

STANDARD OPERATING PROCEDURE
Calibration and Use of the PCTSTestr 50 pH Meter for Groundwater Sampling

KEY WORDS

pH, pH meter, buffer, calibration, groundwater, sampling

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1.0 INTRODUCTION

1.1 Purpose

Basic water quality parameters, such as pH, are commonly measured during the collection of groundwater samples. The pH is a measure of how acidic or basic a solution is according to the relative amount of free hydrogen (H⁺) and free hydroxyl (OH⁻) ions present. A pH value of 7.0 indicates a neutral pH and is the absolute value of the ion product of pure water at 25°C. Lower values of pH indicate increasing acidity (more free H⁺ ions) and higher values indicate increasing alkalinity (more free OH⁻ ions). Values are reported as logarithmic units with each unit representing a ten-fold difference in free hydrogen. A solution with a measured pH value of 5.0 is ten times more acidic than a solution with a pH value of 6.0.

The equation for pH is:

$$pH = -\log_{10}[H^+]$$

Geochemical properties, including the pH of water and soil, influence the efficacy and persistence of pesticides in the environment (Barbash, 2007). For groundwater studies, the pH of water can affect pesticide transformation rates and pathways; both directly by changing reactant concentrations (such as H₃O⁺ and OH⁻), and indirectly by affecting organisms and surfaces involved in pesticide reactions (Barbash and Resek, 1996). To obtain accurate pH measurements, proper calibration and testing procedures must be followed.

1.2 Scope

This Standard Operating Procedure provides proper methods for calibrating and using a PCTSTestr 50 pH meter to measure the pH of groundwater when sampling in the field. The pH is measured at each sampling site and the PCTSTestr 50 pH meter must be calibrated before each sampling trip. For more sampling procedures beyond the scope of this SOP, refer to SOP FSWA001.03: Obtaining and Preserving Well Water Samples (Kocis, 2020).

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2.0 MATERIALS

Materials needed are listed below and shown in **Figure 1**:

- 2.1 PCTSTestr 50 pH meter
- 2.2 Instruction manual for PCTSTestr 50 pH meter (not shown)
- 2.3 Buffer solutions: pH 7.0, and 4.0 or 10.0.
- 2.4 Two 50 mL or 100 mL beakers
- 2.5 Deionized (DI) water in a squirt bottle (not shown)
- 2.6 Half-pint glass jar
- 2.7 Laboratory wipes
- 2.8 Nitrile gloves



Figure 1. Materials used to calibrate pH meter: 10.0 buffer solution, 7.0 buffer solution, 2 beakers, gloves, PCTSTestr 50 pH meter, laboratory wipes, half-pint glass jar, and deionized water in squirt bottle (not shown).

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3.0 PROCEDURES

3.1 Calibration of the PCTSTestr 50

- 3.1.1 Put on gloves and check the expiration date of the buffers before performing calibration.
- 3.1.2 Perform a two-point calibration using a pH 7.0 buffer and either a pH 4.0 or pH 10.0 buffer. Use pH 7.0 and pH 10.0 for water samples expected to be basic or near pH 7.0. Use pH 4.0 buffer solutions for water samples expected to be acidic. Pour enough of the buffer solutions into the separate beakers to fully immerse the pH meter electrode when calibrating (minimum 2-3 cm depth). **Never immerse the pH meter into stock buffer solutions.**
- 3.1.3 Press the **ON/OFF** (⏻) button to turn on meter. Press **Menu/√** to open the menu and press again until “Measure” is highlighted. Press **Hold/↵** to select pH mode. The meter will display “pH” and a checkmark to confirm selection (**Figure 2**, left).
- 3.1.4 Remove the cap and rinse the pH electrode with deionized (DI) water.
- 3.1.5 Immerse the electrode into one of the beakers that contains a pH buffer. Continuously and gently swirl the meter. Press **CAL/ESC** to begin the calibration. The upper display will show measured pH and lower display will show the pH standard buffer solution.
- 3.1.6 Allow the primary display to stabilize (about 2 minutes). A timer icon will blink until the reading stabilizes. Confirmation that the pH meter has been calibrated is indicated by a checkmark and “Cal” shown on the display. The display will automatically return to the measurement window after the reading is calibrated to the pH standard buffer solution (**Figure 2**, right).
- 3.1.7 Rinse the electrode with DI water before immersing into another buffer solution. Repeat steps 3.1.5 and 3.1.6 with additional buffers.
- 3.1.8 Rinse the pH electrode with DI water. Pat dry and replace cap.
- 3.1.9 Pour pH buffers down the sink, rinse beakers with DI water, and put away the materials.

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Figure 2. Left: PCTSTestr 50 pH meter displaying pH mode is selected. Right: PCTSTestr 50 pH meter submerged in a beaker with a pH buffer.

3.2 Field Determination of pH

- 3.2.1 Place a clean plastic sheet or bag on the ground or vehicle and put on gloves to prevent contamination.
- 3.2.2 Remove the cap from the pH meter and rinse the electrode with deionized (DI) water.
- 3.2.3 Directly before samples are to be taken (after purging the well), rinse the half-pint glass jar with groundwater three times. Then, fill the half-pint jar with enough groundwater to fully immerse the pH meter electrode (minimum 2-3 cm depth) and place it on the clean bag.
- 3.2.4 Press **On/Off** (⏻) to turn on the meter. Note: If the last use of the meter was for calibration, press **Menu/√** to open the menu and highlight measure. Press **Hold/↵** to select. Press **Menu/√** to highlight pH mode, then press **Hold/↵** to select pH. The meter will display “pH” and a checkmark to confirm the selection has been made (**Figure 2**, left).

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- 3.2.5 Immerse the pH electrode into groundwater in the jar (Figure 3). Gently swirl the electrode and leave immersed until the pH reading stabilizes.
- 3.2.6 Record the pH to the hundredth place and the temperature in degrees Celsius on the Well Information Sheet and on the Chain of Custody forms (see SOP FSWA001). To freeze and unfreeze the reading, press **Hold/↵**.
- 3.2.7 Rinse the pH electrode with DI water, pat dry, replace cap, and store in the well sampling kit.



Figure 3. pH meter submerged in half-pint glass jar filled with a groundwater sample. Jar is placed on a plastic sheet to prevent contamination of equipment.

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4.0 REFERENCES

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