Thermometer Accuracy Check and Use

1. SCOPE AND APPLICATION

1.1. This method is used to ensure that thermometers used in the bioassay laboratory are accurate to ±0.2°C. It is applicable for thermometers used to measure the temperatures of aqueous solutions in the range of 0.1°C to 30°C. Typical range of use should be bracketed by a calibration check (verification). Please be aware that SOP LB-035 (which uses the fluke for temperature verification) is presently used to verify accuracy of temperature measuring devices in the Tox Lab. This SOP exists for use in the event the fluke is not available.

2. SUMMARY OF METHOD

2.1. A two-point verification/calibration check is performed by placing a certified thermometer and a thermometer that is to be checked in aqueous solutions that bracket the range of use. The temperatures registered by the checked thermometer are compared to the temperatures registered by the certified thermometer. Thermometers meeting acceptance criteria are labeled and are suitable for use in the bioassay laboratory.

Note: Bureau SOP LB-035 *Calibration of Lab Thermometers Using a Constant Temperature Calibration Bath* is the primary method for verifying calibrations of bioassay laboratory thermometers. All thermometers exceeding a readability range of 10°C - 30°C should have their calibrations verified per SOP LB-035 (ex. oven and autoclave thermometers).

2.2. Calibration verifications shall be performed using a recognized National Metrology Institute traceable reference, such as NIST, when available.

2.2.1. If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable.

2.2.2. If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

3. EQUIPMENT AND SUPPLIES

3.1. Thermometers (electronic and glass) that are to be checked

3.2. Certified Digital thermometer

3.2.1. There is a certified NIST digital thermometer available for use with the fluke that can be borrowed and used for these manual accuracy verification checks.

3.3. Beaker (size and number as needed)

3.4. Ice cubes

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3.5. Hot-plate (Corning® Model 320)

3.6. Labeling tape

3.7. Water

3.8. *Thermometer Calibration Log*

3.9. Black permanent pen or marker

4. ACCURACY CHECK

4.1. Determine the temperatures needed to check all thermometers being verified.

4.2. For thermometers used over a range of temperatures, an upper and lower temperature must be used to verify. These temperatures must bracket the used range. For thermometers that are used within a small range, 10 degrees or less, only one midpoint temperature is needed to verify.

4.2.1. Generally, the thermometers in the Tox Lab can be lumped into groups with similar verification requirements. Cold (iced), room temperature, incubator temperature, hot (heated).

4.2.2. Some thermometers in the Tox Lab will need to be verified using SOP LB-035 to cover the full range of temperatures as water cannot be used to reach temperatures at or below freezing or above boiling. This includes the drying oven thermometer and the digital thermometers used for a full range of temperatures.

4.3. For all temperature readings, the following procedures apply:

4.3.1. Allow the water in the beaker to stabilize at your desired temperature for 5-10 minutes before taking the readings.

4.3.2. Insert the thermometer to be verified and the NIST certified thermometer into the water at the same time. Be sure not to touch the sides or bottom of the beaker with the thermometers as this could give a false reading.

4.3.3. Thermometers must be submerged to the indicated mark or have the probe submerged properly to get an accurate reading.

4.3.4. Allow the thermometer temperatures to stabilize. This is indicated by a constant temperature for 20 – 30 seconds. This may require adjustments to maintain the temperature, such as the addition of ice.

4.3.5. Record the temperature readings. Because this is a backup method to using the calibration fluke (SOP LB-035), temperature recordings can be made in the *Thermometer Calibration Log* used with the fluke. The pages used to record all Tox thermometer calibrations should be scanned and saved at \\floridadep\data\DEAR\Labs\Lab5\Biology\BenchCommon\ToxCommon\QC\Thermometer Calibrations.

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4.3.6. The thermometers must be within ±0.2°C of the NIST thermometer to verify.

4.3.6.1. Do not correct the temperature based on the calibration verification value. Recorded temperatures are assumed to be correct within ±0.2°C, which is the maximum deviation allowed during calibration for accepting a thermometer for use.

4.3.6.2. If the thermometer does not meet verification, it should be recycled or returned to the manufacturer, and a verifiable thermometer should replace it. Be sure to make note of this in the logbook.

4.3.6.3. Mercury thermometers are classified as hazardous waste, **DO NOT PLACE THEM IN THE TRASH.** Notify the safety officer that you have a thermometer that needs collecting. The Tox Lab no longer uses mercury thermometers, but you should verify the thermometer you are disposing of is safe to dispose of by normal means.

4.3.7. Once a thermometer is verified, label the thermometer with labeling tape. The thermometer ID is the serial number or a pre-designated number for digital thermometers. The label should include: Thermometer name (location), Setup Date, Calibration (verification) Date, Calibration Expiration Date (one year from calibration date), ID, analysts initials.

4.4. Cold temperature verification.

4.4.1. For verification temperatures that are colder than room temperature, fill the beaker with water and cool to the desired temperature using ice (directly or by setting the beaker in an ice bath) or by placing the beaker in the walk-in refrigerator or freezer. Note that use of the walk-in freezer will cause the water in the beaker to freeze over time.

4.4.1.1. Ice is available from the ice machine in B227.

4.4.2. Follow verification steps found in section 4.3.

4.5. Room temperature verification.

4.5.1. For room temperature verification, fill the beaker with water and allow it to acclimate to room temperature.

4.5.1.1. If the room temperature is hotter or colder than the desired verification temperature, minor heating (step 4.7) or cooling (step 4.4) can be performed as needed.

4.5.2. Follow verification steps found in section 4.3.

4.6. Incubator temperature verifications.

4.6.1. The Tox Lab has incubators set at two different temperature ranges: ~20°C (Incubator #7) and ~25°C (Incubator #1, #4, #5,and #8). Because the

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incubators are required to stay within a range of less than 10°C, only one calibration point is required to verify those thermometers.

4.6.2. Fill a beaker with water and allow it to acclimate inside the incubator(s) until the desired temperature is reached.

4.6.3. Follow verification steps found in section 4.3.

4.7. Hot temperature verifications.

4.7.1. For temperatures warmer than room temperature, use a hot-plate to heat the water to the desired temperature.

4.7.2. Follow verification steps found in section 4.3.

5. DATA ARCHIVAL

5.1. Use a black, waterproof pen for all bench sheets and logbooks.

5.2. Record information in the *Thermometer Calibration Log* and scan all pages to \\floridadep\data\DEAR\Labs\Lab5\Biology\BenchCommon\ToxCommon\QC\Thermometer Calibrations.

5.3. To correct raw data entries, place a single line through the incorrect or illegible entry, write the corrected entry near the error, date and initial the correction. Do not overwrite entries.

5.3.1. The corrected entry is written as near as possible to the error or in the comment box on the appropriate bench sheet.

5.3.2. If the correction requires an explanation, write a comment and reference the error with a letter. Initial and date the explanation. Do not attempt to put all information (correction and comments) into a small space.

5.4. Use sequential alphabetical annotation to identify errors and corresponding comments (i.e. use “A” for first error and use “A” for corresponding explanatory comment; use “B” for second error and “B” for corresponding explanatory comment, etc.).

6. QUALITY CONTROL

6.1. Refer to the DEP Laboratory Quality Assurance Manual for corrective action and handling out-of-control data.

7. SAFETY/HAZARDOUS WASTE MANAGEMENT

7.1. Proper laboratory protection, including lab hood or ventilation system, lab coat, gloves, and safety glasses, is required when working with chemicals and unprocessed samples.

7.2. Refer to the DEP Laboratory Quality Assurance Manual for sample disposal.

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7.3. Refer to the DEP Health and Safety Manual and Hazardous Waste Management.

8. REFERENCES

8.1. DEP Laboratory Quality Assurance Manual

8.2. DEP Health and Safety Manual

8.3. Standard Methods for the Examination of Water and Wastewater 20th Ed. Section 2550 B.

8.4 SOP LB-035, *Calibration of Lab Thermometers Using a Constant Temperature Calibration Bath*

APPENDIX OF CHANGES

01/30/2015 Formatted for 508 compliance.

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