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WP 02-EM1015

Revision 0

Water Quality Monitoring Using the YSI Model 3560 Monitoring System

Technical Procedure

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SIGNATURE	PRINTED NAME	DATE

APPROVED FOR USE

REVIEW ORGANIZATIONS

Environmental Monitoring	Industrial Safety	Quality & Regulatory
RCRA Permitting	N/A	N/A
N/A	N/A	N/A
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INTRODUCTION

This procedure provides the instructions necessary for the operation of the YSI Model 3560 Water Quality Monitoring System used by Environmental Monitoring (EM) personnel for monitoring groundwater quality. This activity is performed as part of the Waste Isolation Pilot Plant (WIPP) Groundwater Surveillance Program.

The following records are generated by the performance of this procedure:

- Attachment 1, YSI 3560 Water Quality Monitor Performance Checks
- Attachment 2, Water Quality Sampling Daily Summary Sheet

REFERENCES

BASELINE

- Instruction Manual, YSI Model 3560 Water Quality Monitoring System
- WP 02-1, Groundwater Surveillance Program Plan

EQUIPMENT

- YSI 3560 Water Quality Monitoring System including the following:
  - 3500 Water Quality Monitor
  - 3510 Temperature Probe
  - 3520 Flow-Through Conductivity Cell
  - 3530 pH Probe
  - 3540 ORP (Redox) Electrode Assembly
  - 3550 Sample Chamber Assembly
- Peristaltic Pump
- Detergent, Liquinox

REAGENTS

- Conductivity Standards (1000 / 10,000 / 100,000 µmhos/cm)
- Partial Immersion Thermometer, with Subdivisions of 0.1° C
- pH Buffer Solutions (NIST Traceable, pH 7.00, pH 4.00 or 10.00)
- Zobell Reference Solution

PRECAUTIONS AND LIMITATIONS

- Personal protective equipment such as protective eye glasses, laboratory apron, and rubber gloves are to be worn when performing this procedure.
- A spill control kit and eye wash station will be available.
- MSDS book will be up to date and readily available.
- Only personnel qualified in accordance with applicable EM qualification cards or under the direct supervision of a qualified individual may perform this procedure.
- Do not exceed 1.5 gpm flow through the sample chamber. Leakage or damage to chamber will result.

PREREQUISITE ACTIONS

1.0 Verify calibration of YSI 3500 Water Quality Monitor and thermometer.

2.0 Verify reference standards have not expired.

PERFORMANCE

NOTE

Performance check is to be performed once per day, at the beginning of each day while pumping well.

1.0 TEMP PROBE / CONDUCTIVITY CELL PERFORMANCE CHECK

1.1 Plug temperature probe and conductivity cell into 3500 Monitor.

1.2 Turn 3500 Monitor OFF/ON switch ON.

1.3 Record the following on Attachment 1, Water Quality Monitor Performance Checks:

- Well
- Zone
- Round
- Sample
- Monitor Serial No.
- Cal Due Date

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NOTE

Conductivity standards are available with values of 1000, 10,000 and 100,000 µmhos/cm.

1.4 Select two reference standards that will bracket expected sample conductance, if possible.

1.5 Record Conductivity Standards and Conductivity Lot No.s on Attachment 1.

1.6 Rinse thermometer, conductivity cell, and temperature probe with deionized (DI) water.

1.7 Place thermometer, conductivity cell, and temperature probe in reference standard 1.

1.8 Allow thermometer, conductivity cell, and temperature probe to equilibrate with reference standard 1.

1.9 Read thermometer temperature and display temperature.

1.10 Verify thermometer temperature and display temperature do not vary by more than ±0.4 °C.

1.11 Record Thermometer Temp (°C) and Display Temp (°C) on Attachment 1.

1.12 Remove thermometer.

NOTE

Overrange is indicated by a display of 1.___ . Display reads out in millimhos/cm. Readings are converted to µmhos/cm by multiplying display reading by 1000. Maximum measurable conductivity on each scale is as follows:

2ATC	0 to 2 millimhos/cm (0 to 2000 µmhos/cm)
20ATC	0 to 20 millimhos/cm (0 to 20,000 µmhos/cm)
100ATC	0 to 100 millimhos/cm (0 to 100,000 µmhos/cm)

1.13 Switch conductivity range switch to 2ATC, 20ATC, or 100ATC to obtain reading.

1.14 Read reference standard 1 conductivity from the middle display.

1.15 **IF** conductance is not within ± 10% of standard,
THEN perform the following:

1.15.1 Replace reference standard 1.

1.15.2 Inspect monitor and conductivity cell for defects or damage.

1.15.3 Repeat steps 1.13 and 1.14.

1.16 Record the following on Attachment 1:

- Standard 1 Conductivity (µmho/cm)
- Standard 1 Time
- Standard 1 Temp (°C)
- Standard 1 Display Reading (converted to µmho/cm)

1.17 Rinse conductivity cell and temperature probe in DI water.

1.18 Place conductivity cell and temperature probe in reference standard 2.

1.19 Allow conductivity cell and temperature probe to equilibrate with reference standard 2.

1.20 Switch conductivity range switch to 2ATC, 20ATC or 100ATC to obtain reading.

1.21 Read reference standard 2 conductivity from the middle display.

1.22 **IF** conductivity is not within ± 10% of standard,
THEN perform the following:

1.22.1 Replace reference standard 2.

1.22.2 Inspect monitor and conductivity cell for defects or damage.

1.22.3 Repeat steps 1.20 and 1.21.

1.23 Rinse conductivity cell and temperature probe with DI water.

1.24 Record the following on Attachment 1:

- Standard 2 Conductivity (µmho/cm)
- Standard 2 Time
- Standard 2 Temp (°C)
- Standard 2 Display Reading (converted to µmho/cm)

2.0 pH ELECTRODE PERFORMANCE CHECK

2.1 Set pH function switch to pH.

2.2 Remove shorting cap from mV input jack and install on pH input jack.

2.3 Set manual temperature compensation knob to 25°C.

2.4 Adjust CAL potentiometer until pH-mV display reads 7.00 (6.99 to 7.01).

2.5 Remove shorting cap from pH input jack.

2.6 Install shorting cap on mV input jack.

2.7 Connect pH electrode to pH input jack.

2.8 Verify buffers are immersed in a tempering bath at temperature of sample water.

2.9 Rinse electrode and temperature probe with DI water.

2.10 Place electrode and temperature probe in pH 7.00 buffer solution and stir on mixing plate.

2.11 Allow pH and temperature reading to equilibrate.

2.12 Read temperature on upper display.

2.13 Adjust pH manual temperature compensation knob to value read in step 2.12.

2.14 Adjust CAL potentiometer until pH-mV display reads 7.00 (6.99 to 7.01).

2.15 Record the following on Attachment 1:

- pH Buffers Lot No. And Exp. Date
- pH 7.00 Time
- pH 7.00 Temp (°C)
- pH 7.00 Display Reading

2.16 Rinse electrode and temperature probe with deionized water.

2.17 Place electrode and temperature probe in second buffer solution and stir on mixing plate.

NOTE

The pH values of the buffers should bracket the expected pH of sample (4.0 or 10.0).

2.18 Allow pH and temperature reading to equilibrate.

2.19 Adjust SLOPE control until pH-mV display reads within ± 0.01 pH units of buffer's stated pH.

2.20 Record the following Performance Check values on Attachment 1:

- pH 4.00 (or 10.00) Time
- pH 4.00 (or 10.00) Temp (°C)
- pH 4.00 (or 10.00) Display Reading

2.21 Rinse pH electrode and temperature probe with DI water.

3.0 Eh ELECTRODE PERFORMANCE CHECK

3.1 Set pH function switch to mV.

3.2 Verify display reads 000 (-002 to 002) mV.

3.3 Remove shorting cap.

3.4 **IF** pH electrode is not attached to 3500 Monitor,
THEN install shorting cap on pH input jack.

3.5 Connect Eh electrode to mV input jack.

3.6 Rinse Eh electrode and temperature probe with DI water.

3.7 Place Eh electrode and temperature probe in Zobell standard.

3.8 Allow Eh electrode and temperature probe to equilibrate.

NOTE

Eh display is not temperature compensated.

3.9 Record the following on Attachment 1:

- Zobell Time
- Zobell Temp (°C)
- Zobell Display Reading (mV)

3.10 Calculate temperature corrected Eh using the following formula:

$$Eh\ mV\ (25\ °C) = Display\ Reading + [(Display\ Temp - 25°C)\ X\ (1.3\ mV)]$$

3.11 Verify corrected value of Zobell solution is 231 (221 to 241) mV and record on Attachment 1.

3.12 Complete the Prepared By and Date on Attachment 1.

4.0 SAMPLE CHAMBER HOOKUP

4.1 Install the following sensors into the Sample Chamber Assembly:

- Temperature probe
- Conductivity cell
- pH electrode
- Eh electrode

4.2 Connect “down hole” sample line to sample chamber inlet.

4.3 Connect storage tank sample return line to sample chamber outlet.

CAUTION

Do not exceed 1.5 gpm sample chamber flow.

4.4 Establish flow through sample chamber.

5.0 MEASUREMENT OF GROUNDWATER TEMPERATURE, CONDUCTIVITY, Eh AND pH.

5.1 Record the following on Attachment 2, Water Quality Sampling Daily Summary Sheet:

- Well
- Zone
- Round
- Sample

5.2 Record pH, Eh, temperature and conductivity measurements 3 times per day while well is pumping, as follows:

5.2.1 Temperature Measurement

[A] Allow temperature reading to equilibrate.

[B] Record sample temperature on Attachment 2, Water Quality Sampling Daily Summary Sheet.

5.2.2 Conductivity Measurement

[A] Switch conductivity range switch to 2ATC, 20ATC or 100ATC to obtain reading.

[B] **IF** display indicates Overrange on 100ATC range, **THEN** replace Eh electrode in flow chamber with electrode from YSI 32 or 35 and measure conductivity.

[C] Record sample conductivity on Attachment 2.

5.2.3 Eh Measurement

[A] Set pH function switch to mV.

[B] Read Eh on display.

[C] Calculate temperature corrected Eh using the following formula:

$$Eh\ mV\ (25\ °C) = Display\ Reading + [(Display\ Temp - 25°C)\ X\ (1.3\ mV)]$$

[D] Record sample EH on Attachment 2.

5.2.4 pH Measurement

[A] Set pH function switch to pH.

[B] Set manual temperature compensation knob to indicated temperature.

[C] Allow reading to equilibrate.

[D] Read pH on bottom display.

[E] Record sample pH on Attachment 2.

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5.3 Complete the Prepared By and Date on Attachment 2.

6.0 POST MEASUREMENT PERFORMANCE CHECKS

NOTE

Post maintenance performance checks are to be performed once per day while pumping, after last measurement has been taken.

6.1 Divert sample flow away from sample chamber.

6.2 Remove pH electrode and temperature probe from sample chamber.

6.3 Rinse pH electrode and temperature probe with DI water.

6.4 Place pH electrode and temperature probe in pH 7.0 buffer and stir on mixing plate.

6.5 Allow pH and temperature reading to equilibrate.

6.6 Read temperature on upper display.

6.7 Adjust pH manual temperature compensation knob to value read in step 6.6.

6.8 Record the following on Attachment 1:

- pH 7.0 Time
- pH 7.0 Temp (°C)
- pH 7.0 Display Reading

6.9 Remove conductivity cell from sample chamber.

6.10 Rinse conductivity cell and temperature probe with DI water.

6.11 Place conductivity cell and temperature probe in reference standard 1 solution.

6.12 Set conductivity range switch to 2ATC, 20ATC or 100ATC to obtain reading.

6.13 Allow conductivity and temperature reading to equilibrate.

6.14 Read reference standard 1 temperature from top display and conductivity reading from the middle display.

6.15 Record the following on Attachment 1:

- Standard 1 Conductivity
- Standard 1 Time
- Standard 1 Temp
- Standard 1 Display Reading (converted to µmho/cm)

7.0 SYSTEM SHUTDOWN AND DECONTAMINATION

7.1 Switch ON/OFF switch to OFF.

7.2 Disconnect inlet line from down-hole pump.

7.3 Connect inlet hose to outlet from peristaltic pump.

7.4 Place peristaltic pump intake line on valve supplying DI water/detergent mixture.

7.5 Switch peristaltic pump ON.

7.6 Pump 3 to 4 gallons of DI water/detergent mixture through sample chamber.

7.7 Switch peristaltic pump intake line to valve supplying DI water.

7.8 Pump 3 to 4 gallons of DI water through sample chamber.

7.9 Disconnect peristaltic pump at sample chamber.

7.10 Disconnect sample return line at sample chamber outlet.

7.11 Remove fittings and sensors on sample chamber.

7.12 Store Eh and pH electrodes in soaker bottles to prevent drying out.

7.13 Store conductivity cell moist to minimize equilibrium time on next sample.

7.14 Store temperature probe dry.

7.15 Drain sample chamber and allow chamber to air dry.

8.0 DATA MANAGEMENT

8.1 Team Leader (TL), perform the following

8.1.1 Make check print and information copies of Attachments 1 and 2 (2 copies).

8.1.2 Stamp original attachments “ORIGINAL.”

8.1.3 Stamp check print copies “CHECK PRINT.”

8.1.4 Check all entries on check print copy of attachments.

8.1.5 Complete the Checked By and Date on check print copies of Attachments 1 and 2.

8.1.6 Enter sampling data into Sampling Round Data Book.

8.1.7 Store attachments in EM 1-hour, fire-rated files.

Attachment 1 YSI 3560 Water Quality Monitor Performance Checks

WELL:_____ PREPARED BY:_____ DATE:_____

ZONE:_____

ROUND:_____ CHECKED BY:_____ DATE:_____

SAMPLE:_____

EQUIPMENT/REAGENTS

MONITOR ID: YSI 3560 SERIAL NO: _____ CAL DUE DATE: _____

CONDUCTIVITY STANDARD: _____ µmhos/cm LOT NO: _____

CONDUCTIVITY STANDARD: _____ µmhos/cm LOT NO: _____

PH 7.00 BUFFER LOT NO: _____ EXP. DATE: _____

PH (4.00 OR 10.) BUFFER LOT NO: _____ EXP DATE: _____

PERFORMANCE CHECKS

TEMPERATURE

THERMOMETER TEMP (°C) _____ DISPLAY TEMP (°C) _____

CONDUCTIVITY

STANDARD	TIME	TEMP (ºC)	DISPLAY READING (µmhos/cm)

pH

STANDARD	TIME	TEMP (°C)	DISPLAY READING
pH (7.00)			
pH (4.00 or 10.00)			
pH (7.00)			

Eh

SOLUTION	TIME	TEMP (°C)	DISPLAY READING (mV)	TEMP. CORRECTED Eh
Zobell				

REMARKS: _____

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Attachment 2 Water Quality Sampling Daily Summary Sheet

WELL:__________________ PREPARED BY:___________________________________DATE:_______

ZONE:_________________

ROUND:________________ CHECKED BY:_____________________________________DATE:_______

SAMPLE:_______________

PARAMETER	UNITS	TEST RESULTS	ANALYST	TIME TESTED
Eh	mV			
pH	S. U.		______________	______________
Temperature	^0C			
Sp. Conductivity at °C	µmhos/cm			

PARAMETER	UNITS	TEST RESULTS	ANALYST	TIME TESTED
Eh	mV			
pH	S. U.		______________	______________
Temperature	^0C			
Sp. Conductivity at °C	µmhos/cm			

PARAMETER	UNITS	TEST RESULTS	ANALYST	TIME TESTED
Eh	mV			
pH	S. U.		______________	______________
Temperature	^0C			
Sp. Conductivity at °C	µmhos/cm			

REMARKS: ____

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