On-site Verification of Water Temperature Readings

Procedure Number: SOP # 6.3.2.1.4
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1. **Title** On-site Verification of Water Temperature Readings

2. **Purpose** To provide expectations and instruction on verifying water temperature data during on-site maintenance at a station.

   Some stations are located in environments that make it too difficult to compare water temperatures in a safe and effective way. Therefore, although it would be ideal that an in-situ comparison be conducted at all stations, a comparison is not expected if the location makes it too difficult or unsafe to do so. Please note this exception in the site report for these types of stations.

3. **Background/History** In the early 1990s, CO-OPS began installing water temperature sensors for operational purposes, such as to monitor freezing at a station, and also to supplement water level measurements. Water temperature has always been part of the standard configuration of a water level station, and CO-OPS currently measures water temperature at approximately 170 water level stations. Water temperature data have become critical to a number of and variety of users as record-breaking water temperatures become a concern to local areas. Thus, water temperature data has become one of CO-OPS' most-requested 'ancillary' data sets; however, water temperature sensors fail most often of the ancillary sensors.

   CO-OPS uses thermistors to measure water temperature, which measure the temperature based on resistance. If the sensor is cracked or damaged, the data increase to 100+ ºF, indicating a sensor failure. These failures are easier to troubleshoot as this usually means that the sensor needs to be replaced. Other stations water temperature data have been 'questionable,' meaning that the data appear to be 5 ºF too high, for example. Gulf stations are particularly hard to diagnose during the summertime, as a thermistor in shallow water can measure temperatures up to 95 ºF. Because the station's environment is not characterized, the data reviewer must rely on remote sensing data (which is usually too coarse) or nearby stations, for which installation environments differ. The best way to provide assurance on the accuracy of the temperature data is to take a secondary reading on site with a second thermistor to verify that the primary thermistor is functioning as expected.

4. **Scope/Applicability** This SOP applies to all personnel who service the water level stations with an ancillary water temperature sensor, whether personnel are in-house or under a maintenance contract or task order.

5. **Main Processes**

A secondary water temperature reading should be obtained using a calibrated thermistor once per year during an annual inspection as described below:

1. Ensure a NIST-certified hand-held thermistor is available for the maintenance event
2. Take a comparison temperature measurement during maintenance (i.e., in situ or bucket test) at stations where this is feasible.
3. Document the readings in the comments portion of the E-site.

6. **Detailed Sub-Processes/Checklists**

1. Ensure a comparison thermistor is included with the maintenance equipment.
    a. Use a NIST-certified thermistor.
    b. The calibrated accuracy should be within 0.1 ºC to 0.2 ºC.

2. Compare the operational and hand-held thermistor readings during maintenance. Allow the thermistors to equilibrate thermally for 60 seconds, until the readings stabilize to within 0.2 ºC. If the readings don't stabilize then take the best reading possible (e.g. what appears to be the median of the fluctuating values). A sensor should not fail a comparison test due to the inability for a thermistor to stabilize.

3. For installations that are too difficult (unsafe or not feasible) to conduct a comparison with a hand-held thermistor, please note these exceptions in the E-site report. If a NOAA diver is already working on site, then they likely have at least one water temperature indicator on their depth gauge. Although this cannot be used as a standard to compare temperatures with confidence it is still useful for providing some information on the accuracy of the thermistor. For these situations, confirm the temperature within 5 ºC to identify any gross discrepancies. Then document the results in the E-site report. Please note that a diver should never be procured for the sole purpose of conducting a water temperature comparison. This comparison should only be considered secondary to their main work.

    Aquatrak

    Pull the water temperature sensor out and conduct a bucket test. Drop the operational and comparison thermistor in a bucket of ambient water.

    Paros or MWWL

    Please see the instructions above (6.3) if the installation does not allow a safe or feasible on-site comparison.

    If possible, locate the comparison thermistor in the water column as close to the operational thermistor as possible. In high flow environments, ensure that the sensor is at the same depth as the operational thermistor. If the

thermistor is located below the constraints of the calibration unit or in an environment where this is not possible, then extend the probe as deep as possible but make a note in the e-site that the depths are different.

Well/Sump (Great Lakes)

Lower the comparison sensor along the same weighted cable/block in the well/sump at the same position, or if sensor is mounted directly in the water column, locate the comparison sensor directly adjacent to the operational sensor however possible, keeping the sensor from contacting metallic or conductive materials.

4. Document the difference between the operational and comparison water temperatures in the comments field in the E-site or Excel Site Report.
    a. If the operational thermistor value is not +/- 1.0 ºC of the standard then the sensor needs to be replaced.
    b. See Engineering Bulletin 09-001 for guidelines on the regular replacement cycle for water temperature sensors.

7. **<u>Quality Assurance/Control</u>** The Field Crew Chief will oversee the comparison on site and ensure that all field and documentation requirements are met. The Data Monitoring and Assessment Team (DMAT) can identify any suspect water temperature data and ensure that the field crews obtain a secondary reading at a specific station. This should be documented in an Operations Jira ticket, if needed. Also, the Configuration Operational Engineering Team (COET) documentation review will determine that this step was taken during maintenance.

8. **<u>Management/Responsibility</u>** The Field Operations Division Branch Chiefs who oversee field crew activities work have the responsibility to ensure that CO-OPS field crews are properly equipped and trained to perform this requirement and supervise their execution performance. Task Managers have oversight responsibilities for ensuring CO-OPS requirements are met as required in the Statement of Work when contractors are involved. The CO-OPS' Meteorological Team in the Oceanography Division is responsible for establishing the water temperature data acquisition requirements and updating this SOP.

9. **<u>Updates:</u>**

11/5/2020 – Included MWWL in section 6 and changed reference of Razor to Jira.