Standard Operating Procedure #007
Air Temperature

Version 1.0
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Water Resources Division
Natural Resources Department
Lummi Indian Business Council

Prepared for:
EPA Region 10

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SIGNATURE PAGE

Document: Air Temperature SOP #007

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The following technical staff have read this manual. A copy of this page will be distributed to the employee training record file.

Signature	**Date**
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1. INTRODUCTION

This document, the Standard Operating Procedures (SOP) for air temperature, should be used any time air temperature is measured. This document describes the standard operating procedures and best practices for measuring air temperature, including measurement technique, equipment needed, and quality assurance/quality control (QA/QC) procedures. This document is to be used in conjunction with the relevant project Quality Assurance Project Plan (QAPP).

1.1 Method Summary

Air temperature is measured at all marine and freshwater sites using an armored, non-toxic, liquid-in-glass thermometer at a representative location in the immediate vicinity of the sample site. Quality assurance and quality control procedures include duplicate measurements at 10% of sites sampled on a given day and quarterly accuracy checks.

1.2 Health and Safety Warnings

No water quality measurement is worth risking injury or death. Field personnel must be aware of the environment, use common sense and training, and not exceed their abilities or limits. Field work is never conducted alone. All Lummi Natural Resources (LNR) Water Resources Division (LWRD) Health and Safety Plan (LWRD 2015) requirements and guidelines are followed at all times while conducting fieldwork.

Although the thermometers used for air temperature measurement are non-toxic, the instrument contains a mineral spirit or petroleum distillate that is combustible, and can cause irritation if it makes contact with skin or eyes.

2. INSTRUMENT SPECIFICATIONS

Air temperature is measured using a Lamotte armored, non-toxic, liquid-in-glass thermometer. The range, accuracy, and readability of the equipment used for these measurements are listed in Table 2.1.

Table 2.1 Range, Accuracy, and Readability of Air Temperature Equipment

Range	Accuracy	Readability
-5 to 45°C	±0.5°C	±0.5°C

3. TEMPERATURE MEASUREMENT

Air temperature is measured *in situ* at marine and freshwater sites. Air temperature is measured in a representative location in the immediate vicinity of the sample site. Air temperature is not a critical measurement, but is collected to provide additional information about site conditions on the day sampling occurred.

A representative location is selected based on previous experience and assessment of representative climate at the sample site. A dry and undamaged thermometer is placed in a sheltered, shaded location several feet off the ground soon after arriving at the sample site. The temperature reading should be taken at or near the end of the site visit.

Temperature is measured over a one-minute period. If the temperature is not variable during this period, record the temperature in Water Database or on field datasheet. If the temperature is variable, allow additional time (if possible) for temperature stabilization and re-attempt temperature measurement. If temperature remains variable, record average, range, and trend (if present) in Water Database or on field datasheet (LWRD 2018e).

If equipment malfunction is suspected, discontinue measurement of air temperature. Note problems in Water Database or field datasheet and assign a data qualifier to temperature measurements due to faulty equipment. See Quality Management Plan [QMP] (LWRD 2018d) and Water Database User Guide (LWRD 2018e). Upon return to the laboratory, repair or replace the thermometer as soon as possible. Back-up thermometers are maintained to ensure that a functioning thermometer is available in the event that one thermometer is damaged or malfunctions and requires replacement.

4. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The thermometer cannot be calibrated. Quality assurance/quality control activities include duplicate measurements and quarterly accuracy checks.

4.1 Duplicates

Duplicate air temperature measurement may be collected as determined by the relevant project QAPP. Duplicate air temperature measurements inform the sampler of thermometer precision and the natural variability in air temperature at the site.

4.2 Accuracy Checks

Once per quarter, an accuracy check of the air temperature equipment is conducted. During the accuracy check for temperature, the accuracy of the Lamotte armored thermometer temperature reading is compared to the temperature reading of a National Institute of Standards and Technology (NIST)-traceable reference lab thermometer.[1] Detailed instructions for conducting the air temperature accuracy check follow:

- The Lamotte armored thermometer and NIST-traceable reference lab thermometer are placed near one another, but not touching, in a sheltered, shaded location. Allow to stabilize for 1-3 minutes.
- The reference thermometer temperature is measured and recorded after stabilization when the same temperature is observed during three rapid and consecutive viewings of the mercury or alcohol column (within a few seconds of each other). Parallax error is eliminated by viewing the thermometer at eye-level and lining up (or blocking) the graduation mark in the thermometer with its reflection. The temperature indicated by the Lamotte armored thermometer is measured immediately after the reference thermometer is recorded.
- Meets QA if Lamotte armored thermometer reads ±0.5°C of reference thermometer

[1] The reference thermometer can be either a non-toxic spirit-in-glass or mercury-in-glass thermometer that is (one of the following):

- NIST-certified
- Manufacturer-certified as NIST-traceable and carrying a current NIST certification
- NIST-traceable certification that is no more than 2 years old or still current according to the manufacturer.

In the event that a reference thermometer meeting the required criteria is not available, a secondary standard for the reference thermometer is as follows: NIST-traceable certificate of calibration with expiration date no greater than 5 years prior. The reference thermometer must remain within ±0.2°C of 0°C in ice water bath. Note the use of a reference thermometer meeting the secondary standard in Water Database.

- Note the accuracy check value, reading, reference thermometer serial number and the expiration date of the NIST-traceable manufacturer or calibration certificate in Water Database.

If temperature accuracy check is unsuccessful, attempt accuracy check again using best practices. Ensure that:

- Thermometers are in sheltered, shaded location
- Thermometers are clean. If not clean, wash with mild detergent (*e.g.,* Alconox)
- Thermometers are not touching any surfaces
- Bulbs of the thermometers are near each other but not touching
- The thermometers are undamaged. Do not use a damaged thermometer for air temperature measurements or as a reference thermometer. Dispose of non-toxic thermometers in the lab garbage. Dispose of mercury thermometers at a hazardous waste facility using appropriate safety procedures and personal protective equipment.

If accuracy checks remain unsuccessful, repair, replace, or service the Lamotte armored thermometer as soon as possible. Back-up thermometers are maintained to ensure that a functioning thermometer is available in the event that one thermometer fails accuracy checks.

5. ACRONYMS AND ABBREVIATIONS

LIBC	Lummi Indian Business Council
LNR	Lummi Natural Resources
LWRD	Lummi Water Resources Division
NIST	National Institute of Standards and Technology
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QMP	Quality Management Plan
SOP	Standard Operating Procedure

6. REFERENCES

Lummi Water Resources Division (LWRD). 2015. Health and Safety Plan. Prepared for the Lummi Indian Business Council. April.

LWRD. 2018a. Quality Assurance Project Plan: Ambient Surface Water Quality Monitoring Project. Version 1.0. Prepared for the Lummi Indian Business Council. Lummi Reservation, Washington. October.

LWRD. 2018b. Quality Assurance Project Plan: Department of Health Support National Shellfish Sanitation Program (NSSP) Project. Version 1.0. Prepared for the Lummi Indian Business Council. Lummi Reservation, Washington. October.

LWRD. 2018c. Quality Assurance Project Plan: First Flush Monitoring Project. Version 1.0. Prepared for the Lummi Indian Business Council. Lummi Reservation, Washington. October.

LWRD. 2018d. Quality Management Plan for the Lummi Nation Water Quality Monitoring Program. Version 1.0. Prepared for the Lummi Indian Business Council. Lummi Reservation, Washington. October.

LWRD. 2018e. Water Database User Guide. Prepared for the Lummi Indian Business Council. Lummi Reservation, Washington. October.