FW: Current Procedures

Maestas, Ricardo, NMENV
Sent: Wednesday, June 12, 2013 7:42 AM
To: Allen, Pam, NMENV
Attachments: 02-EM1010.pdf (385 KB) ; 02-EM1014.pdf (60 KB) ; 02-EM1021.pdf (79 KB) ; 02-EM1026.pdf (118 KB) ; 02-EM3001.pdf (415 KB) ; 02-EM3003.pdf (288 KB) ; 02-RC.01.pdf (90 KB) ; 10-AD3029.pdf (145 KB) ; WP 13-1.pdf (334 KB)

Email and documents for WIPP file.
A CD with docs may be easier.

From: Salness, Rick - RES [mailto:richard.salness@wipp.ws]
Sent: Monday, April 08, 2013 1:46 PM
To: Maestas, Ricardo, NMENV; Jimenez, Richard - RES; Stone, Anthony - DOE
Cc: Kliphuis, Trais, NMENV; Holmes, Steve, NMENV
Subject: RE: Current Procedures

Here are the procedure in Table L-3. For the sampling event the procedures are: 02-EM1010 and 02-EM1014. Please let me know if you need anything else.

Rick Salness, P.G.
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Nuclear Waste Partnership, LLC. - Regulatory Environmental Services Contractor for the U.S. Department of Energy
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"A leader is best when people barely know he exists, when his work is done, his aim fulfilled, they will say we did it ourselves" – Lao Tzu

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From: Maestas, Ricardo, NMENV [mailto:Ricardo.Maestas@state.nm.us]
Sent: Monday, April 08, 2013 10:25 AM
To: Salness, Rick - RES; Jimenez, Richard - RES; Stone, Anthony - DOE
Cc: Kliphuis, Trais; Holmes, Steve
Subject: Current Procedures

Good morning Rick,

Could you please provide me with the all the current procedures from Table L-3 of Attachment L?
Please also specify which of these procedures you will be using for the upcoming sampling of WQSP-5.

Thanks!

Ricardo Maestas
>><<<>>><<<>>><<<>>><<<

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Working Copy

WP 02-EM1010

Revision 1

Field Parameter Measurements and Final Sample Collection

Technical Procedure

EFFECTIVE DATE: 02/25/13

Rick Salness
APPROVED FOR USE

TABLE OF CONTENTS

CHANGE HISTORY SUMMARY

REVISION NUMBER	DATE ISSUED	DESCRIPTION OF CHANGES
0	02/27/12	• New Procedure for Detection Monitoring Well Field and Final Sampling. Procedure WP 02-EM1010 has been created to fulfill the field parameter and final sample collection processes identified in the revised permit effective March 1, 2012, that incorporates the Class 2 Groundwater Monitoring Plan Permit Modification approved by the NMED. Because procedures WP 02-EM1005 and WP 02-EM1006 are listed in the permit to fulfill the former permit sampling conditions, they are retained in Document Services and the QMIS database until a Class 1 Permit Modification can be submitted to remove these from the permit, but will not be used.
1	02/25/13	• Removed unnecessary references. • Revised SC and pH analysis for continuous measurements; refer to steps 1.12.6 through 1.12.9 and steps 2.13.6 through 2.13.9, respectively. • Deleted section 11.0, Regulatory Review Process. • Streamlined steps throughout documents; removed extraneous wording or consolidated steps where appropriate/applicable.

INTRODUCTION [1, 2, 3]

This procedure describes processes for field parameter measurement and final sample collection for the Detection Monitoring Wells (DMWs) of the Detection Monitoring Program (DMP). Groundwater (GW) parameters are measured in the field laboratory until indicator-parameters are stable. Final samples collected for Resource Conservation and Recovery Act (RCRA) and radiological analyses are submitted to analytical laboratories in accordance with WP 02-1.

Tasks listed under the Performance section are independent and can be performed as stand-alone procedures. Samplers determine the order of final sample collection. Several tasks may be performed simultaneously during field operations by one or more qualified samplers.

Measurements described herein follow established field procedures per industry standards. Results of field parameters determine when purged GW is representative of the undisturbed native-GW of the Culebra Member of the Rustler Formation.

Field measurements and their corresponding performance sections are as follows:

- Section 1.0 Specific Conductance and Temperature Measurement
- Section 2.0 pH Measurement
- Section 3.0 Specific Gravity Measurement
- Section 4.0 Stabilization Calculations
- Section 5.0 Sample Number Development
- Section 6.0 Preserving Final Samples
- Section 7.0 Collection of Final Samples
- Section 8.0 Shipping and Storage of Final Samples
- Section 9.0 Field Data Management
- Section 10.0 Quality Assurance/Quality Control Implementation

Field data is entered into electronic worksheets representing attachments 2 through 5 and are automatically summarized on attachment 1. Formulas (mathematical and logical) required for comparisons, whether calculated and/or transferred, are included in the attachments.

Qualified field-personnel interpret measurement results to determine when parameters are stable (representative of undisturbed native-GW) and when to start collecting final samples. If parameter stabilization does not occur after three well bore volumes (WBV) are purged, field personnel will note this observation, where appropriate, and proceed with final sampling. Final samples are shipped or hand-delivered to analytical laboratories for analysis, in accordance with WP 02-1.

Performance of this procedure generates the following record(s), as applicable. Records are handled in accordance with departmental Records Inventory and Disposition Schedules.

- Attachment 1, Example Field Parameter Measurement Summary Report
- Attachment 2, Example Field Parameter Measurement for Specific Conductance and Temperature
- Attachment 3, Example Field Parameter Measurement for pH
- Attachment 4, Example Field Parameter Measurement for Specific Gravity
- Attachment 5, Example Final Sample Checklist
- Attachment 6, Example Final Sample Labels
- Attachment 7, Example Combined Chain of Custody/Request for Analysis
- Sample tracking documentation (waybills, carrier's electronic tracking history, analytical laboratory notification)
- DMW data package

This procedure and relevant records generated will be kept on file in the Operating Record as required by the WIPP Hazardous Waste Facility Permit (Permit). Information and analytical data generated by DMP are considered quality records.

REFERENCES			
DOCUMENT NUMBER AND TITLE	BASELINE DOCUMENT	REFERENCED DOCUMENT	KEY STEP
ASTM Method D1429-08, *Standard Test Method for Specific Gravity of Water and Brine*		✓	
Hazardous Waste Facility Permit, Identification No. NM4890139088-TSDF (Permit)	✓		2
Standard Method 2550 B, *Temperature – Laboratory and Field Methods*		✓	
Standard Method 4500-H+ B, *pH Value – Electrometric Method*		✓	
WP 02-1, WIPP Groundwater Monitoring Program Plan	✓		1
WP 10-AD3029, *Calibration and Control of Monitoring and Data Collection Equipment*		✓	
WP 12-IH.01, *WIPP Chemical Hygiene Plan*		✓	
WP 13-1, *Nuclear Waste Partnership LLC Quality Assurance Program Description*		✓	
WP 15-RM, *WIPP Records Management Program*		✓	
PROD-156 Job Hazard Analysis, Field Parameter Measurements and Final Sample and Serial Sample Collection		✓	
Orion Star™ and Star Plus Meter – Users Guide. Thermo Fisher Scientific, Inc., Beverly, MA. 2008.		✓	
Orion Star™ Plus M Navigator21 – Software Manual. Thermo Fisher Scientific, Inc., Beverly, MA. 2008.		✓	

EQUIPMENT LIST

SAFETY

- Chemical resistant gloves
- Chemical spill kit
- Portable eyewash/safety shower station
- Safety glasses (with side shields)

GW PURGING

- Dedicated sampling line (inert material), in-line filter holder (47-mm, stainless steel) and support frame or equivalent
- Flow cell (in-line), Geotech Multi-probe Flowblock Sampling System or equivalent

MEASUREMENT

- Digital thermometer, VWR Model 100A or equivalent
- Orion 5-Star™ Plus multimeter or equivalent
- Orion DuraProbe™ Conductivity Cell Model 013005MD or equivalent
- Orion Epoxy ATC Probe Model 927005MD or equivalent
- Orion Ross Ultra® pH Electrode Model 8102BNUWP or equivalent
- Hydrometer, scale 1.000 – 1.220 or equivalent
- Hydrometer cylinder, plastic or glass

ACIDS, SOLUTIONS AND STANDARDS

NOTE
Acids, solutions and standards obtained commercially and vendors provide Certificate of Analysis (COA).

- Deionized water (DI-H_2O), ≥18.0 megaohms-cm at 25°C

- Electrode Filling Solution, Orion Ross 3M KCl or equivalent
- pH Buffer Solutions (NIST traceable; pH 4.01, 7.00 and 10.01), Hach Chemical Company or equivalent
- Specific Conductivity (SC) Standards (NIST traceable; 1,000 µmhos/cm [1K], 10,000 µmhos/cm [10K] and 100,000 µmhos/cm) [100K], Ricca Chemicals or equivalent
- Hydrochloric acid (HCl), 1:1 Vialservatives™ (EP Scientific), trace-metal grade or equivalent
- Nitric acid (HNO_3), 1:1 or 70% Vialservatives™ (EP Scientific), trace-metal (JT Baker) or equivalent
- Sulfuric acid (H_2SO_4), 1:1 Vialservatives™ (EP Scientific), trace-metal (JT Baker) or equivalent

OTHER CONSUMABLES

- Glass stir rods or disposable transfer pipets
- Graduated cylinder, Class A
- Plastic (disposable) or glass beakers
- EMD ColorpHast pH Strips (full or narrow range) or equivalent
- Paper towels (WypAlls™ or Kimwipes™ or equivalent)
- Phosphate–free detergent (Liqui-Nox®, Citranox® or Contrad 70®) or equivalent
- Wash bottles, Nalgene™ or equivalent
- Indelible pens and markers
- Laptop computer, printer and paper

FINAL SAMPLE COLLECTION AND SHIPPING

NOTE
RCRA sample containers are provided by the analytical laboratory. Radiological sample containers are purchased and meet Level 1 EPA quality assurance (QA) washing and treatment standards. **Pre-rinse is not required for any containers.** Other containers should not be used.

- Sample containers: amber bottles, high-density polyethylene (HDPE) bottle/jugs and volatile organic analyte (VOA) vials
- Filters, cellulose nitrate, 0.45-µm or equivalent.
- Tweezers
- Chain of Custody/Request for Analysis forms (CofC/RFA)
- Custody seals, tamper-proof (adhesive backs which are destroyed when removed or the container is opened
- Packing materials (e.g., butcher paper, bubble wrap, sample container cushion sleeves, clear packing tape, duct tape)
- Crushed ice and/or ice packs
- Zip-seal plastic bags
- Waterproof, insulated coolers (supplied by analytical laboratory)

PRECAUTIONS AND LIMITATIONS

- Only personnel with current EM-23 Field Parameter Measurements/ Final Sample Collection qualification can perform this procedure unsupervised. Personnel in training (unqualified) may perform this procedure only in the presence of and under the direct supervision of a qualified individual.
- Personnel must contact the Environmental Monitoring and Hydrology (EM&H) Manager if unable to perform this procedure as written, or if abnormal conditions are observed.
- Material Safety Data Sheets (MSDS), Automated Job Hazard Analysis (AJHA) and a copy of WP 12-IH.01 *WIPP Chemical Hygiene Plan* are bound and readily accessible to personnel working in the field laboratory.

- Personnel must wear safety glasses, chemical resistant gloves, full-length pants and closed-toe shoes while performing this procedure. Exceptions are as follows:

  — Samplers may remove chemical-resistant gloves when labeling final sample containers (applying labels and protective tape).

- Handle acids initially inside the fume hood (preserving radiological sample jugs), except when filling final sample containers.

- Flow cell and glassware must be washed using a phosphate–free detergent (e.g., Liqui-Nox®, Citranox® or Contrad 70®) and triple-rinsed with DI-H_2O after use.

  — Flow cell and glassware may be rinsed in a dilute acid solution (< 10%) of HNO_3, HCl or aqua regia (3 parts HCl:1 part HNO_3) followed by a triple-rinse with DI-H_2O.

- Rinsate from washing measurement equipment should be captured in a container (e.g., beaker) and emptied between rinsing events

- No hazardous wastes generated by this procedure. All reagents are non-hazardous and are disposed with purged GW

- Calibrate and maintain measurement instruments per WP 10-AD3029, if required by Permit.

- Obtain field measurements and collect final samples from each DMW through a dedicated sample line (includes a filter holder assembly) and under atmospheric conditions (pressure, temperature).

- Purge each DMW no more than three well bore volumes (WBV), or until field parameters stabilize, whichever occurs first.

  — A WBV is defined as the volume of water from the static water level to the bottom of the well sump.

  — Well stabilization occurs when field-analyzed parameters are within ± 5% for three consecutive measurements

- When instructed to record data on an attachment in this procedure, **users understand that attachment referenced is the electronic version.** Data entry occurs on the computer.

PREREQUISITE ACTIONS

- Provide final sample collection plans, shipping and delivery dates in advance to analytical laboratories.
- Ensure monitoring and data collection (M&DC) equipment is calibrated and working properly.
- Verify chemicals, reagents and standards are not expired.
- Ensure all safety equipment (spill control kit, first aid kit and eyewash/safety shower station) is available and working properly before each DMP round.
- Prepare spreadsheet templates for attachments 1 through 4 for each DMW before start of DMP round.
- Verify DMW stability criterion is met before collecting final samples

PERFORMANCE

NOTE

Field parameters (pH, SC, and temperature) are measured simultaneously using an in-line flow cell and specific gravity is measuring using classical techniques.[MSOffice1] Sequence of measurements is at discretion of sampler(s) performing the tests.

1.0 SPECIFIC CONDUCTANCE AND TEMPERATURE MEASUREMENT

1.1 Complete the following on attachment 2:

- DMW Identification (ID)
- Date
- Zone
- DMP Round #
- Day Measured
- Sampler
- Meter M&DC ID, Serial # and Calibration Expiration Date
- Conductivity Cell Vendor, Model # and Serial #
- Temperature Probe Vendor, Model #, and Serial # (if required)
- SC Standards Vendor, Lot # and Expiration Dates

1.2 Remove conductivity standards from storage and equilibrate to room temperature.

1.3 Connect SC cell, with or without built-in automatic temperature compensation (ATC), to multimeter. Rinse cell with DI-H_2O.

1.4 Place SC cell into beaker of clean DI-H_2O until ready for use.

1.5 Connect multimeter to laptop, turn on by pressing <**POWER**> key,  .

1.6 Open Star Plus™ Navigator[21] software using desktop icon,  , and press <**OK**>.

NOTE

Calibration verifies the conductivity cell and meter system work properly. Performing a daily, 3-point calibration before using the instrument is necessary because measured cell constants vary from the nominal cell constant (K). Variation between measured and nominal constants, K, is due to environmental conditions and may change over time.

Conductance (*k*) is the ability of aqueous solutions to carry electrical currents. This ability depends strongly upon the presence of ions, the total concentration of these ions, their mobility, ionic charge and temperature. The common practice is to report SC values referenced to 25°C

NOTE

In this procedure, µS and uS refer to the same unit of measure. The Orion 5-Star™ Plus multimeter displays uS instead of µS. The multimeter expresses SC sample results as either uS/cm or mS/cm. Specific conductance results are generally reported as µmho/cm.

1.7 Perform a 3-point calibration as follows:

1.7.1 Prepare disposable beakers, containing stir bars, for SC standards 1K, 10K, and 100K.

1.7.2 Select <**COND**> from the main screen (shaded blue when active).

1.7.3 Verify active method = 1.

1.7.4 Place SC cell into beaker of fresh 1K SC calibration standard. Stir slowly using stir plate.

1.7.5 Enter [SC Calibration] in *Sample Name* field on main screen.

1.7.6 Enter [DMW ID, DMP round, day measured, date and samplers] in *Comment* field on main screen.

1.7.7 Select <**CALIBRATE**> icon, 

.

1.7.8 Select <**COND**> on *Calibration Measurement Type* screen.

1.7.9 Verify *Buffer Set* = **USA.**

1.7.10 Enter <**3**> for number of standards (Uncheck *auto-detection* boxes).

1.7.11 Enter <**1000**>, <**10000**> and <**100000**> in fields *P1, P2, and P3*, respectively.

1.7.12 Press <**NEXT**>, then <**START**> on the P1 screen (reading complete when "*Press 'Next> ' to accept calibration*" message appears at bottom of screen).

1.7.13 Select <**NEXT**> to accept 1K standard value. The "*Next Standard*" window appears and directs user to change standards.

1.7.14 Remove SC cell from standard, rinse with DI-H_2O and blot dry.

1.7.15 Move SC cell to next calibration standard (10K) beaker.

1.7.16 Press <**OK**>.

1.7.17 Select <**NEXT**> to accept 10K standard value when reading is complete. The "*Next Standard*" window appears and directs user to change buffers.

1.7.18 Remove SC cell from standard, rinse with DI-H_2O and blot dry.

1.7.19 Move SC cell to next calibration standard (100K) beaker.

1.7.20 Press <**OK**>.

1.7.21 Select <**NEXT**> to accept the value when 100K standard calibration is complete. Software informs samplers when calibration sequence is complete.

NOTE

In steps 1.7.22 and 1.7.23, cell constants (K/cm) are dependent upon SC cell used. True SC calibrations standard values should be ± 10% from their certified concentrations after correcting for constant differences.

1.7.22 Review *COND Calibration Data and Coefficients Summary Table.* Conductance (uS) values are approximately twice the standard values entered.

1.7.23 Obtain "true" SC calibration standard values using the following equation (attachment 2 electronic version automatically calculates).

SC, µmhos/cm = (Conductivity, µS) x (Cell constant, K/cm)

1.7.24 Verify SC calibration standards are within ± 10% of their certified concentrations.

1.7.25 **IF** SC calibration results are not within specifications, consult Orion Star™ and SC Cell User Guide for troubleshooting assistance.
RETURN TO step 1.8 when calibration passes.

1.8 Select <**FINISH**>when the calibration is completed.

1.9 Perform a quality control (QC) check to verify calibration as follows:

1.9.1 Rinse SC cell with DI-H_2O; blot dry.

1.9.2 Place cell in beaker of SC calibration standard (1K, 10K or 100K).

1.9.3 Enter [QC check standard name] in *Sample Name* field.

1.9.4 Enter [DMW ID, DMP round, day measured, date and samplers] in *Comment* field on main screen.

NOTE

Results for all subsequent steps are visible in the *COND* result field (lower left-hand corner of the computer screen) when testing complete

1.9.5 Select <**MEASURE**> to begin testing.

1.9.6 Verify QC check standard is within 10% of expected concentration.

1.9.7 **IF** QC check results are not within specifications, consult Orion Star™ and SC Cell User Guides for troubleshooting assistance. **RETURN TO** step 1.10 when QC check passes.

1.10 Rinse SC cell with DI-H_2O; blot dry.

1.11 Place SC cell into appropriate flow cell well and finger-tighten well-cap nut.

1.12 Measure SC of GW inside in-line flow cell as follows:

1.12.1 Divert GW flow through flow cell by turning T-valve of dedicated sampling line to the open position.

1.12.2 Allow several flow cell volumes (cell capacity ≈ 40 mL) of GW to pass through in-line sampling system (5 - 10 minutes)

1.12.3 Ensure flow cell is void of air pockets. A few, minute air bubbles are permissible due to native GW properties.

1.12.4 Enter [DMW ID] in *Sample Name* field in *Comment* field on main screen.

1.12.5 Enter [DMW ID, DMP round, day measured, date and samplers] in *Comment* field on main screen.

1.12.6 Select <**CONTINUOUS MEASUREMENT**> to begin testing.

1.12.7 Enter <**300**> in the *Data Capture Interval in Seconds* field on Continuous Monitor screen.

- This entry programs the software to record SC and temperature measurements every five (5) minutes.

1.12.8 Select <**START**> to begin continuous measurements.

1.12.9 Collect readings until SC values are within ± 5% for three consecutive measurements.

- Enter SC and temperature values on attachment 2 to calculate percent change between readings (discussed later, see section 4.0.

1.13 Perform post-testing QC check as follows:

1.13.1 **GO TO** step 1.9 and perform substeps 1.9.1 through 1.9.7, where applicable.

RETURN TO step 1.14 when post-testing QC check passes.

1.14 Rinse SC cell with DI-H_2O and prepare for storage as specified in Cell Users Guide.

1.15 Print SC calibration and measurements results by selecting LabSpeed™ Navigator desktop icon, 

. This is the reporting software for the Orion 5-Star™ Plus multimeter.

1.16 Start a "**New Session**" as follows:

1.16.1 Press <**NEW SESSION**> icon,  .

1.16.2 Select *Calibration Cond.set* session template and press <**OPEN**>.

1.16.3 Activate search criteria (e.g., Today) using options buttons and press <**SEARCH**>.

1.16.4 Select <**GET ALL**> to display the following reports:

- Calibration Reference Report
- Calibration Table Report

1.16.5 Add QC and GW data to session as follows:

[A] Select <**OPEN VIEW**> icon,  .

[B] Select *Cond Report.vrp* and press <**OPEN**>.

1.17 Save session file as follows:

1.17.1 Select **<FILE**>, then **<SAVE SESSION**> from main toolbar.

1.17.2 Save session file using format shown below:

DMW ID-Zone-DMP Round #-Day Measured_Testing.ses

Example: WQ6-C-R31-D1_COND.ses

NOTE

Printing instrument reports and attachment data entry may be performed later during sampling day (e.g., after all testing performed) since data are time- and date-stamped. Data integrity not affected.

1.18 Print testing report as follows:

1.18.1 Highlight *Cond Calibration Tables* on the left side of screen.

1.18.2 Select <**PRINT**> icon  .

1.18.3 Highlight *Cond Report* on the left side of screen.

1.18.4 **REPEAT** step 1.18.2.

1.19 Initial/sign and date LabSpeed™ Navigator reports. Handwrite the following on each page:

- DMW ID
- DMP round #
- Day measured (e.g., D1, D2, D3)

1.20 Transfer remaining data or verify previous data entries from LabSpeed™ Navigator reports to attachment 2 when time permits.

- Report SC to nearest µmho/cm
  Report temperature to nearest tenth, degree Centigrade
- Report testing times using 24-hour format

1.21 Place LabSpeed™ Navigator reports directly behind attachment 2 in data package.

1.22 Exit LabSpeed™ Navigator.

1.23 Clean flow cell with detergent and/or dilute acid. Rinse thoroughly with DI-H_2O; air dry.

2.0 pH MEASUREMENT

2.1 Complete the following on attachment 3:

- DMW ID
- Date
- Zone
- DMP Round #
- Day Measured
- Sampler
- Meter M&DC ID, Serial # and Calibration Expiration Date
- Electrode Vendor, Model #, Serial #, and Electrode Filling Solution
- Temperature Probe Vendor, Model #, and Serial # (if required)
- pH Buffers Vendor, Lot # and Expiration Dates

2.2 Remove buffer solutions from storage and equilibrate to room temperature.

2.3 Connect pH electrode and automatic temperature compensation (ATC) probe (if required) to multimeter.

- Substitution of SC cell with built-in ATC feature for temperature compensation is allowed and must be documented on attachment 3 where temperature probe information is required.

2.4 Uncover pH electrode fill-hole, fill and flush inner chamber at least twice with reference electrode filling solution (Ross 3M KCI).

- Discard spent electrode-filling solution (Ross 3M KCI is non-hazardous).

2.5 Fill inner chamber of pH electrode just below fill-hole with electrode filling solution. Rinse outer surface of electrode with DI-H_2O.

2.6 Place pH electrode and ATC probe/cell into beaker of clean DI-H_2O until ready for use.

2.7 Connect multimeter to laptop, turn on by pressing <**POWER**> key,  .

2.8 Open Star Plus™ Navigator[21] software using desktop icon,  , and press <**OK**>.

NOTE

Calibration verifies the electrode and meter system work properly. Performing a daily, 3-point calibration before using the instrument ensures reliability. Buffers selected must not be greater than 3 pH units nor less than 1 pH unit apart. An acceptable calibration has an average electrode slope of 92 - 102% (manufacturer specification) and a QC check that is ± 0.1 pH units from its known value (may differ due to calibration buffer tolerances). Report pH values in standard units (SU).

Temperature affects pH measurement in many ways, but the two most common are (1) mechanical effects caused by changes in electrode properties (e.g., slope, temperature sensor errors), and (2) chemical and/or physical effects due to equilibrium changes (e.g., buffers, samples, and reference element drift).

2.9 Perform a 3-point calibration as follows:

2.9.1 Prepare disposable beakers, containing stir bars, for pH buffers 4.01, 7.00 and 10.01.

2.9.2 Select <**pH**> from the main screen (shaded blue when active).

2.9.3 Verify active method = 1.

2.9.4 Place pH electrode and ATC probe/cell into beaker of fresh pH Buffer 4.01. Stir slowly using stir plate.

- Reference solution fill-hole must remain open during calibration and testing.

2.9.5 Enter [pH Calibration] in *Sample Name* field on main screen.

2.9.6 Enter [DMW ID, DMP round, day measured, date and samplers] in *Comment* field on main screen.

2.9.7 Select <**CALIBRATE**> icon, 

.

2.9.8 Select <**pH**> on *Calibration Measurement Type* screen.

2.9.9 Verify *Buffer Set* = **USA.**

2.9.10 Enter <**3**> for number of standards (Uncheck *auto-detection* boxes).

2.9.11 Enter <**4.01**>, <**7.00**> and <**10.01**> in fields *P1, P2 and P3, respectively*.

2.9.12 Press <**NEXT**>, then <**START**> on the P1 screen (reading complete when "*Press 'Next> ' to accept calibration*" message appears at bottom of screen).

2.9.13 Select <**NEXT**> to accept buffer 4.01 value. The "*Next Standard*" window appears and directs user to change buffers.

2.9.14 Remove pH electrode and ATC probe/cell from buffer, rinse with DI-H_2O and blot dry.

2.9.15 Move pH electrode and ATC probe/cell to next standard (pH 7.00) beaker.

2.9.16 Press <**OK**>.

2.9.17 Select <**NEXT**> to accept buffer 7.00 value when reading is complete. The "*Next Standard*" window appears and directs user to change buffers.

2.9.18 Remove pH electrode ATC probe/cell from buffer; rinse with DI-H_2O and blot dry.

2.9.19 Move pH electrode ATC probe/cell to next standard (pH 10.01) beaker.

2.9.20 Press <**OK**>.

2.9.21 Select <**NEXT**> to accept the value when buffer 10.01 calibration is complete. Software informs samplers when calibration sequence is complete.

2.9.22 Review *pH Calibration Data and Coefficients Summary Table*. Verify average slope of calibration is 92 – 102%.

2.9.23 Select <**FINISH**> when the calibration is completed.

2.9.24 **IF** pH calibration results are not within specifications, consult Orion Star™ and Electrode User Guide for troubleshooting assistance.
RETURN TO step 2.10 when calibration passes.

2.10 Perform a quality control (QC) check to verify calibration as follows:

2.10.1 Rinse pH electrode and ATC probe/cell with DI-H_2O; blot dry.

2.10.2 Place pH electrode and ATC probe/cell into beaker of pH 7.00 buffer.

2.10.3 Enter [QC check standard name] in *Sample Name* field.

2.10.4 Enter [DMW ID, DMP round, day measured, date and samplers] in *Comment* field on main screen.

NOTE

Sample measurement results for subsequent steps are visible in the pH result field (lower left-hand corner of the computer screen) when testing is complete.

2.10.5 Select <**MEASURE**> to begin testing.

2.10.6 Verify QC check standard is 7.00 ± 0.10 SU corrected to 25°C.

- QC limits are determined by tolerance limits of buffers.
- Check accuracy limits of buffers and adjust QC range accordingly, if necessary.

2.10.7 **IF** QC check results are not within specifications, consult Orion Star™ and Electrode User Guide for troubleshooting assistance.

2.11 Rinse pH electrode and ATC probe/cell with DI-H_2O; blot dry.

2.12 Place pH electrode and ATC probe/cell into appropriate flow cell wells and finger-tighten well-cap nut.

2.13 Measure pH of GW inside in-line flow cell as follows:

2.13.1 Divert GW flow through flow cell by turning T-valve of dedicated sampling line to the open position.

2.13.2 Allow several flow cell volumes (cell capacity ≈ 40 mL) of GW to pass through in-line sampling system (5 - 10 minutes)

2.13.3 Ensure flow cell is void of air pockets. A few, minute air bubbles are permissible due to native GW properties.

2.13.4 Enter [DMW ID] in *Sample Name* field on main screen.

2.13.5 Enter [DMW ID, DMP round, day measured, date and samplers] in *Comment* field on main screen.

2.13.6 Select <**CONTINUOUS MEASUREMENT**> to begin testing.

2.13.7 Enter <**300**> in the *Data Capture Interval in Seconds* field on Continuous Monitor screen.

- This entry programs the software to record pH and temperature measurements every five (5) minutes.

2.13.8 Select <**START**> to begin continuous measurements.

2.13.9 Collect readings until pH values are within ± 5% for three consecutive measurements.

- Enter pH values on attachment 3 to calculate percent change between readings (discussed later, see section 4.0.

- Temperature values are carried over from attachment 2 since measurements are obtained simultaneously.

2.14 Perform post-testing QC check using pH 7.00 buffer as follows:

2.14.1 **GO TO** step 2.10 and perform substeps 2.10.1 through 2.10.7, where applicable.
RETURN TO step 2.15.

2.15 Rinse pH electrode and ATC probe/cell with DI-H_2O and prepare for storage as specified in Electrode Users Guide.

2.16 Print pH calibration and measurements results by selecting LabSpeed™ Navigator desktop icon, 

. This is the reporting software for the Orion 5-Star™ Plus multimeter.

2.17 Start a "**New Session**" as follows:

2.17.1 Press <**NEW SESSION**> icon,  .

2.17.2 Select *Calibration pH.set* session template and press <**OPEN**>.

2.17.3 Activate search criteria (e.g., Today) using options buttons and press <**SEARCH**>.

2.17.4 Select <**GET ALL**> to display the following reports:

- Calibration Reference Report
- Calibration Table Report

2.17.5 Add QC and GW data to session as follows:

[A] Select <**OPEN VIEW**> icon,  .

[B] Highlight *pH Report.vrp* and press <**OPEN**>.

2.18 Save session file as follows

2.18.1 Select **<FILE**>, then **<SAVE SESSION**> from main toolbar

2.18.2 Save session file using format shown below:

DMW ID-Zone-DMP Round #-Day Measured_Testing.ses

Example: WQ6-C-R31-D1_pH.ses

NOTE

Printing instrument reports and attachment data entry may be performed later during sampling day (e.g., after all testing performed) since data are time- and date-stamped. Data integrity not affected.

2.19 Print testing report as follows:

2.19.1 Highlight *pH Calibration Tables* on the left side of screen.

2.19.2 Select <**PRINT**> icon  .

2.19.3 Highlight *pH Report* on the left side of screen.

2.19.4 **REPEAT** step 2.19.2.

2.20 Initial/sign and date LabSpeed™ Navigator reports. Handwrite the following on each page:

- DMW ID
- DMP round #

- Day measured (e.g., D1, D2, D3)

2.21 Transfer remaining data or verify previously entered data from LabSpeed™ Navigator reports to attachment 3 when time permits.

- Report pH to nearest hundredth SU
- Report temperature to nearest tenth, degree Centigrade
- Report testing times using 24-hour format

2.22 Place LabSpeed™ Navigator reports directly behind attachment 3 in data package.

2.23 Exit LabSpeed™ Navigator.

2.24 Clean flow cell with detergent and/or dilute acid. Rinse thoroughly with DI-H_2O; air dry.

3.0 SPECIFIC GRAVITY MEASUREMENT

3.1 Complete the following on attachment 4:

- DMW ID
- Date
- Zone
- DMP Round #
- Day Measured
- Sampler
- Thermometer M&DC ID, Serial #, and Calibration Expiration Date
- Hydrometer M&DC ID, Serial #, and Calibration Expiration Date

3.2 Divert GW flow into a clean, hydrometer cylinder by turning T-valve of dedicated sampling line to the open position.

3.3 Collect approximately 0.5 L to 1 L of GW into a hydrometer cylinder.

3.4 Record GW Collection Time on attachment 4.

NOTE

Degassing time varies amongst DMWs, but generally is about 30 minutes. Highly carbonated GW may require longer degassing periods (60 minutes or longer). Degassing is complete when air bubbles are minimally visible on inner surface of hydrometer cylinder. Accelerate degassing by gently tapping on cylinder's outer surface to dislodge air bubbles.

3.5 Set hydrometer cylinder aside and allow GW to degas using guidelines above.

3.6 Immerse hydrometer into cylinder containing degassed GW.

3.7 Press down (slightly) on hydrometer stem while simultaneously giving hydrometer a quick spin. This action causes hydrometer to "bob."

3.8 Allow sufficient time for hydrometer to equilibrate with degassed GW.

3.9 Obtain specific gravity (SG) reading as follows:

3.9.1 Ensure hydrometer is not touching inner surface of cylinder.

3.9.2 Observe reading at intersecting plane of the horizontal liquid surface and hydrometer stem (eye level).

3.10 Obtain GW temperature (°C) using digital temperature probe or equivalent instrumentation.

3.11 Record the following testing information on attachment 4:

- Test time, 24-hour format
- Temperature, report to nearest tenth, degree Centigrade
- Hydrometer reading (SG), report to nearest thousandth (unitless)

3.12 Calculate degas time using following equation (attachment 4 automatically performs calculation in electronic version):

Degas Time = Test Time – GW Collection Time

3.13 Discard tested GW, wash hydrometer cylinder and triple rinse with DI-H_2O.

4.0 STABILIZATION CALCULATIONS

NOTE

Each DMW is purged no more than three WBV, or until field parameters stabilize, whichever occurs first. Well stabilization occurs when field-analyzed parameters are within ± 5% of three consecutive measurements.

Should field parameters not stabilize after 3 WBV have purged from DMW sampler(s) will make notation in the field data sheets, where appropriate.

Typical field-parameter stabilization ranges are ± 0.2 pH units (SU) for pH and ± 3% of reading for SC. Calculations (value change and percent change) are available to assist field personnel when parameters are within ± 5% of three consecutive measurements.

4.1 Perform testing described in steps 1.0 through 3.0.

4.2 Enter measurement data on attachments 1 through 4, where appropriate, as results become available.

4.3 Determine if GW from DMW has stabilized by performing the following calculation for each field parameter measured.

NOTE

Attachments 2 through 4 will automatically perform stabilization calculations in electronic version after measurement data is recorded.

4.3.1 Percentage Change

[A] Calculate percentage change between three consecutive field-analyzed parameters using the following equation:

Percentage Change = {(Max – Min of Last 3 Readings) / Last Reading} x 100

[B] Record results for each parameter measured on attachments 2 through 4, where appropriate.

4.4 Stabilization achieved when percentage change is ± 5% of three consecutive measurements.

4.5 **IF** percentage change is not within ± 5% for three consecutive measurements, continue field testing.
RETURN TO steps 4.3.1 and **REPEAT** percentage change calculation.

4.6 **GO TO** step 7.0 and collect final samples when percentage change results are acceptable.

NOTE

Sample number development conducted in advance of the DMP round.

5.0 SAMPLE NUMBER DEVELOPMENT

5.1 Develop unique DMW final sample numbers using steps 5.1.1 through 5.1.4.

NOTE

A DMW sample number consists of the following, compiled in descending order:

- Subprogram code – "GW" followed by a dash.
- Location code – three alphanumeric characters (to identify DMW) followed by a dash.
- Zone code – one or two letter code (to identify the geologic formation member) followed by a dash.
- DMP round number code – the letter "R" followed by round number and dash.
- Sample ID code – letter "N" followed by number identify samples for specific analysis.

— Example: GW-WQ6-C-R7-N5

5.1.1 **GO TO** attachments 5 and 6 and perform the following, where appropriate:

[A] Record subprogram code (i.e., GW), followed by a dash.

NOTE

For DMW (WQSP-1 through -6), only "WQ" is used for the location code. WQ6 is sample from well WQSP-6.

For radionuclide samples, “BU” is used for the location code of blank samples only. BU6 is blank sample (DI-H_2O) from well WQSP-6.

[B] Record location code, followed by a dash.

NOTE

The zone is designated by a one or two letter code for the water-bearing geologic formation member (e.g. "C" for the Culebra, "M" for Magenta, "DL" for Dewey Lake, "SR" for Santa Rosa or "O" for Other).

5.1.2 Determine and record zone code, followed by a dash.

NOTE

Identify DMP round number with the letter "R" followed by a number. A DMP round is one sampling event where each DMW is purged, measured for stability and final samples taken for analysis.

5.1.3 Determine and record DMP round number code, followed by a dash.

NOTE

Primary sample codes identify samples with the letter "N" followed by a number. There may be more than one primary sample for each analysis. The primary sample is used for the Matrix Spike/Matrix Spike Duplicate.

Duplicate sample codes are identical to primary sample number, except the letter “D” is placed after the number. Duplicate samples are used for precision of combined sampling and analysis. There may be more than one duplicate sample for each specific analysis

5.1.4 Determine and record primary or duplicate sample code, where appropriate.

6.0 PRESERVING FINAL SAMPLES

WARNING

Chemical-resistant gloves and safety glasses are required. Refer to Precautions and Limitations section for exceptions .

NOTE

Preservatives added to sample containers before or during collection, depending on sample container origin (analytical laboratory vs. in-house procurement).

6.1 Consult attachment 5, Example Final Sample Checklist, for sample container and preservative requirements for each DMW sample number (Items 10, 11 and 14-18).

- Volatile organic compounds (VOC) require special sample containers/handling and will be addressed separately (refer to step 6.4).

6.2 Perform one of the following preservation techniques to acidify final samples to pH < 2, depending on parameter sampled (where required).

- For final samples requiring nitric (HNO_3) or sulfuric (H_2SO_4) acid:
  - Add 1 or 2 premeasured Vialservative™ (≈ 2 mL each) of required acid to each sample container.
  - Add ≈ 2 mL of required trace-metal acid to each sample container.
- For VOC final samples:
  - Add 1 premeasured HCl Vialservative™ (≈ 0.5 mL) to each VOA vial.
  - Add 5-6 drops (≈ 0.5 mL) of trace-metal HCl to each VOA vial.

6.3 Fill preserved samples (other than VOC) as follows:

6.3.1 Fill sample container(s) to shoulder height with GW sample and cap.

6.3.2 Invert container gently several times to mix acid and GW sample.

6.3.3 Uncap one of the first 2 sample containers from each parameter after filling and verify final pH requirements with a pH test strip.

— **DO NOT IMMERSE** pH test strip into sample container.

— Obtain pH aliquot using a clean glass stir rod or disposable transfer pipet.

— If sample pH > 2, add another premeasured Vialservative™ or ≈ 0.5 mL of required acid.

6.3.4 Repeat step 6.3.2 through step 6.3.3 until sample pH < 2.

6.3.5 Add any additional preservative (relative) to each sample container of that parameter based on the results of steps 6.3.3 and 6.3.4, if required.

6.3.6 Label and prepare sample containers for shipping.

6.4 Fill VOA vials as follows:

NOTE

Vials are filled in a single process and are not opened once sealed. Avoid checking pH of VOA vials to maintain sample integrity.

6.4.1 Fill sample vials slowly to the top rim so that a dome or convex meniscus is present.

6.4.2 Ensure inner vial cap/septum makes contact with sample when sealing.

6.4.3 Turn vials upside down and verify that only minute or no air bubbles exist.

6.4.4 Label vials and prepare for shipping.

7.0 COLLECTION OF FINAL SAMPLES

NOTE

Final samples are collected annually from each DMW identified in the HWFP. Split or duplicate samples provided to oversight agencies upon request.

Samples for VOCs collected with zero headspace and should be void of air bubbles. A few minute air bubbles are permissible due to native GW properties.

Sample containers for remaining parameters filled to shoulder height.

7.1 Dedicated Filter Holder

7.1.1 Verify dedicated filter holder for each DMW is contaminant-free before installation by visual inspection. Wash filter holder with phosphate-free detergent (if required) and/or rinse thoroughly with DI-H2O before installing.

7.2 Unfiltered Final Sample Collection

7.2.1 Disconnect in-line flow cell from dedicated sampling line, if installed.

7.2.2 Install clean dedicated filter holder (without inner support/frit) and clamp to support frame.

7.2.3 Divert GW flow by turning T-valve of dedicated sampling line to the open position.

7.2.4 Fill sample containers with GW (consult Attachment 5, Final Sample Checklist) by alternating sample containers (except for VOCs) under GW stream during collection process.

7.2.5 Record collection time (24-hour format) for each parameter on attachment 5, Example Final Sample Checklist (Item 19).

7.2.6 Refer to attachment 5, Example Final Sample Checklist to determine which samples to preserve and the acid required.

- If sample requires preserving, refer to section 6.0 for guidance and then **GO TO** step 7.2.7.

- If sample does not require preserving, secure sample container lid.

7.2.7 Label sample containers with the following information (example attachment 6):

- Sample number
- Project name
- Zone
- DMW ID
- Matrix (DI-H_2O or GW)
- Samplers
- Sample date/Sample time
- Filtered (yes/no)
- Acid wash (yes/no)
- Parameter or destination
- Preservative used
- Bottle number of sequence and total bottles required (1 of 6, 2 of 6, etc.)
- Temperature requirements

7.2.8 Affix label to dry sample container and protect with clear tape.

NOTE

Deionized water is the matrix for field or trip blanks. Trip blanks supplied by analytical laboratory.

7.3 Filtered Final Sample Collection

7.3.1 Disconnect in-line flow cell from dedicated sampling line, if installed.

7.3.2 Install clean dedicated filter holder (with inner support/frit) and clamp to support frame.

7.3.3 Disassemble filter holder and place a 0.45-µm filter on inner frit using clean tweezers.

7.3.4 Wet filter surface thoroughly with DI-H_2O to prevent air-locks.

7.3.5 Reassemble filter holder and clamp to support frame.

7.3.6 Divert GW flow by turning T-valve of dedicated sampling line to the open position.

7.3.7 Fill sample containers with GW (consult Final Sample Checklist) by alternating sample containers under GW stream during collection process.

7.3.8 Record collection time (24-hour format) for each parameter on attachment 5, Example Final Sample Checklist (Item 19).

7.3.9 Refer to attachment 5, Example Final Sample Checklist, to determine which samples to preserve and the acid required.

- If sample requires preserving, refer to section 6.0 for guidance and then **GO TO** step 7.3.10.

- If sample does not require preserving, secure sample container lid.

7.3.10 Label sample container with the following information (example attachment 6):

- Sample number
- Project name
- Zone
- DMW ID
- Matrix (DI-H_2O or GW)
- Samplers
- Sample date/Sample time
- Filtered (yes/no)
- Acid wash (yes/no)
- Parameter or destination
- Preservative used
- Bottle number sequence and total bottles required (1 of 6, 2 of 6, etc.)
- Temperature requirements

7.3.11 Affix label to dry sample container and protect with clear tape.

7.4 Field and Trip Blanks

7.4.1 Ensure that each DMW sampled contains a set of field blanks and a set of trip blanks. These blanks apply **ONLY** to VOC analysis.

7.4.2 Acquire trip blanks from analytical laboratory and ensure they remain with sample containers/coolers throughout entire final sampling event. Trip blanks and groundwater samples for VOC analysis must ship in same cooler.

7.4.3 Prepare field blanks using DI-H_2O. Refer to step 6.4 for guidance.

7.4.4 Label field blanks as described in steps 7.3.10 and 7.3.11. Trip blanks are sealed and labeled by analytical laboratory.

7.5 Disassemble filter holder and discard used filter.

7.6 Clean filter holder with detergent and/or dilute acid rinse.

7.7 Rinse filter holder thoroughly with DI-H_2O and air dry.

8.0 SHIPPING AND STORAGE OF FINAL SAMPLES

NOTE

Custody seals have adhesive backs that provide tampering evidence when removed or container opened.

A combined Chain of Custody/Request for Analysis (CofC/RFA) form shall accompany samples. The CofC/RFA form provides a document trail, including the date/time of sample transfer and persons having custody of the sample(s). Samples are considered under custody if in an authorized person's (1) possession; (2) within view after being in possession; (3) in possession and locked it up by an authorized person or sealed it with tamper evident custody seal; or (4) in a designated secure area accessible only to authorized personnel.

8.1 Sign and date custody seals with an indelible pen or marker.

8.2 Affix custody seals around or across sample container lids. **NEVER** place custody seals over VOA vial septa. Wrap seal around junction between cap and glass.

8.3 Verify sample number on each container corresponds to sample number listed on the CofC/RFA form(s).

8.4 Package sample containers for shipping as follows:

- Place HDPE sample containers in zip-seal plastic bags.
- Place glass sample containers in bubble wrap sleeves or other cushioning material before placing in zip-seal plastic bags.

8.5 Place sample containers **UPRIGHT** in shipping cooler.

8.6 Position and secure sample containers with packing material(s) so they do not move (or tip) during transit. Leave room for cooling materials.

8.7 Place doubled zip-seal plastic bags of crushed ice, freezer packs or both inside cooler on top of or near sides of sample containers.

- Pack cooler to maintain sample temperature at 4°C ± 2°C until arrival at analytical laboratory.

8.8 If shipping final samples to analytical laboratory, perform the following:

8.8.1 Enter signature, date, and time on the original CofC/RFA form(s) to relinquish sample custody.

8.8.2 Retain “pink” original copies of the CofC/RFA form(s).

8.8.3 Separate signed originals CofC/RFA forms (white and yellow copies) if shipping more than one cooler.

8.8.4 Place forms inside doubled zip-seal plastic bags and tape to inner lid of coolers(s). Each cooler should have a set of completed multipart CofC/RFA form(s) included within when shipping.

8.8.5 Seal cooler on both ends by wrapping duct tape completely around cooler.

8.8.6 Prepare carrier's waybill. Enter the DMW ID and DMP round number as the billing reference.

NOTE

Samples must ship "priority overnight” to ensure samples remain properly cooled and arrive at laboratory before analyses hold times expire.

8.8.7 Transport samples to carrier’s drop-off location.

8.8.8 Retain original copy of carrier’s waybill.

8.8.9 Confirm, via e-mail from analytical laboratory or via on-line carrier’s tracking history, the receipt of samples the following day after shipment. Include a copy of the communication(s) in the appropriate section of the DMW data package.

8.9 If samples are hand-delivered to analytical laboratory, perform the following:

8.9.1 Complete the CofC/RFA form(s) and leave forms outside transportation container. **DO NOT** sign or date forms.

8.9.2 Place samples in suitable transportation container based on their storage requirements (cooled vs. room temperature) and transport to analytical laboratory.

8.9.3 Relinquish custody of samples by signing CofC/RFA forms in the presence of person receiving samples at analytical laboratory.

8.9.4 Obtain signature of analytical laboratory's representative receiving samples.

8.9.5 Retain "pink" original copies of the CofC/RFA form(s).

8.10 Place copies of all forms (CofC/RFA, carrier waybill, tracking history) in appropriate section of DMW data package.

8.11 Perform the following for HOLD Sample(s):

8.11.1 Complete CofC/RFA form (where applicable) and enter "HOLD" or "RETAIN" under the Comments section.

8.11.2 Place CofC/RFA forms in the HOLD CofC file or in the appropriate section of DMW data package.

8.11.3 Place HOLD samples in lockable storage cabinet.

8.11.4 Retain HOLD samples for at least one (1) year.

8.11.5 Examine HOLD samples periodically for damage.

- Segregate HOLD samples with damaged custody seals or illegible labels and mark as "**NONCONFORMING SAMPLE/DO NOT USE**."

- Replace HOLD sample label that is deteriorated, but still legible, with a new identical label.

8.12 Record disposition of HOLD samples on CofC/RFA form(s) and sign/date the entry.

8.13 Place completed HOLD sample CofC/RFA form in appropriate section of DMW Data Package.

9.0 FIELD DATA MANAGEMENT

NOTE

Final measurement results import automatically into attachment 1 Example Field Parameter Measurement Summary Report.

9.1 Print attachments 1 through 4 after field measurements and data entry are complete.

9.2 Review transcribed data for accuracy (attachments 1 through 4 and instrument printouts).

9.3 Initial with indelible ink, next to typewritten name in "Sampler" field on each attachment.

9.4 Verify attachment 5 Example Final Sample Checklist is complete.

9.5 Make copies of attachments 1 through 5 and all LabSpeed™ Navigator reports for check printing review.

9.6 Stamp "Check Print" on all copies of attachments and LabSpeed™ Navigator reports.

9.7 Place original documents and check-print copies in the appropriate section of the DMW data package.

9.8 Verify that project records are complete and appropriately stored in the project files.

10.0 QUALITY ASSURANCE/QUALITY CONTROL IMPLEMENTATION

10.1 Data Sheet Verification

NOTE

The validator shall be familiar with the current revision of this procedure and knowledgeable with the field process.

Unverified data used outside EM&H for information only must be marked or noted as "INFORMATION ONLY," "PRELIMINARY," or "DRAFT."

10.1.1 Sampler, complete original documentation.

10.1.2 Validator, check-print for the following:

- Corrections single-lined out, dated, and initialed
- Complete entries
- Correct mathematical calculations, where applicable

10.1.3 Validator, if discrepancies found, resolve discrepancies with sampler or qualified designee.

10.1.4 Sampler or designee, make corrections on mistakes found during check print verification, and return work to reviewer.

NOTE

Calculations cannot change after final resolution of check print corrections.

10.1.5 Validator, sign or initial, and date check printed pages.

10.1.6 Store, protect, and maintain data packages and field data sheets (records) as prescribed in WP 15-RM, WIPP Records Management Program.

ATTACHMENTS

Attachments 1 through 4 are reconstructed as individual worksheets within a single file. Worksheets contain mathematical and logical formulas required to obtain the calculated results for field parameters of interest. Attachments 5 is reconstructed as individual worksheets within a single file for all DMWs. Attachment 6 is an example taken from a standard label template used to make final sample labels.

Format and appearance of these attachments (1 through 6) may differ slightly between programs; however, all information is included on the worksheet. Slight differences in appearance are due to the formatting capabilities of each application.

Attachment 7 is a preprinted, multipart CofC/RFA (combined format) associated with final sample custody and analysis requested from analytical laboratories.

Attachment 1 – Example Field Parameter Measurement Summary Report

DMW ID:_____ Date:_____

Zone: _____ DMP Round #:_____

Day Measured:_____ Sampler:_____

Field Parameter	Unit	Final Field Measurement[a]	Date Tested	Time Tested	Sampler
Specific Conductance @ 25 C	µmhos/cm				
Temperature	°C				
pH	SU				
Specific Gravity		@ °C			

[a] Data represent last measurement (after determining parameters have stabilized).

Remarks:_____

_____

Attachment 2 – Example Field Parameter Measurement for Specific Conductance and Temperature

DMW ID:_____ Date:_____
Zone: _____ DMP Round #:_____
Day Measured:_____ Sampler:_____

Equipment / Calibration Standards

Meter: M&DC ID, Serial #:_____ Calibration Expiration Date:_____
Conductivity Cell: Vendor, Model #, Serial #: _____
Temperature Probe: Vendor, Model #, Serial #:_____
1K Standard: Vendor, Lot #: _____ Expiration Date: _____
10K Standard: Vendor, Lot #: _____ Expiration Date: _____
100K Standard: Vendor, Lot #: _____ Expiration Date: _____

Equipment Calibration / QC Checks

Standard	Test Time	Temperature, °C	Conductivity, uS	Cell Constant, K/cm	SC, µmhos/cm @ 25°C[a]
1K					
10K					
100K					
Circle One **QC 1:** 1K 10K 100K			N/A		
Circle One **QC 2:** 1K 10K 100K					

[a] SC, µmhos/cm = [(Conductivity, uS) x (Cell Constant, K/cm)]

GW Measurements

GW Test ID	Test Time	SC, µmhos/cm @ 25°C	Temperature, °C	Percentage Change[b]
SC-1				N/A
SC-2				N/A
SC-3				N/A
SC-4				
SC-5				
SC-6				
SC-7				
SC-8				

[b] Percentage Change = {(Max – Min of Last 3 Readings) / Last Reading} x 100

Remarks_____

_____

Attachment 3 – Example Field Parameter Measurement for pH

DMW ID:_____ Date:_____
Zone: _____ DMP Round #:_____
Day Measured:_____ Sampler:_____

Equipment / Calibration Buffers

Meter: M&DC ID, Serial #:_____ Calibration Expiration Date:_____
Electrode: Vendor, Model #, Serial #:_____ Electrode Filling Solution:_____
Temperature Probe: Vendor, Model #, Serial #:_____
pH 4.01 Buffer: Vendor, Lot #:_____ Expiration Date:_____
pH 7.00 Buffer: Vendor, Lot #:_____ Expiration Date: _____
pH 10.01 Buffer: Vendor, Lot #: _____ Expiration Date:_____

Equipment Calibration / QC Checks

Buffer	Buffer Type	Test Time	Temperature, °C	pH Value, SU	Average Electrode Slope, %
pH 4.01	Calibration				N/A
pH 7.00	Calibration				
pH 10.01	Calibration				N/A
QC Check 1	QC Check				
QC Check 2	QC Check				

GW Measurements

GW Test ID	Test Time	Temperature, °C	pH Value, SU	Percentage Change[a]
pH-1				N/A
pH-2				N/A
pH-3				N/A
pH-4				
pH-5				
pH-6				
pH-7				
pH-8				

[a] Percentage Change = {(Max – Min of Last 3 Readings) / Last Reading} x 100

Remarks_____

_____

Attachment 4 – Example Field Parameter Measurement for Specific Gravity

DMW ID:_____ Date:_____

Zone:_____ DMP Round #:_____

Day Measured_____ Sampler:_____

Equipment

Thermometer: M&DC ID, Serial #:_____ Calibration Expiration Date:_____

Hydrometer: M&DC ID, Serial #:_____ Calibration Expiration Date: _____

GW Measurements

GW Test ID	GW Collection Time	Degas Time	Test Time	Temperature, °C	Hydrometer Reading (SG)	Percentage Change[a]
SG-1						N/A
SG-2						N/A
SG-3						N/A
SG-4						
SG-5						
SG-6						
SG-7						
SG-8						

[a] Percentage Change = {(Max – Min of Last 3 Readings) / Last Reading} x 100

Remarks_____

_____

Attachment 5 – Example Final Sample Checklist

(1) Project Name: WIPP / DMP

(2) DMW ID: WQSP-

(3) DMP Round #:

(4) Zone: Culebra

(5) Filter Type: Whatman, cellulose nitrate

(6) Pore Size: 0.45 µm

(7) Lot #:

(8) Samplers:

(9) Date Sampled:

FINAL SAMPLES

(10) Sample Number	(11) Parameter	(12) Matrix	(13) Destination	Sample Containers			(17) Filtered	(18) Preservative	(19) Collection Time
				(14) # Required	(15) Volume	(16) Container Type			
GW-WQ1-C-R34-N1	VOC	GW	Lab Name	6	40 mL	VOA	No	HCl pH<2	
GW-WQ1-C-R34-N1D	VOC	GW	Lab Name	4	40 mL	VOA	No	HCl pH<2	
GW-WQ1-C-R34-N2	VOC Field Blank	DI-H_2O	Lab Name	4	40 mL	VOA	No	HCl pH<2	
GW-WQ1-C-R30-N3	VOC Trip Blank	DI-H_2O	Lab Name	4	40 mL	VOA	No	HCl pH<2	
GW-WQ1-C-R34-N4	TOC	GW	Lab Name	4	40 mL	VOA	No	HCl pH<2	
GW-WQ1-C-R34-N4D	TOC	GW	Lab Name	2	40 mL	VOA	No	HCl pH<2	
GW-WQ1-C-R34-N5	SVOC	GW	Lab Name	6	1 Liter	Amber Glass	No	None	
GW-WQ1-C-R34-N5D	SVOC	GW	Lab Name	2	1 Liter	Amber Glass	No	None	
GW-WQ1-C-R34-N6	Metals	GW	Lab Name	2	500 mL	HDPE	No	HNO_3 pH<2	
GW-WQ1-C-R34-N6D	Metals	GW	Lab Name	2	500 mL	HDPE	No	HNO_3 pH<2	
GW-WQ1-C-R34-N7	General Chemistry	GW	Lab Name	1	1 Liter	HDPE	No	None	
GW-WQ1-C-R34-N7D	General Chemistry	GW	Lab Name	1	1 Liter	HDPE	No	None	
GW-WQ1-C-R34-N8	Radionuclides	GW	Lab Name	2	2 Liters	HDPE	Yes	HNO_3 pH<2	
GW-WQ1-C-R34-N8D	Radionuclides	GW	Lab Name	2	2 Liters	HDPE	Yes	HNO_3 pH<2	
GW-BU1-C-R34-N9	Radionuclides Blank	DI-H_2O	Lab Name	2	2 Liters	HDPE	Yes	HNO_3 pH<2	
GW-WQ1-C-R34-N10	HOLD	GW	RETAIN	1	2 Liters	HDPE	Yes	HNO_3 pH<2	
GW-WQ1-C-R34-N11	Nitrate Backup	GW	Lab Name	1	250 mL	HDPE	No	H_2SO_4, pH<2	
ACID/REAGENT BLANKS (Collect on first and last well of each DMP round)									
GW-WQ1-C-R34-N12	Metals Blank	DI-H_2O	Lab Name	1	1 Liter	HDPE	No	HNO_3 pH<2	
GW-WQ1-C-R34-N13	Metals Blank	DI-H_2O	Lab Name	1	1 Liter	HDPE	No	None	

PRESERVATIVES

(20) Preservative	(21) Manufacturer	(22) Lot #	(23) Expiration Date	(24) Date Opened
Hydrochloric Acid (HCl)	Vendor Name			
Nitric Acid (HNO_3)	Vendor Name			
Sulfuric Acid (H_2SO_4)	Vendor Name			

FILTER HOLDER

(25) DI-H_2O	(26) SC, µmhos/cm
Pre-rinse	
Post-rinse	

Attachment 6 – Example Final Sample Labels

Sample No.:	**GW-WQ1-C-R34-N1**
Project Name: WIPP/DMP	Zone: Culebra
DMW ID.: WQSP-1	Matrix: Groundwater
Samplers: _____	
Sample Date: _____	Sample Time: _____
Filtered: NO	Acid Wash: NO
Parameter: **VOC**	Preservative: **HCl, pH < 2**
Bottle Number:	**2** of 6
Temperature Requirements:	4°C ± 2°C

Sample No.:	**GW-WQ1-C-R34-N10**
Project Name: WIPP/DMP	Zone: Culebra
DMW ID.: WQSP-1	Matrix: Groundwater
Samplers: _____	
Sample Date: _____	Sample Time: _____
Filtered: YES	Acid Wash: NO
Parameter: **VOC**	Preservative: **HNO_3, pH <2**
Bottle Number:	**2** of 1
Temperature Requirements:	NONE

Attachment 7 – Example Combined Chain of Custody/Request for Analysis

[MSOffice2]

CHAIN OF CUSTODY RECORD

Page _____ of _____

Project Number:	Project Name:			Total Number of Containers	Requested Analyses									Analytical Laboratory
Sampler(s):														
Sample Date	Sample Time	Matrix	Sample Number											Comments

Relinquished By: (Signature, Date/Time)	Received By: (Signature, Date/Time)	Relinquished By: (Signature, Date / Time)	Received By: (Signature, Date/Time)
Relinquished By: (Signature, Date/Time)	Received By: (Signature, Date / Time)	Relinquished By: (Signature)	Received at Laboratory: (Signature, Date/Time)

Requested Turnaround Time:

☐ *Routine* ☐ *Rush* _____

Sample Receipt Remarks:

Special Instructions:

Sample Disposal:

☐ *Return to Client* ☐ *Disposal by Lab*

Carrier / Airbill No.:

Results To:

RES
PO Box 2078, MS 452-09
Carlsbad, NM 88221-2078

Phone: _____ Fax: 575-234-6003

EDD:

WHITE - Analytical Laboratory
YELLOW - Field copy
PINK - Record Copy

AF - Air Filter(s)
AN - Animal(s)
DI - Deionized Water
GW - Groundwater
SE - Sediment
SO - Soil
SW - Surface Water
VG - Vegatation

FM-CofC/RFA-GW, Rev. 0

Working Copy

WP 02-EM1014

Revision 7

Groundwater Level Measurement

Technical Procedure

EFFECTIVE DATE: 11/20/12

Rick Salness
APPROVED FOR USE

TABLE OF CONTENTS

CHANGE HISTORY SUMMARY

REVISION NUMBER	DATE ISSUED	DESCRIPTION OF CHANGES
6	04/25/11	Added WP 02-2 and PROD-116 to the Baseline Documents Took out wording for sample and sample collection in the 1st bullet of Precautions and Limitations Changed wording in Step 1.2.2 from excluding to depending on Added Note above Step 2.1 Took out word fresh in Step 2.7.1 Changed Team Leader to Performer Moved Instrument ID number and Calibration Due date from inside table to on top of table on Attachment 2 and added Performer signature lines
7	11/20/12	• Editorial revision in accordance with MD 1.1.

INTRODUCTION [1, 2]

This document describes the method used for groundwater level measurements in support of groundwater monitoring at the Waste Isolation Pilot Plant (WIPP).

Performance of this procedure generates the following record(s), as applicable. Any records generated are handled in accordance with departmental Records Inventory and Disposition Schedules.

- Attachment 2, Water Level Measurement Field Data Sheet.

REFERENCES			
DOCUMENT NUMBER AND TITLE	BASELINE DOCUMENT	REFERENCED DOCUMENT	KEY STEP
DOE/WIPP-99-2194, *WIPP Environmental Monitoring Plan*	✓		**1**
WP 02-1, *WIPP Groundwater Monitoring Program Plan*	✓		
WP 02-2, *WIPP Discharge Permit 831 Monitoring Plan*	✓		
WP 02-EM3001, *Administrative Processes for Environmental Monitoring and Hydrology Programs*	✓		
WP 10-AD3029, *Calibration and Control of Monitoring and Data Collection Equipment*	✓		
WP 13-1, *Nuclear Waste Partnership LLC Quality Assurance Program Description*	✓		**2**
DA:03:02636, Hydrogen Sulfide Safety Requirements	✓		
PROD-116, Groundwater Level Monitoring	✓		

EQUIPMENT

- H_2S Monitor (Only for operations in the vicinity of oil field operations with a known H_2S problem.)
- Calibrated Water-Level Probe
- Radio/Telephone-Communications (always available)
- Rinse water and bottle
- Clean cloths for wiping down equipment

PRECAUTIONS AND LIMITATIONS

- Only personnel with a current EM02 Groundwater Level Measurements qualification card and trainees operating under the direct supervision of a qualified staff are authorized to perform the activities specified in this procedure.
- If this procedure cannot be performed as written, Environmental Monitoring & Hydrology (EM&H) Manager shall be contacted.
- If abnormal conditions are found during the performance of this procedure, EM&H Manager shall be contacted.
- The wearing of leather gloves is required when handling well lid and measuring tape reel.
- SAF-112, Hydrogen Sulfide Training is required for operations in the vicinity of H_2S hazards only.

PREREQUISITE ACTIONS

1.0 Obtain copy of most recent water level measurements (monthly or quarterly, as applicable).

PERFORMANCE

1.0 OPERATIONAL CHECKS OF THE WATER-LEVEL PROBE

1.1 Verify that probe calibration is current.

1.2 Perform the following to check Water-Level Probe:

1.2.1 Set toggle switch to ON position, **OR** turn rotary dial fully clockwise (depending on the probe).

1.2.2 Depress TEST button to test the battery and circuitry (depending on the probe).

1.3 Perform the following to check Water-Level Sensitivity Adjustment once per day.

NOTE

A clockwise rotation of rotary dial of some Water-Level Probes turns meter ON and increases sensitivity. Regardless of probe type, the highest sensitivity position is **ALWAYS** selected, then the sensitivity decreased as necessary.

1.3.1 Set Water-Level Probe sensitivity switch to highest sensitivity position.

1.3.2 Submerge the electrode (probe) in water to activate the alarm.

1.3.3 If alarm continues after removing probe from water, clean and dry probe to deactivate the alarm.

2.0 WATER LEVEL MEASUREMENT USING WATER-LEVEL PROBE

NOTE

If a measurement is not possible (i.e., a test is under way that blocks entry to the well bore), then a notation as to why the measurement was not taken will be recorded in the comment column. Personnel will also use the comment column to report to any security observations or unusual conditions that may affect water level (i.e., well lock missing or nearby oil field activities).

2.1 Unlock well and verify well location.

2.2 Turn probe power ON.

2.3 Lower probe into well. Slow descent rate when within 20 feet of most recent measurement.

NOTE

When probe reaches water level, an electrical circuit is completed, causing an alarm to sound.

NOTE

Water-Level Probe is marked in increments of 0.01 of a foot. Reference point for measurement of top of casing (TOC) is stamped "X" on the casing by the survey crew, or otherwise the reference point is to the north.

NOTE

For beveled well-heads, a straight edge should be laid across well-head using lowest edge to take measurement.

2.4 When alarm sounds, read footage on embossed electrical cable to the nearest hundredth of a foot.

2.5 Compare the water level measurement with the previous measurement for the well. If the difference is 1 foot or less, continue with next step. If the difference is greater than 1 foot, remeasure. If the change in water level measurement is verified to be greater than 1 foot, note observed change in the comment column on Attachment 2.

NOTE

The adjustment measurement in the field, and on the Water Level Measurement Field Data Sheet (Attachment 2), is only for indication that the Production Injection Packer (PIP) has not been re-set. Refer to Attachment 1, Reference Point Determination and Adjustment for Variably Installed Tubing.

2.6 Record the following on Water Level Measurement Field Data Sheet (Attachment 2) :

- Date measurement was taken
- Time measurement was taken (24-hour clock)
- Water level measurement recorded to within 0.01 of a foot
- Adjustment, if needed
- Initials of performer
- Instrument identification (ID) number

- Calibration due date
- Comments of unusual events, if any, in the comment column
- Any security observation, record in comments column.

2.7 After completing water level measurement, raise probe to surface and perform the following:

2.7.1 Clean and rinse equipment with water in preparation for next well.

2.7.2 Performer or designee, verify that all field data sheets are filled out properly.

2.7.3 Performer or designee, verify that all applicable records are stored in accordance with site standards.

Attachment 1 – Reference Point Determination and Adjustment for Variably Installed Tubing

The top of casing is always the innermost, permanent casing for the well. See Attachment 1, Figure 1.

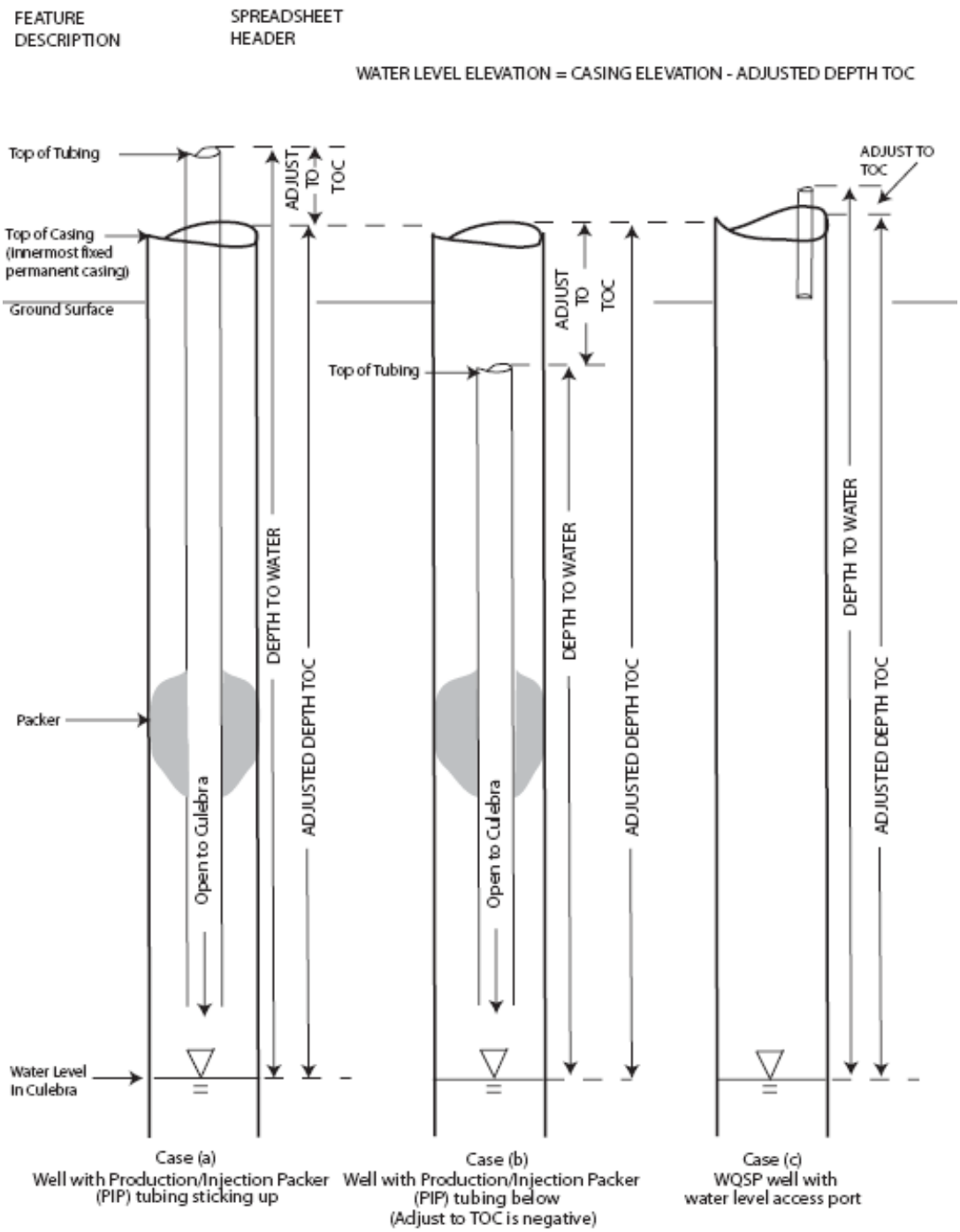
If a well is completed with PVC or fiberglass reinforced plastic casing protected by outer surface casing, the reference point is the inner casing.

If there is only one surface casing, that casing is the reference point. Record the adjustment ("Adj") as 0 (zero) on the Water Level Measurement Data Sheet (Attachment 2).

For wells with tubing installed on which a PIP is installed to isolate the Culebra, the tubing elevation may change each time the packer is reset. The measuring point for the water level is the top of tubing.

Measure and record the adjustment to the nearest inch for the tubing relative to the innermost, permanent casing, because this elevation will never change. If the tubing is a "stickup", or higher than the permanent reference point, the entry is positive. If the tubing is below the permanent reference point, the entry is negative.

Attachment 1 – Reference Point Determination and Adjustment for Variably Installed Tubing



Attachment 1, Figure 1 – Reference Point Determination and Adjustment for Variable Tubing Configuration

Attachment 2 – Water Level Measurement Field Data Sheet

Instrument I.D. Number: _____ **Calibration Due Date:** _____

WATER LEVEL MEASUREMENT FIELD DATA SHEET Page ____ of ____							
Well Number	**Zone**	**Date**	**Time**	**Measurement in Feet**	**Adjt.**	**Initials**	**Comments**

Performer: _____
Printed Name Signature Initials

Performer: _____
Printed Name Signature Initials

Performer: _____
Printed Name Signature Initials

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WP 02-EM1021

Revision 8

Pressure Density Survey

Technical Procedure

EFFECTIVE DATE: 06/06/11

Rick Salness
APPROVED FOR USE

TABLE OF CONTENTS

CHANGE HISTORY SUMMARY

REVISION NUMBER	DATE ISSUED	DESCRIPTION OF CHANGES
8	06/06/11	Removed 4 SNL documents from references section. Added “calculator” to MAT & EQUIP section Updated JHA info and moved reference from PRECAUTIONS to Baseline Documents section Deleted last bullet and added new final bullet regarding data entry and checkprinting in PRECAUTIONS section PERFORMANCE section: switched order of steps 1.1 & 1.2, deleted 1.6, 1.23, 1.25, 2.1, & note above 1.10, added new 1.9 Changed “data logger” to “handheld computer” and modified/updated wording throughout document

INTRODUCTION [1]

This procedure defines the field methodology used to determine the average density of fluid standing in the well bores of groundwater-level monitoring wells. The data derived from the survey are used to calculate equivalent freshwater heads at nondetection monitoring wells and to construct density corrected potentiometric surface maps as required by conditions of the Hazardous Waste Facility Permit.

Density is derived through the following general steps: (1) measuring the hydrostatic pressure of the water column with a pressure transducer placed as near to the mid-formation level as possible; (2) measuring the transducer submergence; and (3) converting measured pressure to fluid density.

Performance of this procedure generates the following records, as applicable:

- Attachment 1, Pressure Density Field Data Sheet
- Attachment 2, Density Calculation Worksheet

REFERENCES

BASELINE DOCUMENTS

- Hazardous Waste Facility Permit, EPA Identification No. NM4890139088 by the New Mexico Environment Department
- DOE/WIPP 99-2194, *Waste Isolation Pilot Plant Environmental Monitoring Plan*
- WP 02-1, *WIPP Groundwater Monitoring Program Plan*
- AJHA PROD-105

REFERENCED DOCUMENTS

- WP 02-EM1014, *Groundwater Level Measurement*
- WP 10-AD3029, *Calibration and Control of Monitoring and Data Collection Equipment*
- WP 15-RM, *WIPP Records Management Program*

MATERIALS AND EQUIPMENT

- Trailer-mounted cable reel and electric motor winch
- Pressure transducer
- Digital transducer cable with connections on both ends (1,000 feet or more) taped and labeled every 20 feet
- Water level probe
- Field data logger and equipment manual
- Handheld computer
- Calculator
- Tape Measure
- Water bottle and water for cleaning probes
- Clean dry cloths

PRECAUTIONS AND LIMITATIONS

- Personnel performing this procedure shall successfully complete qualifications for water level measurement, Qualification Card EM-02, or be under the direct supervision of qualified personnel.
- Personnel performing this procedure shall successfully complete qualifications for pressure density survey, Qualification Card EM-19, or be under the direct supervision of qualified personnel.
- If this procedure cannot be performed as written, or if abnormal conditions are found, the Environmental Management & Hydrology (EM&H) Manager shall be contacted.
- Personnel performing data entry and checkprinting must be different persons.

PREREQUISITE ACTIONS

1.0 Prior to performing a field survey, obtain a list of active wells from the Manager of EM&H, in order to plan field performance.

2.0 To determine which wells need to have the pressure density performed, identify fluid density measurement(s) obtained or to be obtained from Sandia National Laboratory for the current calendar year.

3.0 Obtain from project files and prepare a field copy of reference materials for mid-formation depth, well construction and depth, recent water level measurements, and last year's density measurement.

4.0 Verify pressure transducer and water-level probe calibrations are current in accordance with WP 10-AD3029. Verify that within the last year, the pre-measured markings on the transducer cable have been manually checked against a calibrated measuring instrument or standard measuring tape. Record equipment numbers and calibration/check due dates on Attachment.

PERFORMANCE

1.0 PRESSURE DENSITY SURVEY

1.1 Unlock the well cap and position trailer, cable boom, and transducer cable directly over well bore.

NOTE

Steps 1.2 through 1.8 do not necessarily have to be performed in the order in which they are listed.

1.2 Record on Attachment 1:

- Well Number
- Test Date
- Weather Conditions (general observations)
- Mid-Formation Depth (ft below top of casting [btoc]) (obtain value from reference materials)

NOTE

Static water level refers to the first water level measurement, intended to represent a relatively undistributed surface and is obtained before introducing the pressure transducer.

1.3 Measure the static water level in accordance with WP 02-EM1014, and record the measurement to the nearest 0.01 feet on Attachment 1.

1.4 Install pressure transducer on cable.

1.5 Turn on power supply to electric reel on trailer.

1.6 Attach the transducer cable connector to the handheld computer.

1.7 Set up test on handheld computer using the manufacturer-supplied pressure monitoring software.

1.8 Define log name, parameters, log method, and pressure measurement interval (e.g., one minute).

1.9 Start test and record start time on Attachment 1.

1.10 Release the brake.

1.11 Lower the transducer to the approximate mid-formation depth based on reference materials. Perform by marking the transducer cable to the whole foot nearest the mid-formation depth. Adjust the transducer so that the mark is on the top of the casing and set the brake. Record transducer depth in the water column to the nearest 0.1 feet on Attachment 1. If not near mid-formation, annotate observations in remarks section of Attachment 1.

1.12 Remove transducer cable connection from cable reel bracket clip and reconnect to the handheld computer.

1.13 Measure water level in accordance with WP 02-EM1014. Record time (24-hour format) and water level to the nearest 0.01 feet on Attachment 1.

1.14 After water temperature stabilizes to ± 0.2^{o}C or 15 minutes, and as pressure measurement test runs, start to measure and record water level and time at approximately 5-minute intervals until stable or water level changes do not exceed 5/100 of a foot in two successive measurements.

1.15 After the water level measurement has stabilized, take final, stabilized pressure measurement at water column set point using manufacturer's pressure monitoring software.

1.16 Record time (24-hour format), stabilized pressure (±0.001 psi), and stabilized (final) water level (±0.01 feet) on Attachment 1.

1.17 Save pressure measurement test data from the transducer to the field handheld computer.

1.18 Calculate a field pressure density as defined in Attachment 2.

1.19 Record the calculated field density to the nearest 0.001 sg units on Attachment 1. Record the previous year's measurement on Attachment 1.

1.20 Compare the pressure density measurement with the previous measurement. If results are suspect (e.g., greater than 0.02 specific gravity [SG] units difference from the prior year, or SG <1.0) the test shall be repeated once before moving to the next well pad. Use a second set of Attachments for re-run.

1.21 Record basis for making re-run in Remarks section of Attachment 1 for the original test. Note in Remarks section of Attachment 1 for re-run, that the "test is a re-run." If re-run fails, discontinue test and report to Team Lead or EM&H Manager.

1.22 Disconnect transducer cable connection from handheld computer and attach to cable reel bracket on cable drum.

1.23 Record End Time (24-hour format) on Attachment 1 at last pressure reading.

1.24 Raise water level probe from well, rinse with water and dry with clean cloth.

1.25 Release cable reel brake and raise transducer from selected depth to surface, progressing at medium speed.

1.26 Clean pressure transducer using soft clean cloth and fresh water.

1.27 Dry pressure transducer.

1.28 Remove pressure transducer from transducer cable.

1.29 Return pressure transducer to storage location.

2.0 PREPARE TRAILER FOR TRAVEL TO NEXT SITE

2.1 Raise cable boom and place in boom brace.

2.2 Secure cable and transducer connection port to boom.

2.3 Turn power off with switch in tool box fixed on trailer.

3.0 CALCULATE AVERAGE FLUID DENSITY

3.1 Calculate average fluid density using the following differential pressure equation:

$\rho = 2.3066\ P([psig]/z)$

Where:

ρ	=	density
P (psig)	=	transducer gauge pressure (psig) from vented cable
z	=	Height of water column (ft)

Sample Calculation

$\rho = 2.3066\ P([psig]/z)$

Where:

ρ	=	density
P (psig)	=	transducer pressure at water column set point
z	=	Height of water column (ft)

Given:

Measured transducer depth	=	662 (ft Btoc)
Water level	=	412.41 (ft Btoc)
Mid-formation pressure	=	1 23.726 (psig)

Then:

z	=	662 -412.41 = 249.59
P (psig)	=	123.726

Therefore:

ρ = 2.3066 (123.726/249.59) = 1.143 (sg units)

3.2 Record the calculation and results on Attachment 2. The recorder and person who preparer shall review and sign Attachments 1 and 2.

4.0 RECORD COMPLETION AND STATUS EVALUATION

4.1 EM&H personnel, check Attachments 1 and 2 for completeness and sign as checker.

4.2 EM&H personnel, ensure that all records are archived in accordance with WP 15-RM.

4.3 EM&H personnel, evaluate completion status for current calendar year relative to required active well measurements.

Attachment 1 – Pressure Density Field Data Sheet

Well Number _____ Test Date _____ Weather _____

Start Time _____ End Time _____

Mid-Formation Depth _____ (ft btoc)

Water Level Probe, Equipment # _____ Calibration Due _____

Transducer Equipment # _____ Calibration Due _____

Cable Marking, Check Due _____

Measured Static water Level _____

Transducer Depth in Water Column _____ (ft btoc)

Water Level Measurements (btoc)

Time/Feet	Time/Feet	Time/Feet	Time/Feet
____/____	____/____	____/____	____/____
____/____	____/____	____/____	____/____
____/____	____/____	____/____	____/____

Time (24-hour format) Stabilized Pressure (psig) Stabilized (final) Water Level (ft)

_____ _____ _____

Pressure Density, Field Calculation _____ (sg units) _____

Pressure Density, Previous Measurement _____ (sg units) _____

Remarks: _____

_____

Test Data Recorded by _____

Test Data Checked by _____

Attachment 2 – Density Calculation Worksheet

Note: This worksheet is provided for documentation of a manual calculation. The calculation may also be completed using an Excel® (or equivalent) spreadsheet. Print out spreadsheet and add preparer and check signatures.

$\rho = 2.3066 (P[psig]/z)$

Where:

ρ = density (sg units)
P (psig) = transducer gauge pressure from vented cable
z = height of water column (ft)

Measured Transducer depth in water column = _____ (ft Btoc)

Water level = _____ (ft Btoc)

Reading of transducer in water column = _____ (psig)

Calculation prepared by _____ Date _____

Calculation checked by _____ Date _____