

Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedures for Instantaneous Measurements of Temperature in Water

Version 1.0

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Signatures on File

Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

Environmental Assessment Program

Standard Operating Procedure for Instantaneous Measurements of Temperature in Water

Introduction

Temperature can be measured instantaneously or continuously. This protocol focuses on instantaneous measurements. The Environmental Assessment Program has many types of instruments that measure temperature, including mercury thermometers, alcohol thermometers, Hydrolab DataSondes[®], Hydrolab MiniSondes[®], YSI Model 30 Conductivity Meters, and HOBO StowAway[®] TidbiTs[®]. Several other devices used in the field have built-in thermometers and can be used if appropriate for the project needs. The investigator should make sure that the equipment chosen meets their project accuracy and precision requirements. Devices for making continuous temperature measurements, including the HOBO StowAway[®] TidbiTs[®], are covered in the Continuous Temperature SOP and are not covered here.

1.0 Purpose and Scope

- 1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for Instantaneous Measurements of Temperature in Water.

2.0 Applicability

- 2.1 This SOP should be followed when making an instantaneous measurement of temperature in water.

3.0 Definitions

3.1 Water Temperature

- 3.1.1 The measure of heat present in water is a key parameter which affects aquatic ecosystems. It influences the physiological and behavioral processes of most aquatic organisms and is associated with dissolved oxygen concentrations, conductivity, pH, alkalinity and other water parameters.
- 3.1.2 Running water temperature fluctuates greatly with daily, seasonal, geographical, and environmental influences.
- 3.1.3 Human influences, via point source discharge, streamside vegetative alterations, and stream morphology changes, may affect water temperatures.

4.0 Personal Qualifications/Responsibilities

4.1 No special qualifications required.

5.0 Equipment, Reagents, and Supplies

5.1 Temperature Measurement Equipment

5.1.1 Mercury thermometers do not rely on electronics and are simple to use. The major disadvantage is that they break easily, releasing mercury, a hazardous substance, to the environment. Because of this, mercury thermometers should be used only for calibration when necessary, and not in the field. Please see safety manual for further information.

5.1.2 Alcohol thermometers are an alternative to mercury thermometers. They may be accurate within a smaller range than mercury thermometers, but if they break, there is no release of a hazardous substance. A downside to alcohol thermometers is that gaps can form in the thermometer liquid (spirit). To prevent this from happening store thermometers with bulb down and in a cool location.

5.1.3 Before use, inspect thermometers for gaps - an alcohol thermometer with gaps will not read accurately. If the spirit has gaps, you can try chilling the thermometer sufficiently to pull the alcohol into the bulb, or heating to pull the alcohol to the top. The thermometer can also be given to the Operations Center technician for possible repair. If these remedies fail, the thermometer should not be used.

5.1.4 Temperature can easily be determined with the use of a Hydrolab DataSonde® or MiniSonde®. They can provide both instantaneous and short-term continuous data. They are convenient if one is already required to measure another parameter within the stream. Accuracy is +/- 0.10°C, and ranges from -5°C to 50°C. Please reference the Hydrolab SOP for more information.

5.1.5 The YSI Model 30 Conductivity Meter ranges from -5°C to 95°C, and has an accuracy of +/-0.1°C. As with the Hydrolabs®, they are convenient if already gathering conductivity or salinity data.

- 5.2 Supplies
- 5.2.1 Mercury thermometer for calibration (if necessary), a scale marked every 0.1° C; and/or
- 5.2.2 Alcohol thermometer; or
- 5.2.3 Hydrolab DataSondes®, Hydrolab MiniSondes®, with deck unit and protective covering; or
- 5.2.4 YSI Model 30 Conductivity Meter.
- 5.2.5 Field notebook (preferably with waterproof paper).
- 5.2.6 Writing utensil (pen/pencil).
- 5.2.7 Batteries and spare batteries for meter.

6.0 Summary of Procedure

- 6.1 If possible, select a representative area of the water body to measure the temperature directly in the water body. If not, equilibrate the sample bottle to the water's temperature; collect a sample at least 1 L in volume, and measure immediately, especially on warm days.
- 6.2 If the thermometer is digital (such as a Hydrolab DataSonde® or YSI meter) make sure the meter is set to the required unit of measure (°C or °F).
- 6.3 Allow the immersed thermometer to equilibrate before reading.
- 6.4 Read temperature. If the thermometer is unreadable while it's immersed in the water, pull the thermometer out and check the reading quickly. Do this multiple times until an accurate reading is achieved (the lowest reading for a reading from cold water when the air is hot and still, or the highest reading if the water is warm and a wind is cooling the wet thermometer).
- 6.5 Record temperature in the field notebook, along with ancillary information such as project name, site, date, and time.
- 6.6 If temperature readings are unstable (which can occur in lakes or poorly mixed streams), take multiple readings.

7.0 Records Management

(NA)

8.0 Quality Control and Quality Assurance

8.1 Calibration

8.1.1 Check all temperature instruments at the beginning of a project against a thermometer certified by the National Institute of Standards and Technology (NIST).

8.1.2 Temperature calibration for the Hydrolab water quality monitoring systems are factory set and requires no recalibration.

9.0 Safety

9.1 When measuring water temperature, as with all activity associated with water bodies, be aware of your surroundings. Select an area in which you feel safe and secure both from water and land hazards.

9.2 For further field health and safety measures, please refer to the EAP safety manual.