

Cutherine E. Heigel, Director Promoting and protecting the health of the public and the environment

MEMORANDUM

Date:	February 9, 2016
To:	Mr. Michael V. Peyton, Director U. S. EPA Region IV
Through:	Renee Shealy, Bureau Chief Bureau of Environmental Health Services
Through:	Sandra A. Flemming, Asst. Bureau Chief Bureau of Environmental Health Services
From:	Mr. Micheal Mattocks, Director Initials Redacted Analytical and Radiological Environmental Services Division
	Ms. Carol Smith, Director Office of Environmental Laboratory Certification

Subject: Response to Drinking Water On-Site SC DHEC Laboratory and Laboratory Certification Program

This memorandum is a response to the findings and recommendations of the EPA during the audit of the South Carolina DHEC Columbia Laboratory and Laboratory Certification Program conducted August 25 - August 28, 2015. The responses are listed below and are numbered in accordance with the audit report. Your findings and recommendations have been written verbatim as stated in the audit report. The laboratory would like to thank EPA for the recommendations intended to improve the work being performed. However, it would be very helpful to the laboratory if EPA could provide funding to support these recommendations. Please let us know if you have questions or concerns regarding any of the responses.

3.0 GENERAL LABORATORY QUALITY, TRAINING AND DOCUMENTATION

3.1 Recommendation: Due to the varying timeframes used for the certification of equipment such as thermometers, pipettes, balances and autoclaves, it is recommended that the certification expiration date be recorded on the equipment.

Response: The laboratory ensures calibration of all equipment and apparatus as required. This includes accompanying documentation. However, the laboratory does see some potential of this recommendation enhancing overall QA goals and will where feasible and found to be efficient within the work processes of the lab, try to implement this practice.

3.2 Recommendation: The laboratory should consider entering PT samples and other QC samples such as MDL samples into the LIMS. This will create consistency across the laboratory with sample login and QC data management.

Response: The laboratory understands the intent of this recommendation. However, PT samples as received from the vendor and collected samples from the field are not "apples to apples". Samples collected in the field are whole volume samples. Proficiency Test (PT) samples are received from the vendor in varied volumes and containment (ampules, etc.) specific to a given parameter. Additionally, the paperwork as received from the vendor is specifically intended for the analyst with unique instructions specific for a given parameter. This changes the receiving logistics as compared to a sample collected in the field. Having a limited number of staff dedicated to sample receiving duties and the huge number of different parameters analyzed in our laboratory would make implementing this practice impossible. A general receiving duty would become too involved for this level of staff at this point in the analysis process. Method Detection Limit (MDL) studies would likewise create a challenge logistically. The MDL process would have to start with the analyst and result in a process where the analyst would have to work with the sample receiving group to have these study samples entered into LIMS. This would create a backward process opposite of how samples are normally received and ultimately result in an inefficient circular process which would only eat valuable time that analysts need to ensure that MDLs are performed and completed annually. The laboratory does not see this recommendation as providing anything which would enhance the overall OA or prove to be a benefit at this time.

3.3 Recommendation: The laboratory should consider purchasing disposable containers for VOA, SVOA and pesticide analyses. There is possible risk of contamination when reusing sample containers. However, if this is not economically feasible, the laboratory should designate groups of bottles cleaned together with a unique lot number and analyze one bottle to demonstrate lack of contamination.

Response: The laboratory has a defined system of cleaning sample collection containers in place that has proven to be adequate. The laboratory has never identified a contamination issue attributed to the sample containers. However, the laboratory will continue to evaluate its current process relevant to regulatory requirements and good laboratory practices accepted by the science community as advances are made.

4.0 SAMPLE RECEIVING, REPORTING AND STORAGE

4.1 Finding: The ID of the certified thermometer used in the sample receipt area was not documented in the receipt logbook.

Corrective Action: In accordance with Chapter IV, Sect. 8.1 of the Certification Manual, compliance monitoring data should be made defensible by keeping thorough and accurate records. Begin recording the unique identifier of the thermometer on sample receipt forms so that a link can be made to the thermometer calibration.

Response: The unique identifier for the thermometer was being recorded in the logbook. However, when a new book was started, this information was not carried over to the new book. The unique identifier is recorded and now documented on each page and traceable to each sample (see Attachment 1).

4.2 Recommendation: The laboratory indicated that samples were dropped off at a loading dock. It is recommended that samples be secured in a locked area when they are dropped off.

Response: Samples are dropped off at the lab at the loading dock area located at the rear entrance of the building. However, it is believed that this was misunderstood by the auditors that this meant on the dock itself. Samples are placed inside of the building at the loading dock area. This area is locked and at no time are samples in an unsecured location.

5.0 ORGANIC CHEMISTRY

General Organic Chemistry

The findings described under the General Organic Chemistry category are those that span over multiple methods.

5.1 Finding: Residual Chlorine checks were not performed for organic analysis to verify that the preservative added to the sample was sufficient to neutralize any chlorine that may have been present.

Corrective Action: The Drinking Water Certification Manual, Chapter IV, Section 6.3, requires that laboratories verify that samples' preservation was sufficient to neutralize residual chlorine. This should be performed for all associated methods, by a chlorine test strip, and documented in the sample preparation logbook or bench sheet.

Response: Item 6.3 of the Drinking Water Certification Manual does not state that residual chlorine checks must be performed. It states that: Samples must be analyzed within the maximum holding times required by the method and references Table IV-6. The laboratory is following this requirement as stated and exampled in Table IV-6 with regard to preservatives, sample holding times, extract holding time and storage conditions, suggested sample size, and type of container for each parameter. The sample collection process is a shared endeavor where the lab provides bottles to the field staff. Samples which require dechlorinating agents are pre-prepared by the laboratory with the appropriate amount of dechlorinating agent already added as required by the methodology. The laboratory verifies appropriate preservation of samples as required by controlling this part of the sample collection process. Additionally, the Federal Register does not require that the residual chlorine be checked with test strips, but only requires that appropriate preservation as required for a given parameter be done. The laboratory has looked at a number of various versions of test strips to perform residual chlorine checks and this would incur a huge cost for the laboratory. The laboratory is of the opinion that since there is no document which clearly states or mandates that residual chlorine be checked, but only that the appropriate preservation be added, this finding should have been a recommendation. Each method in its "Sample Collection, Preservation, and Storage" section states the amount of dechlorinating agent to be added for appropriate elimination of potential chlorine presence.

Method Specific Organic Chemistry

The findings described under the method specific organic chemistry category are those that relate specifically to a particular method and each finding is referenced by a citation for requirements found in the method, Code of Federal Regulations, and/or Certification Manual.

EPA Method 515.3, Chlorinated Herbicides

5.2 Finding: The laboratory was raising the pH of the sample extract to greater than 12 as required in the method but this was not documented.

Corrective Action: All steps in a method or procedure must be documented during the process by the analyst which performs the step(s). See Chapter IV, Section 8.4 of the DW Cert Manual.

Response: This pH is performed as part of the procedural steps listed in the SOP. The laboratory will update the sample batch worksheet for this method, which are included with each data pack, to include a place for the recording of this pH adjustment (see Attachment 11). The laboratory however, does not agree that 8.4 implies or states that steps of a procedure must be documented as stated in the Finding 5.2. Part 8.4 of the Drinking Water Certification Manual states: *Data should be recorded in ink with any changes lined through such that original entry is visible. Changes need to be initialed and dated. The following information should be readily available:*

- 8.4.1 Laboratory and persons responsible for performing analysis;
- 8.4.2 Analytical Techniques/methods used
- 8.4.3 Date and time of analysis
- 8.4.4 Results of sample and quality control analyses
- 8.4.5 Calibrations and standards information
- 8.4.6 Analyst and technicians Initial Demonstration of Capability documentation should be kept on file as results of proficiency testing.

The laboratory is of the opinion that since there is no document which clearly states or mandates that this step needs to be documented as stated in Finding 5.2, this finding should have been a recommendation.

EPA Method 524.2, Volatile Organics

5.3 Finding: The laboratory was using a sample surrogate (4-BFB) which is also used to verify the tuning criteria for the Gas Chromatograph/Mass Spectrometer, to verify that the instrument was acceptable for further analysis.

Corrective Action: The method requires that the tune criteria check be performed with a blank standard which is spiked with the tune check criteria solution (4-BFB). A sample is inappropriate as there may be positive or negative interferences which would affect the results of the tune criteria verification. See Section 10.3.1 of EPA Method 524.2.

Response: The laboratory will implement the use of blanks for the BFB tune check. The SOP associated with this finding will be updated by March 1, 2016.

EPA Method 525.2, Semi-Volatile Organics

5.4 Finding: The acceptable limits designated in the laboratory SOP for the Laboratory Fortified Blank (LFB) and the Laboratory Fortified Matrix (LFM) were 37 - 68% recovery and 32 - 74% recovery respectively. These are outside of the acceptable limits required by the method (70 - 130% recovery).

Corrective Action: The method requires that the control charts be generated that establish an acceptable range for each analyte of interest. However, these limits cannot exceed the maximum allowable limits set in the method. See Chapter IV, Section 7.2.8 of the DW Cert Manual.

Response: The calculated limits are only used for the compound metribuzin. Metribuzin, as indicated in the method, is a poor responder when fortified with other compounds in this method as indicated in Section 13, Part 13.2.7 of EPA Method 525.2. It is also given a very conservative \pm 50% recovery for PT studies as an unregulated compound which also points toward this compound as a poor responder when fortified with other compounds. The laboratory feels that based on this and years of data where this compound has always been consistent with the methodology theory of a poor responder, it is unreasonable to expect this compound to meet the set limits. The more realistic approach would be to calculate limits which are reflective of the poor response of this compound. All other compounds analyzed for by this procedure by the laboratory do follow the EPA method set limits for quality control. The laboratory is currently and will continue to test the use of different consumables used in the procedure to improve the recovery of metribuzin. However, any guidance that can be provided would be appreciated by the laboratory regarding improving recovery for this compound.

EPA Method 549.2 Diquat and Paraquat

5.5 Finding: The pH meter used to determine appropriate pH measurements during the sample preparation was calibrated before each use but was not documented.

Corrective Action: All steps in a method or procedure must be documented during the process by the analyst which performs the step(s). See Chapter IV, Section 8.4 of the DW Cert Manual.

Response: The pH meter calibration was documented, although the lot numbers of each buffer solution were not included. We have updated the batch sheet to include the buffer lot numbers (see Attachment 111).

EPA Method 551.1, Trihalomethanes (THMs)

5.6 Finding: Section 6.11 of the laboratory SOP describes the Laboratory Performance (LPC). It notes that four compounds (not listed) are used to determine the performance of the instrument. However, the SOP has a photocopy of the LPC table that is in the method and it lists seven compounds that must be analyzed for various performance acceptance criteria before the analysis of samples can begin. Data packages verify that only four compounds, Lindane, Hexachlorocyclopentadiene, Bromodichloromethane and Trichloroethylene are checked. The remaining three, Bromacil, Alachlor, and Endrin are not evaluated.

Corrective Action: The method requires that all seven compounds must pass various acceptance criteria for the instrument to be properly calibrated. See section 7.5 and table 7 of the method.

Response: The laboratory is only analyzing the trihalomethane compounds with this procedure. EPA Method 551.1 states in section 7.5.1 that the three compounds; bromacil, alachlor, and endrin can be omitted from the LPC if not analyzing for the high molecular weight compounds. The LPC table copied into the laboratory's SOP will be updated to exclude these as to prevent confusion. The associated SOP will be updated by March 1, 2016. Please see below the referenced excerpt from EPA Method 551.1.

7.5.1 If a laboratory is not conducting analyses for the high molecular weight pesticides and herbicides, a modified LPC may be prepared. This modified LPC can omit the endrin analyte breakdown component as well as the resolution requirement for bromacil and alachlor under column performance. In addition, substitute analytes in place of lindane for the sensitivity check and hexachlorocyclopentadiene for chromatographic performance can be selected. These substitute compounds must meet the same criteria as listed in Table 7 with the concentration for sensitivity check near the substitute analyte's EDL and the concentration for chromatographic performance near 50 times the substitute analyte's EDL. The column performance criteria for resolution between bromodichloromethane and trichloroethylene cannot be modified.

5.7 Finding: Sample extracts were stored in the same freezer as calibration standards.

Corrective Action: Chapter IV, Section 2 of the DW Lab Cert Manual requires that "The analytical and sample storage areas should be isolated from all potential sources of contamination." Sample extracts should be relocated to an area free of potential contamination.

Response: The laboratory does not analyze samples for this method, but only maintains primacy. There were no samples analyzed during this evaluation period, only PT samples. Moving forward the laboratory will provide a separate freezer unit for extracts for this analysis.

5.8 Recommendation: The laboratory should consider purchasing disposable sample containers for VOA, SVOA, and pesticide analyses. The risk of contamination is possible when reusing sample containers. However, if this is not economically feasible, the laboratory should designate groups of bottles cleaned together with a unique lot number and analyze one bottle to demonstrate lack of contamination.

Response: (Same response as provided for 3.3) - The laboratory has a defined system of cleaning sample collection containers in place that has proven to be adequate. The laboratory has never identified a contamination issue attributed to the sample containers. However, the laboratory will continue to evaluate its current process relevant to regulatory requirements and good laboratory practices accepted by the science community as advances are made in science.

6.0 METALS AND INORGANIC CHEMISTRY

General Inorganic Chemistry

The findings described under the general chemistry category span over multiple methods.

- 6.1 Finding: The metals and general chemistry analysts are capturing most of the information on preparation logs needed to trace standards back to the manufacturer and on run logs that allow for the reconstruction of the data. However, there were some gaps in documentation and traceability that prohibit the unambiguous reconstruction of data and analytical conditions. Examples include:
 - a. The preparation of the matrix spike was not documented for nearly all areas of inorganic chemistry. The spike ID, volume, and final volume needs to be documented.
 - **b.** Hot blocks and thermometers used for metals analysis did not have unique IDs for analyst to definitively determine calibration status.
 - c. For metals analysis by EPA Method 200.7, the working QCS prepared on 07/15/15 was made from High Purity standards, but AccuStandard was hardcoded (typed) into the preparation logbook. Auto-pipettes used for dilution did not contain a unique ID for analyst to definitively determine calibration status. The unique ID of ICP (B) was missing from analytical run logs.
 - d. For metals analysis by EPA Method 200.8, the preparation of working QC solutions was not documented.
 - e. For metals analysis by EPA Method 200.9, the balance ID was not documented for the preparation of palladium/magnesium nitrate matrix modifier. The exact weight shown on the balance was not recorded, only the nominal weight required, which was hardcoded (typed) into the preparation logbook.

- f. For mercury analysis by SM 3112B, the preparation of reagents, QC standards, and the matrix spike was not documented. The balance ID was not documented in preparation logbooks. The addition of reagents for sample pretreatment was not documented for each sample batch. The heating of samples for 2 hrs at 90-95 °C was not documented for each sample batch. The certified thermometer ID used for monitoring temperature was not recorded.
- g. For disinfection by product analysis by EPA Method 300.1, the preparation of the working Quality Control Solution (QCS) was not documented.
- **h.** For cyanide analysis by SM 4500 CN E, the distillation logbook did not document the temperature and heating time.
- i. For fluoride analysis by Lachat QuikChem 10-109-12-2-A, the balance ID was not documented on the preparation log, and only a nominal weight was being recorded, instead of all places on the balance.

Corrective Action: In accordance with Chapter IV, Sect. 8.1 of the Certification Manual, compliance monitoring data should be made defensible by keeping thorough and accurate records. Also, in accordance with Chapter IV, Sect. 8.5 of the Certification Manual, adequate information should be available to allow the auditor to reconstruct the final results for compliance samples and PT samples. A procedure should be developed to ensure that samples, reagents, calibration standards, and QC standards are unambiguously traceable from data system printouts, run logs, sample preparation logs, and standard preparation logs back to the original sample containers or chemical lot numbers. Sample preparation logs should document all measurements and required procedures performed in the utilized method such as interference checks, heating at a certain temperature, and weighing.

Response: See below the laboratory's response to the itemized Finding 6.1 (a-i).

*Please Note, each itemized sub-finding under Finding 6.1 has been intentionally presented a second time below, above the response for convenience of the reader.

**Please Note, the nomenclature for reagent lot numbers are as follows: analyst initials, date of preparation, and reagent acronym. As an example, for a Mercury Rinse solution prepared on 01/15/16 by John Black would be; JB011516MR. This nomenclature applies only to the inorganic chemistry metals laboratory.

Finding 6.1(a): The preparation of the matrix spike was not documented for nearly all areas of inorganic chemistry. The spike ID, volume, and final volume need to be documented.

Response 6.1(a): The lot number of the spike is captured either on the batch sheet or solution preparation log depending on the analysis. However, we did not have a sheet for the mercury analyses. A sheet for this area has been created (see Attachments IV-A through IV-D). The laboratory will add the additional information to the batch sheet. We are temporarily handwriting the required information. All forms will be updated by March 1, 2016.

Finding 6.1(b): Hot blocks and thermometers used for metals analysis did not have unique IDs for analyst to definitively determine calibration status.

Response 6.1(b): The laboratory has added unique identifiers to the digestion book for the hot block. However, thermometers in our laboratory have always had unique identifiers (see Attachment V). The laboratory will add the additional information to the forms. We are temporarily handwriting the required information. All forms will be updated by March 1, 2016.

Finding 6.1(c): For metals analysis by EPA Method 200.7, the working QCS prepared on 07/15/15 was made from High Purity standards, but AccuStandard was hardcoded (typed) into the preparation logbook. Auto-pipettes used for dilution did not contain a unique ID for analyst to definitively determine calibration status. The unique ID of ICP (B) was missing from analytical run logs.

Response 6.1(c): The laboratory has corrected the preparation logbook for the 07/15/15 standard which was incorrectly recorded. Auto-pipettes used for dilution will use their serial numbers as the unique identifier to associate the pipette used with its calibration status. The 1CP instrument used will be captured on the analytical run logs (see Attachments VI-A and VI-B). The laboratory will add the additional information to the logbook and forms. We are temporarily handwriting the required information. The forms and logbook will be updated by March 1, 2016.

Finding 6.1(d): For metals analysis by EPA Method 200.8, the preparation of working QC solutions was not documented.

Response 6.1(d): The laboratory feels the auditor may have not been clear regarding the process for the preparation of standards and QC. The QC solutions are documented and were shown to the auditors (see Attachment VII). Please note that the dark spots on the document are not strike-overs, but are the result of converting the documents (containing gray-shaded areas) to JPEG files.

Finding 6.1(e): For metals analysis by EPA Method 200.9, the balance ID was not documented for the preparation of palladium/magnesium nitrate modifier. The exact weight shown on the balance was not recorded, only the nominal weight required, which was hardcoded (typed) into the preparation logbook.

Response 6.1(e): The laboratory has updated the balance logbook and the balance ID is now being documented in the preparation logbook. The laboratory will now record the exact weight. An updated form will be implemented to better accommodate this request. Attachment VIII-B will be the new form used by the laboratory, (see Attachments VIII-A and VIII-B). The laboratory will add the additional information to the logbook. We are temporarily handwriting the

required information. The logbook will be updated by March 1, 2016.

Finding 6.1(f): For mercury analysis by SM3112B, the preparation of reagents, QC standards, and the matrix spike was not documented. The balance ID was not documented in preparation logbooks. The addition of reagents for sample pretreatment was not documented for each sample batch. The heating of samples for 2 hours at 90-95 °C was not documented for each sample batch. The certified thermometer ID used for monitoring temperature was not recorded.

Response 6.1(f): The preparation of reagents, QC standards, and matrix spikes will be more clearly documented. The balance ID is now documented in the preparation logbook (see Attachments IX-A through IX-J). The laboratory has temporarily edited the forms by handwriting the required information in the established form documents. A new form for mercury has been included to capture the heating times for samples. All other associated forms to this finding will be updated. We are temporarily handwriting the required information. The forms will be updated by March 1, 2016. It should be noted, that Attachments IX-H through IX-J will appear to have dark spots on first line of entered information. This is not a strike-over but the result of converting the original document.

Finding 6.1(g): For disinfection by product analysis by EPA Method 300.1, the preparation of the working Quality Control Solution (QCS) was not documented.

Response 6.1(g): The QCS will be documented in the QCS logbook (see Attachment X).

Finding 6.1(h): For cyanide analysis by SM 4500 CN E, the distillation logbook did not document the temperature and heating time.

Response 6.1(h): The laboratory will document the temperature and heating time in the distillation logbook (see Attachment X1). The laboratory will add the additional information to the logbook. We are temporarily handwriting the required information. The logbook will be updated by March 1, 2016.

Finding 6.1(i): For fluoride analysis by Lachat QuikChem 10-109-12-2-A, the balance ID was not documented on the preparation log, and only a nominal weight was being recorded, instead of all places on the balance.

Response 6.1(i): The laboratory will now record the balance 1D and the exact weight (see Attachment XII).

6.2 Finding: Residual Chlorine checks were not performed for inorganic analysis by EPA Method 200.7 and 200.8, and SM3112B to verify that the preservative added to the sample was sufficient to neutralize any chlorine that may have been present.

Corrective Action: The Drinking Water Certification Manual, Chapter IV, Section 6.4, requires that laboratories verify that samples' preservation was sufficient to neutralize residual chlorine. This should be performed for all associated methods, by a chlorine test strip, and documented in the sample preparation logbook or bench sheet.

Response: Residual Chlorine checks are not required for these methods and Section 6.4 does not state that residual chlorine checks must be performed. Section 6.4 states: There must be strict adherence to correct sampling procedures, sample handling, complete identification of the sample, and prompt transfer of the sample to the laboratory when required by the method. When the laboratory is not responsible for sample collection and transport, it must verify that the paperwork, preservatives, containers, and holding times are correct as required by the methods or reject the sample. The rejection criteria should (EPA Order 5360.1) be documented in writing. Methods 200.7, 200.8, and SM3112B are preserved with the appropriate acid in the field and the pH of the sample is checked once the sample is received by the laboratory verifying the sample has been acidified accordingly. The laboratory does not feel this should have been a finding as residual chlorine does not apply to any of the inorganic parameters as such.

SM 3112B Mercury

6.2 Finding: The laboratory not analyzing a minimum reporting level (MRL) check standard every time the instrument was calibrated.

Corrective Action: In accordance with Standard Methods 3020 B Sect. 2e governing method QC requirements, begin analyzing a QC standard at the minimum reporting level every new calibration.

Response: The laboratory will begin analyzing a Minimum Reporting Level (MRL) standard each time the instrument is calibrated. The associated SOP will be updated by March 1, 2016.

11.0 FINDINGS AND RECOMMENDATIONS - MICROBIOLOGY

11.1 Finding: There was no record of contents or analyst's initials each time the autoclave was used.

Corrective Action: The following information should be recorded each time the autoclave is used: date, contents, sterilization time and temperature, total time in the autoclave, and analyst's initials. Refer to Chapter 5, Section 3.5.3 of the Certification Manual.

Response: Autoclave services for the microbiology laboratory are provided by

the Media, Reagent, and Glassware section in the Bureau of Laboratories. The Media, Reagent, and Glassware section has updated their records to reflect autoclave operator initials, process date, and who services were provided to. Each autoclave strip will reflect this information (see Attachment XIII).

11.2 Finding: All drinking water samples were not shaken 25 times before analysis.

Corrective Action: All water samples should be shaken vigorously at least 25 times before analyzing. The laboratory should add this procedure to their SOP. Refer to Chapter 5, Section 5.1.3 of the Certification Manual.

Response: The microbiology laboratory will shake samples 25 times before analysis. The associated SOP will be updated by March 1, 2016.

11.3 Finding: The instrument services laboratory had questionable readings when using the UV light meter. There were no standard procedures on how to accurately take readings each time, therefore the laboratory needs to create a SOP for the UV light meter.

Corrective Action: The laboratory should have a Standard Operating Procedure available, pertaining to its own calibration of equipment or supplies. Refer to Chapter 5, Section 7.1 of the Certification Manual.

Response: Instrument Services performs this calibration service for the laboratory. The Instrument Service group has revised their quarterly UV light check SOP. The SOP has been revised requiring the technician to allow the UV lamp to warm up for a minimum of 10 minutes before taking a reading. Once the lamp has warmed up, the technician will place the UV sensor directly on the bulb in the middle and then take the reading. This will result in uniform readings.

Finding: During the review of the pre-audit data packages, it was noted for:
 EM15-PT - The wrong expiration date for Simplate Multi-dose was recorded.
 EM15-PT 6F - The wrong 48 hour incubation date for Simplate was recorded.

Corrective Action: The laboratory should peer review data to ensure that all data reported by the laboratory meets the required quality assurance and regulatory criteria. Refer to Chapter 5, Section 1.1 of the Certification Manual.

Response: No response required, as noted in the report, this finding was corrected at the time of the audit.

11.5 Recommendation: The laboratory should start recording/documenting the prewarming incubation times for Colilert-18 samples.

Response: The required pre-warm incubation time for colliert-18 is stated in the laboratory's SOP. The laboratory feels no other documentation is necessary.

11.6 Recommendation: The laboratory should follow the manufacturer's recommendation concerning the subculture of commercial stock cultures.

Response: The laboratory is currently using one swab every six months to maintain stock cultures. The manufacturer recommends a swab be done each month. Following the manufacturer's recommendation would result in substantial cost for the laboratory. This recommendation will not be implemented. The laboratory will continue to evaluate this recommendation.

11.7 **Recommendation:** The laboratory should take the actual pH reading of any commercial reagents or media if the manufacturer's certificate of analysis (COA) lists a range instead of a specific pH for that lot number.

Response: The laboratory uses commercial media that is accompanied with a COA. Efforts will be made to purchase media that has a specific pH listed rather than a pH range, but this may not be possible in all cases. QC is run on all media before it is used and if the QC passes, the media should be fine for use.

11.8 Recommendation: When analyzing annual Proficiency Testing (PT) samples, EPA auditors recommend occasionally alternating between Colilert and Colilert 18 samples since the laboratory is certified for both.

Response: The laboratory will implement this practice. The associated SOP will be updated by March 1, 2016.

11.9 Recommendation: The laboratory should modify the Calibration of Thermometers SOP to include:

a. Allowing time for equilibration before comparing the NIST thermometer to the laboratory thermometer.

b. Checking several degree increments instead of just one (i.e at, below and above the temperature at which the thermometer will be used) when verifying thermometers to obtain a more accurate correction factor.

Response:

- **a.** The Instrument Services laboratory has revised the thermometer calibration check SOP to allow a 1 hour equilibration time before checking the NIST thermometer against the lab thermometer being checked.
- **b.** Due to limited staff and the large volume of thermometers checked, the instrument services laboratory will only check the thermometer at one increment.

14.0 EVALUATION OF THE SOUTH CAROLINA DRINKING WATER LABORATORY CERTFICATION PROGRAM

14.5 **Recommendation:** It is recommended that the Certification program retain the auditor's checklists, which contain the original observations, and that they be available for review. This is noted in Chapter 11, Section 15 of the EPA's "Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition".

Response: The Office of Environmental Laboratory Certification will ensure that records for the on-site laboratory assessments and certification program reviews be maintained in an easily accessible location for a period of six years to include the last two on-site audits. This includes records/correspondence used to determine compliance with the requirements in the certification manual. Records may include checklists, corrective action reports, final reports, certificates, PT study results and related documents. These records will be maintained as paper documents or electronically in an easily accessible location.

Table 4 of the on-site evaluation report documented the incorrect numbers of certified drinking water laboratories in South Carolina. An updated Table 4 has been provided with the number of certified laboratories.

State	# Chemistry	# Microhiology	# Radiochemistry	# Cryptosporidium
	Laboratorics	Laboratorics	Laboratories Certified	Laboratorics Certified in
	Certified in State	Certified in State	in State	State
	(# Out of State)	(# Out of State)	(# Out of State)	(# Out of State)
SC	187 (5)	117 (6)	1 (3)	0 (5)

Table 4 - South Carolina	Certified Lab	poratories
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Attachment 1

				I.R. The recommendation <u>"Mondael DREAD, 201: 0727.</u> Calibratical The Internetical IDD 5.070 "33. 1933. WIRT Mr. 1984. 1984. Science Factor 9.0 "It Unit United Science Notes of
N.		C IR	Calibration Log - Sam	ole Receiving
				ental Services Division
	Date	Analyst	IR Thermometer Temperature (°C)	Calibrated Thermometer Temperature (°C) 3.\$
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MIR	12/18/15	this fer-	4.1	4.0 U.Z
	12/2/115	Pomber segrore	And and a support of the support of	
1.10	12/22/15	this lag-	4.2	4.1
193	12/23/15	1 thin loing	4.2	4.0
	12/29/15	Min las	4.2	44.1
	12/30/15	- China lar-	4.3	4.2
-	12/31/15	This am	4.5	4.5
	14110	In ben damost	4,2	4.0
	15/16	Chin lim	4.4	4.4
T.	116116	Free Sur	4,7	Le, 4
-	11746	Jantotto	41	4.2
	1816	Amber Reonad	4.6	4.4
	11116	Limber areconand	<u>Ц.</u> 7	4.5
-	1/12/2	Chin lin-	4.5	4.5
1000	1/19/16	Vilin lorg	4.5	4.5
	Vielic	Thin lan	4.5	4.5
-	115/14	Chin 12-	4.5	4.5
	1/19/16	Chur lin	4.5	4.5
	112011	Prosan	4.7	4.5
	1124/16	- Cu Sulla	4.5	4.5
105	1122114	- En Somen	4.4	6, 10
	12516	Ambendeunerf	4.6	4.1
0				
19				
1				
ų	The temperatu	ire readings of the IR and er	librated thermometers m	ust agree within 0.5°C.
	Comments:			
	Contrainer and		The second	
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Attachment II

BONOTI, PROTECT PROSPIL	Acid Herbicides	IX-E-3(n)	EPA 515.3
Date:	Sta	ndard <u>s Used (Lot N</u>	umber)
Chemist:		Surrogate Spike:	
QC#:			12
	-		pike:
Sample Identification	<u>pH>12</u>		
-	Re	agents Used (Lot Nu	
1.		4N NaOH:	
2.		H ₂ SO ₄ :	
3.		CuSO4-5H2O:	
4		Na ₂ SO ₄ :	
5		Diazald:	
6		Carbitol:	
7		Ethyl Ether:	
8		37% KOH;	
9		Silica Gel:	
10.		Florisil:	All
11.		Acidified Na ₂ SO ₄	
12			
13		Solvents Used (Lot	
14		MtBE:	
15		Ethyl Ether:	
16	DI	Water System Used	•
17			
18		Batch Comments:	
19			
20,			
21			
22			
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27			······
28		••••••••••••••••••••••••••••••••••••••	
29		••••••••••••••••••••••••••••••••••••••	
		yst:	

Attachment III

Date:			Standards Used (L	
Chemist:	CHARGE T		Analyte Spike:	
QC#:				
Sample Identification	pH <u>Initial</u>	pH <u>Adi.</u>	3M C8 Disks (Lot	Number):
1			Reagents Used (Lo	t Number)
2				
3 4			10% HCl:	
5.			Cond. Solutio	n A:
6.			Cond. Solutio	n B:
7.			Disk Eluting S	Solution:
8.			Ion-pair Conc	entrate:
9				*
10				
11			Solvents Used (Loi	
12.		-	Methanol:	
13.				
14.				
15				
16				
17				
18			Batch Comments:	
19 20			Daran Continentar	
21.				
22.				
23.				
24				
			······	and the second
pH Meter Calibration:				- Million - 700000000000000000000000000000000000
Buffer 4: Lot/				
Buffer 7: Lot/				
Buffer 10: Lot	t avent NP 15	and states		
Slope:	Verifica	tion Analy	yst:	Date:

Attachment IV-A

Anaph Cardina Departmental Canado	A			ac	diolog	er Nitrite in Wat dical Environme nated Analysis S	ntal Services	s Division	
THE DATA SET SUBMITT	ED AD	HERS TO 1	THIE	C F	FOLL	DWING:			
Calibrated with at least 5 stand	ards pro	oducing a cu	rve v	wi	ith an 1	R value of 0.995 or	higher.		
A LRB, LFB, MRL and QCCS samples. The results for each t							r to any		
A LFM and duplicate LFM we Prepared by adding 100 µL of with the sample. Recoveries (a	100 mg	/L stock solu	tion	i ti	o a 25	mL volumetric fla	sk and brought blished control	t to volume limits.	
A Blank and Calibration Check	k Stand	ard (CCC) w	as a	פת	ilyzed	with each set of 10	samples.		
The integration of peaks appea	red con	sistent and re	caso)ni	able.				
REAGENTS USED IN THIS	BATC	H:							
			17 B.T			DATE MADE:	EXP.		
BUFFER		REAG RAA-			20	01/13/16	28 DAYS		
COLOR REAGENT		RAB-			13	01/22/16	28 DAYS		- <u></u>
STANDARDS USED IN TH		CH: ck [=]nterm	edia	ate	: W=\	Vorking			
CONC. (mg/L)	TYPE					DATE MADE:	EXP.	1	
100	S	S-NO2-	16	Ŀ	220	01/28/16	5 DAYS		-
10	1	S-NO2-	16	Ŀ	212	01/14/16	1 DAY		<u> </u>
2.0	W	S-NO2-	16	Ŀ	213	01/14/16	1 DAY		
1.5	W	S-NO2-	16	Ŀ	214	01/14/16	1 DAY		
1.0	W	S-NO2~	16	Ŀ	215	01/14/16	<u>1 DAY</u>		<u></u>
0.5	W	\$-NO2-	16	-	216	01/14/16	I DAY		
0.1	w	S-NO2-	16	-	217	01/14/16	I DAY		<u> </u>
0.05	W	S-NO2-	16	-	218	01/14/16	I DAY		
0.02	W	S-NO2-	16			01/14/16	I DAY		
QCCS # 163	<u> </u>	ERA Lot	<u>152</u>	10	-695	11/05/15	11/30/2016		<u> </u>
Batch analyzed by: Results entered in LIMS and C	-	mented by:				Date:			
	D-1								

Attachment IV-B

) Intermediate (X					
DI Water: MQRM324			Lot #: TEL	22115KCS +	L
Date Prepared: 122115			Prepared		
Vendor of Parent Solut	ion: High-Purity Sta	ndards			
			Stock Conc.	Amt. Used	Final Conc
Compound	ltem #	Lot #	(mg/L)	(mL)	(mg/L)
1. Sodium (Na)	INFCS-7	1429612	1000	10	10.0
2. Magnesium (Mg)	INFCS-7	1429612	1000	10	10.0
3. Aluminum (Al)	INFCS-7	1429612	1000	10	10,0
4. Calcium (Ca)	INFCS-7	1429612	1000	10	10.0
5. Iron (Fc)	INFCS-7	1429612	1000	10	10.0
			Pipette	EH53805	
			- IPCIN	011930-	
					• •
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				•	
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	·····				
In addition to the above concentrated hydrochlo mL of deionized water.	oric acid were added	to a 1000 mL cla	ss A volumetric	flask contain	

Attachment IV-C

	Analytical &	Preparation of Inorga & Radiological E	nic Section	I Services]	
() Intermediate (X)	Working		Lot #: FED		
Date Prepared: 021015)		Prepared By:		
Vendor for Silver is Ultra	Scientific.		DI Water: M	QRM324	
		Stock Conc.	Amt. Used	Final Vol.	FinalCo
Compound	Stock Lot #	(mg/L)	(mL)	(mL)	(mg/L
Silver (Ag)	KOD662-08/31/16	10,000	1,0	1000	10
In addition to the above listed flask containint about 500 ml					
1:1 Nitric Acid Lot#: FE	020315N		Remake ann	ually or as n	weded.
() Intermediate (X)	Working		Lot #:		
Date Prepared:			Prepared By:		
Vendor for Silver is Ultras	Scientific.		DI Water: M		
		Stock Conc.	Amt. Used	Final Vol.	FinalCo
Compound	Stock Lot #	(mg/L)	(mL)	(mL)	(mg/L
Silver (Ag)		10,000	1.0	1000	10
lask containint about 500 mL	of deionized water. The	solution was then o	Eluted to volume	with deioniz	
Date Prepared:	of deionized water. The	solution was then o	liuted to volume	s needed.	
flask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V	of deionized water. The	solution was then c Remake	Lot #: Prepared By: DI Water: M	s needed. QRM324	
lask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared:	of delonized water. The	solution was then c Remake Stock Conc.	Lot #: DI Water: M Amt. Used	s needed.	ed water.
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultra Compound	of deionized water. The	Solution was then c Remake Stock Conc. (mg/L)	Lot #: Prepared By: DI Water: M Amt. Used (mL)	s needed. QRM324 Final Vol. (mL)	FinalCo
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultra	of delonized water. The	solution was then c Remake Stock Conc.	Lot #: DI Water: M Amt. Used	s needed. QRM324 Final Vol.	FinalCo
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultra Compound Silver (Ag) In addition to the above listed	of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m	Stock Conc. (mg/L) 10,000	Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0	s needed. S needed. QRM324 Final Vol. (mL) 1000 s 1000 mL da	FinalCo (mg/L 10
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultra Compound	of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m	Stock Conc. (mg/L) 10,000	Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0	e with deioniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL di e with deioniz	FinalCo (mg/L 10 ass A volume ed water.
flask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound Silver (Ag) In addition to the above listed flask containint about 500 mL 1:1 Nitric Acid Lot#:	of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m	Stock Conc. (mg/L) 10,000	Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 vas added to the iluted to volume	e with deioniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL di e with deioniz	FinalCo (mg/L 10 ass A volume ed water.
flask containint about 500 mL 1:1 Nitric Acid Lot#:	of delonized water. The Vorking Scientific, Stock Lot # aliquot of standard, 50 m of delonized water. The Vorking	Stock Conc. (mg/L) 10,000	Eluted to volume annually or a Lot #: Prepared By: DI Water: M Amt. Used (mL) 1,0 1,0 1,0 Remake annu	s needed. s needed. QRM324 Final Vol. (mL) 1000 s 1000 mL d. s with dejoniz tally or as n	FinalCo (mg/L 10 ass A volumed water.
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound Silver (Ag) In addition to the above listed flask containfnt about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V	of delonized water. The Vorking Scientific, Stock Lot # aliquot of standard, 50 m of delonized water. The Vorking	Stock Conc. (mg/L) 10,000	Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 vas added to the iluted to volume Remake annu Lot #: Prepared By: DI Water: M	e with deioniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL di e with deioniz tally or as n tally or as n	FinalCo (mg/L 10 ass A volumed water.
flask containint about 500 mL 1:1 Nitric Acid Lot#:	of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m of delonized water. The Vorking	Stock Conc. (mg/L) 10,000 L of 1:1 nitric acid v solution was then d	Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 Nas added to the iluted to volume Remake annu Lot #: Prepared By: DI Water: M Amt. Used	e with deioniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL di e with deioniz tally or as n tally or as n	FinalCo (mg/L 10 ass A volume ed water.
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound Silver (Ag) In addition to the above listed flask containfnt about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound	of delonized water. The Vorking Scientific, Stock Lot # aliquot of standard, 50 m of delonized water. The Vorking	Stock Conc. (mg/L) 10,000 L of 1:1 nitric acid v solution was then d	Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 Nas added to the iluted to volume Remake annu Lot #: Prepared By: DI Water: M Amt. Used (mL)	e with deioniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL di e with deioniz tally or as n tally or as n	FinalCo (mg/L 10 ass A volumed water. ccdcd. FinalCo (mg/L
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound Silver (Ag) In addition to the above listed Rask containfnt about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras	of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m of delonized water. The Vorking	Stock Conc. (mg/L) 10,000 L of 1:1 nitric acid v solution was then d	Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 Nas added to the iluted to volume Remake annu Lot #: Prepared By: DI Water: M Amt. Used	e with dejoniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL Ci. e with dejoniz tally or as n QRM324 Final Vol.	FinalCo (mg/L 10 ass A volumed water. ccdcd. FinalCo
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound Silver (Ag) In addition to the above listed flask containfnt about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound	of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m	Stock Conc. (mg/L) 10,000 L of 1:1 nitric acid v solution was then d Stock Conc. (mg/L) 10,000	Eluted to volume annually or a Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 vas added to the iluted to volume Remake annu Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 use added to the	e with deioniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL de with deioniz tally or as n QRM324 Final Vol. (mL) 1000 e 1000 mL de	FinalCo (mg/L 10 ass A volume ed water. ceded. FinalCo (mg/L 10 ass A volume
Itask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound Silver (Ag) In addition to the above listed Rask containint about 500 mL 1:1 Nitric Acid Lot#: () Intermediate (X) V Date Prepared: Vendor for Silver is Ultras Compound Silver (Ag) n addition to the above listed	of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m of delonized water. The Vorking Scientific. Stock Lot # aliquot of standard, 50 m	Stock Conc. (mg/L) 10,000 L of 1:1 nitric acid v solution was then d Stock Conc. (mg/L) 10,000	Eluted to volume annually or a Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 vas added to the iluted to volume Remake annu Lot #: Prepared By: DI Water: M Amt. Used (mL) 1.0 use added to the	e with deioniz s needed. QRM324 Final Vol. (mL) 1000 e 1000 mL di e with deioniz tally or as p QRM324 Final Vol. (mL) 2000 e 1000 mL da e with deioniz	FinalCo (mg/L 10 ass A volume ed water. cedcd. FinalCo (mg/L 10 ass A volume ed water.

Attachment IV-D

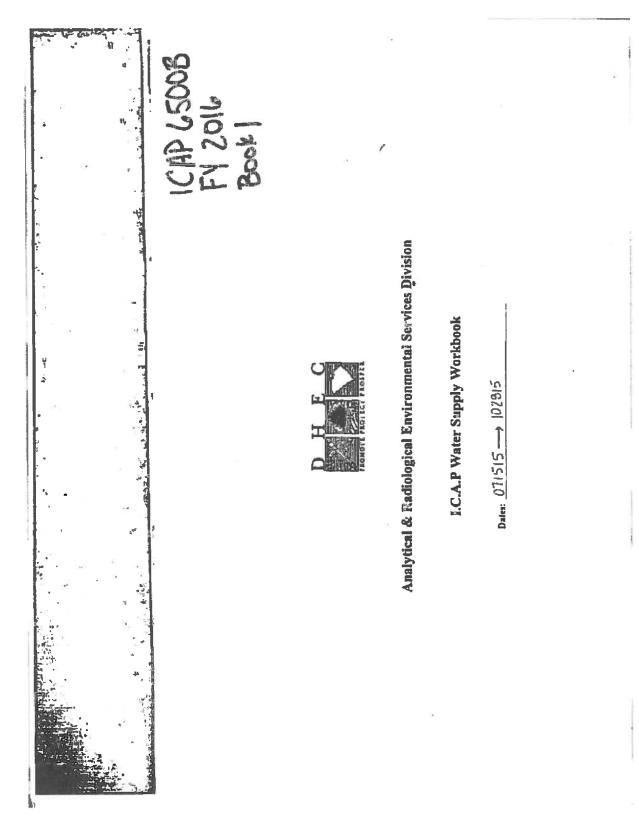
			Standard I	QCS Solution Methods 3117	th				
	48	ALYDCAL	MLIAI	S SECTION	ERVICES DI	VISION			
lake Dally	Ar.	and a state of the			and the state of t		a. 9	2	
Stock Standard Source	Lot Number/ Expriration data	Amount Stock Used (ml)	Lot Number Aeld	nsi Acid Used	Di Water	Finel Volume/ Conc.(ppb)	Date Prepared	Prepared By	
Johne		famt			j	Conception 1			
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			Meta Anal	Metals Digestion Workbook for Water, Sediment, and Fish Analytical & Radiological Environmental Services Division	orkboo logical]	k for Water, Environment	Sedime tal Servi	nt, and ices Div	Fish ision
Beaker Number	Sample Number	Charge Code	Weight (g)	Parameters Requested	Beaker Number	Sample Number	Charge Code	Weight (g)	Parameters Requested
1	RB		Soml						
2	Frame LFB(HS)								
~	LFB (F)								
5	AD68309	WSR			Б				
٦,	Duplicak								
و	1068333	WSR							
٢	(Hz) (Hz)					•			
в	M68119	WSR							
6	((LTm(E))								
01	1067857	WSR							
11	68315								
4	63536								
(3	L 69160								
	Drustian black .	FTWTT			Rixtles	H143536			
						HH16877			Thermometer, 83.960
Date: 01 21 16	12116		_ Lot #1	Lot # HNO3: RGD11916N		Initial Dig	Initial Digestion Temperature:		91.2 °C
Matrix:	Hw		Lot # (Lot # of Digestion Tubes: (504344-7A+5316-E0	4346-74.53		Final Digestion Temperature:	_	92.5 °C
Analyst: Lot # HC	Analyst: It Lot # HCI: FEDININH		Lot # (Lot # of Spike Stocks: <u>[FEO22415]WS (2.5ml</u>) <u>R60104086F1 (50 ml)</u>	720224150WS (2.5m) RG010416561 (50 21)		Start Time: []:00 Disection SOP Used:	Ending Time:	Time: <u>4.00</u> b.)
			1						

Attachment V

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Attachment VI-A



Attachment VI-B

) Working				
DI Water: MQRM324			Lot #: FE	0711515 DC	SHL
Date Prepared: 0715	15 15082	515	Prepared	By: m	
Vendor of Parent Solut	ion: AccuStandard	High Ruily Sta	ndards		
			Stock Conc.		Final C
Compound	Item #	Lot #	(mg/L)	(mL)	(mg/]
1. Sodium (Na)	INFCS-7	1429612	1000	10	10.0
2. Magnesium (Mg)	INFCS-7	1429612	1000	10	10.0
3. Aluminum (Al)	INFCS-7	1429612	1000	10	10.0
4. Calcium (Ca)	INFCS-7	1429612	1000	10	10.0
5. Iron (Fe)	INFCS-7	1429612	1000	10	10.0
1					
				1	
In addition to the abov	e listed alignot of s	tandards, 10 mL of	concentrated ni	tric acid and	50 mL of
concentrated hydrochl	oric acid were add	ed to a 1000 mL cla	ss A volumetric	flask contain	ing abou
mL of deionized water	The solution was	then diluted to volu	me with deioniz	zed water.	
hur of deformined water	· THE SOLUTION MUS	Such Allanda IO FOID			

Attachment VII

				orking Stan			
) Intermediate (X) Working	a 1			5 5		_
Date Prepared: 4-17		Prepared I	Ry: en	Remake Da	ailar	· · · · ·	24
DI Water ID: MORM3		I repared i		11D0/24150			
	Slock	ĩ	ACIO ROME	1100724150	PIN S	¥	-
	Canc.(wg/L)	Amount	Volume	Final Conc. ug/1	mi i+i		ت قر
Compound	Se 5x Conc	used(ml)	made(mi)	Se 5x Conc.	Nitrie Acid	Standerd Lot #	
0.5 ppb(Ultra Std A & D)	10000	0.0025	50	0.5	1.0	DR0812159.5WS	-
0 ppb (Ultre Std A. R. El)	10000	0.005	50	1	1.0	D10812151.0WS	
D ppb (Ultra Std A & B)	10000	0.05	50	10	1.0	D1008121510.0WS	
20 ppb (Ultra 5td A & E)	10080	01	50	20	1.0	DIL08121520.0WS	
100 ppb (Utim Sid A & E)	10000	0.5	50	100	1.0	D11081215100WS	
200 ppb (Ultra STD A & B)	10000		50	200	1.0	DH081215200W5	
Californion Blank(Reagent Blank) CS Part A (Part B)(LFB)	N/A	N/A	50	0	1.0	DHORI215WSCB	-
AccuStandard)	10000	0.25(0.25)	50	50	10	DII08)215WSQCS	
CS Part A(Part B) AccesStandard)	Sec Chart	0.15(0.010)	50	See Chart	1.0	DEIO81215WSICS	
	Uirs/Accelenatore Conc.(mg/L)	Dete	Atomtandard Laut/ Esp. Date	Annelandard Jaharfaranar Check	Circl. (ppts)	Attentendard Latifi Kap- Bala	Final Can (og1.)
SULATION SITE OF	10	T99879	212065118-02	Part A		213035902-01	
Aluminam (Al) was shared	10	02/28/18	7/16	I-Aluminum (Al)	1000	2/16	300
Anlinony (Sb); making (Strate	10		· · · · · · · · · · · · · · · · · · ·	2.Carbon (C1) 2	2000		600
Statenie (AD)	10		-	1'Calcium (Ga) -El	3000		900
Beryllium (Bb)	10			4 Chlorine (CI)	18000		
(Caddalum)(Cd))+	10			Sliron (Fe)	2500		4500
Cromoun (C)	10					*	750
	10			(Me) merek fin	1000		300
Kernyeshika ang	10				20		6 0
	10			B.Phillphiotust.(P)	1000		300
	FU			9 Polassium (K.) si	1000		300
U. MERSENELE IN D. Frank Shows	10			10.Sodiam:(Na) 2	2500		750
Molybeenum (Mo) manerican vi	10						
2. Nickel (NI) A Statement August	10						
3. Selenum (Se) and manuals	50			L'Argenic (Ailerin	10	212025082-02	10
A REAL PROPERTY OF A REAL PROPER				2. Caldialain (Cd) :	10	2/16	10
				The second se	-/11		
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	10			diChiomifiel (Ci)	20		20
n († 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Marine Martin, f. 1997, frankriger Stationer, f. 1997	10			() () () () () () () () () () () () () (20		20 20
n († 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Marine Martin, f. 1997, frankriger Stationer, f. 1997	10 10 10			lichtenifiel (Ci) S.Cojper (Ti) (Si Si Shermani (Ti)	20		20 20 20
n († 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Marine Martin, f. 1997, frankriger Stationer, f. 1997	10 10 10				20 20 20 20		20 20 20 20
n († 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Constanting († 19. – Stationer Stationer, f. 1997) 19. – Marine Martin, f. 1997, frankriger Stationer, f. 1997	10 10 10			45Childenifiel (C) 5.Copper (C) Es 61.Stangenetie musi 7.Nickel((N))2002 6.Schellung (Si)1	20 20 20 20 20		20 20 20 20 20 10
5. Elektrony (ED) 5. Supplier (EE) 6. Junit (EE) (EC) (EC) (EC) 7. Junit (EE) (EC) (EC) (EC) 8. Since (En) (Jacobio) (EC) (EC) 8. Since (En) (Jacobio) (EC) (EC) (EC) (EC) (EC) (EC) (EC) (EC) (EC) (EC) (EC)	10 10 10	CL-2415	212885074.07		20 20 20 20 20		20 20 20 20 20 10 20
	10 10 10	CL-2515 07/31/17		45Childenifiel (C) 5.Copper (C) Es 61.Stangenetie musi 7.Nickel((N))2002 6.Schellung (Si)1	20 20 20 20 20 20 20 20		20 20 20 20 20 10
5. Elektromy (ED) 5.2 might and first D. Upmitting (ED) 5.2 might and first 2.2 Vanishing (ED) 5.2 might and first 8.3 Zinci (Zn) Unishing Arbitration Statis B (65:22/2005-100-100-100-100-100-100-100-100-100-	10 10 10 10	CL-2515 \$7/31/17	212885974-03 6/16		20 20 20 20 20 20 20 20		20 20 20 20 20 10 20

Attachment VIII - A

DH	EC	Palladium/N	Aagnesium Matrix	<u>Modifier</u>
		•	Metals Section Radiological Environmo Division	ental Services
Alfa Aesar Palladium Lot # /exact weight (300 mg)	DJ Water	Conc. Nitric Lot # (1 mL)	Alfa Acsar Magnesium Nitrate Lot # /exact weight (200 mg)	Modifier Lot # (Final volume = 100 mL)
23960	MQRM324	1114110	23106	CH062315PM1
HIZEYees	MQRM324	11 4070	2316/ (0.02.00	RG.0528151M
425 Yess	MQRM324	111 4110	1 400.25	Gr 1024 KP
M 18 Yest WY. 0.6014	MQRM324	111 5080	23106 (0. 4071	G 0114/6F
QQGC(T	MQRM324	112000		UT DITIO
	MQRM324			
······································	MQRM324			
	MQRM324			

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Attachment VIII-B

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Ana	Preparation GFAA M. lytical & Radiological Envi	ronmental Servi	ces Divisio	n an
) Intermediate (X) Working	ng		5 B AS 55	
Date Prepared:	Prepared By:			
Remake As Needed	Balance used:		5	
Lot Number:	가락이 가락 가락 가 봐.	A 21 3		5 8
	ē	Amount	Volume	Final
Compound	Lot #	used(mg/ml)	made(ml)	Conc.
alladium Nitrate			maac(IIII)	00110.
Magnesium Nitrate Conc. Nitric Acid				
Conc. Nitric Acid				
Type I DI Water	MQRM330			
				• •
				_
			<u>a (j</u>	

Attachment IX-A

MERCURY DIGESTION

STANDARD METHODS 3112B

<u>STEP</u>

COMPLETED 1. Turn on water bath and allow to reach 95 +/- 2 deg. C. 2. Add standards and samples to proper digestion vessels. 3. Add Sulfuric acid solution to all digestion vessels. 4. Add Nitric acid solution to all digestion vessels. 5. Add Potassium Permanganate solution to all digestion vessels. 6. Wait 15 minutes. START:_____ FINISH:____ 7. Add Potassium Persulfate to all digestion vessels. 8. Transfer all digestion vessels to 95 +/- 2 degree water bath. 9. Digest for two(2) hours. START:_____ FINISH:___ 10. Remove and allow to cool to room temperature(may be held overnight). 11. Turn on Cetac Analyzer(A or 8) and allow lamp to warm. 12. Just prior to analysis add Sodium Chloride-Hydroxylamine Hydrochloride solution and mix. Add extra if Potassium Permanganate color does not dissipate. 13. Pour into appropriate sample tubes and analyze.

Attachment 1X-B

	Preparation Analytical &	Padiological En	um Permanganate Solution vironmental Services Division
Intermediate (X) Wo		madiological Di	VITOI MENTAL SET VICES DIVISION
		·····	
otassium Permanganate Lot#	Amount Added	DI Water	5% Potassium Permanganate Lot #
12166ala	200 grams	RO332	6P030615PPM
121666	200 grams	ROJSZ	GP OLIGIS POM
12/11/0	200 grams	R0332	GPOLIGISPPM GPOROSISPPM
121660	200 grams	R0332	mA102215 (PM
	200 grams		
	200 grams 200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams	•	
	200 grams		
	200 grams	-	
	200 grams		
Date of Manufacture			Final Volume = 4000 mL
Palance ED- Fi	1628		*
		<u> </u>	
			- /
			Page:

Attachment IX-C

Intermediate (X) We	orking		
Potassium Persulfate			
Lot#	Amount Added 200 grams	DI Water RO332	5% Potassium Persulfate Lot # GP030915 PF
083939	200 grams		
<u></u>	200 grams		GP061915 PP
094173	200 grams	_R033Z	GROGOJISPPS
	200 grams		
	200 grams 200 grams		······
	200 grams		
	200 grants		
	200 grams		······································
	200 grams		
Date of Manufacture Calance FD - F76			Final Volume = 4000 mL

Attachment IX-D

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Sodium Chloride		Hydroxylamine Hydrochloride			Final Solutio
Lot#	Amount Added	Lot#	Amount Added	DI water	Lot#
	480 grams		480 grams	RO332	600309155
113666	480 grams	1174004	480 grams	R0332	
113666	480 grams	1/7400A	480 grams	Rosz Mi	640619155
113600	480 grams	1174001	480 grams	Ro322	
13460	480 grams	11/40011	480 grams	<u></u>	MA 62815-S
h	480 grams		480 grams		
	480 grams		480 grams		
<u> -</u>	480 grams		480 grams		
	480 grams	· · · · · · · · · · · · · · · · · · ·	480 grams		
	480 grams		480 grams		_
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams	-	
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
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	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams	-	
	480 grams		480 grams		
	480 grams		480 grams		1
	480 grams		480 grams		
	480 grams		460 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
	480 grams		480 grams		
Date of Manu Balance T-D-	facture included in 1 F767g	Lot #	Final	Volume = 4000	m Ļ.

Attachment D	X-E	
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Intermediate	X) Working	Radiological Envi	Tottinenta.	Services Division
) maintediate (.	A) Working	Actuality as needed		
	·			
tannous Chloride		Conc. HCL Acid		
Lot#	Amount Added	Lot#	DI water	
140-175	400 grams	4113110	RO332	6 POG //15SCR
140475	400 grams	4113110		GADG19155CRS
140475	400 grams	ી//4/12/	KU332	GPUOPOU FISCAS
140475	400 grams 400 grams	47141021	R0332	MA 0910 15520
140 475	400 grams	4114070	<u>20332</u>	MA 112515500
	400 grams			
	400 grams 400 grams			
	400 grams			
	400 grams 400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			<u> </u>
	400 grams			
-	400 grams			
	400 grams			<u> </u>
	400 grams		·	<u> </u>
	400 grams			
_	400 grams			
Date of M 000mL	anufacture inclue	led in Lot#.		Final Volume :
Jalance ED .	F7678			

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Attachment IX-F

	Analytical & Ra	on of 1:1 Preservati diological Environm	nental Services Division
Intermediate (X) W	orking	and Break and the and	Nemet Coll 11003 Prevaluit
Concentrated Nitric	High Purity Acid		Preservative 1:1 Nitric Ac
Acid Lot #	Vendor	DI Water	Lot#
4156260	Nito Punty Stds	MQRM324	1415626MR 061815
501737	High Purity Sole	MORM324	1509773 ML-090415
1521026	High Pricipe - He	<u>MQRM329</u>	1521026 ML 012016
	<u>├</u>		
· · · · · · · · · · · · · · · · · · ·			
			-
		<u></u>	
Date of Manufacture	included in fact #		187-1 1000 7
vale of Manniac(0)	HIGHTED IN FOR #	19 8.0	al Volume ≈ 4000 mL
			<u></u>
			Page:

Attachment IX-G

	Prepa	ration of Mercury Rinse Radiological Environme	Acid Solution
Intermediate (X) Wor		Radiological Environme	atal Services Division
		<u>}</u>	
80mL Concentrated		80mL Concentrated HCI	
Nitric Acid Lot #	DI Water	Lot #	Manage Disea Antil Land
	RO332	4114050	Mercury Rinse Acid Lot #
1114080	ROSSIC	4//3/10	GPO4Z11SM
1114080	- Heussie		62061715 MR
1114080	ROSSZ	-AIMAKI	GHOROSIAS MA
11-10-00		1	GOGOIS MR
1115010	R0332	4114121	MA102 Lus MR
115010	RD 332	1	MA 102615m/2
115010	R 0332	4114070	mA120115 MR
1115010	R0332	4114070	- mA-120115 M
115010		4114070	MA-121015ml
1115010	R0332 R0332	4114070	MA RIOIS MR
115010	Rn 332	4114.70	MA 010416 MR
	• .		
	· ···		
	<u></u>		
. <u> </u>			
Date of Manufacture i	ncluded in Lot #	Final	Volume = 4000 mL
	····		
			Page:/

Attachment IX-H

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		Radiological Environ			1011	1
X) Intermediat		Remak	е ечегу б п	ionths.		Į
DI Water ID: R	.0332					
	······					1
Acid Lot	Stock #-Exp.	Working Standard	Stock	Amount	Final	
		Lot	Conc.	used	Conc.	4.902
		CPOST IS MUTOD	1000		2.50.00	Deam
iH 4660	TONICK-OG/0/2	-69090X15	- + 09	25	100	
1114080	Taahaz-06302	GAPO90515 MILOO	1000	<u> </u>	0.6	× 0907
						1
						J
_						
]		
n addition to th	c above listed aliquats	of standards, 0.5 ml of	concentrat	ed nitrie		
cid was added	to the 50 ml volumetr	ic flask containing abo	ut 20 ml of	deionized		
		o volume with deionize				
/endor is VWI	R .					
DJ Water: RO3						

Attachment IX-I

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		aration Mercury adiological Enviro			ision
X) Intermediate		Remake every mo			
DI Water ID: RO3					
endor of Parent S	olution is Ultra Scien	tific			_
Acid Lot	100 ppm Lot#	Working Standard Lot#	Stock Conc.	Amount used	Final Conc.
SAN2/02/08/18	56005'19/5MI100			16	mg/L 381!003
1114080	1000110311100	WRD90515MI			
11408D	GP070315milloo	CONCING IC IN	1000m		1.00
114080	GPN903KMILOD		100 pm	lal	1.00
111 5010	6-P 0903 15MI 100	MA HARICON	looppo	-lat	1.0
11:5010	GP Mazisalla	MAL IN A SWEET		- Jack	
11.5010	C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-	MALA CI 116 MU	1. rapm	Line	1.00
112010	GP09 0315 M1100	NO. 13-11 W 1-11-16	100 mm	100	1.00
					-11-16
<u> </u>					
]		
		L sect			
addition to the al	ove listed aliquats of	standards 25 ml o	Concentrat	ed nitric	
	he 100 ml volumetric				
	e solution was then d				
endor is VWR .			· · · · · · · · · · · · · · · · · · ·		
Water: RO332					
nto -63 fame Contan	e is included in the W	larking Latil	Page		~

Attachment IX-J

) Intermediate ()	K) Working	Remake weekly.			
DI Water ID: RO33	2				
Vendor of Parent S	olution is UltraScie	ntific			
	l ppm	Working Standard	Stock	Amount	Final Conc
Acid Lot #	Lot #	Lot#	Conc.	used	ug/L (ppb)
N-SI/114080		6407067-SHOOPPB	in l'ppml	10	100
1114080	GPOTES STARS	GPOTISISI BOOK	leam	10 ml	100
11140 80	GPOTOGE MIL	GPDTZTK 100 PP6	lippo	10	108
1114080	GRUSDSISMI	GPOBOSIS 100 poin	1 ppm	10 ml	100
1114080	GRORDSISMI	6PMBIDIS 102 pob	loon	10.	60_
11/4080	GOBOSISMIL	690875 100 pol		10.1	100
L	611905151111	GADRZSISIOD DOL	Later	Dal	100
1		GROBSI ISIODach	1 ODAL	10.01	(12)
1140 SD	GPD90315MIN	6050815 100,000	Dom.	(Dml)	100
114087	C-P090315M11	MANGHUS IMAND	lam	Jarek	100
1114080	3-P090315 MII	ma 092115 Intel	1 Sam	bund	
1141080	68090315m11	MA 092215 4 10-1	100m	Jank	100
1114080	6-2090315m1	mAnagels loopp	l ath	Lund	100
114050	MAID #715mil	mA 120715 10000	jam	Inul	
11140 80	MA 100715 MI	m4 10 13 15 100mb	1000	Inush	1:00
1114080	ma-1007 15 4411	MA 101915 alonh	Ippm	10.11	
114080	MA 1007 15 MIL	MA 102615 100000		121	
1115010	MA 100715 MI	MA HOZIC Imcob	- ippin-		_/m
1115010	MAH 0915ml	11 11 03 15 100 cola	- 10pm	10 ml	100
11 5010	mA 110915m11	ma 112315 hard	1.000	louiL	100
111 5010	mauraismil	ma 1130 15 bolt	- loom	Jour	
1115010	-ma 12065 -	-mA 12-0K.5	1 hono		
115010	m(1)-20715 MII	MA 12 1815 100000	lopm	lome	100
115010	mA 120715 m11	MA 11415 100 al		lo w.L	
	100 120715 mil	ma li	- loom	-10-20-5	n
1115010	MA 12075 MI	mt- 12 2915 10000 b	- acagana	low	100
1115010	mA-OIHI6 MIN	mA DINIL 10000	-100-	town	100
19010	mA at 13 16 rain	mA chail isada		InuL	
		this areas	-1903-	1000 -	100
n addition to the ab	ove listed aliquats	of standards, 2 ml of 1:1	nitric acid w	as added to	the 100 ml
		l of deionized water. Th			

The 1:1 nitric acid vendor is: VWR

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Attachment X



A Waters Company

Reference Materials

- Certificate of Analysis -

 Product:
 WatR™ Supply Inorganic Disinfection #1

 Catalog Number:
 5272

 Lot No.
 S195-5272 - QCCS - D181-15-1

 Certificate Issue Date:
 January 22, 2013

 Expiration Date:
 February 28, 2015

 Revision Number:
 Original

CERTIFICATION

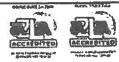
Parameter	Certified Value ¹	Uncertainty ²	QC Performance Acceptance Limits ³	PT Performance Acceptance Limits ⁴
	μg/L	%	μg/L	jug/L
Chlorate	83.1	5.90	62.5 - 101	58.2 - 108
Chlorite	317	3.05	217 - 425	222 - 412

ANALYTICAL VERIFICATION

Parameter	Certified Value ¹	Proficiency T	esting Study		NIST Tra	ceability
	3	Mean	Recovery ⁵	n	SRM Number	Recovery
	μg/L,	µg/L	%		s	76
Chlorate	83.1	B4.2	101	9	-	
Chlorite	317	306	96.6	10		

Prepared using ImL of lot # 5195-5272 diluted to 200 mL DI water DI-water - synergy UV Serial # F8 MN17457B (room 320)

prepared by CDM 1/23/15



Page 1 of 2 Lot: \$195-5272

16341 Table Mountain Pkwy • Golden, CO 80403 • T: 800.372.0122 • 303.431.8454 • www.eragr.com

- 1,4 " *

Yorkbook Vorkbook Mavedengdt: 578 nm Varbortving Absortving	Cyantide Workbook Analytical & Radiological Environmental Services Division -9-16 Colorinente Analysis Dus. -19-16 Warelength. Strate Warelength. Strate -9-16 Colorinente Analysis Dus. -19-16 Warelength. Strate Monothus Analytical & Radiological Environmental Services Division -9-16 Colorinente Analysis Dus. -19-16 Warelength. Strate Monothus Ananching Reported Analytical & Source of m. Longinal m. Abacching Abacching Abacching Source of m. Curre 0.0374 0.5123 0.417 1-10 -1 -1 -1 50 50 0.0374 0.5123 1-10 1 1 50 50 50 0.0374 0.5123 1-10 1 1 50 1 50 5 0.0379 10.4125 1 1 50 50 50 50 0.3379 10.0717 1 1 1 50 50 50 0.3379 10.0717 1 1 1 50 50 <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></td<>											
Attalytical & Radiological Environmental Services Division Attalytical & Radiological Environmental Services Division -9-16 Culorimetric Analysis Duc. -1.9-16 Weedengie. Weedengie. Culorimetric Analysis Duc. Colorigation Mile of Spin Solution Mile of Spin Spin Spin </td <td>Analytical & Radiological Environmental Services Division -9-16 Colorments Analysis Date: /-19-16 Wardength: S13 nm Cell Publicand 19-16 Colorments Analysis Date: /-19-16 Wardength: S13 nm Cell Publicand 19-16 Colorments Analysis Date: /-19-16 Wardength: Stondard Absorbage Publicand Ell Publicand 10-16 0 0 10 0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Cyanide</td> <td>e Workboo</td> <td>×</td> <td></td> <td></td> <td></td>	Analytical & Radiological Environmental Services Division -9-16 Colorments Analysis Date: /-19-16 Wardength: S13 nm Cell Publicand 19-16 Colorments Analysis Date: /-19-16 Wardength: S13 nm Cell Publicand 19-16 Colorments Analysis Date: /-19-16 Wardength: Stondard Absorbage Publicand Ell Publicand 10-16 0 0 10 0						Cyanide	e Workboo	×			
-19-16 Colorimeric Analysis Date: $I - I - I - I_{\rm ent}$ Wendergut: S18 ann Colorimeric Analysis Date: $I - I - I_{\rm ent}$ Reported Sampling Location mL of Spin Source of and (Spin Source of (Spin So	-19-16 Colorimetric Analysis Date: $I-19-16$ Wavelength: S18 mm Coll Perth Langht Reported Namping Leasion ml of Spits Source of Source Source of Source Monothance Monothance Monothance Monothance Reported 0 N/H 50 50 0.024 0.51423 10 1 0 1 5 5 0.034 0.5145 10 1 0 5 0 0.75 1 5 10 2 1 5 5 0.037 0.5145 10 1 5 5 0.037 0.5145 10 1 5 5 0.037 0.5145 10 1 5 5 0.037 10.457 10 1 5 5 0.037 10.457 10 1 5 5 0.337 10.6457 10 1 5 5 0.337 10.6457 10 1 5 5 0.337 10.6457 10 1 1 1 5 5 0.337 10 1 5 5 5 0.337 10.6457				Analytic	al & Radi	ological E	nvironmer	ital Servic	es Division		5
Reported Value my/L Sampling Location added "Long fight (1/2) Source of sample sample (1/2) "Long fight sample (1/2) Source of sample (1/2) "Long fight sample (1/2) Source of sample (1/2) "Long fight scale "Long fight scale <th"long fight<br="">scale "Long fight scale<td>Reported Value mg/L Sampling location added The offspite (17.27) Source of Sample Source of Absorbance Monotance Machina for Absorbance Machina Source of Source of Source</td><td>Distillation Date: /-/</td><td>19-16</td><td>Colonimetric</td><td>e Analysis Date:</td><td>1-19-16</td><td></td><td>Wavelen</td><td>gth: 578 nm</td><td>Cell Path Length:</td><td>1 cm</td><td>Τ</td></th"long>	Reported Value mg/L Sampling location added The offspite (17.27) Source of Sample Source of Absorbance Monotance Machina for Absorbance Machina Source of Source	Distillation Date: /-/	19-16	Colonimetric	e Analysis Date:	1-19-16		Wavelen	gth: 578 nm	Cell Path Length:	1 cm	Τ
$c e \cdot e I_{c} M_{eb}$ O n/I $5 O$ $c 0 = 7$ $0 = 0.17$ $0.001 = 7$ $1 = 0$ $1 = 0$ $1 = 0$ $1 = 0$ $1 = 0$ $5 = 0$ 0.024 0.5423 $0.01 = 0.7$	$c = 0.0/m_0 V_{ex}$ O wir $5O$ $5O$ $5O$ $5O$ 0.0317 0.5123 93.5 V_{ex} 0.5 I° $5O$ $5O$ 0.037 0.3346 93.5 V_{ex} 1.0 I° $5O$ $5O$ 2.0668 $4.831/$ 96.8 K_{ex} 5.0 I° $5O$ $5O$ 2.0668 $4.831/$ 100 X_{bx} I° $5O$ $5O$ $5O$ 2.0668 $4.831/$ 100 I° $5O$ $5O$ $5O$ 3.9369 I° $4.931/$ 100 I° $5O$ $5O$ $5O$ $5O$ 3.99668 $4.831/$ 100 I° $5O$	Sample Number	Reported Value mg/L	Samplang Location	mL of Spike added	Source of Standard (1°/2°)	mL Original Sample	mL.Absorbing Solution	Absorbance	H& CN ⁻ from Curve	Calculated CN Value me/L	
$1c^{0}$ Z d_{cc} 0.5 1° 5_{0} 5_{0} 5_{0} 5_{0} 2° 1° 5_{0} 2° 1° 5_{0} 2° <td>$log' L_{c}$ 0.5 $l'o$ f_{co} f_{co}</td> <td>Blank</td> <td>< 0.01mg</td> <td></td> <td>0</td> <td>NIA</td> <td>50</td> <td>18</td> <td>0.007</td> <td>7190.0</td> <td>0.00195</td> <td>Т</td>	$log' L_{c}$ 0.5 $l'o$ f_{co}	Blank	< 0.01mg		0	NIA	50	18	0.007	7190.0	0.00195	Т
93.7 Åz 1.0 1.0 1.0 1.0 1.0 2.0 2.0 1.0 5.0	93 k Rk 1.0 2.0 3.0 3.0 1.0 1.0 1.0 1.0 2.0 3.0 3.0 1.0 0.0 3.0 1.0 0.0 3.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.5	স্থ	V	0.5	01	50	50	0.024	0.5423	0.01045	-
Ico & Alz 2.0 10 50	Ico \mathcal{R} Ac $2, \circ$ $1 \circ$ $5 \circ$ $5 \circ$ $2, \circ$	1:0			1.0	10	50	50	0.039	0.9346	0.01669	Γ
q_6 2. k_c 5.0 7^o 50 50 50 50 50 73 910^{10}	q_6 Z, k_{eb} $5,0$ $7o$ 50 $5o$ $5,0$ $7o$ $8^{21/1}$ $1oo$ $7o$ 50 $5o$ $5o$ $5o$ 2337 $1o.0875$ $1oo$ $1oo$ $7o$ $5o$ $5o$ $5o$ 3373 $1o.0875$ $1oo$ $1oo$ $1oo$ $1oo$ $5o$ $5o$ 2373 $1o.0875$ $1oo$	2.0	100 % Re	J	2.0	10	50	50	0.080	2.0068	0.04014	ŀ
Toe \mathbb{Z} Rek 10.0 10 50 50 50 50 50 50 50 e1 ppm Standard D: 16-404 1:1 H2SO4 Acid D: 15-373 Date Curve Analyzed: 1-19-16 Tearler 12.5 e1 ppm Standard D: 16-405 NaOH 0.25N D: 16-402 Curve Stope: 0.038 9:Air/lefton T.* e1 ppm Standard D: 16-405 NaOH 0.25N D: 16-406 Curve Stope: 0.038 3:Air/lefton T.* 16-418 Color Reagent D: 16-405 NaOH 0.25N D: 16-406 Curve Stope: 0.038 3:Air/lefton T.* 16-418 NaOH 0.25N D: 16-406 Curve Stope: 0.038 3:Air/lefton T.* 16-418 NaOH 0.25N D: 16-406 Curve Stope: 0.038 3:Air/lefton T.* 16-418 NaOH 0.25N D: 16-406 Curve Stope: 0.038 3:Air/lefton T.* 16-418 Dife Analyset: CN, mg/L= AX 50 Where: A = µg CN read from cultination curve B:X C B = mL origenal sample used in distiltation 0.038 Spectrophotomerer D: 2:474 16-407 Dife Analyset: CN, mg/L= AX 50 Where: A = µg CN read from cultination curve B:X C Dife Analyset: P:474 16 Dife Dife Analyseti	ree $7.0.0$ 7.0 5.0 5.0 5.0 3.337 10.0875 e ¹ ppm Standard D: $16-406$ 1:1 H2SO4 Acid D: $15-513$ Date Curve Analyzed: $1-15-16$ e ¹ ppm Standard D: $16-405$ NaOH 0.25N D: $16-406$ Curve Slope: 0.038 e ¹ lppm Standard D: $16-405$ NaOH 0.25N D: $16-406$ Curve Intercept: 2.0038 $16-48$ Color Reagent D: $16-406$ Curve Intercept: 2.038 $1-15-16$ $16-48$ Color Reagent D: $16-405$ NaOH 0.25N D: $16-406$ Curve Ratespace $16-407$ NaOH 0.25N D: $16-406$ Curve Intercept: 2.0038 $16-407$ R value: 0.038 Curve Paseedf $16-407$ R value: 0.038 0.038 $16-407$ R value: 0.038 0.038 0.038 $16-407$ R value: 0.038 0.038 0.038 $16-407$ R value: 0.038 0.038 0.038 0.038 $16-407$ R value: 0.9996 0.03	5.0			5,0	10	50	50	0.188	118.4	0.09662	Γ
el Ippm Standard ID: <u>I6-400</u> li 11 H2SO4 Acid ID: <u>I5-\$13</u> Date Curve Analyzed: <u>I-15-16</u> li Ppm Standard ID: <u>I6-405</u> li Ppm Standard ID: <u>I6-405</u> le 100 Standard ID: <u>I6-405</u> le	e 1 ppm Standard ID: <u>16-4004</u> 1:1 H2SO4 Acid ID: <u>15-373</u> Date Curve Analyzed: <u>1-19-16</u> e 1 ppm Standard ID: <u>16-405</u> NaOH 0.25N ID: <u>16-401</u> Curve Stope: <u>0.038</u> 16-407 Di Water Source: <u>0.0996</u> Curve Passed/F 16-407 Di Water Source: <u>0.0996</u> Curve Passed/F 16-407 Di Water Source: <u>0.0996</u> Curve Passed/F 16-407 Di Water Source: <u>0.0996</u> Curve Passed/F tric Anatyses: CN, mg/L= <u>AX50</u> Where: A = µg CN read from calibration curve B x C B x mL original sample used in distillation tric Anatyses: CN, mg/L= <u>Di K verified By</u> . <u>0.05167</u> R value: <u>0.9996</u> Curve Passed/F C = mL absorbing solution used in colorimetric analysis Spectrophotometer ID: <u>4</u> Date: <u>114</u> Date Analyzed: <u>114</u> QC Verified By: <u>Date</u> Date: <u>114</u> Date: <u>114</u> QC Verified By: <u>Date</u> Date: <u>114</u>	10.0	100 % Re		10.0	10	50	So	0.389	10.0875	0.20175	1
e1 Ippm Standard ID: $I_6 - 4Od$ 1:1 H2SO4 Acid ID: $I_5 - 813$ Date Curve Analyzed: $I - 13 - 14$ e1 Ippm Standard ID: $I_6 - 4Od$ 1:1 H2SO4 Acid ID: $I_6 - 4Od$ 1:1 H2SO4 Acid ID: $I_6 - 4Od$ I_{11} H2SO4 I_{11} H2SO4 I_{12} $I_{12} - 12 - 16$ $I_{12} - 12 - 16$ $I_{12} - 12 - 16$ $I_{12} - 4Od$ $I_{12} - 4Odd$ $I_{12} - 4Odd$ $I_{12} - 4Odd$ <t< td=""><td>e I ppm Standard ID: I.E + YOH 1.1 H2SO4 Acid ID: I S - \$13 Date Curve Analyzed: I - 19-16 e I ppm Standard ID: I.E - ¥OH 1.1 H2SO4 Acid ID: I S - \$13 Date Curve Analyzed: I - 19-16 e I ppm Standard ID: I = - ¥OE NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S Naoh 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S Naoh 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/OT DI Water Source: I L - 4/OL Ratine: 0.038 I L - 4/OT DI Water Source: I L - 4/OL Ratine: I N - 9/OL I L - 4/OT DI Water Source: I L - 4/OL Ratine: I N - 9/OL I L - 4/OT DI R Analyzed: I - 19-16 R coorded Results Verified By: D ate: I I A Date: I - 19-16 R coorded Results Verified By: D ate:</td><td></td><td></td><td></td><td></td><td>_</td><td></td><td></td><td></td><td></td><td></td><td>Γ</td></t<>	e I ppm Standard ID: I.E + YOH 1.1 H2SO4 Acid ID: I S - \$13 Date Curve Analyzed: I - 19-16 e I ppm Standard ID: I.E - ¥OH 1.1 H2SO4 Acid ID: I S - \$13 Date Curve Analyzed: I - 19-16 e I ppm Standard ID: I = - ¥OE NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S NaOH 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S Naoh 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/S Naoh 0.25N ID: I L - 4/OL Curve Stope: 0.038 I L - 4/OT DI Water Source: I L - 4/OL Ratine: 0.038 I L - 4/OT DI Water Source: I L - 4/OL Ratine: I N - 9/OL I L - 4/OT DI Water Source: I L - 4/OL Ratine: I N - 9/OL I L - 4/OT DI R Analyzed: I - 19-16 R coorded Results Verified By: D ate: I I A Date: I - 19-16 R coorded Results Verified By: D ate:					_						Γ
e Ippm Standard ID: <u>16-404</u> 1:1 H2SO4 Acid ID: <u>15-513</u> Date Curve Analyzed: <u>1-19-16</u> Teuror 12-5 t Ippm Standard ID: <u>16-405</u> NaOH 0.25N ID: <u>16-4021</u> Curve Stope: <u>0.036</u> Stort 10:32 <u>16-407</u> Color Reagent ID: <u>16-406</u> Curve Intercept: <u>0.036</u> Stort 10:32 <u>16-407</u> DI Water Source: <u>202167</u> R value: <u>0.9996</u> Curve Passed/Failed: <u>Pass</u> <u>16-407</u> DI Water Source: <u>202167</u> R value: <u>0.9996</u> Curve Passed/Failed: <u>Pass</u> <u>16-407</u> Date Analyzed: <u>1-19-16</u> Recorded Results Verified By: <u>Date:</u> <u>1-19-16</u> <u>26-4147</u> Date: <u>214747</u> Date: <u>1-19-16</u> Octor Results Verified By: <u>Date:</u> <u>1-19-16</u> <u>26 Analyzed: <u>1-19-16</u> Recorded Results Verified By: <u>Date:</u> <u>1-19-16</u> Date: <u>1-19-16</u> Date: <u>1-19-16</u></u>	e1ppm Standard ID: $I_6 - 4Ocf$ 1:1 H2SO4 Acid ID: $I_5 - 873$ Date Curve Analyzed: $I1Q1Q$ e1ppm Standard ID: $I_6 - 4O5$ NaOH 0.25N ID: $I_6 - 4O2$ Curve Slope: 0.038° e1ppm Standard ID: $I_6 - 4O5$ NaOH 0.25N ID: $I_6 - 4O2$ Curve Slope: 0.038° $I_6 - 48^\circ$ Color Reagent ID: $I_6 - 4O5$ NaOH 0.25N ID: $I_6 - 4O2$ Curve Intercept: 0.038° $I_6 - 48^\circ$ Color Reagent ID: $I_6 - 4O6$ Curve Intercept: 0.038° $I_6 - 407$ D1 Water Source: $D_6 - 4O6$ Curve Intercept: 0.038° $I_6 - 407$ D1 Water Source: $D_2 I_6 - 4O6$ R value: 0.038° $I_6 - 407$ D1 Water Source: $D_2 I_6 - 4O6$ R value: $D_1 O_2 O_2 S_3$ $I_6 - 407$ D1 Water Source: $D_2 I_6 - 4O6$ R value: $D_1 O_2 O_2 S_3$ $I_6 - 407$ D1 Water Source: $D_2 I_6 - 7$ R value: $D_1 O_2 O_2 S_3$ $I_6 - 407$ D1 Water Source: $D_2 I_6 - 7$ R value: $D_1 O_2 O_2 S_3$ $I_1 A_1 + O_2$ Date Dater											Γ
e 1 ppm Standard ID: $16 - 400$ 1:1 H2SO4 Acid ID: $15 - 873$ Date Curve Analyzed: $1 - 18 - 16$ $76 - 12 - 5$ e 1 ppm Standard ID: $16 - 405$ NaOH 0.25N ID: $16 - 406$ Curve Stope: 0.038 $5x_{int}/kehm T^{-1}$ e 1 ppm Standard ID: $16 - 405$ NaOH 0.25N ID: $16 - 406$ Curve Stope: 0.038 $5x_{int}/kehm T^{-1}$ $16 - 448$ Color Reagent ID: $16 - 406$ Curve Intercept: 0.038 $5x_{int}/kehm T^{-1}$ $16 - 448$ Color Reagent ID: $16 - 406$ Curve Intercept: 0.038 $5x_{int}/kehm T^{-1}$ $16 - 448$ D Color Reagent ID: $16 - 406$ Curve Intercept: 0.038 $5x_{int}/kehm T^{-1}$ $16 - 4407$ D Water Source: $16 - 4066$ Curve Intercept: 0.038 $5x_{int}/kehm T^{-1}$ $16 - 407$ D Water Source: $16 - 4066$ Curve Intercept: 0.038 $5x_{int}/kehm T^{-1}$ $11:332$ $16 - 407$ D Water Source: $26 - 4066$ Curve Intercept: 0.038 0.038 0.038 0.038 $11:332$ $16 - $	e Ippm Standard ID: $16-404$ 1:1 H2SO4 Acid ID: $15-373$ Date Curve Analyzad: $1-19-16$ c Ippm Standard ID: $16-405$ NaOH 0.2SN ID: $16-401$ Curve Stope: 0.038 16-448 Color Reagent ID: $16-406$ Curve Stope: $0.03816-407 Date Curve Passed/P Curve Passed/P R value: 0.9996 Curve Passed/P Curve Passed/P R value: 0.9996 Curve Passed/P R free Analyses: CN, mg/L = \Delta X S0 Where: A = \mu g CN read from calibration curve B X Color Reagent ID: 16-406 Curve Passed/P Curve Passed/P D I Water Source: 0.038 Curve Passed/P D I Water Source: 0.038 Color Reagent ID: 16-406 Curve Passed/P D I Water Source: 0.0996 Curve Passed/P D I Water Source: 0.0916-7 R walter: 0.9996 Curve Passed/P D I Water Source: 0.0916-7 R walter: 0.9996 Curve Passed/P D I Water Source: 0.0016-7 R walter: 0.9996 Curve Passed/P D I Water Source: 0.0016-7 R walter: 0.9996 Curve Passed/P D I D I D I D I D I D I D I D I D I D$											Γ
e Ippm Standard ID: $16-404$ 1:1 H2SO4 Acid ID: $15-313$ Date Curve Analyzed: $1-16-16$ Terrer 12.5 c Ippm Standard ID: $16-405$ NaOH 0.25N ID: $16-40.1$ Curve Stope: $1-16-16$ Terrer 10:30 16-46 Curve Intercept: 0.036 Start 10:30 16-407 DI Water Source: $16-40.6$ Curve Intercept: 0.036 Start 10:30 16-407 DI Water Source: $20216-7$ R value: $0.999.6$ Curve Passed/Failed: $Passstrict Analysis: CN, mg/L = AX50 Where: A = \mug CN read from calibration curveBXC$ $B = mL original sample used in distillation Feating Block ID: H4747Date: Date Analysed: 1-19-16 Recorded Results Vorified By: Date: 1-19-16 Recorded By: 1-19-16 Date: 1-19$	e ¹ Ipm Standard D: $16 - 4Od$ 1:1 H2SO4 Acid D: $15 - 313$ Date Curve Analyzedi: $1 - 19 - 16$ e ¹ Ippm Standard ID: $16 - 4O5$ NaOH 0.2SN D: $16 - 4O6$ Curve Stope: 0.036 $16 - 418$ Color Reagent D: $16 - 4O6$ Curve Intercept: 0.036 $16 - 418$ Color Reagent D: $16 - 4O6$ Curve Intercept: 0.036 $16 - 418$ Dit Water Source: $90016-7$ R value: 0.036 Curve Passed/F $16 - 410$ Dit Water Source: $90016-7$ R value: 0.036 Curve Passed/F $16 - 4107$ Dit Water Source: $90016-7$ R value: 0.036 Curve Passed/F $16 - 4107$ Dit Water Source: $90016-7$ R value: 0.036 Curve Passed/F $16 - 4107$ Dit Water Source: $90016-7$ R value: 0.036 Curve Passed/F $16 - 4107$ Dit walter Source: $90016-7$ R value: 0.036 0.036 $16 - 4107$ Dit walter Source: $16 - 406$ R value: 0.036 0.036 0.036 $16 - 4107$ <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></td<>											1
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$16-48$ Color Reagent D: $16-406$ Curve Intercept: 0.033 349^{13} $16-407$ DI Water Source: $20216-7$ R value:: 0.9996 Curve Passed/Failed: $16-407$ DI Water Source: $20216-7$ R value:: 0.9996 Curve Passed/Failed: $16-407$ DI Water Source: $20216-7$ R value:: 0.9996 Curve Passed/Failed: $16-407$ DI Water Source: $20216-7$ R value:: 0.9996 Curve Passed/Failed: $16-407$ BX C B * mL original sample used in distillation Heating Block ID: $H+7+7$ $BX C D * mL original sample used in distillation Heating Block ID: H+7+7+7 0.9996 Curve Fassed/Failed: 7 74 0.014 D * mL original sample used in colorimetric smalysis Spectrophotometer ID: 4+7+7+7+7+7+7+7+7+7+7+7+7+7+7+7+7+7+7+7$	16-48 Color Reagent D: 16-406 Curve Intercep J6-407 DI Water Source: 20216-7 R value: 0. stric Analysis: CN, mg/L = AX 50 Where: A = µg CN read from calibration curve R value: 0. stric Analysis: CN, mg/L = AX 50 Where: A = µg CN read from calibration curve R value: 0. attic Analysis: CN, mg/L = AX 50 Where: A = µg CN read from calibration curve R value: 0. B X C B * mL original sample used in distillation C = mL absorbing solution used in colorimetric snalysis 0. A 14. Date Analyzed: /-19-16 R ccorded Results Verified By: 0. Date: Date: /1.4 QC Verified By: 0.	2° Working Cyanide	l ppm Standard 1	D: 14-405	NaOH	0.25N ID:	104-71	Curve	Slape: 0		Distillation Time Start 10:30	
J6-407 Df Water Source: Del Water Source: Del Water Source: Del Water Source: Del Mater Source:	J6-407 Df Water Source: D2016-7 R value: etric Analysts: CN, mg/L = AX 50 Where: A = µg CN read from calibration curve B X C B * mL original sample used in distillation C = mL absorbing solution used in colorimetric analysis C J14 Date Analyzed: J-19-16 Recorded Results Verified By: Date: Date: J14 QC Verified By: QC	Acctate Buffer D:	16-48		Color R	keagent ID: _	16-406	Curve		0.0033	Stop: 11:32	
<pre>stric Analysts: CN, mg/L = <u>A X 30</u> Where: A - µg CN read from calibration curve B X C B * mL original sample used in distillation Heating Block ID; <u>H 471-1</u> C = mL absorbing solution used in colorimetric analysis Spectrophotometer ID: <u>H 477-1</u> Spectrophotometer ID: <u>H 477-1</u> C = mL absorbing solution used in colorimetric analysis Spectrophotometer ID: <u>H 477-1</u> Date Date <u>J - 1 9 - 16</u> Recorded By: <u>Date: 1 - 1 9 - 16</u> Date: <u>J - 1 9 - 16</u> Date: <u>Date: Date: Dat</u></pre>	stric Analysus: CN, mg/L = <u>A X 50</u> Where: A = µg CN read from calibration curve B X C B * mL original sample used in distillation C = mL absorbing solution used in colorimetric analysis Date Analyzed: <u>/-19-16</u> Recorded Results Verified By: Date: <u>/114</u> QC Verified By: <u>QC Verified By</u> :		16-407		DI Wat	er Source:	Celler 7	R value				
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Date:	Date:	Analyst:					Recorded Res	ults Verified By		Date:		
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		Kesuits Ventied By:		- Date:			QC Varified B			Date:		

Attachment XI

Attachment XII

ARESD - Automated Analysis Section Reagent Prep Log for Fluoride Buffer Solution (Fluoride Analysis)

	(Fluoride Analysis)
	Reagent ID number RBJ - 14 - 8 .
	Fluoride Buffer Solution was prepared on 12/7/16 at 10 : 2020
	by Using Balance id
	114.0 mL of glacial acetic acid, CH3COOH was added to a 2.000 liter volumetric flask
	containing about 1000 ml of deionized water. While stirring 60.0 grams of sodium
	hydroxide, NaOH, 116.0 grams of sodium chloride, NaCl, and 8.0 grams of trans 1,2-
	diaminocyclohexane, CDTA, was slowly added to the volumetric flask. The solution
	was stired for a minimum of 30 minutes. 1.0 mL of 100.0 mg/L Stock Standard was
	added. The solution was then brought to volume with deionized water
	The vendor for the glacial acetic acid, CH3COOH, is <u>Fisher Scientific</u> .
	The Lot # for the glacial acetic acid, CH3COOH, is 104 22.1
	The vendor for the sodium hydroxide, NaOH, is Fisher Scientific .
	The Lot # for the sodium hydroxide, NaOH, is _16.2.11
	Actual weight for NaOH OODD
	The vendor for the sodium chloride, NaCl, is <u>VWR</u> .
	The Lot # for the sodium chloride, NaCl, is 144028
	Actual weight for NaCl is 1119.0000
	The vendor for the trans 1,2-diaminocyclohexane, CDTA is <u>GFS Chemicals</u> .
	The Lot # for the trans 1,2-diaminocyclohexane, CDTA is
	Actual weight for trans 1,2-diaminocyclohexane, CDTA is Q. 0000
-	Reagent ID number RBJ - 110 - 19 .
-	Fluoride Buffer Solution was prepared on 1 / 8 / 16 at 9 : 46mm
	oy Ork Using Balance id Using Balance id
	114.0 mL of glacial acetic acid, CH3COOH was added to a 2.000 liter volumetric flask
	containing about 1000 ml of deionized water. While stirring 60.0 grams of sodium
- 1	hydroxide, NaOH, 116.0 grams of sodium chloride, NaCl, and B.0 grams of trans 1,2-
	diaminocyclohexane, CDTA, was slowly added to the volumetric flask. The solution
24 1 20 00 00 10 10 10 10 10 10 10 10 10 10 10	was stired for a minimum of 30 minutes. 1.0 mL of 100.0 mg/L Stock Standard was
and a farmer of the second	was stired for a minimum of 30 minutes. 1.0 mL of 100.0 mg/L Stock Standard was added. The solution was then brought to volume with deionized water
and the second	was stired for a minimum of 30 minutes. 1.0 mL of 100.0 mg/L Stock Standard was added. The solution was then brought to volume with deionized water The vendor for the glucial acetic acid, CH ₁ COOH, is Fisher Scientific . CFL 13
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Attachment XIII

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CYCLE COUNT- A 25
CYCLE COUNT OF THE OPERATOR CONTRACT OF THE CONTRACT OF THE CONTRACT OF THE CONTRACT OF THE CYCLE NO. 1
CONTROL TEMP = 124.0C CONTROL TEMP = 123.3C STEP. TIME = 0:50:00 DRV TIME = 0:05:00
U≐inHe - TIME T= C P=⊭sis
C 8:54:50A 74.9 1.2P
C 3:55:51A 88.1 10.5P S 9:59:10A 124.8 29.1P S 9:04:11A 125.8 25.6P S 9:09:11A 125.7 23.2P S 9:19:11A 125.7 22.7P S 9:19:11A 125.5 22.4P S 9:29:11A 125.5 22.1P E 9:29:11A 125.5 21.5P 4 ALARM TOO LONG IN EXHAUST 7 9:34:21A 102.0 5.9P E 9:34:22A 101.9 3.9P
E 9:39:23A 92.3 11.80 2 9:39:46A 92.7 2.00
LOAD 110591
CHAMBER TEMP MAX=126.40 CHAMBER TEMP MIN=124.00
CONDITION = 4:28 STERILIZE =30:00 EXHAUST =10:35 TOTAL CYCLE =44:55

READY TO UNLOAD

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