

# Standard Operating Procedures for Measuring Turbidity

A Guide to Field Measurements Using a Handheld Turbidity Meter



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## **1. Purpose and Scope**

- 1.1. This document is for the Washington State Department of Health (WSDOH) Standard Operating Procedure (SOP) for turbidity measurements.
- 1.2. This document describes the procedure for using a hand held turbidity meter to measure the turbidity of wastewater. The turbidity meter and sensor measures the interaction between light and suspended particles in water. Turbidity is a useful indicator of water treatment efficiency. This procedure is performed in accordance with Standard Methods 2130B.

## **2. Applicability**

- 2.1. This procedure was developed for field measurements of turbidity of wastewater using the handheld Global Water WQ770-B Turbidity Meter and Sensor. This document is intended for measuring turbidity in the 0-50 NTU range.

## **3. Definitions**

- 3.1. Calibration- To standardize or correct sensor after determining, by measurement or comparison with a standard, the correct value.
- 3.2. Turbidity- A measure of the clarity of water, expressed by the interaction between light and suspended particles in water.
- 3.3. NTU- Nephelometric Turbidity Unit
- 3.4. WSDOH- Washington State Department of Health
- 3.5. Field Log- A standard document for recording field measurements. See Appendix.
- 3.6. MSDS- Material Safety Data Sheets

## **4. Personnel Qualifications/Responsibilities**

- 4.1. All field measurements will be performed by WSDOH personnel with lab experience and a professional background in wastewater treatment.
- 4.2. Review appropriate Material Safety Data Sheets before calibration.

## **5. Equipment, Reagents, and Supplies**

- 5.1. Turbidity Meter, Global Water Model: WQ770-B
- 5.2. Turbidity Sensor w/ 25' cable standard, Global Water Model: WQ730
- 5.3. 0 NTU, Suspended Polymer Turbidity Standard
- 5.4. 50 NTU, Suspended Polymer Turbidity Standard
- 5.5. Distilled Water
- 5.6. Three tinted 500 mL Beakers
- 5.7. Cotton Swabs
- 5.8. Rubbing Alcohol
- 5.9. 9 Volt lithium batteries
- 5.10. Disposable Rubber Gloves
- 5.11. Global Water Turbidity Meter and Sensor Manuals
- 5.12. Equipment for Global Water Meter Verification: HACH 2100N Turbidimeter, 30 mL sample cell, silicone oil, 2100N Formazin Calibration Standards, and HACH 2100N User Manual.

## **6. Summary of Procedures**

### **6.1. Turbidity Calibration**

**Calibration Frequency:** According to Global Water manufacturer, the Turbidimeter should be calibrated before each day of usage. Calibration standards have a shelf life of 1 year and may be reused as long as they are not contaminated.

1. Connect the sensor to the meter so that it is turned and locked into place.
2. Turn meter on by pressing the Menu/On button.
3. Once meter is on, enter the calibration screen by holding the Menu/On button for 3 seconds.
4. Press the down arrow key to select 50 NTU. Press the Save button.
5. Press the Menu/On button again to display available units. Select NTU and press the Save button.
6. Press Menu/On button to display the LoSig screen for calibration using 0 NTU standard. The LoSig screen shows a number with NTU. This is not an indication of the real NTU reading. This value includes meter offsets and other variables.
7. Fill a beaker with approximately 5” of 0 NTU Standard.
8. Insert the sensor into the Standard. Make sure that the stainless steel portion of the sensor is in contact with the water and that the sensor tip is at least 3” from the bottom of the beaker. If necessary use a lint free cotton swab bent at 90° angle to remove any air bubbles on the tip of the sensor; these bubbles will cause large errors. (Wiping the sensor with a KimWipe will minimize bubbles). Wait for the sensor to stabilize. Once reading is stable, press the Save button. This step may need to be repeated to ensure that an accurate reading is taken. Rinse and dry the lenses, and clean with alcohol if necessary.
9. Press Menu/On button to display the HiSig screen for calibration using 50 NTU standard. The HiSig screen shows a number with NTU. This is not an indication of the real NTU reading. This value includes meter offsets and other variables.
10. Fill a second beaker with approximately 5” of 50 NTU Standard.
11. Insert the sensor into the Standard. Make sure that the stainless steel portion of the sensor is in contact with the water and that the sensor tip is at least 3” from the bottom of the beaker. If necessary use a lint free cotton swab bent at 90° angle to remove any air bubbles on the tip of the sensor; these bubbles will cause large errors. Wait for the sensor to stabilize. Once reading is stable, press the Save button. This step may need to be repeated to ensure that an accurate reading is taken. Rinse and dry the lenses, and clean with alcohol if necessary.
12. Press the Menu/On button again to advance to the LoLab screen and enter the known Lo Standard (0 NTU). Press Save, and repeat step for the HiLab screen (this time enter 50 NTU, the Hi Standard).
13. Proceed through the Delay screen by pressing Menu/On. The Delay should be set at 5 seconds.
14. Record calibration in the calibration Logbook.

## 6.2. Direct Turbidity Grab Sample Bottle Measurement Procedure

1. Turn meter on by pressing the Menu/On button.
2. Press and hold the Menu/On button for 3 seconds to confirm that the correct range is selected. “Ch50” should be displayed in the bottom right corner indicating a 0-50 NTU range setting. If the range is not correct, refer to step 6.1.4 in the calibration procedure.

3. Rinse the sensor with distilled water. Dry and clean the lenses with alcohol.
4. Insert the sensor into the wastewater sample bottle. Make sure that the stainless steel portion of the sensor is in contact with the water and that the sensor tip is at least 3" from the bottom of the vessel. If necessary use a lint free cotton swab bent at 90° angle to remove any air bubbles on the tip of the sensor; these bubbles will cause large errors. Wait for the sensor to stabilize. Once reading is stable, record the reading in NTUs in the field logbook.
5. Clean the sensor using distilled water.
6. At the end of data collection, verify the instrument's calibration, place the sensor in its calibration environment and check to see that the meter is reading its calibration value. Enter this verification in the Field Data Log.
7. Clean the sensor with distilled water.
8. For storage >30 days, remove the batteries from the instrument.

## 7. Records Management

- 7.1. All hardcopy documentation of the data, such as the completed Field Log will be reviewed, verified, and entered into a database after being approved by the project's designated QA/QC Lead.
- 7.2. All calibration and field records should include: the instrument manufacturer, model number, the standards used to calibrate the instruments (including source), the calibration date and time, instrument readings, the post-calibration check and the name of the person (s) who performed the calibration. An example of a complete Field Log and calibration record is shown in the Appendix.

## 8. Quality Control and Quality Assurance Section

- 8.1. The Sensor and Meter should be calibrated before each use.
- 8.2. Although field instruments are robust, they should still be handled carefully.
- 8.3. All procedures should be completed in accordance with the project Quality Assurance Project Plan.

## 9. Safety

- 9.1. Turbidity Standards are nontoxic, but can irritate eyes and skin.
- 9.2. Wear gloves when handling Turbidity Standards and anytime there is direct exposure to wastewater.
- 9.3. Wear goggles when testing wastewater.
- 9.4. Wash hands after calibration and after exposure to wastewater.
- 9.5. When using equipment in the field, be aware of your surroundings. Select an area in which you feel safe and secure from hazards.

## 10. References

American Public Health Association (APHA) (2005). *Standard Methods for the Examination of Water and Wastewater*. 21<sup>st</sup> ed. A.D. Eaton, L.S. Clesceri, E.W. Rice, and A. E. Greenberg, eds. APAH-AWWA-WEF, Washington D.C.

Global Water Instrumentation, Inc. (2009) *Turbidity Meter: WQ770 Manual*  
<http://www.globalw.com/downloads/WQ/WQ770manual.pdf>

## Appendix A

### HACH 2100N Turbidimeter

NOTE: The HACH 2100 N must be used in a laboratory and requires sample collection and transport. For this project the HACH 2100N will be used as a backup to the Global Water Turbidimeter which will be used in the field. For instructions on calibration of the HACH 2100N refer to the Instruction Manual.

#### **NEPHELOMETRIC MEASUREMENT PROCEDURE**

1. Collect a representative sample in a clean container. Fill the sample cell to the line (approximately 30 mL). Take care to handle the sample cell by the top.  
Cap the sample cell. (*Note: Instrument warm-up stabilization time with Ratio on is 30 minutes and with Ratio off is 60 minutes. Typical application is to leave the instrument on 24 hours a day.*)
2. Hold the sample cell by the cap, and wipe to remove water spots and finger prints.
3. Apply a thin bead of silicone oil from the top to the bottom of the cell—just enough to coat the cell with a thin layer of oil. Using the oiling cloth provided, spread the oil uniformly. Then, wipe off the excess. The cell should appear nearly dry with little or no visible oil. (*Note: See Section 2.3.2 Applying Silicone Oil in the instrument manual.*)
4. Place the sample cell in the instrument cell compartment, and close the cell cover. (*Note: For immediate update of the display, press **ENTER**.*)
5. If necessary, insert the EPA filter. Select manual or automatic ranging by pressing the **RANGE** key.
6. Select the appropriate **SIGNAL AVERAGING** setting (on or off) by pressing the **SIGNAL AVG** key.
7. Select the appropriate **RATIO** setting (on or off) by pressing the **RATIO** key. (*Note: Values >40 NTU require Ratio on.*)
8. Select the appropriate measurement unit (NTU, EBC or NEPH) by pressing the **UNITS/EXIT** key.
9. Read and record the results.