*Name of Facility*

Standard Operating Procedure

for the Analysis of Salinity

Method: SM 2520 B-2011

Effective Date:

Supervisor Signature Date

Supervisor Name (print)

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*Blue text is replaceable instructional language to be customized for your facility.*

1. Summary of Method
   1. To determine salinity, the Conductivity and Temperature are measured and the Salinity is determined from the empirical relationship to Conductivity and Temperature.
   2. *State what type of samples are analyzed, (e.g., estuarine water, industrial wastewater, etc. and the permit limits if applicable).*
   3. The Practical Salinity Scale uses an equation which is valid in the range of 0 to 40 ppt salinity.
2. Definitions
   1. Calibration standard: Potassium chloride (KCl) standard used to calibrate the meter each day of use.
   2. Calibration verification check standard: Potassium chloride (KCl) standard analyzed after calibration of the meter to check the calibration acceptability.
   3. µmhos/cm: Units of measurement of specific conductance. 1 µmhos/cm = 1 µS/cm.
   4. ppt: Units of measurement of Salinity, parts per thousand
   5. NC WW/GW LC: North Carolina Wastewater Groundwater Laboratory Certification
   6. *Add any other applicable acronyms used by your facility*
3. Safety and Waste Handling
   1. *Items that would be included in this section are things such as:*

* *Precautionary measures (list here and at the critical steps in the procedure)*
* *Personal protective equipment (e.g., gloves, eye protection, lab coat, work in a hood, etc.)*
* *Hazardous chemicals/reagents*
* *Storage and disposal of samples and reagents*
* *Reference to Chemical Hygiene Plan, if applicable*
* *Location of Safety Data Sheets (SDS)*

1. Apparatus, Equipment and Reagents

*Note: Include storage conditions. It is recommended catalog numbers also be included*

* 1. *List your meter with make and model*
  2. Calibration standard(s): *state if it is purchased, what concentration and if prepared, how it is made*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Conductivity and Salinity of Potassium Chloride** | | | | | |
| **KCl Molarity (*M)*** | **KCl Wt.\* (grams)** | **Conductivity at 25°C  (µ*mho/cm*)** | **Salinity at 15°C**  **(ppt)** | **Salinity at 20°C**  **(ppt)** | **Salinity at 25°C**  **(ppt)** |
| **0.0001** | **0.00745** | **14.9** | **0.01** | **0.01** | **0.01** |
| **0.0005** | **0.03728** | **73.9** | **0.05** | **0.04** | **0.04** |
| **0.001** | **0.07455** | **146.9** | **0.09** | **0.08** | **0.07** |
| **0.005** | **0.37275** | **717.5** | **0.44** | **0.39** | **0.35** |
| **0.01** | **0.74550** | **1,412** | **0.89** | **0.79** | **0.71** |
| **0.02** | **1.49100** | **2,765** | **1.8** | **1.6** | **1.4** |
| **0.05** | **3.72750** | **6,667** | **4.6** | **4.1** | **3.6** |
| **0.10** | **7.45500** | **12,890** | **9.4** | **8.3** | **7.4** |
| **0.20** | **14.9100** | **24,800** | **19.1** | **16.9** | **15.1** |
| **0.44** | **32.4356** | **42,900** | **35** | **30.9** | **27.6** |

\*Diluted to 1 L.

*Note: Standards may not be diluted because the effect of dilution is not linear. Standards must be purchased or prepared individually at the desired concentration according to Table 2510:I.*

* 1. Check standard: *state if it is purchased, what concentration and if prepared, how it is made*
  2. Laboratory water: *state what type of water is used (e.g., purchased distilled water, etc.).*
  3. *Include glassware if standards are prepared*
  4. *Include pipettes if standards are prepared*
  5. *State sample collection container type and volume*

1. Interferences

N/A

1. Sample Collection, Preservation and Holding Time
   1. If samples are not analyzed *in-situ* they must be collected in plastic or glass containers. (Guidance per EPA Region 4 and SM 1060 C-2011, Table 1060:I).
   2. *If the sample is not analyzed within 15 minutes, transport on ice and store at ≤6 °C.*
   3. Samples should be analyzed as soon as possible, but must be analyzed within 28 days of collection based on the holding time of Conductivity in 40 CFR Part 136.3 Table II per EPA Region 4.
   4. *State where the sample is generally analyzed (e.g., in the stream, immediately at the sampling site, in the lab within holding time, etc.).*
2. Calibration
   1. The meter must be calibrated daily before compliance sample analysis.
   2. The probe must be rinsed with three portions of each standard prior to analysis.
   3. The meter is calibrated using the following standard(s): *state concentration(s) here*
   4. *Give all the manufacturer’s instructions for performing the calibration*
   5. After calibration, a check standard *(state concentration here)* is analyzed and documented
   6. The check standard must read within ±10% of the known value to be acceptable. If the standard does not read within ±10%, the meter must be recalibrated before any samples are analyzed.
3. Procedure
   1. Thoroughly rinse the probe with one or more portions of sample prior to sample measurement. Samples must not be diluted.
   2. *State the steps that are in the instrument manual for analyzing the sample*
   3. *State how the data is recorded on the benchsheet, e.g., number of decimal points.*
   4. *If multiple samples are analyzed in a day, include 8.4, delete if not.* When performing multiple sample analyses, a post-analysis calibration verification check standard must be analyzed at the end of the run. See Section 12 for the acceptance criterion.
   5. Keep the probe clean when not in use. *(State how the probe is stored)*
4. Documentation

The following must be documented in indelible ink whenever sample analysis is performed:

* 1. Date and time of sample collection. If Salinity measurement is made in situ, it must be notated.
  2. Date of sample analysis to verify the 28-day holding time is met
  3. Facility name, sample site (ID or location), and permit number
  4. Collector’s/analyst’s name or initials
  5. True value of the standard used for calibration
  6. True value of the calibration verification check-standard
  7. Value obtained for the check-standard (verification of ± 10% recovery)
  8. If applicable, True value and value obtained for the post-analysis calibration verification(s)
  9. If applicable, Indication of when the post-analysis calibration verification was performed (e.g., time of analysis, end-of-day analysis, etc.)
  10. The final value to be reported
  11. Units of measure
  12. Traceability for chemicals, reagents, standards and consumables
  13. Instrument identification (serial number preferred)
  14. Parameter analyzed
  15. Method reference
  16. Data qualifiers, when necessary
  17. Equipment maintenance (recommended)

1. Proficiency Testing Procedure
   1. Proficiency Testing Samples are not required for this parameter.
2. Calculations and Reporting
   1. Percent Recovery

% Recovery = Value Obtained x 100

True Value

* 1. All data must be reported in parts per thousand (ppt).
  2. Salinity standards must not be diluted. Any sample greater than *(state upper reporting limit)* will be reported as > *(upper reporting limit.)* Any sample less than (*state lower reporting limit)* will be reported as < *(lower reporting limit).* See section *12.3 (update if section numbers change)*.

1. Quality Assurance and Quality Control
   1. The calibration verification check standard must read within ±10% of the true value to be acceptable. See Section 14.0 for corrective action
   2. *Delete this section if the post-analysis calibration verification is not needed:* The value obtained for the post-analysis calibration verification check standard must read within 10% of the standard’s true value. If the obtained value is outside of the ±10% range, corrective action must be taken. See Section 14.0.
   3. Operational Range Verification:
      1. Before using this method or a new instrument, analyze standards at concentrations corresponding to the upper and lower reporting limits to verify the operational range. The standards must read within ±10% of the true value.
         1. The concentration of upper reporting limit verification standard is X
         2. The concentration of the lower reporting limit verification standard is Y
      2. At least quarterly, analyze a standard at the lower reporting limit. *It is recommended that it be analyzed daily.* The standard must read within ±10% of the true value. *State frequency of analysis.*
   4. *State who is transcribing the data to the DMR and whether anyone peer reviews (checks) it. Peer review is recommended, but if that is not possible, it is recommended that the analyst rechecks their own transcription for errors after a certain amount of time has passed.*
2. Preventative Maintenance
   1. *State if a maintenance log or record is maintained and the type of maintenance that may be performed.*
   2. *State if there is any scheduled timeframe for replacing probes.*
   3. *State any other manufacturer recommended maintenance.*
   4. *Describe short-term and long-term storage for the probe.*
   5. *Describe how the probe is conditioned prior to use after dry storage.*
3. Troubleshooting and Corrective Action
   1. If the calibration verification check standard does not read within ±10% of the true value, the problem must be resolved through corrective action before analyzing samples. *State specifically what the corrective actions will be (e.g.,* *prepare fresh standard(s) and reanalyze, or recalibrate the meter).*
   2. If the lower reporting limit check standard does not read within ±10% of the true value, prepare fresh standard(s) and reanalyze, reevaluate the reporting limit, etc.
   3. *(Delete if not needed)* If the post-analysis calibration verification check standard is not within acceptance limits, recalibration is necessary. All samples analyzed since the last acceptable calibration verification must be reanalyzed, if possible. If samples cannot be reanalyzed, the data must be qualified.
   4. *State what will be done if a meter does not pass the calibration check after recalibrating*
4. Employee Training

The following employee training must be documented and kept on file.

* 1. *Include education, training, experience and/or demonstrated skills required for the position*
  2. Employee must have read this SOP *– may also include reading the Approved Procedure for the Analysis of Salinity.*
  3. *Employee must demonstrate proficiency (e.g., side-by-side comparison with trained analyst, etc.) before analyzing compliance samples for reporting*

1. References
   1. Standard Methods, 2520 B-2011 and Standard Methods, 2510 B-2011.

* 1. North Carolina Wastewater/Groundwater Laboratory Certification Approved Procedure for the Analysis of Salinity, Revision 11/26/2019.
  2. 15A NCAC 02H .0800

1. Revision History

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| Type: Review or Revision | Date | Summary of Changes Made if Revision |
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