Measurement of Light Intensity for AGP Cultures, Animal Cultures, Toxicity Incubators and the Bioassay Laboratory

1. SCOPE AND APPLICATION

1.1. This procedure is based on the instruction manual for the Fisher brand -Traceable® Dual Range Light Meter. It is used to measure light intensity in the bioassay laboratory, culture areas, and bioassay test incubators. Measurements are required annually at a minimum. The FDEP Laboratory performs measurements monthly and at the beginning of any algal toxicity test.

1.2. The use of this SOP constitutes acknowledgement that the meter manual has been read and understood. The manual and the meter are stored on the top shelf of the AGP shakers in B246.

2. SUMMARY OF THE METHOD

2.1. Light meter is turned on. The light collector is held near the light source and moved until recommended range is achieved. Incubators are marked with tape or other means to indicate where placement of containers will result in containers being within appropriate ranges. Light bulbs over AGP racks are replaced if appropriate ranges are not met. Light measurements are recorded in the appropriate logbook.

2.2. Meter Correction Factors: Multiply the meter reading by 1.05 for mercury lamps and by 0.91 for fluorescent lamps. Bulbs used in the toxicity laboratory are fluorescent.

2.3. Meter readings and corrected meter readings (true light levels) are indicated in this SOP.

2.4. All lights should be allowed a minimum of five (5) minutes to "warm" up prior to measurements.

3. SUPPLIES

3.1. Traceable® Dual Range Light Meter (Fisher) SN 210750159 (Calibration expires 8/31/2023).

3.1.1. Light meter must be within calibration dates; however, meters with expired calibration dates can be used IF side by side readings are verified to be within 1% of the readings obtained from a meter with a non-expired calibration.

3.1.2. If not recalibrating meter, purchase a new light meter upon reaching calibration expiration date.

3.2. Black waterproof pen

3.3. Ruler, 12 in (30.48 cm) or 18 in (45.72 cm)

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3.3.1. The ruler is used to measure light intensity at set distances from incubator door lights. Incubators #1, #4, #5, and #7 have door lights.

3.4. *AGP Light Measurement* Logbook

3.5. *Light Intensity Measurement QCs* Log sheet

3.6. Thermo Scientific Incubator (Incubator #4, #5, #1, and #7)

4. METHODS

4.1. General Measurement

4.1.1. General measurement is for the culture room, water bath, and the animal cultures. Room light readings usually range between 10-80 Foot-Candles (FC). Readings at the surface of cultures and water bath should range between 55-110 FC (corrected: 50-100 FC). To correct illumination deviations from EPA or NELAC recommended ranges, replace old light bulbs or move test vessels until proper illumination is achieved. These measurements should be conducted annually, at a minimum.

4.1.2. Turn power on by moving the switch on left side of meter from the "Off Line" position to the first black-line (one click). This sets the measurement range to 0-199.9 FC. The light meter has two switches on the front. The left-side switch turns the meter on and sets the measurement range. The right-side switch sets the meter so that the measurement is in FC.

4.1.3. Set meter to foot-candles (FC): Move (slide toward bottom of meter) the right-side meter switch to the first blue line (from top of meter- labeled FAST).

4.1.4. Place the light-collector on or as near as possible to the surface at which the measurement is desired. (The collector is the white dome set in black plastic.) It is attached to the meter by an electric cord. The collector should be parallel to both the surface and the light source.

4.1.5. Allow 5-10 seconds for the reading to stabilize. Record the meter reading in the appropriate logbook.

4.2. AGP Cultures (Shaker Tables) and Incubator #7 (Marine Algal culture and marine AGP tests).

4.2.1. Light measurements should be conducted monthly over the Algal Assay shaker racks and in Incubator #7.

4.2.2. Turn power on per Step 2 in General Measurement (if not already on), except move the left-side switch from the "Off Line" to the second black-line (two clicks). This sets the measurement range to 200-1999 FC.

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4.2.3. Measure the light intensity at the front, left side, right side, and rear of each shaker rack, and each shelf (where flasks are placed) ensuring that the collector is held at the level of the water in the flasks.

4.2.3.1. The light measurement should range between 396-484 FC (corrected: 360-440 FC). Change light bulbs or adjust placement of test flasks on the shakers, as needed, to maintain this range.

4.2.3.2. Record light bulb changes in the *AGP Light Measurement Logbook.*

4.2.4. Record the measurements in the *AGP Light Measurement Logbook*.

4.3. Toxicity Incubators #1, #4, #5, and #7 (Bioassay tests and *C. dubia* cultures)

4.3.1. Light measurements should be taken monthly in each incubator.

4.3.2. Door lights alone are used for vertebrate and invertebrate bioassay tests.

4.3.3. Colored tape or other means (marker, etc.) can be used on the incubator shelves to indicate where test vessels should be placed to meet light intensity recommendations (corrected: 50-100 FC for vertebrate and invertebrate bioassays).

4.3.3.1. If Incubator #7 is occupied by algae rather than a bioassay test, refer to section 4.4 for measurements.

4.3.4. The placement indicator is moved as needed to keep vessels within these parameters.

4.3.5. Additionally, sections of the plastic door lightbulb shield can be strategically covered to block light, thus reducing light intensity as needed to meet requirements.

4.3.6. Note: Steps 4.3.6 through 4.3.9 can be skipped since the distance used in Step 4.3.10 has been previously found to be 15.3 cm (~ 6 inches). However, the Steps remain so that a procedure to determine the proper distance for light measurements is available for new equipment.

4.3.7. Turn the light meter on per Step 2 of General Measurement. Set the meter to the 0-199.9 FC range for bioassay vessel measurements. Set the meter to the 200-1999 FC range for Algal toxicity test vessel placement and for AGP tests or cultures.

4.3.8. Open the incubator door. Ensure door lights are on. Place the ruler on a shelf so that the ruler: (1) is parallel to the side of the incubator; (2) extends sufficiently from the shelf to contact the light bulb as the door is closed; and, (3) is aligned so as to be pushed toward the back of the incubator as the door is closed.

4.3.8.1. If not using exact measurements with a ruler, pick a “front”, “back” and “middle” spot between the two checkpoint shelves for measurements.

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4.3.9. Close the incubator door.

4.3.10. Open the door. Measure the length of the ruler extending from the shelf. Two measurements are needed. (See comment).

4.3.10.1. The second measurement is used to confirm the first. The measurements should be the same; however, if they differ by more than 0.5 cm, the measurements should be repeated. This length represents the distance from the light bulb to the edge of the shelf. It should be the same for each shelf since the light bulbs are parallel to the door and the door is perpendicular to the plane of the shelves. This distance is **15.3 cm** for Incubators #1, #4, #5, and #7.

4.3.11. To turn off the overhead room lights, use the wall switch timer located in the corner near the B246 door to the hallway.

4.3.12. Place the end of the ruler against a door light bulb. Keep the ruler perpendicular to the vertical plane of the door. Measure the light intensity at a distance equal to the distance obtained in Step 4 (represents front of shelf; 15.3 cm for Incubators #1, #4, #5 and #7). Make several more measurements at 5-8 cm increments (away from the light). Record the distance and light measurements on scrap paper. Always ensure that the rear of the light collector is parallel to the vertical plane of the door.

4.3.13. Turn the room lights on.

4.3.14. Place the ruler on the shelf, allowing the ruler to extend the distance measured in Step 4. Use the distance and light measurements recorded in Step 6 to determine placement of colored tape/marker to indicate that the light intensity between the front and the rear indicators falls between 55-110 FC on the meter (corrected: 50-100 FC). TIP: Write the FC values on colored tape.

4.3.15. Record the measurements in the *Light Intensity Measurement QCs* Log sheet.

4.4. Toxicity Incubator #7 (when used for Algal toxicity tests)

4.4.1. Light measurements should be taken before each algal toxicity test.

4.4.2. Colored tape or other marker can be used on shelves to indicate where algal toxicity test vessels can be placed (corrected: 360-440 FC). Algal Toxicity tests can be run in Incubator #6.

4.4.3. Turn on door light and all the additional lights in Incubator #7. (Plug the light on the top shelf into the brown cord. Press the power strip switch to the on position.)

4.4.4. Turn the light meter on per Step 2 of the AGP Culture procedure. Set the meter to the 200-1999 FC range for Algal toxicity test vessel placement.

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4.4.5. Measure the illumination at various distances from the additional lighting so as to establish a meter range of 396-484 FC (corrected 360-440 FC). Mark the established area with colored tape/marker to indicate that test vessels placed on the indicator would receive the appropriate illumination.

4.4.5.1. The distance and illumination from the door lights should already be established. Based on previous measurements, the door lights and additional lights will not cause excessive light intensity unless there is an overlap at the door light intensity indicator. Move the fixtures as needed to obtain the necessary illumination range. TIP: Write the FC values on colored tape.

4.4.6. Record the measurements (range) on the Algal Toxicity Test Bench sheets.

4.5. Toxicity Incubators #1, #4, #5 and #7

4.5.1. Incubator #4 is currently used to culture *C. dubia* but can be used for toxicity testing if needed. (*C. dubia* cultures would be relocated in that case.)

4.5.2. Turn the light meter on per Step 2 of *General Measurement.* Set the meter to the 0-199.9 FC range for bioassay vessel measurements.

Measure the illumination at various distances from the light bulbs (on each shelf) so as to establish a range of 55-110 FC (corrected: 50-100 FC). Mark the boundary of the desired range with colored tape (if used) to indicate that test vessels placed within the area would receive the appropriate illumination.

4.5.2.1. Incubator #7 has light fixtures on the shelves that can be moved horizontally, as needed. Adjust the position of the fixture, as needed. Replace light bulbs, as needed (decreased output, etc.).

4.5.3. Record the measurements in the *Light Intensity Measurement QCs* Log sheet.

5. DATA ARCHIVAL

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

5.2. 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.

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

5.2.2. 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.

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

5.3. Record information in appropriate logbooks (*AGP Light Measurement Log* and *Light Intensity Measurement QCs* Log sheet).

6. QUALITY CONTROL

6.1. Refer to QA manual for corrective action and handling out-of-control data.

6.2. If a problem occurs during sample processing, a nonconformance report (NCR) is submitted describing the problem and the corrective action.

7. 7. SAFETY/HAZARDOUS WASTE MANAGEMENT

7.1. Laboratory safety features (ex. lab hood or ventilation system), and personal protection equipment (PPE) (lab coat, gloves and safety glasses), are required when working with chemicals and unprocessed samples.

7.2. Refer to the Laboratory Quality Manual for sample disposal

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

7.4. Read MSDS information for reagent handling and disposal.

8. REFERENCES

8.1. Fisher brand -Traceable® Dual Range Light Meter Instruction Manual

8.2 Refer to the Laboratory Quality Manual for sample disposal https://floridadep.gov/dear/florida-dep-laboratory/content/dep-laboratory-quality-assurance-manual-and-sops

8.3 Laboratory Health and Safety Manual and Hazardous Waste Management https://www.floridadep.net/resources/health-safety-manual

Appendix of Changes:

05/14/2008 Added Scope and Application, Summary of the Method and Appendix of Changes. Changed dated to dates in comment for **Materials** Step 1. Added Bioassay Laboratory to title.

04/13/2009 Added References section.

04/07/2010 Changed “Culture Lab Light-Measurement Logbook to Light Measurement Log sheet”. Changed associated location Comment for Log Sheet. Added Incubators # 4 and # 5 to appropriate instructions.

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03/18/2011 Added Incubator # 5 to appropriate comments. Replaced orange and green with colored. Replaced 'intensity should' with 'light readings usually' in General Measurements comment.

02/24/2012 Added Incubator # 3, Incubator # 4 and Incubator # 5 to appropriate comments and Steps. Added correction of illegible entries to Documentation Section. Removed references to AGP Room.

01/09/2014 Reformatted SOP.

02/09/2015 Formatted for 508 compliance.

11/04/2015 Updated links.

11/30/2016 Updated links.

10/16/2017 Removed incubator #2. Added incubator #6. Updated meter SN.

10/08/2018 Removed incubator #3. Changed font to Calibri. Added incubator # 7. Added Algal Assay Light Measurement to the supplies section.

10/16/2020 Updated links. Updated data archival section with universal language. Updated materials section. Moved NCR note to quality control section. Updated light meter serial number and expiration date.

10/01/2021 Corrected minor grammatical errors.

10/09/2022 Check links and grammar. Updated all Incubator #6 mentions to Incubator #7. Updated meter SN and expiration date. Updated log sheet titles.

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