

*AZPDES/APP  
Permit Language  
And  
QA/QC Requirements for  
Field Methods*

Fall 2016 Workshops



### 2.5.7 Analytical Methodology

All samples collected for compliance monitoring shall be analyzed using Arizona state-approved methods. If no state-approved method exists, then any appropriate EPA-approved method shall be used. Regardless of the method used, the detection limits must be sufficient to determine compliance with the regulatory limits of the parameters specified in this permit. Analyses shall be performed by a laboratory licensed by the Arizona Department of Health Services, Office of Laboratory Licensure and Certification. For results to be considered valid, all analytical work shall meet quality control standards specified in the approved methods. A list of state-certified laboratories in Arizona can be obtained at the address below:

Arizona Department of Health Services  
Office of Laboratory Licensure and Certification  
250 North 17<sup>th</sup> Avenue  
Phoenix, Arizona 85007  
Phone: (602) 364-0720

### 2.7.2 Operation Inspection / Log Book Recordkeeping

A signed copy of this permit shall be maintained at all times at the location where day-to-day decisions regarding the operation of the facility are made. A log book (paper copies, forms, or electronic data) of the inspections and measurements required by this permit shall be maintained at the location where day-to-day decisions are made regarding the operation of the facility. The log book shall be retained for ten years from the date of each inspection, and upon request, the permit and the log book shall be made immediately available for review by ADEQ personnel. The information in the log book shall include, but not be limited to, the following information as applicable:

1. Name of inspector;
2. Date and shift inspection was conducted;
3. Condition of applicable facility components;
4. Any damage or malfunction, and the date and time any repairs were performed;
5. Documentation of sampling date and time; and
6. Any other information required by this permit to be entered in the log book.

Monitoring records for each measurement shall comply with A.A.C. R18-9-A206(B)(2).

**B. Recordkeeping.**

1. A permittee shall make a monitoring record for each sample taken as required by the individual permit consisting of all of the following:
  - a. The date, time, and exact place of a sampling and the name of each individual who performed the sampling;
  - b. The procedures used to collect the sample;
  - c. The date sample analysis was completed;
  - d. The name of each individual or laboratory performing the analysis;
  - e. The analytical techniques or methods used to perform the sampling and analysis;
  - f. The chain of custody records; and
  - g. Any field notes relating to the information described in subsections (B)(1)(a) through (f).
2. A permittee shall make a monitoring record for each measurement made, as required by the individual permit, consisting of all of the following:
  - a. The date, time, and exact place of the measurement and the name of each individual who performed the measurement;
  - b. The procedures used to make the measurement; and
  - c. Any field notes relating to the information described in subsections (B)(2)(a) and (b).
3. A permittee shall maintain monitoring records for at least 10 years after the date of the sample or measurement, unless the Department specifies a shorter time period in the permit.

## PART II. MONITORING AND REPORTING

### A. Sample Collection and Analysis

1. The permittee is responsible for the quality and accuracy of all data required under this permit.
2. Quality Assurance (QA) Manual

The permittee shall keep a QA Manual on site that describes the sample collection and analyses processes. If the permittee collects samples or conducts sample analyses in house, the permittee shall develop a QA Manual that addresses these activities. If a third party collects and/or analyzes samples on behalf of the permittee, the permittee shall obtain a copy of the applicable QA procedures. The QA Manual shall be available for review by ADEQ upon request. The QA Manual shall be updated as necessary to reflect current conditions, and shall describe the following:

a. Project Management, including:

- Purpose of sample collection and sample frequency;
- When and where samples will be collected;
- How samples will be collected;
- Who will collect samples and their qualifications;
- Laboratory(s) that will perform analyses;
- Any field tests to be conducted (detail methods and specify equipment, including a description of any needed calibrations); and
- Pollutants or analytes being measured and for each, the permit-specific limits, Assessment Levels, or thresholds, (e.g. the associated detection limits needed.)

- Who will collect samples and their qualifications;
- Laboratory(s) that will perform analyses;
- Any field tests to be conducted (detail methods and specify equipment, including a description of any needed calibrations); and
- Pollutants or analytes being measured and for each, the permit-specific limits, Assessment Levels, or thresholds, (e.g. the associated detection limits needed.)

b. Sample collection procedures including

- Equipment to be used;
- Type and number of samples to be collected including QA/QC samples (i.e., background samples, duplicates, and equipment or field blanks);
- Types, sizes, and number of sample bottles needed;
- Preservatives and holding times for the samples (see methods under 40 CFR 136 or 9 A.A.C. 14, Article 6 or any condition within this permit that specifies a particular test method); and
- Chain of custody procedures.

c. Specify approved analytical method(s) to be used and include;

- Limits of Detection (LOD) and Limits of Quantitation (LOQs);
- Required quality control (QC) results to be reported (e.g., matrix spike recoveries, duplicate relative percent differences, blank contamination, laboratory control sample recoveries, surrogate spike recoveries, etc.) and acceptance criteria; and

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- Laboratory(s) that will perform analyses;
- Any field tests to be conducted (detail methods and specify equipment, including a description of any needed calibrations); and
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3. Sample collection, preservation and handling shall be performed as described in 40 CFR 136 including the referenced Edition of *Standard Methods for the Examination of Water and Wastewater*, or by procedures referenced in A.R.S Title 9, Chapter 14 of the Arizona Department of Health Services (ADHS) Laboratory Licensure rules. The permittee shall outline the proper procedures in the QA Manual, and samples taken for this permit must conform to these procedures whether collection and handling is performed directly by the permittee or contracted to a third-party.

4. Analytical requirements

- a. The permittee shall use a laboratory licensed by the ADHS Office of Laboratory Licensure and Certification that has demonstrated proficiency within the last 12 months under R9-14-609, for each parameter to be sampled under this permit. However, this requirement does not apply to parameters which require analysis at the time of sample collection as long as the testing methods used are approved by ADHS or ADEQ in accordance with A.R.S. 36-495.02(A)(3). (These parameters may include flow, dissolved oxygen, pH, temperature, and total residual chlorine.)
- b. The permittee must utilize analytical methods specified in this permit. If no test procedure is specified, the permittee shall analyze the pollutant using:
  - i. A test procedure listed in 40 CFR 136 which is also approved under A.A.C. R9-14-610;
  - ii. An alternative test procedure approved by EPA as provided in 40 CFR 136 and which is also approved under A.A.C. R9-14-610;
  - iii. A test procedure listed in 40 CFR 136, with modifications allowed by EPA or approved as a method alteration by ADHS under A.A.C. R9-14-610(C); or
  - iv. If no test procedure for a pollutant is available under (3)(b)(i) through (3)(b)(iii) above, any Method approved under A.A.C. R9-14-610(B) for wastewater may be used, except the use of field kits is not allowed unless otherwise specified in this permit. If there is no approved wastewater method for a parameter, any other method identified in 9 A.A.C. 14, Article 6 that will achieve appropriate detection and reporting limits may be used for analyses.
- c. For results to be considered valid, all analytical work, including those tests conducted by the permittee at the time of sampling (see Part II.A.4.a), shall meet quality control standards specified in the approved methods.

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8. For all field testing, or if the information below is not included on the laboratory reports required by Part II.B.2, the permittee shall attach a bench sheet or similar documentation to each DMR that includes, for all analytical results during the reporting period:
  - a. the analytical result,
  - b. the number or title of the approved analytical method, preparation and analytical procedure utilized by the field personnel or laboratory, and the LOD and LOQ for the analytical method for the parameter, and
  - c. any applicable data qualifiers using the most current revision of the Arizona Data Qualifiers (available on line at <http://www.azdhs.gov/lab/license/resources/resources.htm>).

#### **D. Monitoring Records**

The permittee shall retain records of the following monitoring information:

1. Date, exact location and time of sampling or measurements performed, preservatives used;
2. Individual(s) who performed the sampling or measurements;
3. Date(s) the analyses were performed;
4. Laboratory(s) which performed the analyses;
5. Analytical techniques or methods used;
6. Chain of custody forms;
7. Any comments, case narrative or summary of results produced by the laboratory. These comments should identify and discuss QA/QC analyses performed concurrently during sample analyses and should specify whether analyses met project requirements and 40 CFR 136. If results include information on initial and continuing calibration, surrogate analyses, blanks, duplicates, laboratory control samples, matrix spike and matrix spike duplicate results, sample receipt condition, or holding times and preservation, these records must also be retained.
8. Summary of data interpretation and any corrective action taken by the permittee.



Note: Statute implemented 1989



Forty-ninth Legislature - Second Regular Session

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### 36-495.01. [Licensure program; rules](#)

A. On or before July 1, 1991, the department shall license environmental laboratories engaged in compliance testing. Upon application for an environmental laboratory license, the department shall issue the license if, after investigation, the department determines that the application conforms with the standards established by the department.

B. The director shall prescribe rules providing for minimum standards of proficiency, methodology, quality assurance, operation and safety for environmental laboratories and may prescribe standards for personnel education, training and experience to meet federal environmental statutes or regulations, or enabling reciprocity with other states and the manner and

### 36-495.02. Exemptions

A. This chapter does not apply to an environmental laboratory in this state that is:

1. Certified or designated by the United States environmental protection agency as the laboratory which provides analytical services to this state required for the delegation of primary enforcement responsibility under a federal law or regulation administered by that agency.
2. Operated by the Arizona department of agriculture or the radiation regulatory agency.
3. Performing only compliance testing of parameters which require analysis at the time of sample collection as long as the testing methodologies employed are approved by the director of the department of health services or the department of environmental quality.
4. Licensed to perform those analyses for which it is licensed or certified by another agency of this state.
5. Accredited by a national voluntary laboratory accreditation program administered by the national institute of standards and technology and approved by the department.

B. In addition to the exemptions established in subsection A, the director may also exempt by rule certain classes of environmental laboratories and types of compliance testing, parameters and methods, if the director determines that the exemptions will not adversely affect the public health or the environment. The rules shall be developed in cooperation with the director of the department of environmental quality and the director of the Arizona department of agriculture.

3. An out-of-state laboratory at which only microbiology testing of bottled water is performed and for which the owner holds a current and valid environmental laboratory license or certificate, issued by another state of the United States, that specifically authorizes drinking water testing;
4. A person that:
  - a. Employs methods approved by either ADEQ or the Department; and
  - b. Tests compliance samples either:
    - i. For turbidity or conductivity at the time of sampling, or
    - ii. With a maximum holding time of 15 minutes after sampling; or
5. A laboratory that only performs compliance testing on daily chlorine dioxide or chlorite drinking water samples or ultra-low-range total residual chlorine wastewater samples as long as that laboratory is:
  - a. Employing methods approved by either ADEQ or the Department; and
  - b. Testing compliance samples immediately at the time of sampling, from which results may be obtained more than 15 minutes after sampling.

**R9-14-603. License Application and Process; Transferability**

- A. To obtain an initial or renewal license to operate a laboratory, an applicant shall submit to the Department, within the time prescribed in subsection (B), an application that contains:
  1. The following information in a Department-provided format:
    - a. The name of the laboratory;
    - b. The current Arizona license number for the laboratory, if any;
    - c. The current EPA certification number for the laboratory, if any;

# Standard Methods

For the Examination of  
Water and Wastewater™

22ND EDITION

**2012**

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## 4500-H<sup>+</sup> B. Electrometric Method

### 1. General Discussion

*a. Principle:* The basic principle of electrometric pH measurement is determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode. The hydrogen electrode consists of a platinum electrode across which hydrogen gas is bubbled at a pressure of 101 kPa. Because of difficulty in its use and the potential for poisoning the hydrogen electrode, the glass electrode commonly is used. The electromotive force (emf) produced in the glass electrode system varies linearly with pH. This linear relationship is described by plotting the measured emf against the pH of different buffers. Sample pH is determined by extrapolation.

Because single ion activities such as  $a_{\text{H}^+}$  cannot be measured, pH is defined operationally on a potentiometric scale. The pH measuring instrument is calibrated potentiometrically with an indicating (glass) electrode and a reference electrode using National Institute of Standards and Technology (NIST) buffers having assigned values so that:

$$\text{pH}_B = -\log_{10} a_{\text{H}^+}$$

where:

$$\text{pH}_B = \text{assigned pH of NIST buffer.}$$

The operational pH scale is used to measure sample pH and is defined as:

$$\text{pH}_x = \text{pH}_B \pm \frac{F(E_x - E_s)}{2.303 RT}$$

where:

- $\text{pH}_x$  = potentiometrically measured sample pH,
- $F$  = Faraday:  $9.649 \times 10^4$  coulomb/mole,
- $E_x$  = sample emf, V,
- $E_s$  = buffer emf, V,
- $R$  = gas constant; 8.314 joule/(mole °K), and
- $T$  = absolute temperature, °K.

NOTE: Although the equation for  $\text{pH}_x$  appears in the literature with a plus sign, the sign of emf readings in millivolts for most pH meters manufactured in the U.S. is negative. The choice of negative sign is consistent with the IUPAC Stockholm convention concerning the sign of electrode potential.<sup>1,2</sup>

The activity scale gives values that are higher than those on Sorenson's scale by 0.04 units:

$$\text{pH (activity)} = \text{pH (Sorenson)} + 0.04$$

The equation for  $\text{pH}_x$  assumes that the emf of the cells containing the sample and buffer is due solely to hydrogen ion activity unaffected by sample composition. In practice, samples will have varying ionic species and ionic strengths, both affecting  $\text{H}^+$  activity. This imposes an experimental limitation on pH measurement; thus, to obtain meaningful results, the differences between  $E_x$  and

## 1020 QUALITY ASSURANCE\*

### 1020 A. Introduction

This section applies primarily to chemical and radiochemical analyses. See Sections 8020 and 9020 for quality assurance and control for toxicity assays and microbiological analyses.

*Quality assurance* (QA) is a laboratory operations program that specifies the measures required to produce defensible data with known precision and accuracy. This program is defined in a QA manual, written procedures, work instructions, and records. The manual should include a policy that defines the statistical level of confidence used to express data precision and bias, as well as method detection levels (MDLs) and reporting limits. The overall system includes all QA policies and quality control (QC) processes needed to demonstrate the laboratory's competence and to ensure and document the quality of its analytical data. Quality systems are essential for laboratories seeking accreditation under state or federal laboratory certification programs.

QA includes both QC (1020B) and quality assessment (1020C). For information on evaluating data quality, see Section 1030.

#### 1. Quality Assurance Plan

Establish a QA program and prepare a QA manual or plan. The QA manual and associated documents include the following items<sup>1-5</sup>: cover sheet with approval signatures; quality policy statement; organizational structure; staff responsibilities; analyst training and performance requirements; tests performed by the laboratory; procedures for handling and receiving samples; sample control and documentation procedures; procedures for achieving traceable measurements; major equipment, instrumentation, and reference measurement standards used; **standard operating procedures (SOPs) for each analytical method**; procedures for generating, approving, and controlling policies and procedures; procedures for procuring reference materials and supplies; procedures for procuring subcontractors' services; internal QC activities; **procedures for calibrating, verifying, and maintaining instrumentation and equipment**; data-verification practices, including inter-laboratory comparison and proficiency-testing programs; procedures for feedback and corrective actions whenever testing discrepancies are detected; procedures for permitted exceptions to documented policies; procedures for system and performance audits and reviews; procedures for assessing data precision and accuracy and determining MDLs;

and frequency of, management review and updates to the QA manual and associated documents.

On the title page, include approval signatures, revision numbers, and a statement that the manual has been reviewed and determined to be appropriate for the scope, volume, and range of testing activities at the laboratory,<sup>2,3</sup> as well as an indication that management has committed to ensuring that the quality system defined in the QA manual is implemented and followed at all times.

The QA manual also should clearly specify and document the managerial responsibility, authority, quality goals, objectives, and commitment to quality. Write the manual so it is clearly understood and ensures that all laboratory personnel understand their roles and responsibilities.

Implement and follow sample-tracking procedures, including legal chain-of-custody procedures (as required by data users) to ensure that chain of custody is maintained and documented for each sample. Institute procedures to trace a sample and its derivatives through all steps from collection through analysis, reporting of final results, and sample disposal. Routinely practice adequate and complete documentation, which is critical to ensure that data are defensible, to meet laboratory accreditation/certification requirements, and to ensure that all tests and samples are fully traceable.

*Standard operating procedures* describe the analytical methods to be used in the laboratory in sufficient detail that a competent analyst unfamiliar with the method can conduct a reliable review and/or obtain acceptable results. SOPs should include, where applicable, the following items<sup>2-4</sup>: title of referenced, consensus test method; sample matrix or matrices; MDL; scope and application; summary of SOP; definitions; interferences; safety considerations; waste management; apparatus, equipment, and supplies; reagents and standards; sample collection, preservation, shipment, and storage requirements; specific QC practices, frequency, acceptance criteria, and required corrective action if acceptance criteria are not met; calibration and standardization; details on the actual test procedure, including sample preparation; calculations; qualifications and performance requirements for analysts (including number and type of analyses); data assessment/data management; references; and any tables, flowcharts, and validation or method performance data. **At a minimum, validate a new SOP before use by first determining the MDL and performing an initial demonstration of capability using relevant regulatory guidelines.** (NOTE: MDL

### QUALITY ASSURANCE (1020)/Quality Control

cially available reference materials certified traceable to international or NIST SRMs to establish the integrity of the laboratory calibration and measurement program. Formulate document-control procedures, which are essential to data defensibility, to cover the entire process: document generation, approval, distribution, storage, recall, archiving, and disposal. **Maintain logbooks for each test or procedure performed, with complete documentation on preparation and analysis of each sample, including sample identification, associated standards and QC samples, method reference, date/time of preparation/analysis, analyst, weights and volumes used, results obtained, and any problems encountered. Keep logbooks that document maintenance and calibration for each instrument or piece of equipment.** Calibration procedures, corrective actions, internal QC activities, performance audits, and data assessments for precision and accuracy (bias) are discussed in 1020B and C.

Data reduction, validation, and reporting are the final steps in the data-generation process. The data obtained from an analytical instrument must first be subjected to the data-reduction processes described in the applicable SOP before the final result can be obtained. In the QA manual or SOP, specify calculations and any correction factors, as well as the steps to be followed when generating the sample result. Also, specify all the data-validation steps to be followed before the final result is made available. Report results in standard units of mass, volume, or concentration, as specified in the method or SOP or as required by regulators or clients. Report results below the minimum quantitation level (MQL) or MDL in accordance with the procedure prescribed in the SOP, regulatory requirements, or general laboratory policy. The MQL is the lowest level that can be quantitated accurately.

Ideally, include a statement of uncertainty with each result. See references and bibliography for other useful information and guidance on establishing a QA program and developing an effective QA manual.

#### 2. References

1. U.S. ENVIRONMENTAL PROTECTION AGENCY. 2002. Guidance for Quality Assurance Plans (QA-G-5), EPA/240/R-02/009. U.S. Environ-

### 36-495.07. Inspection; investigations

A. The department may make an initial inspection, and thereafter an annual inspection, of each laboratory to determine compliance with this chapter or rules adopted pursuant to this chapter.

B. An application for licensure pursuant to this chapter constitutes permission for the department's entry or inspection of the laboratory during the pendency of the application and, if licensed, during the term of the license for the purpose of determining compliance with this chapter or rules adopted pursuant to this chapter.

C. The department may require, as part of its inspections, that the laboratory demonstrate proficiency in performing tests that it offers by examining specimens submitted by the department, the United States environmental protection agency or other proficiency testing services approved by the department.

D. In addition to the inspections provided for in subsection A of this section, the department, on its own initiative or on the receipt of a written complaint from a person setting forth facts which, if proven, constitute a violation of this chapter or rules adopted pursuant to this chapter, may make an investigation of the laboratory's operations, techniques and procedures. If the investigation or an inspection conducted pursuant to this section discloses past or current noncompliance with statutes and rules, the director, in accordance with section 36-495.09, may deny, suspend or revoke a license issued by the department pursuant to this chapter.

E. At any time the department may conduct an investigation of the operation of an unlicensed laboratory performing compliance testing and may conduct on-site inspections of the laboratory, records, procedures and methods to determine whether the laboratory must be licensed pursuant to this chapter.

F. The director by rule shall establish standards and procedures for third party accreditation and exempting inspections and inspection fees for a laboratory that is accredited by a third party.

1. Using ADHS exempt approved method(s) for pH, dissolved oxygen (DO), turbidity, temperature, total residual chlorine (TRC), and specific conductivity (AZPDES, NPDES, APP and Reuse Permits).
2. Standard Operating Procedure (SOP) for each ADHS exempt approved method reported (SM 1020A.1)
  - A. Specifications for reagents and standards;
  - B. Sample collection process;
  - C. Calibration and standardization process;
  - D. Specific quality control practices:
    - i) ID of QC types;
    - ii) Frequency;
    - iii) Acceptance criteria;
    - iv) Required corrective action if acceptance criteria not met
  - E. Details on the actual test procedure;
3. Record of each analyst's training
  - A. Review of the method and the SOP procedure.
  - B. Review of manufacturer's guidelines for instrumentation used.
  - C. Initial demonstration of capability by using 4 replicates of a Laboratory Control sample [LCS] or Laboratory Fortified Blank [LFB] - (Not temperature, DO or in-line meters)
4. Record of each AZPDES/NPDES permitted plant's participation in an annual proficiency test for all reported exempt methods with either a DMRQA or WP sample (Not temperature or DO).
5. Record of a method detection limit study (ultra low level total residual chlorine only).
6. Documented Preventative Maintenance on instrumentation.
7. Records for all reagents and standards.
  - A. Date receipt, lot #, expiration date, dates of use.
  - B. Discard or segregate all expired standards or reagents.
8. Records (Logbooks or bench sheets) maintained for each test or procedure.
  - A. Method reference;
  - B. Sample ID, sampler, sample date and time;
  - C. Standard and QC sample results;
  - D. Reagent blank results (turbidity and TRC only)(not in-line meters);
  - E. Date/time of preparation/analysis for sample;
    - i) Analysis time within 15 minutes of sample time;
  - F. Analyst name or initials;
  - G. Calibration data and sample results obtained;
  - H. Corrective actions if QC or method requirements not met;
    - i) Data not reported until the cause of the problem is identified and either corrected or qualified;
  - I. Indelible ink;
  - J. Corrections to records only made with single line thru incorrect entry, correct entry written to side with initials and date of person making change; and
  - K. Records maintained for at least 10 years (R18-9-A206(B)(3)).

**\*Used by ADHS as checklist**

**Wastewater Treatment Plant QA/QC Requirements for Exempt Methods**

Rev. 2.1, 11/29/2010

1. Using ADHS exempt approved method(s) for pH, dissolved oxygen (DO), turbidity, temperature, total residual chlorine (TRC), and specific conductivity (AZPDES, NPDES, APP and Reuse Permits).
2. Standard Operating Procedure (SOP) for each ADHS exempt approved method reported (SM 1020A.1)
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  - E. Details on the actual test procedure;
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2. Standard Operating Procedure (SOP) for each ADHS exempt approved method reported (SM 1020A.1)
  - A. Specifications for reagents and standards; e.g. pH buffers, DI Water, Stds, etc.
  - B. Sample collection process;
  - C. Calibration and standardization process;
  - D. Specific quality control practices:
    - i) ID of QC types;
    - ii) Frequency;
    - iii) Acceptance criteria;
    - iv) Required corrective action if acceptance criteria not met
  - E. Details on the actual test procedure;
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  - C. Calibration and standardization process;
  - D. Specific quality control practices:
    - i) ID of QC types;
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  - C. Calibration and standardization process; **e.g. thermometer against NIST, 3 pH buffers + check buffer, DO – air calibration procedure**
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e.g. pH check buffer, duplicates,  
accuracy check for ULR TRC

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    - i) ID of QC types;
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    - iii) Acceptance criteria;
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  - E. Details on the actual test procedure;
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e.g. recalibrate

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  - E. Details on the actual test procedure; **e.g. specific to your meter and environment**
3. Record of each analyst's training **environment**
  - A. Review of the method and the SOP procedure.
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# Standard Methods

For the Examination of  
Water and Wastewater™

22ND EDITION

**2012**

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American Public Health Association®  
American Water Works Association®  
Water Environment Federation®

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American Public Health Association  
800 I Street, NW  
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## 4500-H<sup>+</sup> B. Electrometric Method

### 1. General Discussion

*a. Principle:* The basic principle of electrometric pH measurement is determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode. The hydrogen electrode consists of a platinum electrode across which hydrogen gas is bubbled at a pressure of 101 kPa. Because of difficulty in its use and the potential for poisoning the hydrogen electrode, the glass electrode commonly is used. The electromotive force (emf) produced in the glass electrode system varies linearly with pH. This linear relationship is described by plotting the measured emf against the pH of different buffers. Sample pH is determined by extrapolation.

Because single ion activities such as  $a_{\text{H}^+}$  cannot be measured, pH is defined operationally on a potentiometric scale. The pH measuring instrument is calibrated potentiometrically with an indicating (glass) electrode and a reference electrode using National Institute of Standards and Technology (NIST) buffers having assigned values so that:

$$\text{pH}_B = -\log_{10} a_{\text{H}^+}$$

where:

$$\text{pH}_B = \text{assigned pH of NIST buffer.}$$

The operational pH scale is used to measure sample pH and is defined as:

$$\text{pH}_x = \text{pH}_B \pm \frac{F(E_x - E_s)}{2.303 RT}$$

where:

- $\text{pH}_x$  = potentiometrically measured sample pH,
- $F$  = Faraday:  $9.649 \times 10^4$  coulomb/mole,
- $E_x$  = sample emf, V,
- $E_s$  = buffer emf, V,
- $R$  = gas constant; 8.314 joule/(mole °K), and
- $T$  = absolute temperature, °K.

NOTE: Although the equation for  $\text{pH}_x$  appears in the literature with a plus sign, the sign of emf readings in millivolts for most pH meters manufactured in the U.S. is negative. The choice of negative sign is consistent with the IUPAC Stockholm convention concerning the sign of electrode potential.<sup>1,2</sup>

The activity scale gives values that are higher than those on Sorenson's scale by 0.04 units:

$$\text{pH (activity)} = \text{pH (Sorenson)} + 0.04$$

The equation for  $\text{pH}_x$  assumes that the emf of the cells containing the sample and buffer is due solely to hydrogen ion activity unaffected by sample composition. In practice, samples will have varying ionic species and ionic strengths, both affecting  $\text{H}^+$  activity. This imposes an experimental limitation on pH measurement; thus, to obtain meaningful results, the differences between  $E_x$  and

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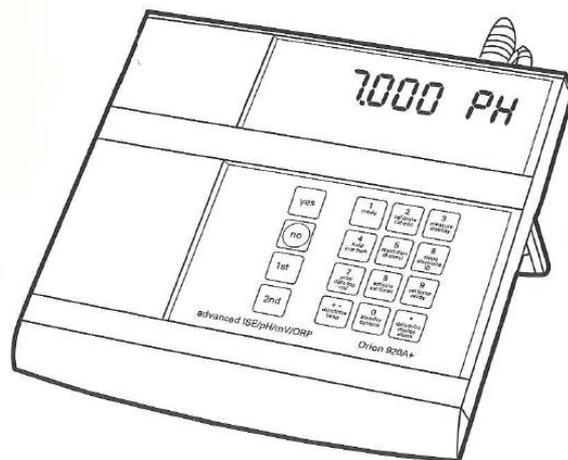
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Orion 410A+, 420A+,  
520A+, 525A+,  
710A+, 720A+,  
920A+

# Orion Aplus™

## Benchtop pH and pH/ISE Meters

INSTRUCTION MANUAL



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7. Records for all reagents and standards.

- A. Date receipt, lot #, expiration date, dates of use.
- B. Discard or segregate all expired standards or reagents.

8. Records (Logbooks or bench sheets) maintained for each test or procedure.

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- B. Sample ID, sampler, sample date and time;
- C. Standard and QC sample results;
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- E. Date/time of preparation/analysis for sample;
  - i) Analysis time within 15 minutes of sample time;
- F. Analyst name or initials;
- G. Calibration data and sample results obtained;
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- K. Records maintained for at least 10 years (R18-9-A206(B)(3)).

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MAY 2011			pH SM 4500-H B										
Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlyst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	<del>3.81</del>	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	<del>7:8</del>	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, Clean Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe
17	8:15A	SB	<del>3.94</del>	7.03	9.97	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
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20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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  - B. Sample ID, sampler, sample date and time;
  - C. Standard and QC sample results;
  - D. Reagent blank results (turbidity and TRC only)(not in-line meters);
  - E. Date/time of preparation/analysis for sample;
    - i) Analysis time within 15 minutes of sample time;
  - F. Analyst name or initials;
  - G. Calibration data and sample results obtained;
  - H. Corrective actions if QC or method requirements not met;
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MAY 2011			pH SM 4500-H B										
Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlyst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	3.81	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	7:8	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, Clean Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.2	21.5	8:10A	SB	Clean Probe
17	8:15A	SB	3.94	7.03	9.99	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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  - D. Reagent blank results (turbidity and TRC only)(not in-line meters);
  - E. Date/time of preparation/analysis for sample;
    - i) Analysis time within 15 minutes of sample time;
  - F. Analyst name or initials;
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  - H. Corrective actions if QC or method requirements not met;
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MAY 2011			pH SM 4500-H B											
Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlyst	Notes	
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB		
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe	
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB		
4	8:03A	SB	<del>3.81</del> 3.94	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11	
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB		
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB		
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB		
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB		
9	<del>7:8</del>	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, <sup>Clean</sup> Probe	
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB	
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB		
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB		
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB		
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB	
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB		
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe	
17	8:15A	SB	<del>3.94</del> 3.94	7.03	9.97	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11	
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe	
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB		
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB	
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB		
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB		
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe	
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB		
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11	
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB		
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT		
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT		
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT		
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT		
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe	

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MAY 2011			pH SM 4500-H B										
Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlayst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	<del>3.81</del>	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	<del>7:8</del>	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, <sup>Clean</sup> Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe
17	8:15A	SB	<del>3.94</del>	7.03	9.97	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlyst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	3.81	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	7:8	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, Clean Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe
17	8:15A	SB	3.94	7.03	9.99	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.01	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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  - B. Sample ID, sampler, sample date and time;
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  - D. Reagent blank results (turbidity and TRC only)(not in-line meters);
  - E. Date/time of preparation/analysis for sample;
    - i) Analysis time within 15 minutes of sample time;
  - F. Analyst name or initials;
  - G. Calibration data and sample results obtained;
  - H. Corrective actions if QC or method requirements not met;
    - i) Data not reported until the cause of the problem is identified and either corrected or qualified;
  - I. Indelible ink;
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MAY 2011			pH SM 4500-H B										
Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlyst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	3.81	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	7:8	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, Clean Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe
17	8:15A	SB	3.94	7.03	9.97	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.71	91.8	22.9	7.41	22.0	7:50A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	91.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	91.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	91.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	91.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	91.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	91.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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MAY 2011			pH SM 4500-H B										
Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlyst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	<del>3.81</del>	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	<del>7:8</del>	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, Clean Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe
17	8:15A	SB	<del>3.94</del>	7.03	9.97	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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MAY 2011			pH SM 4500-H B										
Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlyst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	<del>3.81</del>	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	<del>7:8</del>	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11, Clean Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe
17	8:15A	SB	<del>3.94</del>	7.03	9.99	6.97	93.5	22.2	7.30	22.1	8:23A	SB	3.94 SB 5-17-11
18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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Day	Spl Time	Sampler	4.00	7.00	10.00	7.00C	Slope	Temp	Eff	Temp	Time	Anlayst	Notes
1	7:44A	SB	4.02	7.05	10.01	7.01	98.2	24.3	7.52	22.6	7:56	SB	
2	7:48A	SB	3.99	7.01	9.99	6.98	98.0	24.2	7.48/7.47	21.7	7:59	SB	Clean Probe
3	7:41A	SB	4.00	7.02	10.03	7.04	97.8	23.6	7.44	21.2	7:51A	SB	
4	8:03A	SB	3.81	6.98	9.97	6.99	97.5	23.9	7.42	21.3	8:14A	SB	3.94 SB 5-4-11
5	7:52A	SB	4.06	7.04	10.02	7.05	97.4	23.7	7.41	21.2	8:02A	SB	
6	8:11A	SB	4.01	7.00	10.01	7.01	97.1	23.4	7.54	22.3	8:24A	SB	
7	7:41A	SB	3.94	6.97	9.98	6.96	96.5	24.1	7.40	21.7	7:56A	SB	
8	7:44A	SB	3.99	7.00	10.03	7.00	96.1	23.7	7.34	21.5	7:57A	SB	
9	7:8	SB	3.96	6.99	9.95	6.97	95.8	23.9	7.35/7.38	22.1	8:02A	SB	7:48 SB 5-9-11 Clean Probe
10	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
11	8:20A	SB	3.95	7.01	9.97	6.96	95.4	23.5	7.33	21.6	8:33A	SB	
12	7:51A	SB	3.97	7.06	9.95	6.97	95.1	22.9	7.42	22.4	8:05A	SB	
13	7:46A	SB	3.95	6.98	10.03	7.01	94.4	24.1	7.34	21.9	7:59A	SB	
14	7:39A	SB	3.95	6.96	10.04	7.06	94.3	27.6*	7.29	21.1	7:51	SB	*AC Not on SB
15	7:44A	SB	3.94	6.99	10.05	7.03	94.1	23.4	7.34	21.7	7:59A	SB	
16	7:59A	SB	3.95	7.04	9.97	6.96	93.8	23.1	7.28/7.31	21.5	8:10A	SB	Clean Probe
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18	7:52A	SB	3.93	6.99	9.96	6.89	93.0	22.5	7.33	21.9	7:59A	SB	*clean probe, fill probe
19	7:38A	SB	4.01	6.99	10.01	6.99	97.8	22.9	7.41	22.0	7:56A	SB	
20	-	-	-	-	-	-	-	-	-	-	-	-	Not Taken SB
21	7:45A	SB	4.00	6.99	9.99	7.00	97.7	23.1	7.39	22.5	8:00A	SB	
22	7:51A	SB	4.02	7.00	10.01	7.02	97.9	23.4	7.44	22.6	8:04A	SB	
23	8:02A	SB	4.01	6.99	10.00	6.99	97.4	23.0	7.46/7.49	22.1	8:13A	SB	Clean Probe
24	7:49A	SB	3.99	6.98	9.99	6.99	97.6	22.4	7.81	22.5	8:02A	SB	
25	7:41A	SB	4.00	7.01	10.00	7.00	97.8	23.2	7.75	21.4	7:56A	SB	21.4 SB 5-25-11
26	8:13A	SB	3.97	6.99	9.98	6.98	96.9	22.7	7.73	21.1	8:25A	SB	
27	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
28	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
29	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
30	8:00a	WT	4	7	10	7		23	7.5	23	8:15a	WT	
31	7:44A	SB	3.97	6.99	10.04	7.04	95.3	22.2	7.44	22.8	7:56A	SB	Clean probe

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  - C. Standard and QC sample results;
  - D. Reagent blank results (turbidity and TRC only)(not in-line meters);
  - E. Date/time of preparation/analysis for sample;
    - i) Analysis time within 15 minutes of sample time;
  - F. Analyst name or initials;
  - G. Calibration data and sample results obtained;
  - H. Corrective actions if QC or method requirements not met;
    - i) Data not reported until the cause of the problem is identified and either corrected or qualified;
  - I. Indelible ink;
  - J. Corrections to records only made with single line thru incorrect entry, correct entry written to side with initials and date of person making change; and
  - K. Records maintained for at least 10 years (R18-9-A206(B)(3)).