

NORTH CAROLINA WASTEWATER/GROUNDWATER LABORATORY CERTIFICATION BRANCH

APPROVED PROCEDURE FOR THE ANALYSIS OF SPECIFIC CONDUCTANCE (CONDUCTIVITY)

This document provides an approved procedure for the analysis of Specific Conductance for compliance monitoring per 15A NCAC 02H .0805 (a) (7) and (g) (4).

Holding Time:

- Samples must be analyzed within 28 days of collection (40 CFR Part 136 Table II).
- Samples must be stored above freezing and $\leq 6^{\circ}\text{C}$, if not analyzed immediately.

General Information:

- Sample duplicates are not a required quality control element for Field parameters.
- Some meters may display units in $\mu\text{S}/\text{cm}$, however sample results are to be reported in units of $\mu\text{mhos}/\text{cm}$ ($1 \mu\text{mho}/\text{cm} = 1 \mu\text{S}/\text{cm}$)
- Conductivity samples must not be diluted.
- Thoroughly rinse conductivity cell with one or more portions of sample prior to sample measurement.
- Keep the conductivity cell clean when not in use.
- When performing multiple sample analyses, a post-analysis calibration verification must be analyzed at the end of the run. It is recommended that a mid-day or a mid-batch calibration verification be performed when samples are analyzed over an extended period of time. 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 $\pm 10\%$ range, corrective action must be taken. If 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.
- The Automatic Temperature Compensator (ATC) must be verified prior to initial use and annually (i.e., 12 months) thereafter at two temperatures by analyzing a standard or sample at 25°C (i.e., the temperature to which conductivity values are reported) and a temperature(s) that brackets the temperature ranges of the compliance samples routinely analyzed. This may require the analysis of a third temperature reading that is $> 25^{\circ}\text{C}$ (see #3 below). The manner in which the ATC is verified may depend upon the meter's capabilities and the manufacturer's instructions. The following is one option:
 1. Pour an adequate amount of conductivity standard or sample into a beaker or other container and analyze at $25 \pm 0.5^{\circ}\text{C}$. Document the temperature and conductivity value.
 2. Lower the temperature of the standard or sample (e.g., by placing the container in a refrigerator or ice chest) to less than the lowest anticipated sample temperature and analyze. Document the temperature and conductivity value.
 3. If samples greater than 25°C are to be analyzed, perform the following additional step: Raise the temperature above 25°C to greater than the highest anticipated sample temperature (e.g., by placing the container in a hot water bath) and analyze. Document the temperature and conductivity value.As the temperature increases or decreases, the value of the conductivity standard or sample must be within $\pm 10\%$ of the true value of the standard or $\pm 10\%$ of the value of the sample at 25°C . If not, corrective action must be taken.

Anticipated temperatures can be obtained from a review of the electronic Discharge Monitoring Reports (eDMRs) from the peak summer and winter months. Historical data should provide a reasonably accurate estimation of ranges that will bracket the expected sample temperatures.

Other Certified laboratories may provide assistance in meeting this ATC verification requirement.

Standards:

Potassium Chloride (KCl) conductivity standards may be purchased in the ranges desired, or they may be prepared according to Table 2510:I of Standard Methods, 2510 A-2011. A portion of the standard should not be used for more than one calibration. Discard any used standard portions.

Note: The preparation of the standards in Table 2510:I indicates that the relationship between mass of KCl used and standard concentration is not linear; therefore standards may not be diluted, but must be prepared individually.

TABLE 2510:I. EQUIVALENT CONDUCTIVITY, A , AND CONDUCTIVITY, k_s , OF POTASSIUM CHLORIDE AT 25.0°C.*²⁻⁴

KCl Concentration <i>M</i> or <i>equivalent/L</i>	Equivalent Conductivity, A <i>mho-cm²/equivalent</i>	Conductivity, k_s <i>μmho/cm</i>
0	149.9	
0.0001	148.9	14.9
0.0005	147.7	73.9
0.001	146.9	146.9
0.005	143.6	717.5
0.01	141.2	1 412
0.02	138.2	2 765
0.05	133.3	6 667
0.1	128.9	12 890
0.2	124.0	24 800
0.5	117.3	58 670
1	111.9	111 900

* Based on the absolute ohm, the 1968 temperature standard, and the dm³ volume standard.² Values are accurate to ±0.1% or 0.1 μmho/cm, whichever is greater.

Calibration:

1. Instruments are to be calibrated according to the manufacturer's calibration procedure prior to analysis of samples each day compliance monitoring is performed. For most meters, this is a one-standard calibration.
2. Thoroughly rinse conductivity cell with one or more portions of standard prior to measurement of that standard.
3. Analyze and document a second-source calibration verification check standard prior to compliance sample analysis. It is recommended that this standard value approximate (may be higher or lower than the calibration standard, as applicable) the expected range of sample values measured.
4. The value obtained for the calibration verification check standard must read within 10% of the true value of the calibration verification check standard. If the obtained value is outside of the ±10% range, corrective action must be taken.

Documentation:

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

1. Date and time of sample collection
2. Date of sample analysis to verify the 28-day holding time is met
3. Facility name or permit number, and sample site (ID or location)
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
8. True value and value obtained for the post-analysis calibration verification(s), when applicable
9. Quality control assessments
10. Indication of when the post-analysis calibration verification was performed (e.g., time of analysis, end-of-day analysis, etc.)
11. Units of measure
12. All data must be reported in μmhos/cm at 25 °C or corrected to 25 °C
13. Traceability for chemicals, reagents, standards and consumables
14. Unique instrument identification (serial number preferred)
15. Parameter analyzed
16. Final value to be reported
17. Method reference
18. Data qualifiers, when necessary

Refer to <https://www.deq.nc.gov/about/divisions/water-resources/water-sciences/chemistry-laboratory/laboratory-certification-branch/field-approved-procedures-and-technical-assistance> for additional resources.

Ref: Standard Methods 2510 B-2011 and EPA Method 120.1