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ACTIVITY/PROJECT SPECIFIC PROCEDURE

SP 12-35
USE OF THE 300035 DIGITAL REFRACTOMETER
Revision 1

Effective Date: November 13, 2019

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1.0 Purpose and Scope

This document describes the digital refractometer 300035 procedure. Calibration and operation guidelines are included in the procedure. This SP is in support of activities described in the WIPP Test Plan (TP) 14-04. Both SNL and contractor personnel will use this SP.

Acronyms and definitions for terms used in this procedure may be found in the Glossary located at the Sandia National Laboratories (SNL) WIPP Online Documents web site.

2.0 Implementation Actions

This instrument will be used for the experimental work in support of WIPP-related studies. This document is not meant to be a substitute for the refractometer's manufacturer instruction manual. The user is still responsible for reading and understanding the appropriate manual. Guidelines for documenting and implementing quality assurance (QA) procedures are presented in this document, and follow the general guidelines given in Nuclear Waste Management Procedure (NP) 12-1 "Control of Measuring and Test Equipment."

2.1 Safety and Training

The activities described in this SP shall conform with SNL Environmental Safety and Health programs (ES&H). This document does not address ES&H issues. Laboratory ES&H procedures and specific instrument hazards are described in laboratory-specific TWDs and JSAs, which can be found at the SNL WIPP Online Documents web site.

2.2 Responsibility

The Principal Investigator (PI), or designee, whose activities warrant the use of this procedure, is responsible for implementing the requirements of this procedure.

The PI or designee is responsible for performing the calibrations, usage, operations and measurements following the requirements of this procedure, documenting calibrations, and assuring that the latest revision of this document is followed.

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2.3 Refractometer Selection/Purchase

The PI or designee will ensure that the refractometer is of the proper type, design, range, accuracy, and tolerance to accomplish their required function.

2.4 Identification

The refractometer is identified by manufacturer, model number, and serial number, if applicable. The serial number will be recorded in a laboratory notebook, when the refractometer is used.

2.5 Precautions

- Protect the LCD from exposure to strong light sources.
- Avoid prolonged use or storage in extreme temperatures.
- Clean the prism and window surfaces before and after use with a wet clean cloth or paper towel. Other surfaces may be cleaned with a mild liquid dish detergent and water.
- Do not use in corrosive environments.
- Do not submerge the unit.
- This precision measuring instrument contains delicate optics and electronics. Handle with care and do not drop.
- To avoid electric shock, make sure the battery compartment is covered and do not disassemble the unit.

2.6 Calibration

2.6.1 Standards

Calibration verifies the zero baseline reading, ensuring that subsequent sample readings are correct. Calibration will be performed using standard solution such as distilled or deionized water--water that has been filtered to remove ions such as sodium, calcium, iron and other impurities. Proper calibration requires the water source to “zero” the refractometer so samples can be correctly measured.

2.6.2 Temperature

The ideal temperature of the solution and the unit during calibration of the refractometer should be 65°~79°F (18°~26°C) and recording of the temperature is required to ensure the temperatures are currently being met.

In order to change the temperature scale, with the unit on, press the **FUNC** button as needed until **1.P C (or F)** is displayed. Press the **SCALE** button to view the temperature in Fahrenheit (or Celsius). Press the **READ** button to exit.

The automatic temperature compensation (ATC) feature makes temperature correction unnecessary.

However, to obtain precise readings the sample and the unit should be at similar ambient temperatures. ATC appears on the LCD (liquid crystal display) when the function is activated. To set the ATC function, press the **FUNC** button as needed until **ALC.Y (or *n*)** appears, where ALC stands for alcohol. Press the **SCALE** button to toggle between on or off. Press the **READ** button twice to exit.

2.6.3 Calibration Procedure

1. Clean the **PRISM WINDOW** before and after every use.
2. Fill the **PRISM WINDOW** with a standard solution such as distilled water or deionized water.
3. Make sure the temperature of the solution and unit are at ideal conditions (2.6.2).
4. Close the **COVER**.
5. Press the **ON/OFF** button to turn the unit on.
6. Press the **ZERO** button for 3 seconds.
7. When the procedure is complete, **CAL** will be displayed.
8. To check the nD (refractive index) value, press the **ZERO** button once. This data can be viewed at any time to show the last calibration value.
9. A flashing crosshair symbol is displayed when the calibration solution falls outside the acceptance range.

2.6.4 Frequency

The instrument will be calibrated on the day of use, prior to use and, depending on how many samples are being measured, periodically throughout the sampling process. It will also be calibrated immediately before use if instrument irregularities are observed.

Alternatively, if the user desires to maintain precision over the course of an experiment that lasts more than one day, the unit has sustained a shock, is subjected to temperature changes, or seems inaccurate; the user can perform a Zero Checking test. These performance tests will be documented in the applicable scientific notebook as well as noting the use of the previous calibration.

2.6.5 Acceptance Criteria

The refractometer is acceptable when the slope response of the instrument displays a refractive index between 1.3329~1.3331.

2.6.6 Zero Checking Test

A zero checking test will be performed if the unit has sustained a shock, is subjected to temperature changes, or seems inaccurate.

1. Fill the **PRISM WINDOW** with a standard solution. This should be the same temperature as the solution to be tested (2.6.2).
2. With the unit on, press the **ZERO** button and make sure refractive index values meet the acceptance criteria (2.6.4).
3. Press any button to exit the function.

2.6.7 Troubleshooting

If the refractometer cannot meet the acceptance criteria (see Section 2.6.4), the distilled or deionized water is replaced and a subsequent calibration is attempted. If the refractometer still does not meet the acceptance criteria, consider the following:

- Water source contains impurities.
- Replace the battery.
- Outside light could be causing erratic readings, make sure to close the COVER on the PRISM during measurement.

If the refractometer still cannot meet the acceptance criteria, the meter will either be repaired or replaced and labeled accordingly.

2.7 General Measurement

1. Press the **ON/OFF** button to turn the Digital Refractometer on. The unit will automatically shut off after about 3 minutes of inactivity.
2. Perform the Calibration Procedure (2.6.7).
3. With the unit on, fill the **PRISM WINDOW** with the sample to be measured, then close the **COVER**.
4. Press the **READ** button immediately to ensure accurate readings. Delays may cause the sample to evaporate.

If a red light flashes, then the measurement is outside the range limit. See High/Low Range Limit Alert as described below.

2.8 High/Low Range Limit Alert

A red light will flash when the measurement is outside the range limit.

2.8.1 Setting the High Range Limit Alert

1. With the unit on, press the **FUNC** button as needed until H.L Y and the flashing H-Limit icon is displayed.
2. Press the **READ** button and the last digit flashes.
3. Use the ▼ and the ◄ buttons to set the high range limit.
4. Press the **READ** button to activate the function.
5. Press the **FUNC** button as needed to return to the measurement screen.

2.8.2 Deactivating the High Range Limit Alert

1. Press the **FUNC** button as needed until H.L *n* appears.
2. Press the **READ** button to deactivate the function.
3. Press the **FUNC** button as needed to return to the measurement screen.

2.8.3 Setting the Low Range Limit Alert

1. With the unit on, press the **FUNC** button as needed until L.L Y and the flashing L-Limit icon is displayed.
2. Press the **READ** button and the last digit flashes.
3. Use the ▼ and the ◄ buttons to set the low range limit.
4. Press the **READ** button to activate the function.
5. Press the **FUNC** button as needed to return to the measurement screen.

2.8.4 Deactivating the Low Range Limit Alert

1. Press the **FUNC** button as needed until L.L *n* appears.
2. Press the **READ** button to deactivate the function.
3. Press the **FUNC** button as needed to return to the measurement screen.

2.9 Maintenance

The refractometer shall be stored so as to minimize its exposure to dusty, corrosive, or excessively humid environments, direct sunlight, temperatures inside the range of 10–50ºC, and mechanical shock and vibration.

3.0 Records

The following records generated through implementation of this procedure shall be prepared and submitted to the WIPP Records Center in accordance with NP 17-1, “Records”.

QA Record

- Scientific Notebook

4.0 Appendices

Appendix A: 300035 Digital Refractometer Specifications

Appendix A
300035 Digital Refractometer Specifications

Unit of Measure	Range	Res.	Accuracy
Brix	0 to 60%	0.1%	±0.2%
Salinity %	0 to 28%	0.1%	±0.1%
Salinity ppt	0 to 280	1	±1
Refractive Index	1.3330 to 1.4419	0.0001	±0.001
Temperature °C	0 to 40°	0.1	1°
Temperature °F	32 to 104°	0.1	2°

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