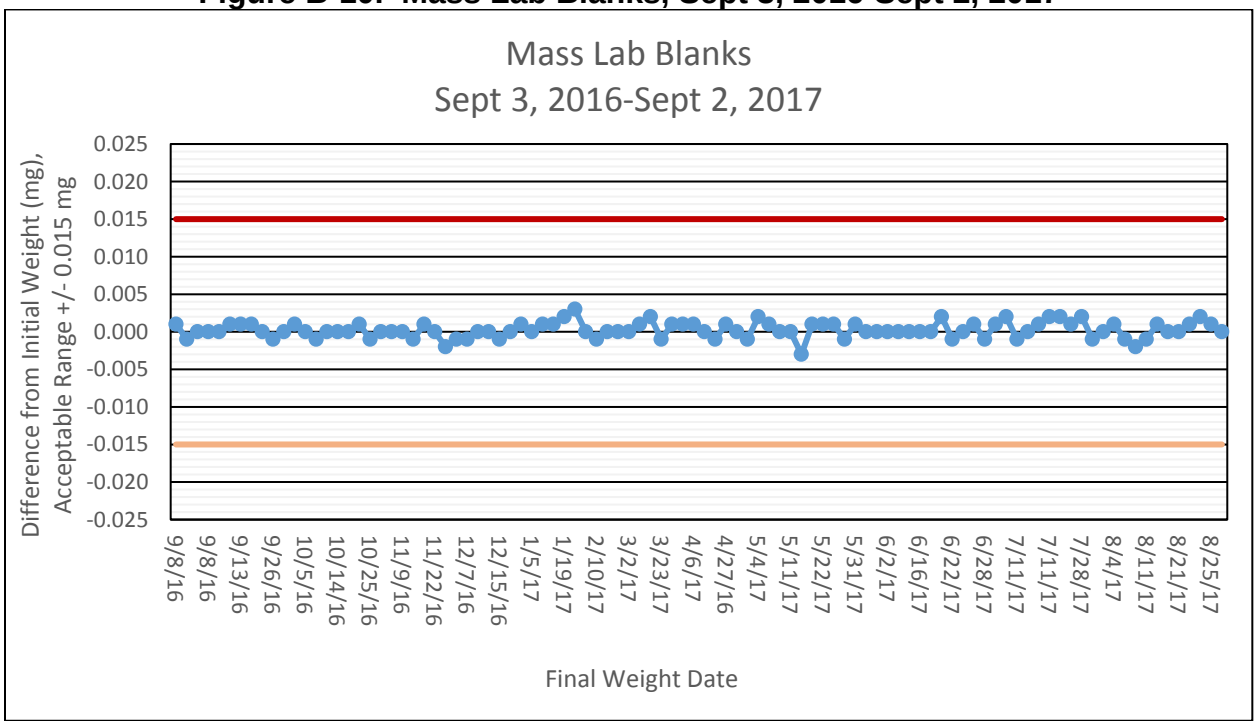


Figure B-11. Mass Field Blanks, Nov 16, 2015 – Sept 2, 2016

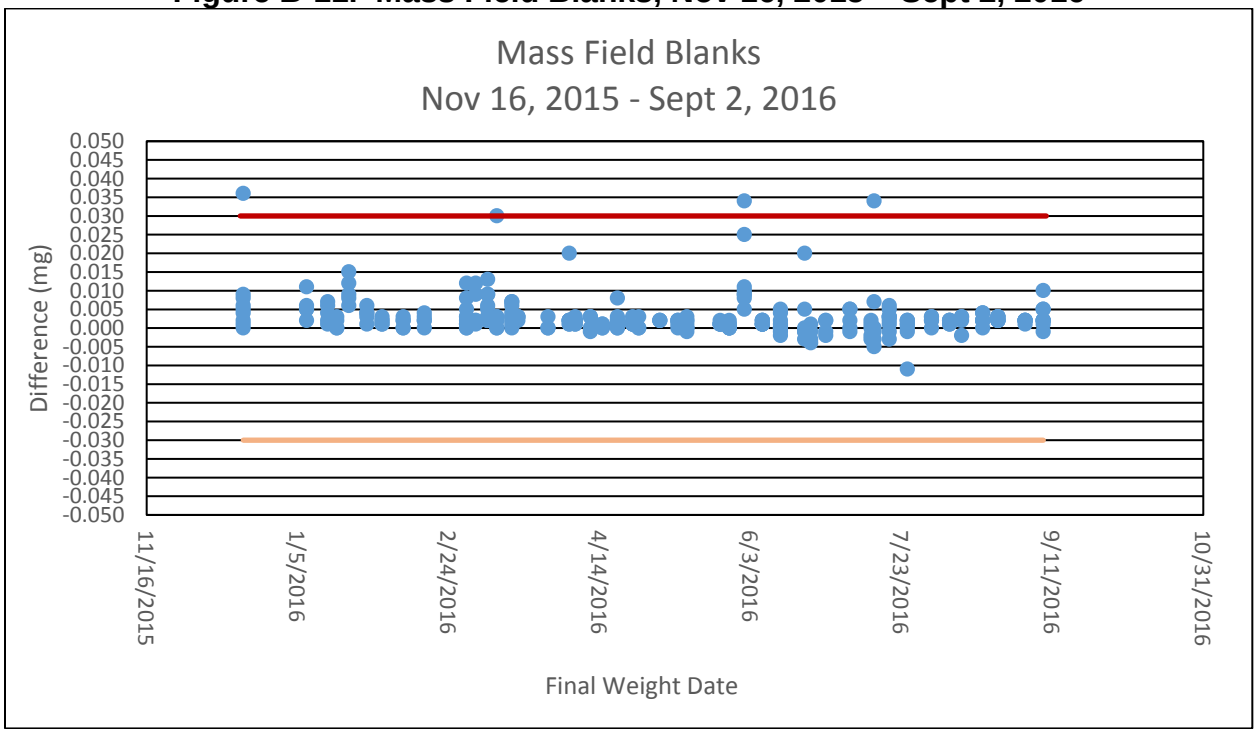
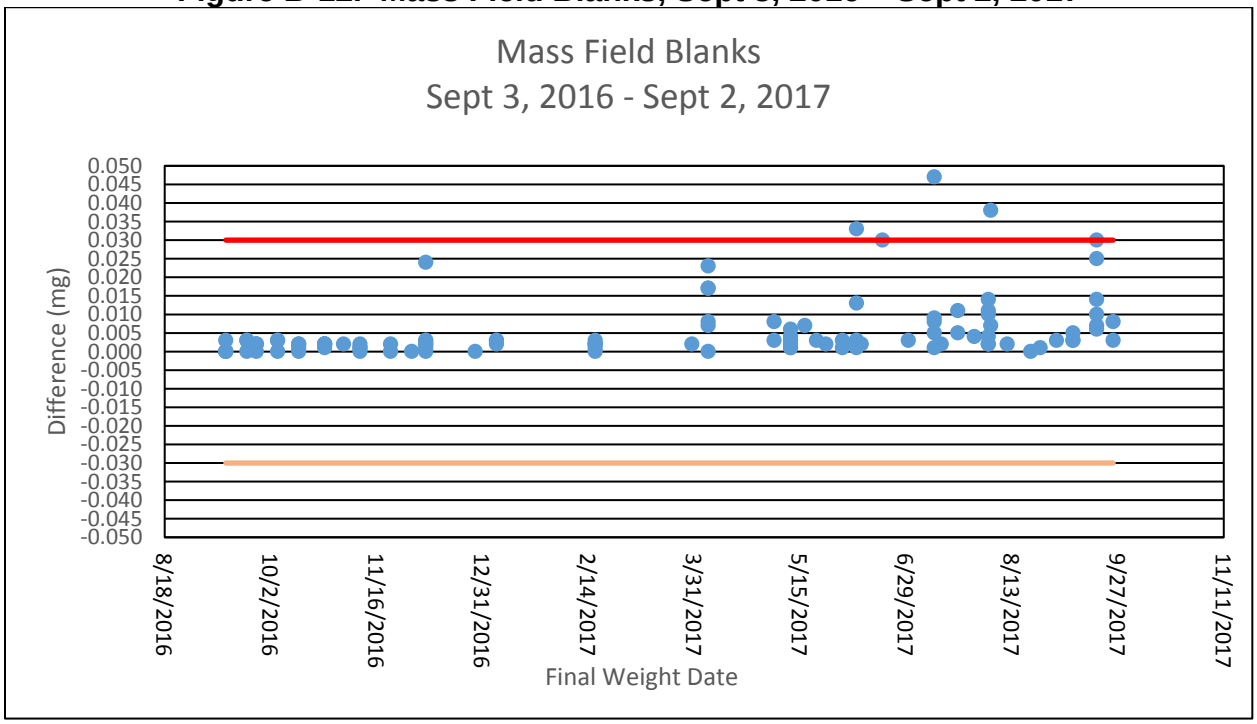


Figure B-12. Mass Field Blanks, Sept 3, 2016 – Sept 2, 2017



Appendix C

Quartz Acceptance Testing Batch QC Data

***In figures C-1 to C-5, control quantity was not included in Table**
***All control quantity data units are in µgC/cm^2**

Figure C-1. Quartz Acceptance Testing Batch QC Data – 10/27/15

TABLE 1:

Pallflex QAT-UP Filter Record: 102715

Filter Type	Size	Date of Pre-firing	Date of Acceptance Test	Pallflex Lot ID	DRI Lot ID	Quantity/ Lot	Control Quantity
Pall QAT-UP	25 mm	101415	102215	57631	CQ0001	90	2
Pall QAT-UP	25 mm	101415	102215	19877	CQ0002	95	2
Pall QAT-UP	25 mm	101415	102215	19877	CQ0003	97	2
Pall QAT-UP	25 mm	101415	102215	19877	CQ0004	95	2
Pall QAT-UP	25 mm	101415	102215	19877	CQ0005	94	2
Pall QAT-UP	25 mm	101415	102215	19877	CQ0006	97	2
Pall QAT-UP	25 mm	101915	102215	19877	CQ0007	97	2
Pall QAT-UP	25 mm	101915	102215	19877	CQ0008	98	2
Pall QAT-UP	25 mm	101915	102215	19877	CQ0009	97	2
Pall QAT-UP	25 mm	101915	102215	19877	CQ0010	97	2
Pall QAT-UP	25 mm	101915	102215	19877	CQ0011	97	2
Pall QAT-UP	25 mm	101915	102215	19790	CQ0012	93	2
					Total	1147	

Figure C-2. Quartz Acceptance Testing Batch QC Data – 11-23-15

TABLE 1:

Pallflex QAT-UP Filter Record: 112315

Filter Type	Size	Date of Pre-firing	Date of Acceptance Test	Pallflex Lot ID	DRI Lot ID	Quantity/ Lot	Control Quantity
Pall QAT-UP	25 mm	110515	112315	19790	CQ0013	95	2
Pall QAT-UP	25 mm	110515	112315	19790	CQ0014	96	2
Pall QAT-UP	25 mm	110515	112315	19790	CQ0015	96	2
Pall QAT-UP	25 mm	110515	112315	19790	CQ0016	89	2
Pall QAT-UP	25 mm	111715	112315	19790	CQ0017	98	2
Pall QAT-UP	25 mm	111715	112315	19790	CQ0018	97	2
Pall QAT-UP	25 mm	111715	112315	19790	CQ0019	97	2
Pall QAT-UP	25 mm	111715	112315	19790	CQ0020	98	2
Pall QAT-UP	25 mm	111715	112315	19790	CQ0021	95	2
					Total	861	

Figure C-3. Quartz Acceptance Testing Batch QC Data – 12/15/15

TABLE 1:

Pallflex QAT-UP Filter Record: 121515

Filter Type	Size	Date of Pre-firing	Date of Acceptance Test	Pallflex Lot ID	DRI Lot ID	Quantity/ Lot	Control Quantity
Pall QAT-UP	25 mm	120915	121115	19877	CQ0022	94	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0023	96	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0024	97	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0025	98	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0026	98	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0027	95	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0028	95	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0029	89	2
Pall QAT-UP	25 mm	120915	121115	19877	CQ0030	98	2
						Total	860

Figure C-4. Quartz Acceptance Testing Batch QC Data – 01/13/16

TABLE 1:

Pallflex QAT-UP Filter Record: 011316

Filter Type	Size	Date of Pre-firing	Date of Acceptance Test	Pallflex Lot ID	DRI Lot ID	Quantity/ Lot	Control Quantity
Pall QAT-UP	25 mm	122815	122915	19955	CQ0031	94	2
Pall QAT-UP	25 mm	122815	122915	19955	CQ0032	94	2
Pall QAT-UP	25 mm	122815	122915	19955	CQ0033	94	2
Pall QAT-UP	25 mm	122815	122915	19955	CQ0034	77	2
Pall QAT-UP	25 mm	122815	122915	19955	CQ0035	75	2
Pall QAT-UP	25 mm	122815	122915	19955	CQ0036	72	2
Pall QAT-UP	25 mm	010516	010616	19955	CQ0037	76	2
Pall QAT-UP	25 mm	010516	010616	19955	CQ0038	97	2
Pall QAT-UP	25 mm	010516	010616	19955	CQ0039	78	2
Pall QAT-UP	25 mm	010516	010616	19955	CQ0040	76	2
Pall QAT-UP	25 mm	010516	010616	19955	CQ0041	85	2
Pall QAT-UP	25 mm	010516	010616	19955	CQ0042	95	2
						Total	1013

Figure C-5. Quartz Acceptance Testing Batch QC Data – 02/08/16

TABLE 1:

Pallflex QAT-UP Filter Record: 020816

Filter Type	Size	Date of Pre-firing	Date of Acceptance Test	Pallflex Lot ID	DRI Lot ID	Quantity/ Lot	Control Quantity
Pall QAT-UP	25 mm	011416	011516	19955	CQ0043	96	2
Pall QAT-UP	25 mm	011416	011516	19955	CQ0044	96	2
Pall QAT-UP	25 mm	011416	011516	19955	CQ0045	95	2
Pall QAT-UP	25 mm	011416	011516	19955	CQ0046	93	2
Pall QAT-UP	25 mm	011416	011516	19955	CQ0047	96	2
Pall QAT-UP	25 mm	011416	011516	19955	CQ0048	93	2
Pall QAT-UP	25 mm	012016	012116	19957	CQ0049	93	2
Pall QAT-UP	25 mm	012016	012116	19957	CQ0050	93	2
Pall QAT-UP	25 mm	012016	012116	19957	CQ0051	96	2
Pall QAT-UP	25 mm	012016	012116	19957	CQ0052	95	2
Pall QAT-UP	25 mm	012016	012116	19957	CQ0053	97	2
Pall QAT-UP	25 mm	012016	012116	19957	CQ0054	96	2
						Total	1139

BK/JTen

Figure C-6. Quartz Acceptance Testing Batch QC Data – 03/07/16

3/7/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results					
						Control 1			Control 2		
						OC	E C	TC	OC	E C	TC
CQ0055	19957	95	2	12616	12916	0	0	0	0.13	0	0.13
CQ0056	19957	93	2	12616	12916	0.21	0	0.21	0.03	0	0.03
CQ0057	19957	89	2	12616	12916	0.01	0	0.01	0.25	0	0.25
CQ0058	19957	83	2	12616	12916	0.05	0	0.05	0	0.37	0.37
CQ0059	19957	83	2	12616	12916	0.07	0	0.07	0	0	0
CQ0060	19957	91	2	12616	12916	0.01	0	0.01	0.23	0	0.23
CQ0061	19957	98	2	20816	30316	0.07	0	0.07	0.16	0	0.16
CQ0062	19957	98	2	20816	30316	0.34	0	0.34	0.65	0	0.65
CQ0063	19957	96	2	20816	30316	0.34	0	0.34	0.26	0	0.26
CQ0064	19957	98	2	20816	30316	0.05	0	0.06	0.17	0	0.17
CQ0065	19957	96	2	20816	30316	0.27	0	0.27	0.36	0	0.36
CQ0066	19957	96	2	20816	30316	0.1	0	0.1	0.11	0	0.11
	Total	1116									

KAL/BSC

Figure C-7. Quartz Acceptance Testing Batch QC Data – 04/05/16

4/5/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0067	19957	94	2	02/17/16	03/03/16	0.16	0	0.16	0.04	0	0.04
CQ0068	19957	93	2	02/17/16	03/03/16	0.19	0.06	0.19	0.1	0	0.1
CQ0069	19957	94	2	02/17/16	03/03/16	0.17	0	0.17	0.05	0	0.05
CQ0070	19957	96	2	02/17/16	03/03/16	0.04	0	0.04	0.2	0.21	0.4
CQ0071	19957	94	2	02/17/16	03/03/16	0.09	0	0.09	0.01	0	0.01
CQ0072	19957	90	2	02/17/16	03/03/16	0.14	0.11	0.25	0.07	0	0.07
CQ0073	19957	95	2	03/02/16	03/03/16	0	0.04	0.04	0.24	0	0.24
CQ0074	19957	98	2	03/02/16	03/03/16	0.08	0	0.08	0	0	0
CQ0075	19957	90	2	03/02/16	03/03/16	0.26	0	0.26	0.12	0	0.12
CQ0076	19957	95	2	03/02/16	03/03/16	0.2	0	0.2	0.19	0	0.19
CQ0077	19957	90	2	03/02/16	03/03/16	0	0.05	0.05	0	0	0
CQ0078	19957	95	2	03/02/16	03/03/16	0.83	0	0.84	0.23	0	0.23
	Total	1124									

KAL/BM

Figure C-8. Quartz Acceptance Testing Batch QC Data – 05/02/16

5/2/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0079	19957	96	2	03/14/16	04/28/16	0.26	0	0.26	0.3	0	0.3
CQ0080	19957	96	2	03/14/16	04/28/16	0.26	0	0.26	0.45	0.01	0.46
CQ0081	19957	97	2	03/14/16	04/28/16	0.49	0	0.49	0.15	0	0.15
CQ0082	19957	96	2	03/14/16	04/28/16	0.18	0	0.18	0.2	0.08	0.28
CQ0083	19957	91	2	03/14/16	04/28/16	0.23	0	0.23	0.33	0	0.33
CQ0084	19957	87	2	03/14/16	04/28/16	0.24	0	0.24	0.22	0	0.22
CQ0085	19957	96	2	03/22/16	04/28/16	0.21	0	0.21	0.17	0	0.17
CQ0086	19957	97	2	03/22/16	04/28/16	0.18	0	0.18	0.3	0	0.3
CQ0087	19957	91	2	03/22/16	04/28/16	0.18	0	0.18	0.44	0	0.44
CQ0088	19957	95	2	03/22/16	04/28/16	0.14	0	0.14	0.12	0	0.12
CQ0089	19957	93	2	03/22/16	04/28/16	0.37	0	0.37	0.34	0	0.34
CQ0090	19957	93	2	03/22/16	04/28/16	1.06	0	1.06	0.23	0	0.23
	Total	1128									

KAL/ABC

Figure C-9. Quartz Acceptance Testing Batch QC Data – 06/06/16

6/6/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
Q0091	19957	97	2	04/24/16	04/28/16	0.18	0	0.18	0.12	0	0.12
Q0092	19957	92	2	04/24/16	04/28/16	0.15	0	0.15	0.21	0	0.21
Q0093	19957	89	2	04/24/16	04/28/16	0.06	0	0.06	0.21	0	0.21
Q0094	19957	92	2	04/24/16	04/28/16	0.37	0	0.37	0.07	0	0.07
Q0095	19957	92	2	04/24/16	04/28/16	0.43	0	0.43	0.28	0	0.28
Q0096	19957	89	2	04/24/16	04/28/16	0.1	0	0.1	0.36	0.01	0.37
Q0097	19955	93	2	04/26/16	04/28/16	0.14	0	0.14	0.2	0	0.2
Q0098	19957	92	2	04/26/16	04/28/16	0.06	0	0.06	0.26	0.01	0.27
Q0099	19957	92	2	04/26/16	04/28/16	0.12	0	0.12	0.18	0	0.18
Q0100	19957	93	2	04/26/16	04/28/16	0	0	0	0.09	0	0.09
Q0101	19957	92	2	04/26/16	04/28/16	0.08	0	0.076	0.39	0	0.39
Q0102	19957	91	2	04/26/16	04/28/16	0	0	0	0.25	0	0.25
	Total	1104									

KAL/abc

Figure C-10. Quartz Acceptance Testing Batch QC Data – 07/06/16

7/6/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
Q0103	19955	92	2	05/11/16	06/29/16	0	0	0	0	0	0.27
Q0104	19955	75	2	05/11/16	06/29/16	0	0	0	0	0	0.034
Q0105	19955	92	2	05/11/16	06/29/16	0	0	0.02	0	0	0.08
Q0106	19955	91	2	05/11/16	06/29/16	0	0	0.013	0	0	0
Q0107	19955	90	2	05/11/16	06/29/16	0	0	0	0	0	0
Q0108	19955	93	2	05/11/16	06/29/16	0	0	0	0	0	0
Q0109	19790	98	2	05/18/16	06/29/16	0.05	0	0.05	0	0	0
Q0110	19790	97	2	05/18/16	06/29/16	0	0	0	0	0	0
Q0111	19790	98	2	05/18/16	06/29/16	0	0.08	0.4	0	0	0
Q0112	19790	93	2	05/18/16	06/29/16	0	0	0	0.15	0.15	1.3
Q0113	19790	98	2	05/18/16	06/30/16	0.43	0	0.43	0.43	0	0.43
Q0114	19790	98	2	05/18/16	06/30/16	0.56	0.03	0.59	0.15	0	0.15
	Total	1115									

KAL/abc

Figure C-11. Quartz Acceptance Testing Batch QC Data – 08/03/16

8/3/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0115	19955	94	2	05/25/16	06/30/16	0.18	0	0.18	0.14	0	0.14
CQ0116	19955	97	2	05/25/16	06/30/16	0.42	0	0.42	0.1	0	0.1
CQ0117	19955	97	2	05/25/16	06/30/16	0	0	0	0	0	0
CQ0118	19790	96	2	07/26/16	07/29/16	0	0	0	0	0	0
CQ0119	19790	95	2	07/26/16	07/29/16	0.29	0	0.29	0.19	0	0.191
CQ0120	19790	98	2	07/26/16	07/29/16	0	0	0	0.35	0	0.35
CQ0121	19790	95	2	07/26/16	07/29/16	0.09	0	0.087	0	0	0
CQ0122	19790	98	2	07/26/16	07/29/16	0	0	0	0.21	0	0.21
CQ0123	19790	97	2	07/26/16	07/29/16	0	0	0	0.22	0	0.219
CQ0124	19790	96	2	07/27/16	07/30/16	0.78	0	0.78	0.08	0	0.08
CQ0125	19790	80	2	07/27/16	07/30/16	0	0	0	0	0	0
CQ0126	19790	96	2	07/27/16	07/30/16	0	0	0	0	0	0
	Total	1139	KAL/ABC								

Figure C-12. Quartz Acceptance Testing Batch QC Data – 09/07/16

9/7/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0127	19790	96	2	07/27/16	07/30/16	0	0	0	0.12	0	0.118
CQ0128	19790	94	2	07/27/16	07/30/16	0.03	0	0.029	0.44	0	0.44
CQ0129	19790	96	2	07/27/16	07/30/16	0.02	0	0.02	0.09	0	0.087
CQ0130	19790	94	2	08/23/16	09/03/16	0.07	0	0.07	0	0	0
CQ0131	19790	98	2	08/23/16	09/03/16	0	0	0	0	0	0
CQ0132	19790	98	2	08/23/16	09/03/16	0	0	0	0	0	0
CQ0133	19790	97	2	08/30/16	09/03/16	0	0	0	0	0	0
CQ0134	19790	97	2	08/30/16	09/03/16	0.04	0	0.041	0	0	0
CQ0135	19790	97	2	08/30/16	09/03/16	0.03	0	0.032	0	0	0
CQ0136	19790	95	2	09/01/16	09/03/16	0.11	0	0.113	0	0	0
CQ0137	19790	95	2	09/01/16	09/03/16	0.08	0	0.081	0	0	0
CQ0138	19790	98	2	09/01/16	09/03/16	0	0	0	0.21	0	0.205
	Total	1155	KAL/JHen								

Figure C-13. Quartz Acceptance Testing Batch QC Data – 10/03/16

10/3/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 EC	Control 1 TC	Control 2 OC	Control 2 EC	Control 2 TC
CQ0139	19790	98	2	09/15/16	09/30/16	0.15	0	0.15	0.03	0	0.03
CQ0140	19877	96	2	09/15/16	09/30/16	0.46	0	0.46	0	0	0
CQ0141	19877	96	2	09/15/16	09/30/16	0	0	0	0.075	0	0.075
CQ0142	19763	95	2	09/19/16	09/30/16	0.04	0	0.04	0	0	0
CQ0143	19763	96	2	09/19/16	09/30/16	0.65	0	0.65	0	0	0
CQ0144	19877	96	2	09/19/16	09/30/16	0	0	0	0	0	0
CQ0145	19790	98	2	09/26/16	09/30/16	0.30	0	0.30	0	0	0
CQ0146	19790	94	2	09/26/16	09/30/16	0.11	0	0.11	0	0	0
CQ0147	19790	96	2	09/26/16	09/30/16	0.025	0	0.025	0.061	0	0.061
CQ0148	19790	98	2	09/27/16	09/30/16	0.038	0	0.038	0	0	0
CQ0149	19790	95	2	09/27/16	09/30/16	0.133	0	0.133	0.199	0	0.199
CQ0150	19790	98	2	09/27/16	09/30/16	0.06	0	0.06	0	0	0
	Total	1156									

Figure C-14. Quartz Acceptance Testing Batch QC Data – 12/05/16

12/5/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 EC	Control 1 TC	Control 2 OC	Control 2 EC	Control 2 TC
CQ0163	19790	98	2	11/02/16	12/02/16	0	0	0	0.21	0	0.209
CQ0164	19790	96	2	11/02/16	12/02/16	0.18	0	0.183	0.17	0	0.165
CQ0165	19790	96	2	11/02/16	12/02/16	0	0	0	0.22	0	0.2249
CQ0166	19790	94	2	11/08/16	12/02/16	0.05	0	0.05	0.25	0	0.249
CQ0167	20171	92	2	11/08/16	12/02/16	0	0	0	0.3	0	0.302
CQ0168	20171	89	2	11/08/16	12/02/16	0.09	0	0.09	0.12	0	0.125
CQ0169	20171	96	2	11/16/16	12/03/16	0.093	0	0.093	0.092	0	0.092
CQ0170	20171	96	2	11/16/16	12/03/16	0	0	0	0	0	0
CQ0171	20171	94	2	11/16/16	12/03/16	0.004	0	0.004	0.23	0	0.23
CQ0172	19877	96	2	11/22/16	12/03/16	0	0	0	0	0	0
CQ0173	19877	92	2	11/22/16	12/03/16	0.097	0	0.097	0	0	0
CQ0174	19877	97	2	11/22/16	12/03/16	0.004	0	0.004	0.08	0	0.08
	Total	1136									

Figure C-15. Quartz Acceptance Testing Batch QC Data – 12/19/16

12/19/2016

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0175	19877	95	2	12/06/16	12/16/16	0.08	0	0.08	0.08	0	0.083
CQ0176	19877	95	2	12/06/16	12/16/16	0.14	0	0.142	0	0	0
CQ0177	19877	92	2	12/06/16	12/16/16	0.03	0	0.025	0.48	0	0.481
CQ0178	19877	96	2	12/06/16	12/16/16	0	0	0	0.12	0	0.124
CQ0179	19877	96	2	12/06/16	12/16/16	0	0	0	0.5	0.01	0.515
CQ0180	19877	94	2	12/06/16	12/16/16	0	0	0	0.11	0	0.114
CQ0181	19877	98	2	12/13/16	12/16/16	0	0	0	0.18	0	0.184
CQ0182	19877	96	2	12/13/16	12/16/16	0.09	0	0.094	0.47	0	0.466
CQ0183	19877	84	2	12/13/16	12/16/16	0	0	0	0	0	0
CQ0184	19877	98	2	12/13/16	12/16/16	0	0	0.004	0.12	0	0.124
CQ0185	19877	96	2	12/13/16	12/16/16	0.25	0	0.248	0.16	0	0.158
CQ0186	19877	97	2	12/13/16	12/16/16	0	0	0	0	0	0
	Total	1137									

Figure C-16. Quartz Acceptance Testing Batch QC Data – 01/24/17

1/24/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0187	20171	92	2	12/29/16	01/22/17	0.18	0	0.177	0.35	0	0.347
CQ0188	20171	96	2	12/29/16	01/22/17	0.23	0	0.226	0.26	0	0.258
CQ0189	20171	89	2	12/29/16	01/22/17	0.11	0	0.113	0.05	0	0.045
CQ0190	20213	94	2	01/03/17	01/22/17	1.07	0.15	1.22	0.22	0	0.22
CQ0191	20213	91	2	01/03/17	01/22/17	0.19	0	0.187	0.02	0	0.017
CQ0192	20213	91	2	01/03/17	01/22/17	0.061	0	0.061	0.1241	0	0.1241
CQ0193	20213	92	2	01/10/17	01/24/17	0.0138	0	0.0138	0	0	0
CQ0194	20213	90	2	01/10/17	01/24/17	0.0162	0	0.0162	0.0894	0	0.0894
CQ0195	20213	90	2	01/10/17	01/24/17	0	0	0	0.0648	0	0.0648
CQ0196	20213	86	2	01/18/17	01/24/17	0	0	0	0.0091	0	0.0091
CQ0197	20213	88	2	01/18/17	01/24/17	0.0048	0	0.0048	0.1324	0	0.1324
CQ0198	20213	92	2	01/18/17	01/24/17	0	0	0	0.2785	0	0.2785
	Total	1091									

Figure C-17. Quartz Acceptance Testing Batch QC Data – 02/27/17

2/27/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0199	20171	94	2	01/30/17	02/25/17	0.15	0	0.15	0.06	0	0.06
CQ0200	20171	95	2	01/30/17	02/25/17	0.0086	0	0.009	0	0	0
CQ0201	20171	96	2	01/30/17	02/25/17	0	0	0	0	0	0
CQ0202	20171	98	2	02/07/17	02/25/17	0.04	0	0.04	0.03	0	0.03
CQ0203	20171	96	2	02/07/17	02/25/17	0	0	0	0.07	0	0.07
CQ0204	20171	94	2	02/07/17	02/25/17	0	0	0	0.05	0	0.05
CQ0205	20171	92	2	02/14/17	02/25/17	0	0	0	0	0	0
CQ0206	20171	95	2	02/14/17	02/25/17	0.099	0	0.099	0.19	0	0.19
CQ0207	20171	94	2	02/14/17	02/25/17	0	0	0	0.08	0	0.08
CQ0208	20171	96	2	02/21/17	02/25/17	0.11	0	0.11	0	0	0
CQ0209	20171	96	2	02/21/17	02/25/17	0	0	0	0.01	0	0.01
CQ0210	20171	97	2	02/21/17	02/25/17	0	0	0	0	0	0
	Total	1143	KAL/KN								

Figure C-18. Quartz Acceptance Testing Batch QC Data – 03/27/17

3/27/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results: Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0211	20171	98	2	02/28/17	03/24/17	0.5169	0	0.5169	0.4402	0	0.4402
CQ0212	20171	96	2	02/28/17	03/24/17	0.8898	0	0.8898	0	0	0
CQ0213	20171	96	2	02/28/17	03/24/17	0.0665	0	0.0665	0	0	0
CQ0214	20171	92	2	03/06/17	03/24/17	0.1352	0	0.1352	0.2137	0	0.2137
CQ0215	20171	94	2	03/06/17	03/24/17	0.0713	0	0.0713	0	0	0
CQ0216	20171	97	2	03/06/17	03/24/17	0.313	0	0.313	0.0819	0	0.0819
CQ0217	20171	94	2	03/13/17	03/24/17	0.0786	0	0.0786	0.0325	0	0.0325
CQ0218	20171	95	2	03/13/17	03/24/17	0.4766	0	0.4767	0.2207	0	0.2207
CQ0219	20171	95	2	03/13/17	03/24/17	0.7363	0.004	0.7404	0	0	0
CQ0220	20171	76	2	03/14/17	03/24/17	0	0	0	0.0649	0	0.0649
CQ0221	20171	93	2	03/20/17	03/24/17	0.0626	0	0.0626	0.1363	0	0.1363
CQ0222	20171	96	2	03/20/17	03/24/17	0.3385	0	0.3385	0.1264	0	0.1264
	Total	1122	KL/KN								

Figure C-19. Quartz Acceptance Testing Batch QC Data – 04/26/17

4/26/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results					
						Control 1			Control 2		
						OC	E C	TC	OC	E C	TC
CQ0223	20171	94	2	03/20/17	04/25/17	0	0	0	0.1009	0	0.1009
CQ0224	19981	91	2	04/03/17	04/25/17	0.005	0	0.005	0.12	0	0.12
CQ0225	19981	92	2	04/03/17	04/25/17	0.07	0	0.07	0.09	0	0.09
CQ0226	19981	94	2	04/03/17	04/25/17	0.07	0	0.07	0	0	0
CQ0227	19981	96	2	04/05/17	04/25/17	0	0	0	0	0	0
CQ0228	19981	96	2	04/05/17	04/25/17	0.1	0	0.100	0.08	0.00	0.08
CQ0229	19981	97	2	04/05/17	04/25/17	0	0	0	0	0	0
CQ0230	20171	93	2	04/10/17	04/25/17	0.17	0	0.17	0	0	0
CQ0231	20171	92	2	04/10/17	04/25/17	0.06	0	0.06	0.15	0	0.15
CQ0232	20171	93	2	04/10/17	04/25/17	0.11	0	0.11	0	0	0
CQ0233	19981	92	2	04/17/17	04/25/17	0.13	0	0.13	0	0	0
CQ0234	19981	96	2	04/17/17	04/25/17	0	0	0	0	0	0
	Total	1126	KAL VN								

Figure C-20. Quartz Acceptance Testing Batch QC Data – 05/23/17

5/23/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results					
						Control 1			Control 2		
						OC	E C	TC	OC	E C	TC
CQ0235	19981	96	2	04/17/17	04/25/17	0	0	0	0.06	0	0.06
CQ0236	19981	94	2	04/26/17	05/16/17	0.08	0	0.08	0	0	0
CQ0237	19981	94	2	04/26/17	05/16/17	0	0	0	0	0	0
CQ0238	19981	89	2	04/26/17	05/16/17	0.09	0	0.09	0.07	0	0.07
CQ0239	20171	94	2	05/02/17	05/16/17	0	0	0	0	0	0
CQ0240	20171	92	2	05/02/17	05/16/17	0.07	0	0.07	0.09	0	0.09
CQ0241	20171	94	2	05/02/17	05/16/17	0	0	0	0	0	0
CQ0242	20325	96	2	05/05/17	05/16/17	0.18	0	0.18	0	0	0
CQ0243	20325	95	2	05/05/17	05/16/17	0	0	0	0.1	0	0.1
CQ0244	20325	94	2	05/05/17	05/16/17	0.09	0	0.09	0	0	0
CQ0245	20171	96	2	05/08/17	05/16/17	0.01	0	0.01	0.08	0	0.08
CQ0246	20171	94	2	05/08/17	05/16/17	0.09	0	0.09	0.1	0	0.1
	Total	1128	KAL VN								

Figure C-21. Quartz Acceptance Testing Batch QC Data - 06/19/17

6/19/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0247	20171	96	2	05/08/17	06/17/17	0	0	0	0.06	0	0.06
CQ0248	20213	91	2	05/17/17	06/17/17	0.3	0	0.3	0.11	0	0.11
CQ0249	20213	94	2	05/17/17	06/17/17	0	0	0	0	0	0
CQ0250	20213	92	2	05/17/17	06/17/17	0.23	0	0.23	0	0	0
CQ0251	20213	98	2	05/26/17	06/17/17	0.45	0	0.45	0.23	0	0.23
CQ0252	20213	97	2	05/26/17	06/19/17	0.08	0	0.08	0	0	0
CQ0253	20213	97	2	05/26/17	06/17/17	0.55	0	0.55	0.53	0	0.53
CQ0254	20213	97	2	05/26/17	06/17/17	0.9	0	0.9	0.3	0	0.3
CQ0255	20213	98	2	05/26/17	06/17/17	0	0	0	0	0	0
CQ0256	20213	96	2	05/26/17	06/17/17	0.66	0	0.65	0.05	0	0.05
CQ0257	20213	90	2	06/05/17	06/17/17	0	0	0	0.02	0	0.02
CQ0258	20213	93	2	06/05/17	06/17/17	0.27	0	0.27	0	0	0
CQ0259	20213	89	2	06/05/17	06/17/17	0	0	0	0	0	0
CQ0260	20213	95	2	06/05/17	06/17/17	0	0	0	0.04	0	0.04
	Total	1323	KAL/EM								

Figure C-22. Quartz Acceptance Testing Batch QC Data – 07/17/17

7/17/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results Control 1 OC	Control 1 E C	Control 1 TC	Control 2 OC	Control 2 E C	Control 2 TC
CQ0261	20213	94	2	06/14/17	07/15/17	0	0	0	0.07	0	0.07
CQ0262	20213	96	2	06/14/17	07/15/17	0	0	0	0.19	0	0.19
CQ0263	20213	97	2	06/14/17	07/15/17	0	0	0	0	0	0
CQ0264	20213	94	2	06/15/17	07/15/17	0.01	0	0.01	0.07	0	0.07
CQ0265	20213	98	2	06/15/17	07/15/17	0	0	0	0	0	0
CQ0266	20213	94	2	06/15/17	07/15/17	0	0	0	0.06	0	0.06
CQ0267	20213	96	2	06/19/17	07/15/17	0	0	0	0	0	0
CQ0268	20213	96	2	06/19/17	07/15/17	0	0	0	0	0	0
CQ0269	20213	94	2	06/19/17	07/15/17	0	0	0	0	0	0
CQ0270	20213	92	2	06/19/17	07/15/17	0	0	0.04	0.03	0	0.03
CQ0271	20013	84	2	06/19/17	07/15/17	0.26	0	0.25	0.30	0	0.29
CQ0272	20013	90	2	06/19/17	07/15/17	0.28	0	0.28	0.20	0	0.20
CQ0273	20213	98	2	06/27/17	07/15/17	0.14	0	0.14	0	0	0
CQ0274	20213	97	2	06/27/17	07/15/17	0.05	0	0.04	0	0	0
CQ0275	20213	96	2	06/27/17	07/15/17	0.40	0	0.40	0	0	0
CQ0276	20213	94	2	06/27/17	07/15/17	0.07	0	0.07	0	0	0
	Total	1510	KAL VN								

Figure C-23. Quartz Acceptance Testing Batch QC Data – 08/21/17

8/21/2017

25 mm Pallflex QAT-UP Filter

DRI Lot ID	Pallflex Lot ID	Quantity/ Lot	Control Quantity	Date of Pre-firing	Date of Acceptance Test	Control Quantity Results					
						Control 1			Control 2		
						OC	E C	TC	OC	E C	TC
CQ0277	19981	96	2	07/01/17	08/19/17	0.10	0	0.09	0.11	0	0.11
CQ0278	19981	94	2	07/01/17	08/19/17	0.22	0	0.21	0.02	0	0.01
CQ0279	19981	96	2	07/01/17	08/19/17	0.17	0	0.17	0.12	0	0.11
CQ0280	20171	95	2	07/15/17	08/19/17	0.13	0	0.12	0.13	0	0.12
CQ0281	20171	93	2	07/15/17	08/19/17	0	0	0	0.01	0	0.01
CQ0282	20171	95	2	07/15/17	08/19/17	0.05	0	0.04	0.10	0	0.10
CQ0283	20342	96	2	07/24/17	08/19/17	0.12	0	0.11	0.17	0	0
CQ0284	20342	94	2	07/24/17	08/19/17	0	0	0	0.06	0	0.06
CQ0285	20342	93	2	07/24/17	08/19/17	0.33	0	0.33	0.34	0	0.33
CQ0286	20342	96	2	07/24/17	08/19/17	0.31	0	0.31	0	0	0
CQ0287	20213	94	2	07/31/17	08/19/17	0	0	0	0	0	0
CQ0289	20213	96	2	07/31/17	08/19/17	0.03	0	0.03	0.06	0	0.06
CQ0290	20213	98	2	07/31/17	08/19/17	0	0	0	0	0	0
CQ0291	20342	91	2	08/02/17	08/19/17	0	0	0	0	0	0
CQ0292	20342	91	2	08/02/17	08/19/17	0	0	0	0	0	0
CQ0293	20342	94	2	08/02/17	08/21/17	0.23	0	0.23	0.2	0	0.2
	Total	1512									

Appendix D

Response Action Review – May 2016 Quality Assurance

Figure D-1. Response Action Review – May 2016 Quality Assurance (page 1 of 3)

Chemical Speciation Network- Filter Shipping and Handling Unit
03MAY16 and 05MAY16 Quality Assurance Review

Response Action Table

Documentation			
Index No.	**Observation**	**Recommendation**	**Response Action** (Incl. Dates for Review Period & Completion)
1A	The position titles listed in the Quality Assurance Project Plan (QAPP) are inconsistent, acronyms are not consistently defined on first use in the QAPP or appended Standard Operating Procedures (SOP), and word capitalization needs review and reconciliation for consistency.	Project documents need technical editing.	Most recent drafts have been edited. - MS 5/8/17
1B	Individual SOP are unsigned.	Documents that are ostensibly "in use" should be reviewed and signed.	Analytical lab SOPs are signed. FiSH SOPs are not signed. - MS 5/8/17
1C	Though Amec Foster Wheeler SOP have been distributed, instructions and forms authored by RTI International, Inc. (RTI) are still being utilized by personnel (e.g. the RTI "SHAL" checklist is used for the cooler checklist) apparently due to the preferred utility of the RTI material.	Amec Foster Wheeler SOP need more illustrations and checklist instructions for practical use. Incorporate Amec Foster Wheeler versions of the forms and instructions utilized routinely by personnel.	Accomplished in most recent drafts. - MS 5/8/17
1D	Personnel were aware of the latest set of SOPs but not consistently able to locate them.	A document control system should be established for the finalized documents – perhaps through SharePoint.	Forms need a document control block (JFK informed during 5/8/17 follow up). FiSH mgmt. concurs that documents should be stored on AKEA drive to facilitate access. - MS 5/8/17

Figure D-2. Response Action Review – May 2016 Quality Assurance (page 2 of 3)

Quality Assurance Review:
Chemical Speciation Network - Filter Shipping and Handling Unit

1E	A number of good and necessary actions are performed but not formally documented. For example – • Informal "temp and store" procedures; • Routine data validation quality control (QC) checks.	The laboratory should take credit for work performed and keep formal records (logs and/or reports) of support actions. The procedures should be documented in an SOP and/or a checklist form including the requirement to establish and maintain the associated records.	Temp & store now in GPM3180-041 § 8.3.2; recorded on Level 0 Validation Form. JFK performs routine outgoing QC checks (observed 5/8 & 5/19). - MS 5/19/17
1F	The acceptable temperature range is not listed in cold room or freezer logbooks.	Determine the acceptable range and document in the logbooks.	Per project QAPP and SOP, use 4 ±2 °C for cold room and ≤ -15 °C for the freezer. MS 6/23/16
1G	An "Incoming Supplies Logbook" is cited in SOP GLO3180-041. This logbook does not exist.	Reconcile the documented procedure with actual practice while ensuring adequate record keeping.	Reference to logbook removed in most recent revision. - MS 5/8/17
1H	Some activities are not described in SOP GLO3180-044.	Establish SOPs for data security, disaster recovery, accounting and inventory or expand the existing SOP to include these operations	Not established. - MS 5/8/17
	Media Processing Procedures		
	Observation	**Recommendation**	**Response Action**
2A	The sticky mat for room 1909 (FiSH "clean room") was not adhered to the floor and in need of changing.	Install the mat properly and establish an appropriate routine schedule for replacement. [This was discussed with the clean room team during the traceability audit conducted 6/22/16 – MS]	Mats currently installed properly and changed at least weekly. Observation shows this should be more frequent. Discussed with JFK 5/8 and 5/19. - MS 5/19/17
2B	Informal "temp and store" procedures – the temporary records of receipt temperatures are small sticky notes	Replaced with log sheets or a logbook for date for receipt and temperature measurements both directly associated with an identifier traceable to the associated shipping container.	A. Donahou has discontinued use of sticky notes, instead using the standard forms required for routine logging. MS 6/23/16
2C	Speciation Air Sampling System (SASS) sampling cartridge assembly/disassembly instructions in GLO3180-041 are not consistently followed.	Personnel should perform alternate tightening of fasteners as described in the SOP and use the equipment described (e.g. cartridge holders). [This was discussed with the clean room team during the traceability audit conducted 6/22/16 – MS]	Alternate tightening now performed. - MS 5/8/17 Discussion with JFK regarding cartridge holders revealed some problems with proper fit. Modification of the holders by JFK is pending. - MS 5/19/17

Figure D-3. Response Action Review – May 2016 Quality Assurance (page 3 of 3)

Quality Assurance Review:
Chemical Speciation Network - Filter Shipping and Handling Unit

2D	It is possible to generate Measurement Request Forms with the same information more than once. It is also possible to enter the shipping date in the sampling date field.	Develop and implement formal screening – automated or manual – for critical form entries.	The system does not now allow for duplicate generation of batches, resolving the problem. - MS 5/8/17
2E	Several forms have fields that should be screened for exceeding a value range.	Develop and implement formal screening – automated or manual – for critical form entries.	Range checks are now routinely performed using pre-written SQL queries (observed 5/8/17). - MS 5/8/17
2F	Manual double entry is required for the project but not yet performed.	Implement automated entry where practical. Develop double entry protocols for remaining manual entries. [Quality affecting items only.]	Correction – double entry not required in checks are now routinely performed using pre-written SQL queries (observed 5/8/17). - MS 5/8/17
Database Operations			
	Observation	**Recommendation**	**Response Action**
3A	C. Nickell and W. Barnard are the only personnel performing QC verification checks on the database.	An automated function is recommended. Train additional personnel to utilize the automated function and interpret the results generated.	Checks are now routinely performed using pre-written SQL queries (observed JFK 5/8/17). - MS 5/8/17
3B	There are data integrity and security challenges in utilizing a Microsoft Access database for the purposes described in the QAPP and SOPs	Establish a transition schedule with milestones to move data tables to the more secure Microsoft SQL Server platform. In the meantime, routine documented database verification and system backups should be performed to ensure timely discovery of errors and complete system recovery.	Planned for June 2017. - MS 5/19/17
3C	Data are backed up by W. Barnard on a daily schedule. Only recent backup files are maintained (i.e. the file from the previous day may be the only one archived). If a problem is discovered that existed prior to the date of most recent backup the system cannot be restored to its "correct" state.	Ensure at least one designee is trained to perform system backups. Establish an automated backup routine. For any backups, retain archives sufficient to recover all data when a problem is observed via the QC verification schedule.	JFK trained and routinely performing backups. - MS 5/19/17