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Catherine 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
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.

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
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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 QA 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 ± 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 III).

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 ICP 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 to a JPEG document and the gray shadow on 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 XI). 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 ID 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.

11.4 **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 pre-warming incubation times for Colilert-18 samples.

Response: The required pre-warm incubation time for colilert-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 altemating 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 II, Section 15 of the EPA's "Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition".

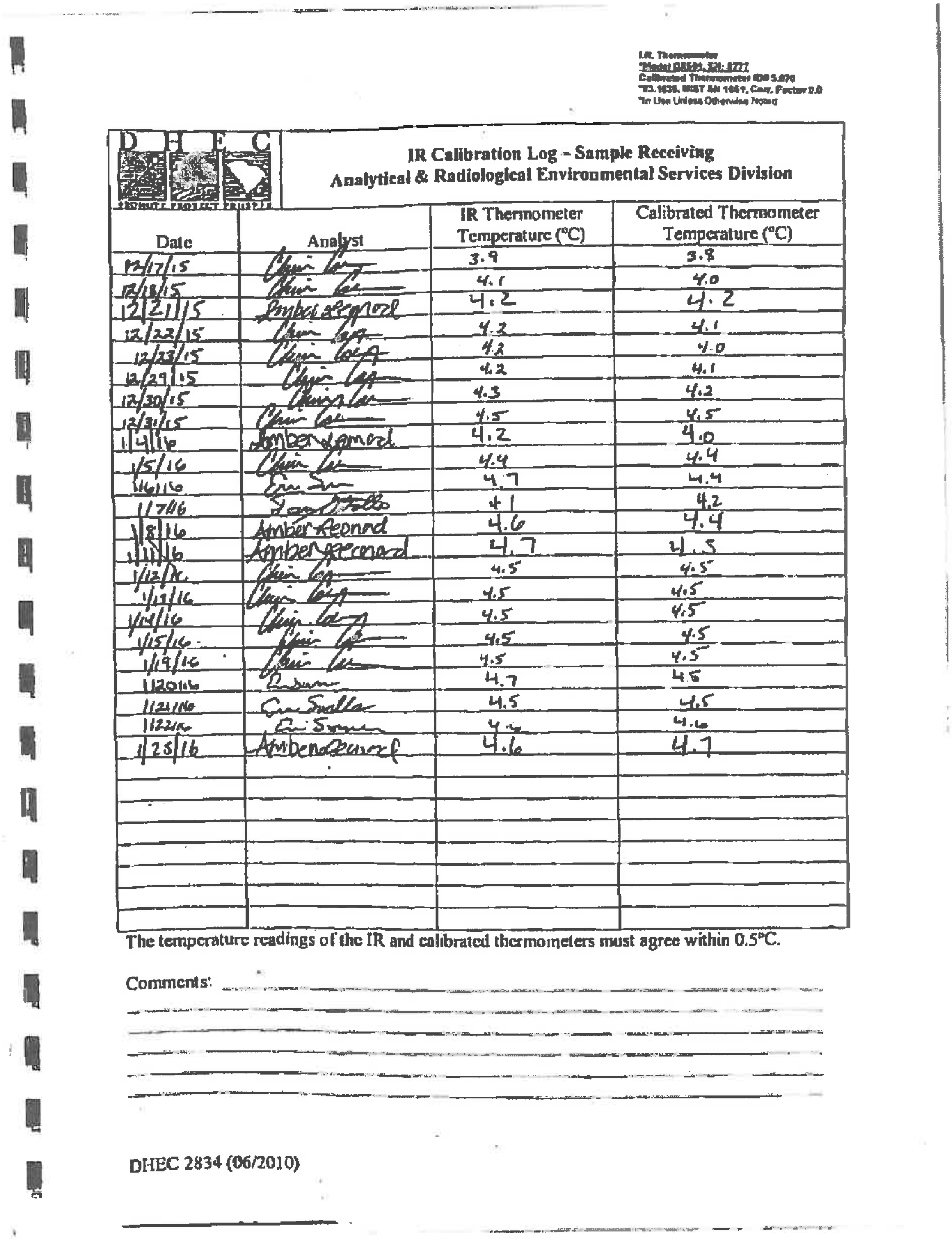
Response: The Office of Environmental Laboratory Certification will ensure that records for the on-site laboratory assessments and certification program reviews be maintained in an easily accessible location for a period of six years to include the last two on-site audits. This includes records/correspondence 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.

Table 4 - South Carolina Certified Laboratories

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

Attachment 1



I.R. Thermometer
*Model DS501, SN: 8777
Calibrated Thermometer ID# 5.070
*S3.1635, NIST SN 1651, Corr. Factor 0.0
*In Use Unless Otherwise Noted

DHEC

IR Calibration Log – Sample Receiving
Analytical & Radiological Environmental Services Division

Date	Analyst	IR Thermometer Temperature (°C)	Calibrated Thermometer Temperature (°C)
12/17/15		3.9	3.8
12/18/15		4.1	4.0
12/21/15	Amber Leonard	4.2	4.2
12/22/15		4.2	4.1
12/23/15		4.2	4.0
12/29/15		4.2	4.1
12/30/15		4.3	4.2
12/31/15		4.5	4.5
1/4/16	Amber Leonard	4.2	4.0
1/5/16		4.4	4.4
1/6/16		4.7	4.4
1/7/16		4.1	4.2
1/8/16	Amber Leonard	4.6	4.4
1/11/16	Amber Leonard	4.7	4.5
1/12/16		4.5	4.5
1/13/16		4.5	4.5
1/14/16		4.5	4.5
1/15/16		4.5	4.5
1/19/16		4.5	4.5
1/20/16		4.7	4.5
1/21/16		4.5	4.5
1/22/16		4.6	4.6
1/25/16	Amber Leonard	4.6	4.7

The temperature readings of the IR and calibrated thermometers must agree within 0.5°C.

Comments:

DHEC 2834 (06/2010)

Attachment II

SC DHEC/ARESD – Organic Sample Batch Worksheet

Acid Herbicides IX-E-3(n) EPA 515.3

Date: ____________
Chemist: ____________
QC#: ____________

	Sample Identification	pH>12
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		
26.		
27.		
28.		
29.		

Standards Used (Lot Number)
Surrogate Spike: ____________
Analyte Spike: ____________
Internal Standard Spike: ____________

Reagents Used (Lot Number)
4N NaOH: ____________
H_2SO_4: ____________
$CuSO_4$-$5H_2O$: ____________
Na_2SO_4: ____________
Diazald: ____________
Carbitol: ____________
Ethyl Ether: ____________
37% KOH: ____________
Silica Gel: ____________
Florisil: ____________
Acidified Na_2SO_4 ____________

Solvents Used (Lot Number)
MtBE: ____________
Ethyl Ether: ____________
DI Water System Used: ____________

Batch Comments:
____
____
____
____
____
____
____
____
____
____
____

Verification Analyst: ____________ Date: ____________

This Form is to be included in Data Pack
Batch Worksheet IX-E-3(n) Acid Herbicides 2016 01 12.doc

Attachment III

SC DHEC/ARESD – Organic Sample Batch Worksheet

Diquat IX-E-5(d) EPA 549.2

Date: ____________
Chemist: ____________
QC#: ____________

Sample Identification	pH Initial	pH Adj.
1. ____________	____	____
2. ____________	____	____
3. ____________	____	____
4. ____________	____	____
5. ____________	____	____
6. ____________	____	____
7. ____________	____	____
8. ____________	____	____
9. ____________	____	____
10. ____________	____	____
11. ____________	____	____
12. ____________	____	____
13. ____________	____	____
14. ____________	____	____
15. ____________	____	____
16. ____________	____	____
17. ____________	____	____
18. ____________	____	____
19. ____________	____	____
20. ____________	____	____
21. ____________	____	____
22. ____________	____	____
23. ____________	____	____
24. ____________	____	____

pH Meter Calibration:
Buffer 4: ____ Lot#________
Buffer 7: ____ Lot#________
Buffer 10: ____ Lot#________
Slope: ____

Standards Used (Lot Number)
Analyte Spike: ____________

3M C8 Disks (Lot Number): ________

Reagents Used (Lot Number)
10% NaOH: ____________
10% HCl: ____________
Cond. Solution A: ____________
Cond. Solution B: ____________
Disk Eluting Solution: ____________
Ion-pair Concentrate: ____________
Mobile Phase: ____________

Solvents Used (Lot Number)
Methanol: ____________

Batch Comments:
____
____
____
____
____
____
____
____
____

Verification Analyst: ____________ Date: ________

This Form is to be included in Data Pack
Batch Worksheet IX-E-5(d) Diquat 2015 09 08

Attachment IV-A

DHEC
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Checklist for Nitrite in Water Analysis
Analytical & Radiological Environmental Services Division
Automated Analysis Section

THE DATA SET SUBMITTED ADHERS TO THE FOLLOWING:

Calibrated with at least 5 standards producing a curve with an R value of 0.995 or higher. ____

A LRB, LFB, MRL and QCCS were analyzed after the calibration curve and prior to any samples. The results for each fell within the established acceptance criteria. ____

A LFM and duplicate LFM were analyzed with each set of 10 samples or less.
Prepared by adding 100 µL of 100 mg/L stock solution to a 25 mL volumetric flask and brought to volume with the sample. Recoveries (Accuracy) and RPD (Precision) fell within the established control limits. ____

A Blank and Calibration Check Standard (CCC) was analyzed with each set of 10 samples. ____

The integration of peaks appeared consistent and reasonable. ____

REAGENTS USED IN THIS BATCH:

REAGENT	REAGENT #				DATE MADE:	EXP.	
BUFFER	RAA-	16	-	20	01/13/16	28 DAYS	____
COLOR REAGENT	RAB-	16	-	13	01/22/16	28 DAYS	____

STANDARDS USED IN THIS BATCH:

S= Stock I=Intermediate W=Working

CONC. (mg/L)	TYPE	STANDARD #				DATE MADE:	EXP.	
100	S	S-NO2-	16	-	220	01/28/16	5 DAYS	____
10	I	S-NO2-	16	-	212	01/14/16	1 DAY	____
2.0	W	S-NO2-	16	-	213	01/14/16	1 DAY	____
1.5	W	S-NO2-	16	-	214	01/14/16	1 DAY	____
1.0	W	S-NO2-	16	-	215	01/14/16	1 DAY	____
0.5	W	S-NO2-	16	-	216	01/14/16	1 DAY	____
0.1	W	S-NO2-	16	-	217	01/14/16	1 DAY	____
0.05	W	S-NO2-	16	-	218	01/14/16	1 DAY	____
0.02	W	S-NO2-	16	-	219	01/14/16	1 DAY	____
QCCS # 163	S	ERA Lot #S210-695				11/05/15	11/30/2016	____

Batch analyzed by: ________ Date: ________

Results entered in LIMS and QC documented by: ________ Date: ________

Batch verified by: ________ Date: ________

Results validated in LIMS and QC verified by: ________ Date: ________

Attachment IV-B

D H E C

Preparation of QCS High Line Working Solution

Inorganic Section

Analytical & Radiological Environmental Services Division

( ) Intermediate (X) Working

DI Water: MQRM324 Lot #: FE122115QCS HL

Date Prepared: 122115 Prepared By: FE

Vendor of Parent Solution: High-Purity Standards

Compound	Item #	Lot #	Stock Conc. (mg/L)	Amt. Used (mL)	Final Conc. (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 (Fe)	INFCS-7	1429612	1000	10	10.0
			Pipette	EH53805	

In addition to the above listed aliquot of standards, 10 mL of concentrated nitric acid and 50 mL of concentrated hydrochloric acid were added to a 1000 mL class A volumetric flask containing about 500 mL of deionized water. The solution was then diluted to volume with deionized water.

Nitric Acid Lot #: 1114070 Hydrochloric Acid Lot #: 4114100

Page ____

Attachment IV-C

D H E C

Preparation of Silver Spike Stock
Inorganic Section
Analytical & Radiological Environmental Services Division

( ) Intermediate (X) Working	Lot #: FE021015DAg
Date Prepared: 021015	Prepared By: FE
Vendor for Silver is UltraScientific.	DI Water: MQRM324

Compound	Stock Lot #	Stock Conc. (mg/L)	Amt. Used (mL)	Final Vol. (mL)	FinalConc. (mg/L)
Silver (Ag)	K00662-08/31/16	10,000	1.0	1000	10

In addition to the above listed aliquot of standard, 50 mL of 1:1 nitric acid was added to the 1000 mL class A volumetric flask containint about 500 mL of deionized water. The solution was then diluted to volume with deionized water.

1:1 Nitric Acid Lot#: FE020315N. Remake annually or as needed.

( ) Intermediate (X) Working	Lot #:
Date Prepared:	Prepared By:
Vendor for Silver is UltraScientific.	DI Water: MQRM324

Compound	Stock Lot #	Stock Conc. (mg/L)	Amt. Used (mL)	Final Vol. (mL)	FinalConc. (mg/L)
Silver (Ag)		10,000	1.0	1000	10

In addition to the above listed aliquot of standard, 50 mL of 1:1 nitric acid was added to the 1000 mL class A volumetric flask containint about 500 mL of deionized water. The solution was then diluted to volume with deionized water.

1:1 Nitric Acid Lot#:__________________. Remake annually or as needed.

( ) Intermediate (X) Working	Lot #:
Date Prepared:	Prepared By:
Vendor for Silver is UltraScientific.	DI Water: MQRM324

Compound	Stock Lot #	Stock Conc. (mg/L)	Amt. Used (mL)	Final Vol. (mL)	FinalConc. (mg/L)
Silver (Ag)		10,000	1.0	1000	10

In addition to the above listed aliquot of standard, 50 mL of 1:1 nitric acid was added to the 1000 mL class A volumetric flask containint about 500 mL of deionized water. The solution was then diluted to volume with deionized water.

1:1 Nitric Acid Lot#:__________________. Remake annually or as needed.

( ) Intermediate (X) Working	Lot #:
Date Prepared:	Prepared By:
Vendor for Silver is UltraScientific.	DI Water: MQRM324

Compound	Stock Lot #	Stock Conc. (mg/L)	Amt. Used (mL)	Final Vol. (mL)	FinalConc. (mg/L)
Silver (Ag)		10,000	1.0	1000	10

In addition to the above listed aliquot of standard, 50 mL of 1:1 nitric acid was added to the 1000 mL class A volumetric flask containint about 500 mL of deionized water. The solution was then diluted to volume with deionized water.

1:1 Nitric Acid Lot#:__________________. Remake annually or as needed.

Page 1

Attachment IV-D

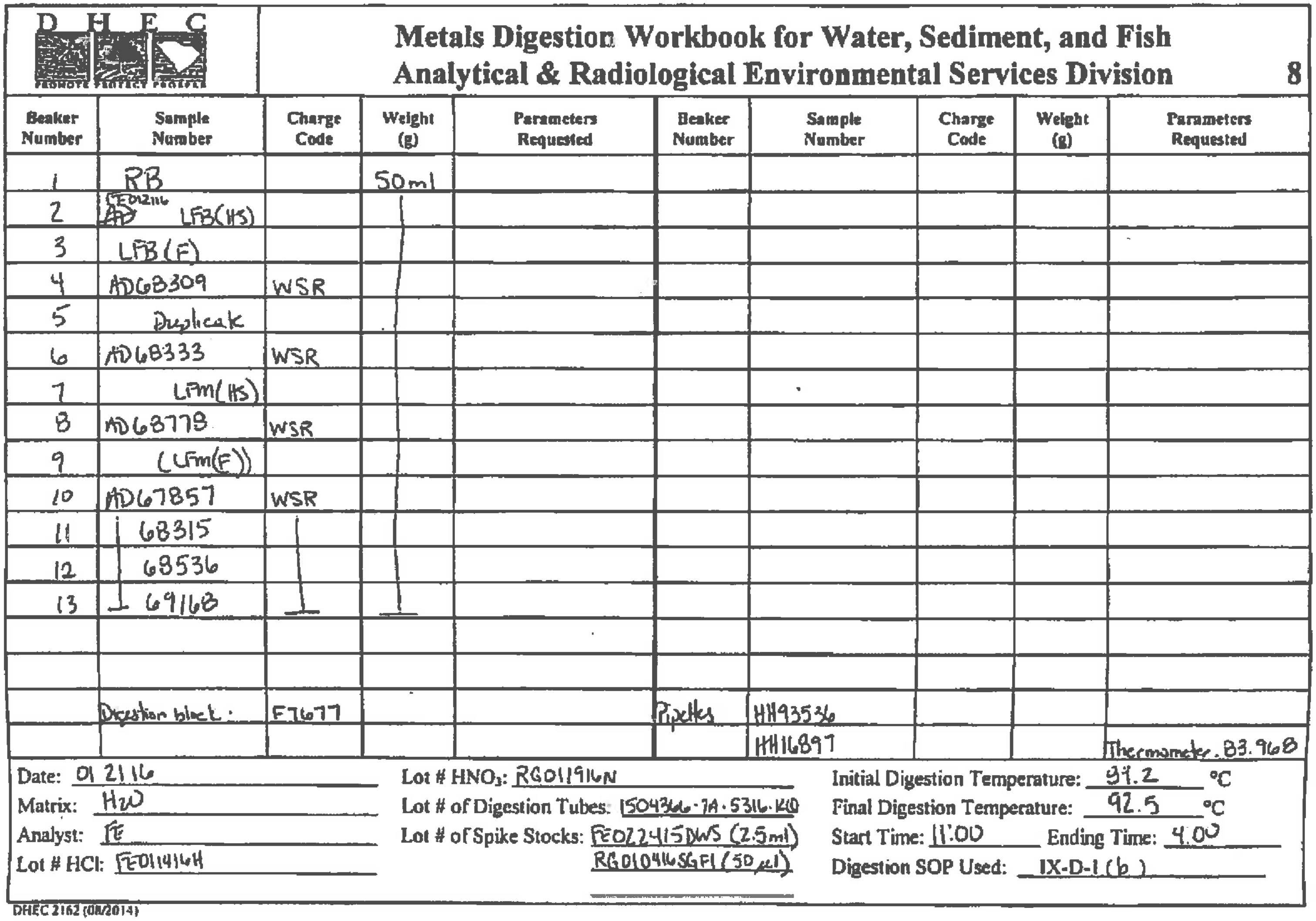
Mercury QCS Solution
Standard Methods 3112b
METALS SECTION

ANALYTICAL ANFD RADIOLOGICAL SERVICES DIVISION

Make Daily

Stock Standard Source	Lot Number/ Expiration date	Amount Stock Used (ml)	Lot Number Acid	ml Acid Used	DI Water	Final Volume/ Conc.(ppb)	Date Prepared	Prepared By

Attachment V



DHEC

Metals Digestion Workbook for Water, Sediment, and Fish
Analytical & Radiological Environmental Services Division

8

Beaker Number	Sample Number	Charge Code	Weight (g)	Parameters Requested	Beaker Number	Sample Number	Charge Code	Weight (g)	Parameters Requested
1	RB		50ml						
2	~~AD~~ FE012116 LFB(HS)								
3	LFB(F)								
4	AD68309	WSR							
5	Duplicate								
6	AD68333	WSR							
7	LFM(HS)								
8	AD68778	WSR							
9	(LFM(F))								
10	AD67857	WSR							
11	68315								
12	68536								
13	69168								
	Digestion block:	F7677			Pipettes	HH93536			
						HH16897			Thermometer. 83.968

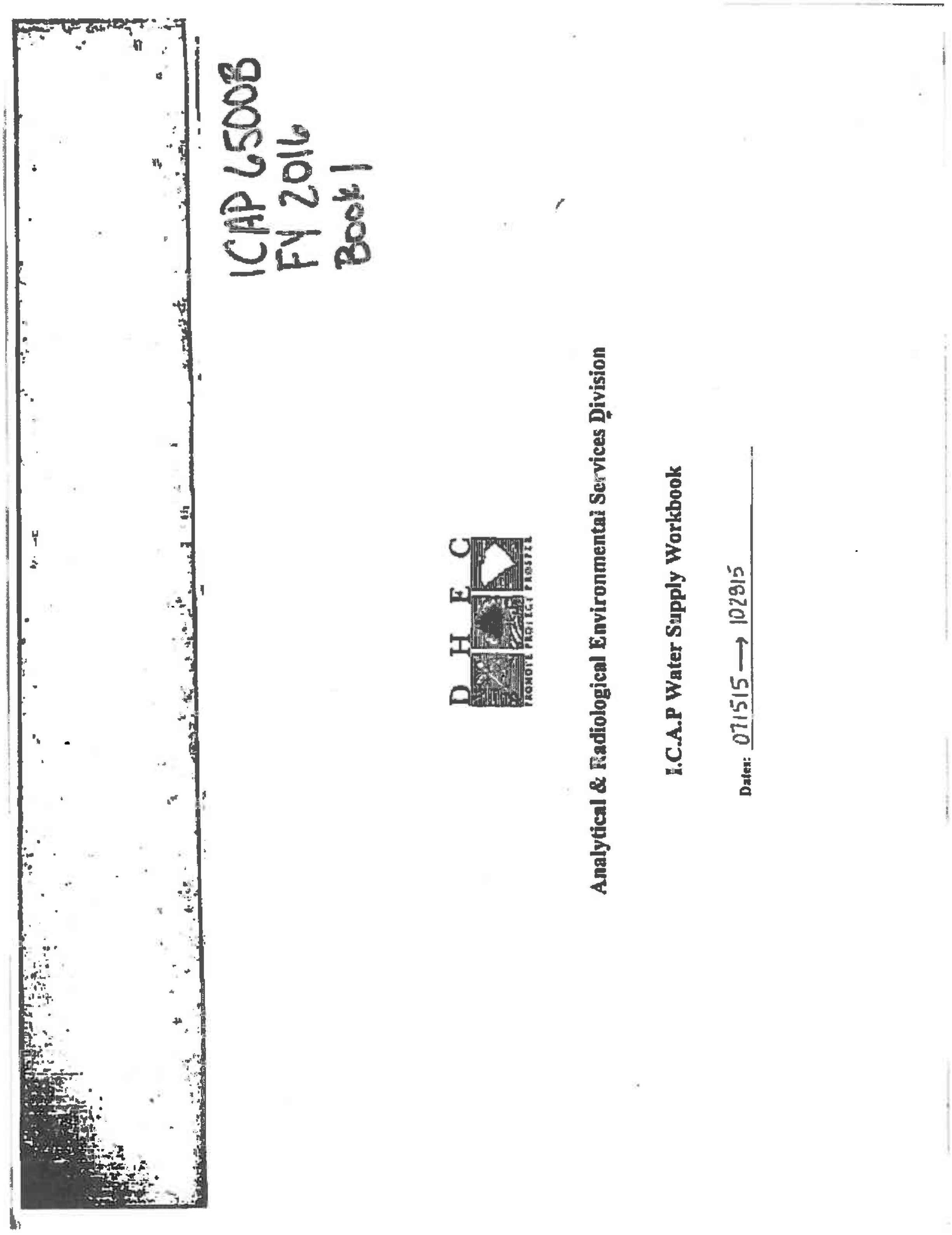
Date: 01 21 16
Matrix: H2O
Analyst: FE
Lot # HCl: FE011416H

Lot # HNO_3: RG011916N
Lot # of Digestion Tubes: 1504366-7A-5316-K10
Lot # of Spike Stocks: FE022415DWS (2.5ml)
RG010416SGF1 (50 µl)

Initial Digestion Temperature: 91.2 °C
Final Digestion Temperature: 92.5 °C
Start Time: 11:00 Ending Time: 4:00
Digestion SOP Used: IX-D-1 (b)

DHEC 2162 (08/2014)

Attachment VI-A



ICAP 6500B
FY 2016
Book 1

D H E C

PROMOTE PROTECT PROSPER

Analytical & Radiological Environmental Services Division

I.C.A.P Water Supply Workbook

Dates: 071515 → 102915

Attachment VI-B

D H E C

Preparation of QCS High Line Working Solution

Inorganic Section

Analytical & Radiological Environmental Services Division

( ) Intermediate (X) Working

DI Water: MQRM324 Lot #: FE071515QCSHL

Date Prepared: 071515 FED32515 Prepared By: FF

Vendor of Parent Solution: ~~AccuStandard~~ High Purity Standards

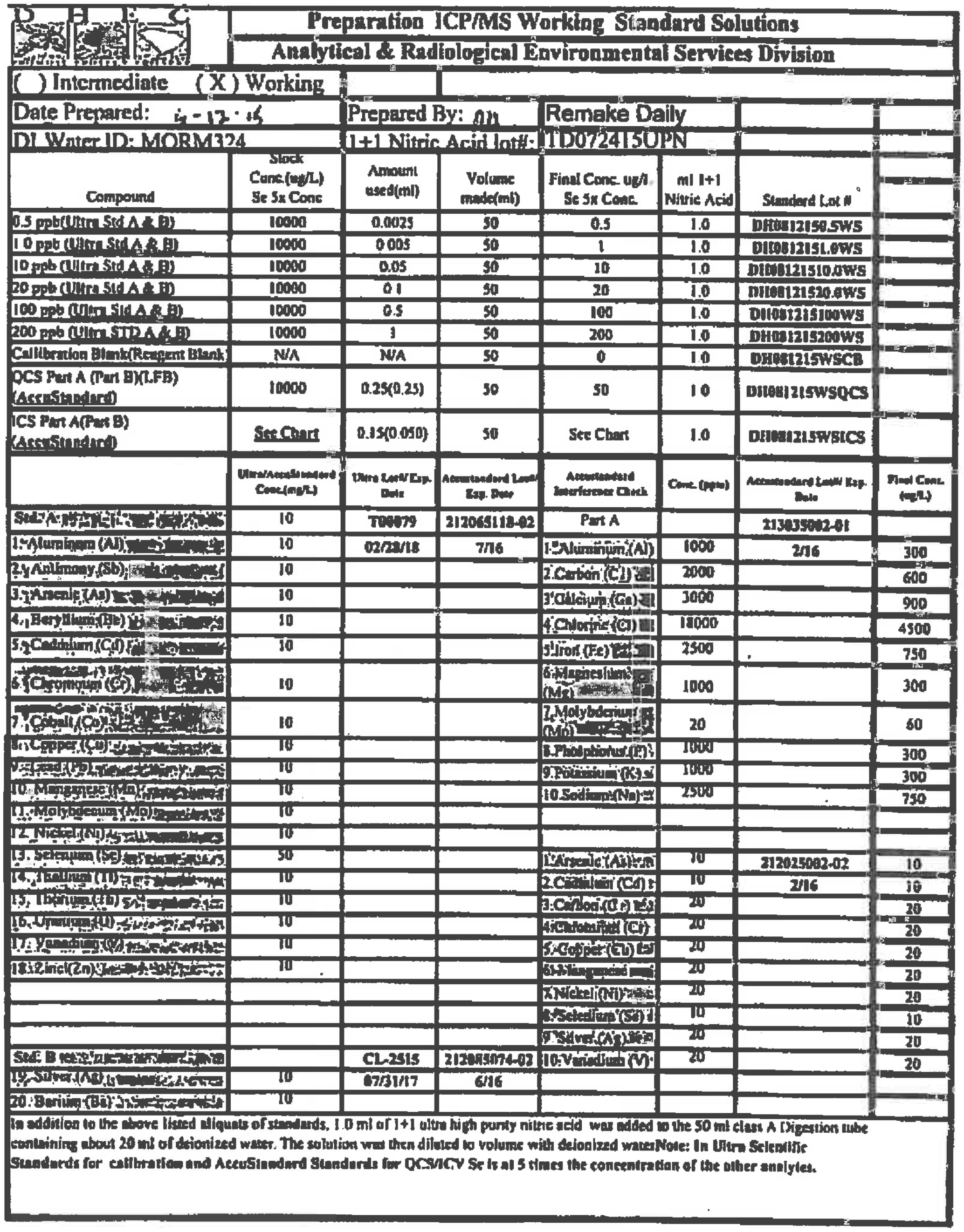
Compound	Item #	Lot #	Stock Conc. (mg/L)	Amt. Used (mL)	Final Conc. (mg/L)
1. Sodium (Na)	INFCS-7	1429612	1000	10	10.0
2. Magnesium (Mg)	INFCS-7	1429612	1000	10	10.0
3. Aluminum (Al)	INFCS-7	1429612	1000	10	10.0
4. Calcium (Ca)	INFCS-7	1429612	1000	10	10.0
5. Iron (Fe)	INFCS-7	1429612	1000	10	10.0

In addition to the above listed aliquot of standards, 10 mL of concentrated nitric acid and 50 mL of concentrated hydrochloric acid were added to a 1000 mL class A volumetric flask containing about 500 mL of deionized water. The solution was then diluted to volume with deionized water.

Nitric Acid Lot #: 1115010. Hydrochloric Acid Lot #: 4114121.

Page 1

Attachment VII



D H E C

Preparation ICP/MS Working Standard Solutions

Analytical & Radiological Environmental Services Division

( ) Intermediate (X) Working

Date Prepared: 4-12-15

Prepared By: an

Remake Daily

DI Water ID: MORM324

1+1 Nitric Acid lot#: TD072415OPN

Compound	Stock Conc.(ug/L) Se 5x Conc	Amount used(ml)	Volume made(ml)	Final Conc. ug/l Se 5x Conc.	ml 1+1 Nitric Acid	Standard Lot #	
0.5 ppb(Ultra Std A & B)	10000	0.0025	50	0.5	1.0	DH0812150.5WS	
1.0 ppb (Ultra Std A & B)	10000	0.005	50	1	1.0	DH0812151.0WS	
10 ppb (Ultra Std A & B)	10000	0.05	50	10	1.0	DH08121510.0WS	
20 ppb (Ultra Std A & B)	10000	0.1	50	20	1.0	DH08121520.0WS	
100 ppb (Ultra Std A & B)	10000	0.5	50	100	1.0	DH081215100WS	
200 ppb (Ultra STD A & B)	10000	1	50	200	1.0	DH081215200WS	
Calibration Blank(Reagent Blank)	N/A	N/A	50	0	1.0	DH081215WSCB	
QCS Part A (Part B)(LFB) (AccuStandard)	10000	0.25(0.25)	50	50	1.0	DH081215WSQCS	
ICS Part A(Part B) (AccuStandard)	See Chart	0.15(0.050)	50	See Chart	1.0	DH081215WSICS	
	Ultra/AccuStandard Conc.(mg/L)	Ultra Lot#/Exp. Date	AccuStandard Lot#/Exp. Date	AccuStandard Interference Check	Conc. (ppm)	AccuStandard Lot#/Exp. Date	Final Conc. (ug/L)
Std: A	10	T00079	212065118-02	Part A		213035002-01	
1. Aluminum (Al)	10	02/28/18	7/16	1. Aluminum (Al)	1000	2/16	300
2. Antimony (Sb)	10			2. Carbon (C)	2000		600
3. Arsenic (As)	10			3. Calcium (Ca)	3000		900
4. Beryllium (Be)	10			4. Chlorine (Cl)	18000		4500
5. Cadmium (Cd)	10			5. Iron (Fe)	2500		750
6. Chromium (Cr)	10			6. Magnesium (Mg)	1000		300
7. Cobalt (Co)	10			7. Molybdenum (Mo)	20		60
8. Copper (Cu)	10			8. Phosphorus (P)	1000		300
9. Lead (Pb)	10			9. Potassium (K)	1000		300
10. Manganese (Mn)	10			10. Sodium (Na)	2500		750
11. Molybdenum (Mo)	10						
12. Nickel (Ni)	10						
13. Selenium (Se)	50			1. Arsenic (As)	10	212025002-02	10
14. Thallium (Tl)	10			2. Cadmium (Cd)	10	2/16	10
15. Thorium (Th)	10			3. Cobalt (Co)	20		20
16. Uranium (U)	10			4. Chromium (Cr)	20		20
17. Vanadium (V)	10			5. Copper (Cu)	20		20
18. Zinc (Zn)	10			6. Manganese	20		20
				7. Nickel (Ni)	20		20
				8. Selenium (Se)	10		10
				9. Silver (Ag)	20		20
Std: B		CL-2515	212085074-02	10. Vanadium (V)	20		20
19. Silver (Ag)	10	07/31/17	6/16				
20. Barium (Ba)	10						

In addition to the above listed aliquots of standards, 1.0 ml of 1+1 ultra high purity nitric acid was added to the 50 ml class A Digestion tube containing about 20 ml of deionized water. The solution was then diluted to volume with deionized waterNote: In Ultra Scientific Standards for calibration and AccuStandard Standards for QCS/ICV Se is at 5 times the concentration of the other analytes.

Attachment VIII - A

D H E C
PROMOTE PROTECT PROSPER

Palladium/Magnesium Matrix Modifier

Metals Section
Analytical and Radiological Environmental Services Division

Alfa Aesar Palladium Lot # /exact weight (300 mg)	DI Water	Conc. Nitric Lot # (1 mL)	Alfa Aesar Magnesium Nitrate Lot # /exact weight (200 mg)	Modifier Lot # (Final volume = 100 mL)
23960	MQRM324	1114110	23106	CH062315PMM
#28Y005 wt: 0.3007	MQRM324	1114070	23106 (0.2006)	RG092815PMM
#28Y005 wt: 0.6019	MQRM324	1114110	23106 (0.4025)	RG102415PMM
#28Y005 wt: 0.6014	MQRM324	1115080	23106 (0.4071)	RG011416PMM
	MQRM324			
	MQRM324			
	MQRM324			
	MQRM324			
	MQRM324			
	MQRM324			
	MQRM324			
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	MQRM324			
	MQRM324			

Remake every 6 months GFAAS LOT #: analyst initials, date prepared, solution acronym
DHEC Asset ID of balance used: F7678

Attachment VIII-B

D H E C

Preparation GFAA MATRIX MODIFER

Analytical & Radiological Environmental Services Division

( ) Intermediate (X) Working

Date Prepared:

Prepared By:

Remake As Needed

Balance used:

Lot Number:

Compound		Lot #	Amount used(mg/ml)	Volume made(ml)	Final Conc.
Palladium Nitrate					
Magnesium Nitrate					
Conc. Nitric Acid					
Type I DI Water		MQRM330			

Attachment IX-A

MERCURY DIGESTION

STANDARD METHODS 3112B

<u>STEP</u> <u>COMPLETED</u>

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 B) 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

D H E C

Preparation of 5% Potassium Permanganate Solution
Analytical & Radiological Environmental Services Division

() Intermediate (X) Working

Potassium Permanganate Lot#	Amount Added	DI Water	5% Potassium Permanganate Lot #
1216666	200 grams	RO332	6P030615PPM
1216666	200 grams	RO332	6P061915PPM
'1216666	200 grams	RO332	6P0805K PPM
121660	200 grams	RO332	MA102215PPM
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
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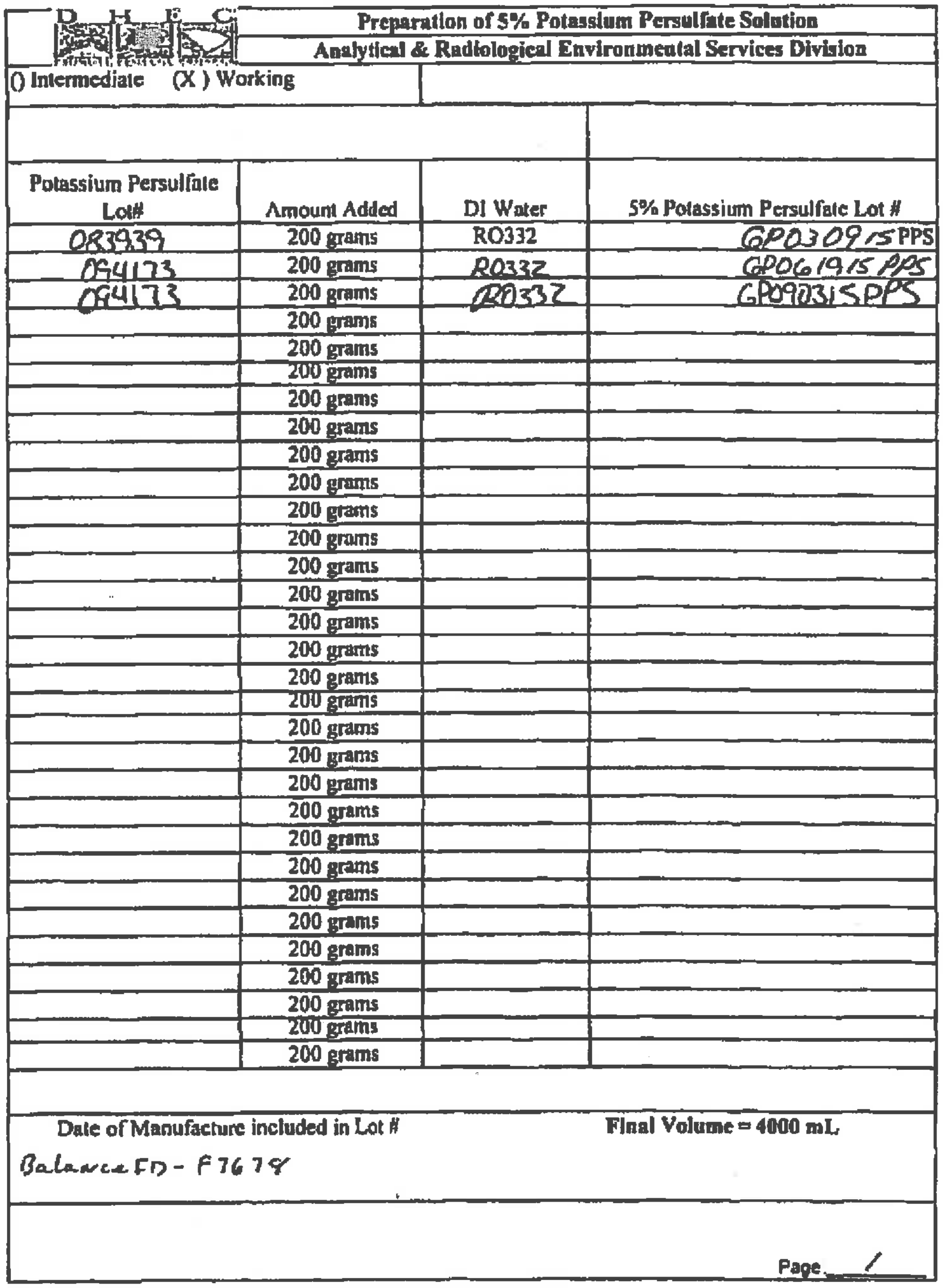
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		

Date of Manufacture included in Lot # **Final Volume = 4000 mL**

Balance FD- F7628

Page 1

Attachment IX-C



D H E C

Preparation of 5% Potassium Persulfate Solution

Analytical & Radiological Environmental Services Division

() Intermediate (X) Working

Potassium Persulfate Lot#	Amount Added	DI Water	5% Potassium Persulfate Lot #
083939	200 grams	RO332	GP030915PPS
084173	200 grams	R0332	GP061915 PPS
084173	200 grams	R0332	GP090315PPS
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
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	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		
	200 grams		

Date of Manufacture included in Lot # **Final Volume = 4000 mL**

Balance FD - F7679

Page 1

Attachment IX-D

Preparation of Sodium Chloride-hydroxylamine Hydrochloride Solution

Analytical & Radiological Environmental Services Division

() Intermediate (X) Working

MA 10-29-15

Sodium Chloride Lot#	Amount Added	Hydroxylamine Hydrochloride Lot#	Amount Added	DI water	Final Solution Lot#
1136666	480 grams	117400A	480 grams	RO332	6A030915SCH
1136666	480 grams	117400A	480 grams	RO332	6A061915SCH
~~113660~~	480 grams	~~117400A~~	480 grams	~~RO332~~	[illegible]
113666	480 grams	117400A	480 grams	RO332	MA62915SCH
	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		

Date of Manufacture included in Lot # **Final Volume = 4000 mL**

Balance ID-F7678

Page 1

Attachment IX-E

Preparation of Stannous Chloride Reducing Solution

Analytical & Radiological Environmental Services Division

() Intermediate (X) Working	Remake as needed

Stannous Chloride Lot#	Amount Added	Conc. HCL Acid Lot#	DI water	Final Solution Lot#
140475	400 grams	4113110	RO332	6P061115SCRS
140475	400 grams	4113110	R0332	GP061915SCRS
140475	400 grams	4114121	R0332	GP080415SCRS
140475	400 grams	4114021	R0332	MA091015SCRS
140475	400 grams	4114070	R0332	MA112515SCRS
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
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	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			
	400 grams			

Date of Manufacture included in Lot#. **Final Volume = 4000mL**

Balance ID - F7678

Page 1

Attachment IX-F

D H E C

Preparation of 1:1 Preservative Acid Solution

Analytical & Radiological Environmental Services Division

() Intermediate (X) Working

Concentrated Nitric Acid Lot #	High Purity Acid Vendor	DI Water	Preservative 1:1 Nitric Acid Lot #
1415626	High Purity Stds.	MQRM324	1415626MR 061815
1509733	High Purity Stds	MQRM324	1509733ML090415
1521026	High Purity Stds	MQRM324	1521026ML012016

Date of Manufacture included in Lot # **Final Volume = 4000 mL**

Page:________

Attachment IX-G

Preparation of Mercury Rinse Acid Solution

Analytical & Radiological Environmental Services Division

() Intermediate (X) Working

80mL Concentrated Nitric Acid Lot #	DI Water	80mL Concentrated HCl Lot #	Mercury Rinse Acid Lot #
1114080	RO332	4114050	GP042115MR
1114080	RO332	4113110	GP06A15 MR
⊥	⊥	⊥	GP071315 mR
1114080	RO332	4114K1	GP080515 mR
⊥	⊥	⊥	GP090115 MR
1115010	RO332	4114121	MA102615 MR
1115010	RO332	⊥	MA102615 mR
1115010	RO332	4114070	MA120115 mR
1115010	RO332	4114070	MA120115 mR
1115010	RO332	4114070	MA121015 mR
1115010	RO332	4114070	MA121015 mR
1115010	RO332	4114070	MA010416 mR

Date of Manufacture included in Lot # **Final Volume = 4000 mL**

Page: 1

Attachment IX-H

D H E S

Preparation Mercury 100 ppm Solution

Analytical & Radiological Environmental Services Division

(X) Intermediate () Working | Remake every 6 months.

DI Water ID: RO332

Acid Lot	Stock #-Exp.	Working Standard Lot#	Stock Conc.	Amount used	Final Conc.
~~1114080~~	~~T00602-06/30/21~~	~~GP052515 MI100~~	~~1000~~	~~5~~	~~50.00~~ 100 ppm KL090915
~~1114080~~	~~T00602-06/30/21~~	~~GP090315~~	K 090315		
1114080	T00602-063021	GP090315 MI100	1000	5	100 ppm ~~50.00~~ K 090915

In addition to the above listed aliquots of standards, 0.5 ml of concentrated nitric acid was added to the 50 ml volumetric flask containing about 20 ml of deionized water. The solution was then diluted to volume with deionized water.

Vendor is VWR.
DI Water: RO332
Date of Manufacture is included in the Working Lot#. Page 1

Attachment IX-I

D H E C	Preparation Mercury 1 ppm Solution
	Analytical & Radiological Environmental Services Division
(X) Intermediate () Working	Remake every month.

DI Water ID: RO332

Vendor of Parent Solution is Ultra Scientific

Acid Lot	100 ppm Lot #	Working Standard Lot#	Stock Conc.	Amount used	Final Conc. mg/L
1114080	GP051915MI100	GP072615MII	100	1	1.00
1114080	⊥	GP090515mII	100ppm	1ml	1.00
1114080	GP090315MI100	GP090315mII	100ppm	1ml	1.00
1114080	GP090315MI100	MA100715MII	100ppm	1mL	1.00
1115010	GP090315MI100	MA110915MII	100ppm	1mL	1.00
1115010	GP090315MI100	MA120715MII	100ppm	1mL	1.00
1115010	GP090315MI100	MA[illegible]0116MII	100ppm	1.00	1.00
		MF 1-11-16	11	1ml	-11-16

In addition to the above listed aliquats of standards, ~~0.5~~ 1 ml ml of concentrated nitric acid was added to the 100 ml volumetric flask containing about 50 ml of deionized water. The solution was then diluted to volume with deionized water.

Vendor is VWR .
DI Water: RO332
Date of Manufacture is included in the Working Lot#. Page ______

Attachment IX-J

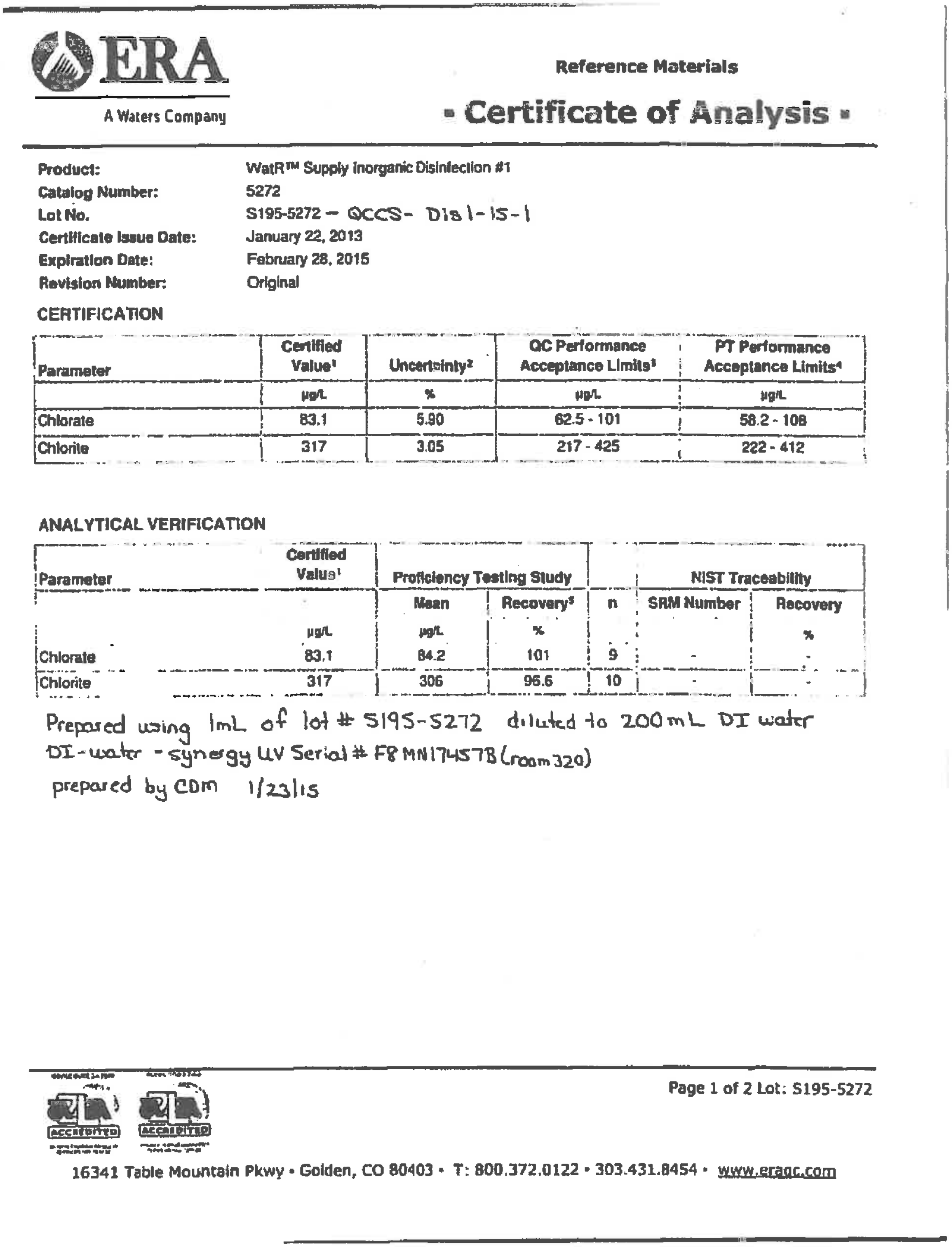
DHEC	**Preparation Mercury Working 100 ppb Standard Solution** **Analytical & Radiological Environmental Services Division**				
() Intermediate (X) Working		Remake weekly.			
DI Water ID: RO332					
Vendor of Parent Solution is UltraScientific					
Acid Lot #	1 ppm Lot #	Working Standard Lot#	Stock Conc.	Amount used	Final Conc. ug/L (ppb)
1114080 [redacted]	GP070615MII	GP070615 100PPB	[redacted] 1ppm	[redacted] 10 [redacted]	[redacted] 100 [redacted]
1114080	GP071515MII	GP071515 100ppb	1ppm	10ml	100
1114080	GP070615MII	GP072715 100 ppb	1ppm	10ml	100
1114080	GP080515MII	GP080515 100 ppb	1ppm	10ml	100
1114080	GP080515MII	GP081015 100 ppb	1ppm	10ml	100
1114080	GP080515MII	GP081715 100 ppb	1ppm	10ml	100
↓	GP080515MII	GP082515 100 ppb	1ppm	10ml	100
↓	↓	GP083115 100 ppb	1ppm	10ml	100
1114080	GP090315MII	GP090815 100 ppb	1ppm	10ml	100
1114080	GP090315MII	MA091415 100ppb	1ppm	10mL	100
1114080	GP090315MII	MA092115 100ppb	1ppm	10ml	100
1114080	GP090315MII	MA092215 100ppb	1ppm	10mL	100
1114080	GP090315MII	MA092815 100ppb	1ppm	10mL	100
1114080	MA100715MII	MA100715 100ppb	1ppm	10mL	100
1114080	MA100715MII	MA101315 100ppb	1ppm	10mL	100
1114080	MA100715MII	MA101915 100ppb	1ppm	10mL	100
1114080	MA100715MII	MA102615 MA102615 100ppb	1ppm	10mL	100
1115010	MA100715MII	MA110315 100ppb	1ppm	10mL	100
1115010	MA110915MII	MA110915 100ppb	1ppm	10mL	100
1115010	MA110915MII	MA112315 100ppb	1ppm	10mL	100
1115010	MA110915MII	MA113015 100ppb	1ppm	10mL	100
~~1115010~~	~~MA120815~~	~~MA 12-08-15~~			
1115010	MA120715 MII	MA120815 100ppb	1ppm	10mL	100
1115010	MA120715 MII	MA121415 100ppb	1ppm	10mL	100
~~1115010~~	~~MA 120715 MII~~	~~MA~~ MA 12-29-15			
1115010	MA 120715 MII	MA 122915 100ppb	1ppb	10mL	100
1115010	MA011116 MII	MA 011116 100ppb	1ppb	10mL	100
1115010	MA011116 MII	MA 011916 100ppb	1ppb	10mL	100

In addition to the above listed aliquats of standards, 2 ml of 1:1 nitric acid was added to the 100 ml volumetric flask containing about 20 ml of deionized water. The solution was then diluted to volume with deionized water.

The 1:1 nitric acid vendor is: VWR

Page ________

Attachment X



ERA
A Waters Company

Reference Materials

▪ Certificate of Analysis ▪

Product: WatR™ Supply Inorganic Disinfection #1
Catalog Number: 5272
Lot No. S195-5272 — QCCS- Dis 1-15-1
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	µg/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 Testing Study			NIST Traceability	
		Mean	Recovery[5]	n	SRM Number	Recovery
	µg/L	µg/L	%			%
Chlorate	83.1	84.2	101	9	-	-
Chlorite	317	306	96.6	10	-	-

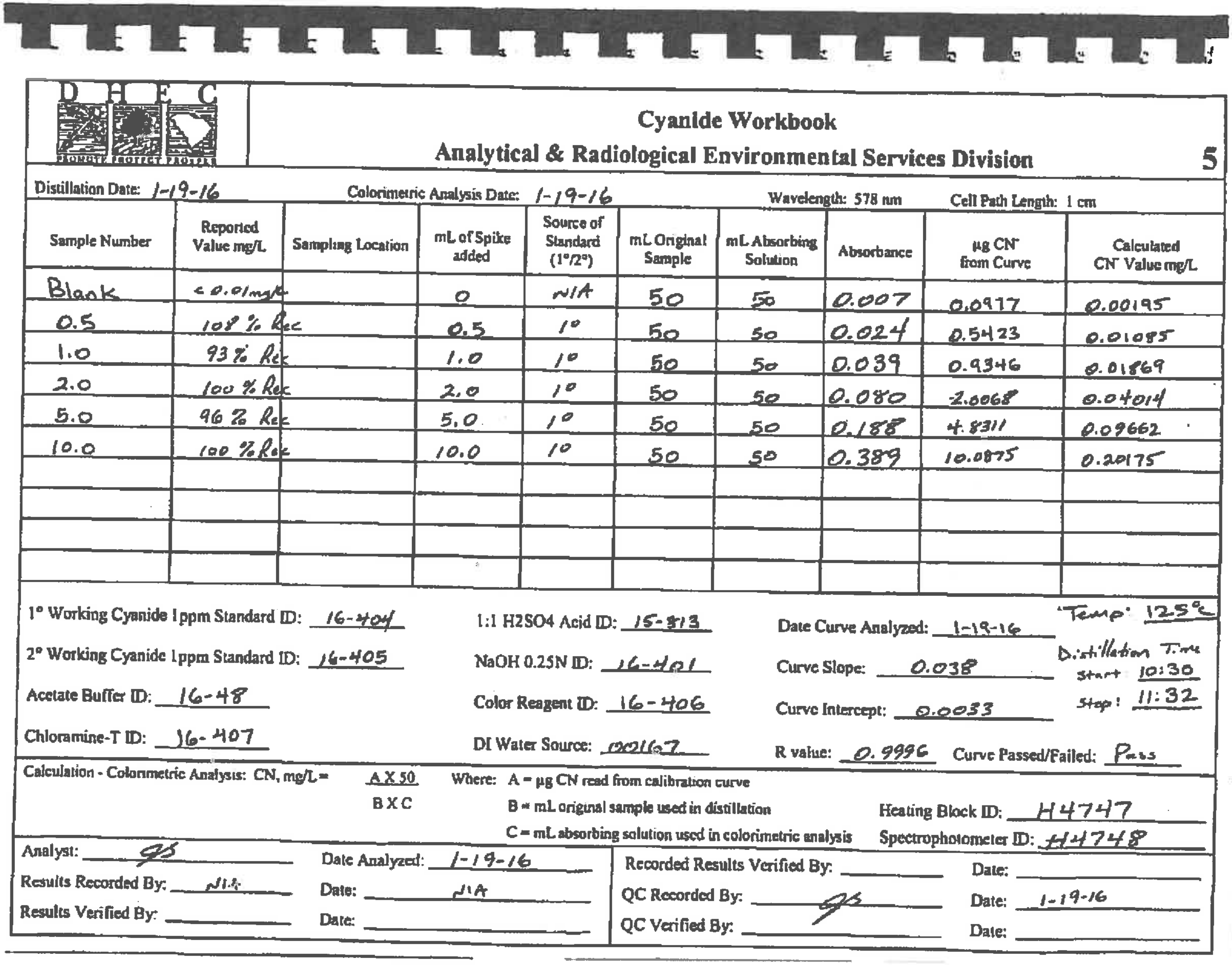
Prepared using 1mL of lot # S195-5272 diluted to 200mL DI water
DI-water - synergy UV Serial # F8MN17457B (room 320)
prepared by CDM 1/23/15

ACCREDITED ACCREDITED

Page 1 of 2 Lot: S195-5272

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

Attachment XI



DHEC

Cyanide Workbook

Analytical & Radiological Environmental Services Division

5

Distillation Date: 1-19-16
Colorimetric Analysis Date: 1-19-16
Wavelength: 578 nm
Cell Path Length: 1 cm

Sample Number	Reported Value mg/L	Sampling Location	mL of Spike added	Source of Standard (1°/2°)	mL Original Sample	mL Absorbing Solution	Absorbance	µg CN⁻ from Curve	Calculated CN⁻ Value mg/L
Blank	<0.01mg/L		0	N/A	50	50	0.007	0.0917	0.00195
0.5	108 % Rec		0.5	1°	50	50	0.024	0.5423	0.01085
1.0	93 % Rec		1.0	1°	50	50	0.039	0.9346	0.01869
2.0	100 % Rec		2.0	1°	50	50	0.080	2.0068	0.04014
5.0	96 % Rec		5.0	1°	50	50	0.188	4.8311	0.09662
10.0	100 % Rec		10.0	1°	50	50	0.389	10.0875	0.20175

1° Working Cyanide 1ppm Standard ID: 16-404
2° Working Cyanide 1ppm Standard ID: 16-405
Acetate Buffer ID: 16-48
Chloramine-T ID: 16-407
1:1 H2SO4 Acid ID: 15-813
NaOH 0.25N ID: 16-401
Color Reagent ID: 16-406
DI Water Source: 002167
Date Curve Analyzed: 1-19-16
Curve Slope: 0.038
Curve Intercept: 0.0033
R value: 0.9996
Curve Passed/Failed: Pass
Temp: 125°C
Distillation Time
Start: 10:30
Stop: 11:32

Calculation - Colorimetric Analysis: CN, mg/L = $\frac{A \times 50}{B \times C}$

Where: A = µg CN read from calibration curve
B = mL original sample used in distillation
C = mL absorbing solution used in colorimetric analysis

Heating Block ID: H4747
Spectrophotometer ID: H4748

Analyst:
Results Recorded By: N/A
Results Verified By:
Date Analyzed: 1-19-16
Date: N/A
Date:
Recorded Results Verified By:
QC Recorded By:
QC Verified By:
Date:
Date: 1-19-16
Date:

Attachment XII

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

Reagent ID number RBJ – 16 - 5 .
Fluoride Buffer Solution was prepared on 12 / 7 / 15 at 10 : 20am
by CFG . Using Balance id H16872
114.0 mL of glacial acetic acid, CH_3COOH 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, CH_3COOH, is Fisher Scientific .
The Lot # for the glacial acetic acid, CH_3COOH, is 101622 .
The vendor for the sodium hydroxide, NaOH, is Fisher Scientific .
The Lot # for the sodium hydroxide, NaOH, is 152171 .
Actual weight for NaOH 120.0000
The vendor for the sodium chloride, NaCl, is VWR .
The Lot # for the sodium chloride, NaCl, is 144828 .
Actual weight for NaCl is 116.0000
The vendor for the trans 1,2-diaminocyclohexane, CDTA is GFS Chemicals .
The Lot # for the trans 1,2-diaminocyclohexane, CDTA is CH169241 .
Actual weight for trans 1,2-diaminocyclohexane, CDTA is 8.0000 .

Reagent ID number RBJ – 16 - 6 .
Fluoride Buffer Solution was prepared on 1 / 8 / 16 at 9 : 45am
by CFG . Using Balance id H16872
114.0 mL of glacial acetic acid, CH_3COOH 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, CH_3COOH, is Fisher Scientific . CFG 1/13/16
The Lot # for the glacial acetic acid, CH_3COOH, is ~~162171~~ 101622
The vendor for the sodium hydroxide, NaOH, is Fisher Scientific .
The Lot # for the sodium hydroxide, NaOH, is 152171 .
Actual weight for NaOH 120.0000
The vendor for the sodium chloride, NaCl, is VWR .
The Lot # for the sodium chloride, NaCl, is 144828 .
Actual weight for NaCl is 116.0000
The vendor for the trans 1,2-diaminocyclohexane, CDTA is GFS Chemicals .
The Lot # for the trans 1,2-diaminocyclohexane, CDTA is CH169241 .
Actual weight for trans 1,2-diaminocyclohexane, CDTA is 8.0000 .

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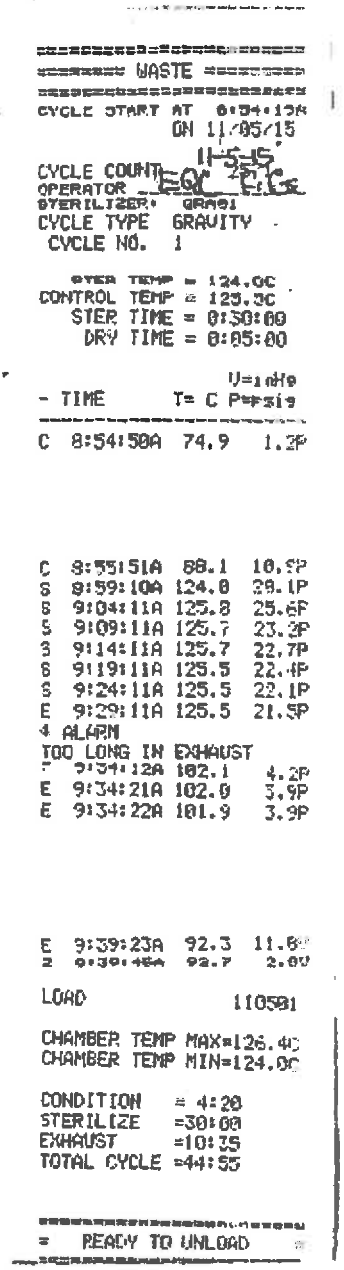
Attachment XIII



```
=============================
========= WASTE =========
=============================
CYCLE START AT   8:54:13A
          ON 11/05/15
               11-5-15
CYCLE COUNT
OPERATOR __EQC__E.G.
STERILIZER:   GRA01
CYCLE TYPE   GRAVITY
 CYCLE NO.   1

    STER TEMP = 124.0C
CONTROL TEMP = 125.3C
    STER TIME = 0:30:00
     DRY TIME = 0:05:00

                   V=inHg
- TIME         T= C P=psig
---------------------------
C  8:54:50A  74.9   1.2P



C  8:55:51A  88.1  10.9P
S  8:59:10A 124.0  29.1P
S  9:04:11A 125.8  25.6P
S  9:09:11A 125.7  23.2P
S  9:14:11A 125.7  22.7P
S  9:19:11A 125.5  22.4P
S  9:24:11A 125.5  22.1P
E  9:29:11A 125.5  21.5P
4 ALARM
TOO LONG IN EXHAUST
E  9:34:12A 102.1   4.2P
E  9:34:21A 102.0   3.9P
E  9:34:22A 101.9   3.9P



E  9:39:23A  92.3  11.6V
Z  9:39:46A  92.7   2.0V

LOAD                110501

CHAMBER TEMP MAX=126.4C
CHAMBER TEMP MIN=124.0C

CONDITION    = 4:20
STERILIZE    =30:00
EXHAUST      =10:35
TOTAL CYCLE  =44:55

=============================
=    READY TO UNLOAD        =
=============================
```