Nebraska Department of Environment and Energy
Standard Operating Procedure (SOP)

Water Quality Division
Water Quality Assessment Section – GW

SOP Number: GW-070
Title: Field Groundwater Quality Measurements – Temperature, pH, Conductivity
Written Date: July 2024

Purpose: To perform field analyses for basic groundwater quality parameters (temperature, pH, and conductivity) in a uniform, efficient, and defensible manner.

Equipment/Materials Needed:

- Thermometer, alcohol-filled, graduated in degrees Centigrade
- pH meter (separate probe or wand type), graduated in standard pH units
- Standard pH buffer solutions--4.0, 7.0, 10.0
- Conductivity meter (separate probe or wand type), graduated in micromhos/centimeter
- Standard conductivity solution
- Squirt bottle filled with deionized water
- Container of sample water (a wide-mouthed 500 ml clear glass jar works well)

Procedures:

1. Temperature

    1.1. Calibration: none.

    1.2. Locate the sampling point. For existing wells, this will be a faucet, gate, sampling port, or system leak. For dedicated monitoring wells, this will mean installing the sampling device and initiating sample withdrawal.

    1.3. While water is flowing from the sampling point, remove the thermometer from its protective sleeve and insert the bulb of the thermometer directly into the midstream of the flow.

    1.4. Keep the thermometer in the flow until the temperature reading stabilizes for approximately 30 seconds.

    1.5. In some cases (e.g. while using a bailer or when sampling from a slow leak), it will not be possible to insert the thermometer into flowing water. If this is the case, collect a small amount of sample water in the wide-mouth 500 ml glass jar and immerse the thermometer bulb in the water. Try to keep the sample and thermometer out of direct sunlight and away from heat sources (e.g. pump engines) and read the stabilized temperature as quickly as possible.

1.6. Record the temperature reading on the field inventory sheet as per SOP # GW-110.

1.7. Reinsert the thermometer into its protective sleeve and secure it for transport to the next sampling site. Discard the sample water (if used).

2. pH

2.1. Calibration (for more specific instructions, consult the manufacturer's instructions for a particular instrument kind/model.)

2.1.1. Immerse the pH probe/wand tip in pH 7.0 standard solution.

2.1.2. Activate the instrument's calibration mode (if so equipped).

2.1.3. Adjust the temperature control on the pH meter (if so equipped).

2.1.4. Adjust pH meter according to manufacturer's instructions so there is no apparent error, i.e. the instrument readout shows a pH value of 7.0.

2.1.5. Rinse the probe/wand with deionized water and test it by inserting it into pH 4.0 and 10.0 standard solutions, rinsing the probe between tests. Note: since most natural groundwater in Nebraska will be close to pH 7.0, it is most important that the pH calibration results agree closely with the pH 7.0 standard solution.

2.1.6. Calibrate the pH meter as necessary, normally once daily. Normally, groundwater pH in Nebraska should fall between approximately 6.5 and 8.0 standard units; recalibrate the meter if a pH reading falls outside these norms. As time goes on and the operator becomes more familiar with a given pH meter, it may become apparent that a certain meter holds its calibration throughout a longer period. If this is the case, pH meter calibration at a longer interval (e.g. every second or third day) will be sufficient.

2.1.7. Record each calibration in the instrument logbook.

2.2. Fill an appropriate container (e.g. wide-mouth 500 ml glass jar, beaker, etc.) with sample water.

2.3. Immerse the pH probe/wand tip in the sample water.

2.4. Adjust the temperature control on the pH meter (if so equipped).

2.5. Allow pH reading to stabilize, usually over a few minutes. Normally, this stabilization can occur while you're performing other sampling tasks.

2.5.1. If the well to be sampled has been running for a significant period (e.g. in the case of an irrigation or municipal well), one (1)

pH reading is sufficient after the above steps have been completed.

2.5.2. If the well to be sampled has not been purged (e.g. in the case of a dedicated monitoring well, some domestic wells, or an irrigation well that has just been started), repeat the above process until three (3) successive pH readings are within 10% of one another.

2.6. Record the pH reading on the field inventory sheet as per SOP # GW-110.

2.7. Turn off the pH meter, remove the probe from the sample water, discard the water, and secure the meter for transport to the next sampling site.

3. Conductivity (Specific Conductance)

3.1. Calibration (for more specific instructions, consult the manufacturer's instructions for a particular kind/model)

3.1.1. Turn the meter switch to the self-calibration ("red line") setting or activate the calibration mode (if so equipped and depending upon make/model).

3.1.2. Turn the adjustment knob so that the meter needle is aligned with the red line (again, if so equipped).

3.1.3. Immerse the probe in standard conductivity solution. Note: if possible, work with your laboratory to get conductivity solution(s) which are in the general range of conductivities expected from the groundwater you will be sampling.

3.1.4. Adjust the temperature compensation and conductivity range knobs (if so equipped) to select the appropriate scale for the temperature and conductivity of the calibration solution.

3.1.5. Adjust the conductivity meter according to manufacturer's instructions until the conductivity reading agrees with the value of the standard solution.

3.1.6. Remove the probe from the standard solution and rinse the probe with deionized water.

3.1.7. Calibrate the conductivity meter as necessary, normally once daily. Field conductivity can vary greatly across Nebraska, but is normally within a range from almost zero up to a few thousand µmhos/cm. Consult available literature for expected conductivity values in the area being sampled and recalibrate the instrument according to those expected values. As time goes on and the operator becomes more familiar with a given conductivity meter, it may become apparent that a certain

meter holds its calibration through a longer period. If this is the case, conductivity meter calibration at a longer interval (e.g. every second or third day) will be sufficient.

3.1.8. Record each calibration in the instrument logbook.

3.2. Fill an appropriate container (e.g. wide-mouth glass 500 ml jar) with sample water.

3.3. Immerse the conductivity probe in the sample water.

3.4. Adjust the temperature compensation knob (if so equipped) to the approximate temperature of the sample water.

3.5. Select the appropriate scale for the conductivity of the sample water.

3.6. Allow conductivity reading to stabilize, usually over a few minutes. Normally, this stabilization can occur while you're performing other sampling tasks.

3.6.1. If the well to be sampled has been running for a significant period (e.g. in the case of an irrigation or municipal well), one (1) conductivity reading is sufficient after the above steps have been completed.

3.6.2. If the well to be sampled has not been purged (e.g. in the case of a dedicated monitoring well, some domestic wells, or an irrigation well that has just been started), repeat the above process until three (3) successive conductivity readings are within 10% of one another.

3.7. Record the conductivity reading on the field inventory sheet as per SOP # GW-110.

3.8. Turn off the conductivity meter, remove the probe from the sample water, discard the water, and secure the meter for transport to the next sampling site.