



STANDARD OPERATING PROCEDURE
MAINE VOLUNTEER RIVER MONITORING PROGRAM
METHODS FOR USING THE LAMOTTE 2020e
TURBIDIMETER IN RIVERS AND STREAMS



Note: The mention of brand names does not constitute recommendation of a specific company.



Volunteer River Monitoring Program
Standard Operating Procedure
Methods for using the LaMotte 2020e Turbidimeter

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1. Applicability. This standard operating procedure is used by the Volunteer River Monitoring Program (VRMP) of the Maine Department of Environmental Protection's Division of Watershed Management. It applies to the collection of turbidity (in NTU units) from rivers and streams in Maine using a LaMotte 2020e turbidimeter.

2. Purpose. The purpose of this SOP is to provide standardized methods for volunteer groups to determine turbidity of rivers and streams as an instantaneous reading using the LaMotte 2020e turbidimeter.

3. Definitions.

- A. LaMotte.** Manufacturer of water quality monitoring equipment.
- B. Calibration.** Set of procedures established by the manufacturer to ensure that the meter is operating properly; a critical quality assurance step in meter preparation prior to use.
- C. Standard Solutions.** The LaMotte 2020e turbidity meter is supplied with three AMCO™ standards of 0 NTU, 1 NTU, and 10 NTU. These standards were manufactured specifically as a reference to calibrate the 2020e turbidimeter.
- D. NTUs.** Nephelometric Turbidity Units. The units of measurement from a calibrated turbidity meter referred to as a nephelometer.
- E. Tube Positioning Rings.** Rings supplied with the LaMotte 2020e that ensure sampling tubes are positioned in meter chamber in the same orientation from one reading to the next to minimize variations in readings due to differences in tube position.
- F. Blank (or Zero Standard).** A baseline standard calibrator which contains no detectable concentration of the analyte being measured.

4. Responsibilities.



A. Volunteer Monitors & Volunteer Groups

- **Certification.** It is the responsibility of the individual obtaining this data to maintain current certification for the parameter(s) they collect if they wish their data to be entered into the VRMP database. Training will be provided to volunteers on an annual basis by VRMP/DEP staff, and certification will last for one year from the date of training.
- **Data recording.** It is the responsibility of the individual obtaining this data to record the results and additional qualifying information on current VRMP field sheets obtained from their affiliated watershed association or through the VRMP program of the DEP.
- **Data Quality Checks and Data Submission.** The data manager for the volunteer group will collect and enter volunteer field sheet data onto the appropriate computer file, perform quality assurance checks (refer to Section 5.10 of the Quality Assurance Program Plan), and submit data to the VRMP following protocols outlined in the volunteer group's latest sampling and analysis plan (SAP) that has been approved by the VRMP.

B. Volunteer River Monitoring Program (VRMP) Staff

- **Oversight of Volunteer Groups and Volunteers.** VRMP staff will oversee volunteer groups and volunteers through a variety of ways including maintaining an up-to-date VRMP quality assurance program plan (QAPP); reviewing sampling and analysis plans (SAPs) of the volunteer groups; providing annual training/certification sessions for volunteers; conducting quality assurance checks on data submitted by volunteer groups and laboratories; and uploading data into the DEP's EGAD database. These tasks are described in greater detail in the VRMP's latest QAPP.

5. Guidelines and procedures

A. LaMotte 2020e Turbidity Meter Preparation:

- **First time use.** Follow manufacturer's instructions for preparing meter for first time use. (Refer to Appendix A:
 - Section "Options and Set Up"; sub-sections "Selecting Turbidity Units", "Selecting a Turbidity Calibration Curve", "Averaging", "Setting the Date and Time", "Selecting a Language", "Setting Auto Shutdown" (pgs. 8-15);
 - Section "Data Logging" (pgs. 16 – 17);
 - Section "The Tube Positioning Ring" (pg. 18); ensure that turbidity tubes are equipped with Tube Positioning Rings;
 - Sections "General Precautions" and "Safety Precautions" (pg. 39).



- **Beginning of field season.** Before each field season, volunteer monitoring groups shall conduct a full inspection of the meter, turbidity tubes, and expiration dates of all turbidity standards. Tubes should be clean and free from lint, fingerprints, dried spills, and significant scratches. Refer to Appendix A, section “Tubes” (pg. 36) for more information about cleaning and handling turbidity tubes. Also, refer to section “Testing Tips” (pg. 29) for other important considerations (e.g., Tip # 13: “Do not use silicone oil on tubes when testing turbidity with the 2020”, which is different than some other brands of turbidity meters). A new battery shall be installed in the meter at the start of the sampling season and additionally, as needed (refer to Appendix A; section “Battery Operation”, pg. 37).
- **Prior to field sampling.** Before each field sample collection, the volunteer shall inspect the meter including an inspection of the turbidity tubes and expiration dates of turbidity standards.
- **LaMotte 2020e Turbidimeter Calibration.** The LaMotte 2020e meter shall be calibrated at the beginning of each field season and at the beginning of each day of use. The LaMotte 2020e turbidity meter is supplied with three AMCO™ standards of 0 NTU, 1 NTU, and 10 NTU. Calibrate the meter with each of these standards. (For instructions, refer to Appendix A, section “Calibration Procedure”, pgs. 24 – 28. See also “Testing Tips”, pg. 29).

C. Turbidity Measurements:

- **Sample period and location.** Sampling period and site location will be documented in SAPs (that require approval by the VRMP) which are submitted by the volunteer groups prior to the beginning of a sampling season. (Detailed information regarding how volunteer groups are to obtain and document site location information can be found in VRMP SOP-02 [Documenting Site Location].)
- **Familiarize Yourself With the Meter.** Volunteers shall familiarize themselves with the basic operation, keypad, and readouts of the meter (Appendix A; section “General Operating Information; pgs. 31 – 35).
- **General Sampling Protocol.**
 - Record site location on data sheet.
 - Turbidity tubes should be wiped with a clean, lint-free cloth (refer to Appendix A, section “Tubes”, pg. 36).
 - Collect water sample at the site where you are monitoring, as described in your group’s approved SAP. (Detailed information regarding how to collect a water sample can be found in VRMP SOP-01 [Methods for Collecting Water Grab Samples in Rivers and Streams].)
 - Follow the instructions specific to measuring turbidity below.
- **Turbidity Measurements.**
 - (1) Review and follow the instructions for making turbidity measurements in section



“Analysis & Calibration” (Appendix A, pg. 18 – 21). Make sure units are taken in NTU.

(2) For testing tips, refer to Appendix A, pg. 29

- **Quality Control:**

(1) At the beginning of each field season, all VRMP staff and VRMP volunteers who will collect turbidity data will have a training/refresher/certification session to (re)familiarize themselves with the contents of this SOP.

(2) For every volunteer, a field duplicate shall be obtained for all parameters for at least 10% of their own sampling efforts. A field duplicate will be collected for every 10 samples monitored.

(3) Refer to the VRMP quality assurance program plan (QAPP) for more QA/QC details.

7. Equipment Care:

A. *Start of Field Season.*

1. Refer to section 5-A of this document.
2. Use new batteries at start of sampling season. Extra turbidity tubes and an extra set of appropriate size batteries should be included in the meter carrying case.

B. *Field Season.*

1. Ideally the meter should be in a water-resistant case with padding to protect it from damage.
2. Allow the case and contents to air-dry at the end of each day. This may be accomplished by simply propping the protective’s case’s lid open. When contents are very wet, remove the contents and spread out to facilitate drying.
3. Clean turbidity tubes at the end of each sampling day (refer to Appendix A; section “Tubes”, pg. 36). Ensure that turbidity tubes are equipped with tube positioning rings (Appendix A; section “The Tube Positioning Ring”, pg. 18).
4. Keep meter from freezing.
5. Refer to Appendix A, section “Maintenance”, pg. 38 for manufacturer’s recommendations for maintenance requirements.

C. *End of Field season.*

1. Completely dry meter and case and all items in the case before storing.
2. Remove batteries.
3. Clean turbidity tubes according to manufacturer’s instructions (refer to Appendix A, section “Tubes”, pg. 36).
4. Keep meter dry and at room temperature to prevent corrosion of electronic parts.
5. Record winterization date and equipment repairs in Equipment Log.
6. Label the meter and case as “WINTERIZED” in an obvious manner (so users will know the current status of the unit.)



8. Specifications

Display	Range	Accuracy	Resolution
Turbidity (NTU)	0.00 – 2000 NTU	.05 or $\pm 2\%$ for readings below 100 NTU, whichever is greater $\pm 3\%$ above 100 NTU	<i>Standard Mode</i> 0.01 from 0.00- 10.99 NTU 0.1 from 11.0 – 109.9 NTU 1 from 110 – 2000 NTU <i>(see owner's manual for EPA mode)</i>

8. Appendix.

- A. LaMotte Turbidimeter 2020e owner's manual:
 LaMotte Company. 2007. Operations Manual: LaMotte 2020 e/i Turbidity Meter.
 Chestertown, MD.

9. References.

- A. Maine VRMP QAPP:
- Maine Department of Environmental Protection (MDEP). 2009. Maine Volunteer River Monitoring Program (VRMP) Quality Assurance Program Plan (QAPP). Portland, ME. DEPLW-0984.

