ISSUED

WP 02-EM1010

Revision 2

Field Parameter Measurements and Final Sample Collection

Technical Procedure

EFFECTIVE DATE: 03/10/14

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APPROVED FOR USE

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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.
2	03/10/14	• Extensive Revision. Major changes include: — Revised sections 1.0 and 2.0 to described calibration only. — Added Section 3.0, Continuous Measurements and Post-Testing QC. — Added Section 4.0, Printing Multimeter Reports. — Revised sections 6.0, and 7.0 into Section 8.0, Collecting and Preserving Unfiltered Final Samples and Section 9.0, Collecting and Preserving Filtered Final Samples. — Added Section 13.0, Field Data Package Completion and Finalization. — Revised Equipment list. — Updated References table. — Editorial changes throughout.

INTRODUCTION [1, 2]

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. In accordance with WP 02-1, final samples are collected and submitted for hazardous constituents, general parameters, and radionuclide analyses.

Tasks listed under the Performance section are independent and can be performed as stand-alone processes. 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 Calibration
- Section 2.0 pH Calibration
- Section 3.0 Continuous Measurements and Post-Testing QC
- Section 4.0 Printing Multimeter Reports
- Section 5.0 Specific Gravity Measurement
- Section 6.0 Stabilization Calculations
- Section 7.0 Sample Number Development
- Section 8.0 Collecting and Preserving Unfiltered Final Samples
- Section 9.0 Collecting and Preserving Filtered Final Samples
- Section 10.0 Shipping Final Samples and Storing Retains
- Section 11.0 Field Data Management
- Section 12.0 Quality Assurance/Quality Control Implementation
- Section 13.0 Field Data Package Completion and Finalization

Field data is entered into electronic worksheets represented by attachments 2 through 4 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 collect final samples. Final samples are shipped or hand-delivered to analytical laboratories for analyses.

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

Records generated by this procedure are kept on file within the Operating Record, as required by the WIPP Hazardous Waste Facility Permit (Permit). Information and analytical data generated by the DMP classify as 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, EPA Identification Number NM4890139088	✓		2
Standard Method 2550 B, *Temperature – Laboratory and Field Methods*		✓	
Standard Method 4500-H+ B, *pH Value – Electrometric Method*		✓	
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.		✓	
Orion VersaStar™ Advanced Electrochemistry Benchtop Meter – Reference Guide. Thermo Fisher Scientific, Inc., Beverly, MA. 2011.		✓	
Orion Star Com – Software Manual. Thermo Fisher Scientific, Inc., Beverly, MA. 2013.		✓	
WP 02-1, *WIPP Groundwater Monitoring Program Plan*	✓		1
WP 04-AD3030, *Pre-job Briefings and Post-job Reviews*		✓	
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 Collection*		✓	

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 or equivalent
- Multimeter capable of measuring pH, temperature and specific conductance or equivalent
- Conductivity cell
- Epoxy ATC probe or equivalent (optional)
- pH electrode, with or without built-in ATC feature
- Hydrometer, scale 1.000 – 1.220 or equivalent
- Hydrometer cylinder, plastic or glass

ACIDS, SOLUTIONS AND STANDARDS

NOTE

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

- Deionized water (DI-H_2O), ≥18.0 megaohms-cm at 25°C
- Electrode filling solution, electrode dependent (e.g., 3M KCl) or equivalent

- pH buffer solutions (NIST traceable; pH 4, 7 and 10) or equivalent

- Specific Conductivity (SC) standards (NIST traceable; 1,000 μmhos/cm [1K], 10,000 μmhos/cm [10K] and 100,000 μmhos/cm) [100K] or equivalent

- Hydrochloric acid (HCl), 37% Vialservatives™ (EP Scientific), trace-metal grade or equivalent

- Nitric acid (HNO_3), 70% Vialservatives™ (EP Scientific), trace-metal grade or equivalent

- Sulfuric acid (H_2SO_4), 48% Vialservatives™ (EP Scientific), trace-metal grade or equivalent

OTHER CONSUMABLES

- Glass stir rods or disposable transfer pipets

- Graduated cylinder, Class A

- Beakers, plastic (disposable) or glass (Class A)

- pH strips, full or narrow range

- 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 SAMPLING AND SHIPPING

NOTE

The analytical laboratory provides sample containers, with preservative added if required, for hazardous constituents. Radionuclide sample containers are purchased to meet Level 1 EPA quality assurance (QA) washing and treatment standards. Pre-rinse not required for any containers.

- Sample containers: amber bottles, high-density polyethylene (HDPE) bottle/jugs and volatile organic analyte (VOA) vials (supplied by analytical laboratory)
- Filters, cellulose nitrate, 0.45-μm or equivalent
- Tweezers
- Sample labels
- 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 and Sample Collection qualifications 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 conduct a pre-job safety briefing per WP 04-AD3030, and include a review of AJHA PROD-156 before starting work.

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

  — Chemical-resistant gloves may be removed when labeling sample containers (applying labels and protective tape).

- 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.

  — A dilute solution (< 10%) of HNO_3, HCl or aqua regia (3 parts HCl to 1 part HNO_3) may also be used, 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 are generated by this procedure. All reagents are non-hazardous and are disposed with purged GW.

- Measurement instruments are to be calibrated and maintained per WP 10-AD3029 if required by Permit.

- Field measurements and final samples from each DMW are collected through a dedicated sample line and under atmospheric conditions (pressure, temperature).

- Purge each DMW no more than three (3) 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 parameters are within ± 5% for three consecutive measurements.

- When instructed to record data on any attachment of this procedure, personnel understand that the electronic version of the attachment is where data entry takes place.

PREREQUISITE ACTIONS

- Provide 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 safety equipment (spill control kit, first aid kit and eyewash/safety shower station) for field lab is available and working properly before each DMP round.
- Prepare electronic attachments 1 through 4 for each DMW in advance of starting fieldwork.
- Verify DMW stability criterion is met before collecting final samples.

PERFORMANCE

NOTE

Field parameters (pH, SC, and temperature) are measured simultaneously through an in-line flow cell, and specific gravity is measured using classical techniques. Sequence of performing calibrations and recording measurements is at discretion of sampler(s).

1.0 SPECIFIC CONDUCTANCE CALIBRATION

1.1 Complete the following sections on attachment 2:

- DMW Sampling Information
- Equipment Specifics/Calibration Standards

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

NOTE

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

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

1.3 Calibrate (3-point) the multimeter/cell in accordance with the instrument's operation manual and/or software guide.

NOTE

Nominal cell constants (K) are dependent upon cell-type used. True SC calibrations standard values should be ± 10% from their certified concentrations after correcting for constant differences.

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

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

1.4.1 Verify SC calibration standards are within ± 10% of their certified concentrations, corrected to 25°C.

1.5 Perform a quality control (QC) check to verify calibration in accordance with the instrument's operation manual and/or software guide.

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

1.5.2 **IF** QC check result is not within specifications,
THEN consult the multimeter manual and/or cell user guide for troubleshooting assistance **AND RETURN TO** step 1.6 when QC passes.

1.6 Record data under the Equipment Calibration/QC Checks section on attachment 2

OR

Obtain data from multimeter report (section 4.0) and record when time permits.

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

1.8 Place SC cell into appropriate flow cell well and finger-tighten well-cap nut unless using the cell for automated temperature compensation (ATC) during pH calibration (section 2.0).

1.9 **GO TO** section 3.0 when calibrations for all parameters to be measured are complete, and perform continuous measurements.

2.0 pH CALIBRATION

2.1 Complete the following sections on attachment 3:

- DMW Sampling Information
- Equipment Specifics/Calibration Buffers

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

NOTE

Calibration verifies that the electrode and multimeter system work properly. Performing a 3-point calibration before using the instrument ensures reliability. An acceptable calibration has an average electrode slope of 92 - 102% and a QC check no greater than ± 0.2 pH units from its known value (may differ due to calibration buffer tolerances).

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).

2.3 Calibrate (3-point) the multimeter/electrode in accordance with the instrument's operation manual and/or software guide.

2.3.1 Verify average slope of calibration is 92 – 102%.

2.4 Perform a QC check to verify calibration in accordance with the instrument's operation manual and/or software guide.

2.4.1 Verify QC check standard is no greater than ± 0.20 SU of the certified value, corrected to 25°C.

- QC limit is determined by tolerance of the buffer used and may differ from guideline above.

- Check accuracy limits of buffers and adjust QC range accordingly, if necessary.

2.4.2 **IF** QC check result is not within specifications,
THEN consult multimeter manual and/or electrode user guide for troubleshooting assistance **AND RETURN TO** step 2.5 when QC passes.

2.5 Record calibration/QC data under the Equipment Calibration/QC Checks section on attachment 3

OR

Obtain data from multimeter report (section 4.0) and record when time permits.

2.6 Rinse pH electrode and ATC source with DI-H_2O; blot dry.

2.7 Place pH electrode and ATC source into appropriate flow cell wells and finger-tighten well-cap nut.

2.8 **GO TO** section 3.0 when calibrations for all parameters to be measured are complete, and perform continuous measurements.

3.0 CONTINUOUS MEASUREMENTS AND POST-TESTING QC

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

3.2 Allow several flow cell volumes (cell capacity ≈ 40 mL) of GW to pass through in-line sampling system.

3.2.1 Ensure multimeter probes are sufficiently immersed in the GW sampling stream inside the flow cell.

3.2.2 Ensure flow cell is void of air pockets; however, minute air bubbles due to native GW properties are allowed.

3.3 Place multimeter in the **CONTINUOUS MEASUREMENT** mode as instructed by the instrument's operation manual and/or the software user guide.

3.3.1 Program the multimeter to obtain SC, temperature, and pH readings every five minutes.

NOTE

Temperature values on attachment 3 automatically carry over from attachment 2 since measurements are obtained simultaneously.

3.3.2 Collect readings until SC, temperature, and pH values are within ± 5% for three consecutive measurements.

- Enter SC and temperature readings on attachment 2 and pH readings on attachment 3 to calculate percent change between readings (section 6.0).

3.4 Perform post-testing QC checks for SC and pH in accordance with the instrument's operation manual and/or software guide.

3.4.1 Verify SC QC check is within 10% of its certified concentration, corrected to 25°C.

3.4.2 Verify pH QC check standard is no greater than ± 0.20 SU from its certified value, corrected to 25°C.

3.4.3 **IF** QC check results are not within specifications,
THEN consult multimeter manual and/or cell or electrode user guide for troubleshooting assistance.

3.5 Rinse SC cell and pH electrode with DI-H_2O and prepare for storage as specified in their respective users guide.

4.0 PRINTING MULTIMETER REPORTS

4.1 Print calibration, measurement and QC results for SC and pH as instructed by the software user's guide.

4.2 Save report files using the following format as a guide.

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

Example: WQ6-C-R31-D1_pH.*

NOTE

Instrument reports may be printed after all testing has been performed. Data integrity is not affected because of time- and date-stamped results.

4.3 Initial/sign and date reports. Analyst should include the following on each page:

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

4.4 Transfer data to attachments 2 and 3 and/or verify previously entered data on attachments when time permits.

4.5 Report data as follows:

- SC to nearest µmhos/cm
- pH to nearest hundredth SU
- Temperature to nearest tenth, degree Centigrade
- Testing times using 24-hour format

4.6 Place calibration, measurement and QC reports directly behind their corresponding attachments in data package.

4.7 Exit instrument software program and shutdown multimeter.

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

5.0 SPECIFIC GRAVITY MEASUREMENT

5.1 Complete the following sections on attachment 4:

- DMW Sampling Information
- Equipment Specifics

5.2 Divert GW flow from the in-line flow cell discharge into clean hydrometer cylinders.

5.3 Collect approximately 0.5 L to 1 L of sample into separate hydrometer cylinders. Sample should be collected in duplicate.

5.4 Record GW collection time(s) on attachment 4.

NOTE

Degassing time varies amongst DMWs, but is generally about 20 minutes when collected from a continuous flowing source. Highly carbonated GW may require longer degassing periods. Degassing is complete when air bubbles are minimally visible on inner surface of hydrometer cylinder

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

- Accelerate degassing by gently tapping on cylinder's outer surface to dislodge air bubbles.

5.6 Immerse hydrometer into cylinder containing degassed GW.

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

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

5.9 Obtain specific gravity (SG) reading as follows:

5.9.1 Ensure hydrometer is not touching inner surface of cylinder.

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

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

5.11 Record the following testing information on attachment 4:

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

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

Degas Time = Test Time – GW Collection Time

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

6.0 STABILIZATION CALCULATIONS

NOTE

Determining GW stabilization is a “real-time” event and takes place during field parameter measurement. Each DMW is purged no more than three (3) WBV or until field parameters stabilize, whichever occurs first.

Should field parameters not stabilize after 3 WBV have purged, sampler(s) will make a notation on field data sheets, and proceed with final sampling.

6.1 Perform testing described in sections 1.0 through 5.0.

6.2 Enter measurement data on attachments 2 through 4.

6.3 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 the electronic version after measurement data is recorded.

6.3.1 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.

6.4 Stabilization occurs when percentage change is ± 5% of three consecutive measurements.

6.5 **IF** percentage change is not within ± 5% for three consecutive measurements,
THEN continue field-testing **AND RETURN TO** substep 6.3.1 **AND REPEAT** percentage change calculation.

6.6 **GO TO** section 8.0 and then 9.0 to collect final samples when percentage change results are acceptable.

NOTE

Sample number development conducted in advance of the DMP round.

7.0 SAMPLE NUMBER DEVELOPMENT

7.1 Develop unique DMW final sample numbers using substeps 7.1.1 through 7.1.4.

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 to identify samples for specific analysis.
    - Example: GW-WQ6-C-R7-N5

7.1.1 **GO TO** attachments 5 and 6 and perform the following:

[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 a sample from well WQSP-6.

For radionuclide samples, “BU” is used in place of the location code for blank samples only. BU6 is a blank sample of DI-H_2O collected during final sampling at 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).

7.1.2 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.

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

NOTE

Primary sample codes identify samples using 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 added after the sample number. Duplicate samples are used for precision of combined sampling and analysis. There may be more than one duplicate sample for each specific analysis

7.1.4 Determine and record primary and/or duplicate sample codes.

WARNING

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

NOTE

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

8.0 COLLECTING AND PRESERVING UNFILTERED FINAL SAMPLES

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

8.2 Inspect the dedicated filter holder visually for contaminants and/or damage before installation.

8.3 Wash filter holder with phosphate-free detergent and/or diluted acid, and rinse thoroughly with DI-H2O (if required).

8.4 Install clean dedicated filter holder without the inner support/frit and clamp to support frame.

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

8.6 Complete the upper section of attachment 5 (items 1 through 9).

8.7 Consult attachment 5 for sample containers and preservatives required for each DMW sample number (items 10, 11 and 14 through 18).

NOTE

The analytical laboratory provides all sample containers and vials for hazardous constituents. Sample containers and vials received either are pre-acidified (preserved) or non-acidified (non-preserved) depending on the parameter of interest.

The sampling team collects additional GW samples for other analyses. Samples are collected in certified-clean containers and if required, preserved with certified acids (certification provided by vendor). To maintain consistency of all with sampling techniques, preservative is also added to containers from sources other than the analytical laboratory before collecting the samples.

8.8 Non-Preserved Sample Collection

8.8.1 Fill non-preserved sample container(s) to shoulder height by alternating sample containers under GW stream during collection process and cap.

8.8.2 Record collection time for each parameter on attachment 5 (item 19).

8.8.3 Affix a label to each dry sample container with the following information (e.g., attachment 6):

- Sample number
- Project name
- Zone
- DMW ID
- Matrix (DI-H_2O or GW)
- Samplers

- Sample date/Sample time
- Parameter or destination
- Preservative used
- Filtered (yes/no)
- Bottle number of sequence and total bottles required (1 of 6, 2 of 6, etc.)

8.8.4 Protect labels with clear tape, and prepare container(s) for shipping (section 10.0).

NOTE

Volatile organic compounds (VOCs) and their respective blanks require special vials and handling as addressed separately in steps 8.10 and 8.11.

8.9 Preserved Sample Collection - Other than VOCs

8.9.1 Fill pre-acidified sample container(s) to shoulder height by alternating sample containers under GW stream during collection process and cap.

- Alternately and before sample collection, add 1 premeasured Vialservative™ of required diluted acid (≈ 2 mL each) or ≈ 1 mL of the concentrated trace-metal acid required to each sample container.

- Acid volume suggested is per Liter of GW. Adjust added volume of preservative according to the volume of sample collected.

8.9.2 Record collection time for each parameter on attachment 5 (item 19).

8.9.3 Invert each container gently several times to mix.

8.9.4 Uncap one of the first two 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 testing aliquot with a clean glass stir rod or disposable transfer pipet.

— If sample pH > 2, add ≈ 1.0 mL from another premeasured Vialservative™(diluted acid) or ≈ 0.5 mL of concentrated trace-metal acid.

8.9.5 Recap sample and repeat steps 8.9.3 and 8.9.4 until sample pH < 2.

8.9.6 Add the same amount of preservative (relative) to each sample container of that parameter based on the results of steps 8.9.4 and 8.9.5, if required.

8.9.7 Label sample containers as described in steps 8.8.3 and 8.8.4.

NOTE

Sample collection for VOC analysis occurs as a single process and once sealed, vials cannot be opened. Sample integrity is maintained by not checking the pH of sample after the vials have been filled.

8.10 Preserved (Pre-Acidified) Sample Collection for VOCs

8.10.1 Fill pre-acidified sample vials slowly to the top rim so that a dome or convex meniscus is present.

- If pre-acidified sample vial is not available, add 1 premeasured HCl Vialservative™ (≈ 0.5 mL each) or 5-6 drops (≈ 0.5 mL) of trace-metal HCl before sample collection to each sample vial.
- Fill vial as described above.

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

8.10.3 Record collection time for each parameter on attachment 5 (item 19).

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

8.10.5 Label sample containers as described in steps 8.8.3 and 8.8.4.

NOTE

Field and trip blanks apply **ONLY** to VOC analysis.

8.11 VOC Field and Trip Blanks

8.11.1 Acquire trip blanks from analytical laboratory.

- Trip blanks are pre-filled with DI-H_2O, sealed and labeled at analytical laboratory.

- Trip and field blanks **MUST** stay with the VOC sample containers/coolers throughout the entire sampling event.

8.11.2 Fill field blanks, as described in steps 8.10.1 through 8.10.5, using DI-H_2O as the matrix.

8.11.3 Label sample containers as described in steps 8.8.3 and 8.8.4.

8.12 If filtered samples are required, **GO TO** section 9.0.

8.13 **IF** sampling is complete,
THEN perform the following:

8.13.1 Disassemble and clean filter holder with detergent and/or dilute acid.

8.13.2 Rinse thoroughly with DI-H_2O and air dry.

8.13.3 Store the dedicated filter holder assembly in a zip seal plastic bag.

WARNING

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

9.0 COLLECTING AND PRESERVING FILTERED FINAL SAMPLES

NOTE

Filtered final samples are for radionuclide analysis only unless otherwise specified by lead chemist or their designee.

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

9.2 Inspect the dedicated filter holder visually for contaminants and/or damage before installation.

9.3 Wash filter holder with phosphate-free detergent and/or rinse with diluted acid solution, and rinse thoroughly with DI-H2O (if required).

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

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

9.6 Reassemble filter holder and clamp to support frame.

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

9.8 Complete the upper section of attachment 5 (items 1 through 9).

9.9 Consult Attachment 5, Example Final Sample Checklist, for sample container and preservative requirements for each DMW sample number (items 10, 11 and 14 through18).

9.10 **REPEAT** steps 8.9.1 through 8.9.7 to collect preserved filtered GW samples.

9.11 Label and prepare sample containers for delivery as described in steps 8.8.3 and 8.8.4.

9.12 **IF** sampling is complete,
THEN discard the used filter **AND GO TO** step 8.13 for cleaning and storage guidance.

10.0 SHIPPING FINAL SAMPLES AND STORING RETAINS

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 form provides a document trail, including the date/time of sample transfers and persons having custody of the samples. 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 up by an authorized person or sealed with tamper evident custody seal; or (4) in a designated secure area accessible only to authorized personnel.

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

10.2 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.

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

10.4 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.

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

10.6 Secure sample containers with packing material to prevent movement (or tipping) during transit. Leave room for cooling material.

10.7 Place doubled zip-seal plastic bags of crushed ice, freezer packs or both inside cooler.

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

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

10.8.1 Enter signature, date, and time on the original CofC/RFA form to relinquish sample custody.

10.8.2 Keep the "pink" copy of the CofC/RFA.

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

10.8.4 Place forms inside doubled zip-seal plastic bags and tape to inner lid of cooler(s).

- Ensure that each cooler contains a copy (original, field, or photocopy) of the completed multipart CofC/RFA form(s) when shipping.

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

10.8.6 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.

10.8.7 Transport samples to carrier's drop-off location.

10.8.8 Retain original copy of carrier's waybill.

10.8.9 Confirm the receipt of samples via e-mail from analytical laboratory and/or via carrier's on-line tracking history. Include a copy of each communication in the appropriate section of the DMW data package.

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

10.9.1 Complete the CofC/RFA form but, **DO NOT** sign or date.

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

10.9.3 Relinquish custody of samples by signing the CofC/RFA in the presence of the laboratory's sample receiving personnel.

10.9.4 Obtain signature from the laboratory's receiving representative.

10.9.5 Retain the "pink" copy of the CofC/RFA.

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

10.11 Perform the following for the RETAIN Sample:

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

10.11.2 Place the CofC/RFA in the appropriate section of DMW data package.

10.11.3 Place the RETAIN sample in lockable storage cabinet.

10.11.4 Keep RETAIN sample for at least one (1) year.

10.11.5 Examine RETAIN samples periodically for damage.

- Segregate RETAIN samples with damaged custody seals or illegible labels and mark as "**NONCONFORMING SAMPLE/DO NOT USE**."
- Replace sample label that is deteriorated, but still legible, with a new identical label.
- Document any finding on the CofC/RFA for the RETAIN sample.

10.12 Record disposition of the RETAIN sample upon disposal on the CofC/RFA. Sign and date the entry.

10.13 Place completed RETAIN CofC/RFA form in appropriate section of DMW Data Package.

11.0 FIELD DATA MANAGEMENT

NOTE

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

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

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

11.3 Initial beside each typewritten name listed under "Sampler" with indelible ink on each attachment.

11.4 Verify attachment 5 (Final Sample Checklist) is complete.

11.5 Prepare field laboratory summary report.

11.6 Make copies of the field summary report, attachments 1 through 5, multimeter data reports, and other supporting documents (e.g., equipment usage log, WBV stats, etc.) for check print review.

11.7 Stamp "Check Print" on copies of the summary report, attachments, multimeter data reports, and supporting documents.

11.8 Place original documents and check print copies in the appropriate sections of the DMW data package.

12.0 QUALITY ASSURANCE/QUALITY CONTROL IMPLEMENTATION

12.1 Data Sheet Verification

NOTE

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

Data used outside EM&H, verified or not, must be marked or noted as "INFORMATION ONLY," "PRELIMINARY," or "DRAFT."

12.1.1 Validator, check print data and summary report for the following:

- Correctly entered and/or transcribed data
- Complete entries on attachments and other documentation
- Corrections made with a single-line mark through, dated, and initialed
- Correct mathematical calculations, where applicable

12.1.2 Validator, identify (highlighter, pen, sticky note) any discrepancy found.

12.1.3 Validator, sign or initial, and date on check printed pages and return to Sampler or designee.

12.1.4 Sampler or qualified designee, make corrections and provide Validator with the corrected data and/or report for secondary review.

- Return all copies (corrected original, first check print showing discrepancies, new corrected check print, etc.) to Validator.

NOTE

Calculations cannot change after final resolution of check print corrections.

12.1.5 **REPEAT** steps 12.1.1 through 12.1.4 until all errors are corrected **AND RETURN TO** step 12.1.6 when complete.

12.1.6 Validator, return verified data package to Sampler or designee for completion.

13.0 FIELD DATA PACKAGE COMPLETION AND FINALIZATION

13.1 Sampler or designee, complete the DMW field data package as follows:

NOTE

The DMW field data package is complete when all three copies of the multipart CofC/RFA have been merged together for hazardous constituent testing only.

An original photocopy of the CofC/RFA form is acceptable for completion since the original CofC/RFA (white copy) **MUST** remain with the hazardous constituent data package.

13.1.1 Obtain a copy of the original CofC/RFA from the hazardous constituent data package and merge with other copies of the CofC/RFA form.

13.1.2 Verify all documents within the field data package are stamped.

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

13.1.4 Store, protect, and maintain data packages and field data sheets (records) as prescribed in WP 15-RM.

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. Attachment 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 Sampling Information

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 Sampling Information

DMW ID:________________________ Date:____________________

Zone: ________________________ DMP Round #:________________

Day Measured:____________________ Sampler:____________________

Equipment Specifics/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	N/A	
Circle One **QC 2:** 1K 10K 100K			N/A	N/A	

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

GW Measurements

GW Test ID	Test Time	SC, µmhos/cm @ 25°C	Temperature, °C	Percentage Change[b]
SC-0				N/A
SC-1				N/A
SC-2				N/A
SC-3				
SC-4				
SC-5				
SC-6				
SC-7				
SC-8				
SC-9				
SC-10				
SC-11				
SC-12				

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

Remarks____

____

Attachment 3 – Example Field Parameter Measurement for pH

DMW Sampling Information

DMW ID:_________________________ Date:_______________________

Zone: ____________________________ DMP Round #:________________

Day Measured:_____________________ Sampler:_____________________

Equipment Specifics/Calibration Buffers

Meter: M&DC ID, Serial #:____________________________ Calibration Expiration Date:___________

Electrode: Vendor, Model #, Serial #:___________________ Electrode Filling Solution:______________

Temperature Probe: Vendor, Model #, Serial #:____

pH 4 Buffer: Vendor, Lot #:___________________________ Expiration Date:____________________

pH 7 Buffer: Vendor, Lot #:___________________________ Expiration Date: ___________________

pH 10 Buffer: Vendor, Lot #: __________________________ Expiration Date:____________________

Equipment Calibration/QC Checks					
Buffer	Buffer Type	Test Time	Temperature, °C	pH Value, SU	Average Electrode Slope, %
pH 4	Calibration				N/A
pH 7	Calibration				
pH 10	Calibration				N/A
QC 7.0 Check 1	QC Check				
QC 7.0 Check 2	QC Check				

GW Measurements				
GW Test ID	Test Time	Temperature, °C	pH Value, SU	Percentage Change[a]
pH-0				N/A
pH-1				N/A
pH-2				N/A
pH-3				
pH-4				
pH-5				
pH-6				
pH-7				
pH-8				
pH-9				
pH-10				
pH-11				
pH-12				

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

Remarks____

____

Attachment 4 – Example Field Parameter Measurement for Specific Gravity

DMW Sampling Information

DMW ID:_________________________ Date:________________________

Zone:____________________________ DMP Round #:________________

Day Measured_____________________ Sampler:_____________________

Equipment Specifics

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-0						N/A
SG-1						N/A
SG-2						N/A
SG-3						
SG-4						
SG-5						
SG-6						
SG-7						
SG-8						
SG-9						
SG-10						
SG-11						
SG-12						

[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: ______

(10) Sample Number	(11) Parameter	(12) Matrix	(13) Destination	Sample Containers (14) # Required	(15) Volume	(16) Container Type	(17) Filtered	(18) Preservative	(19) Collection Time
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	
ACID/REAGENT BLANKS (Collect on first and last well of each DMP round)									
GW-WQ1-C-R34-N11	Metals Blank	DI-H_2O	Lab Name	1	1 Liter	HDPE	No	HNO_3 pH<2	
GW-WQ1-C-R34-N12	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			

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: ______
Parameter: **VOC**	Preservative: **HCl, pH < 2**
Filtered: NO	Bottle Number: **2** of 6
Temperature Requirements:	4°C ± 2°C

Sample No.:	**GW-WQ1-C-R34-8D**
Project Name: WIPP/DMP	Zone: Culebra
DMW ID.: WQSP-1	Matrix: Groundwater
Samplers: ______________________________	
Sample Date: ____________	Sample Time: ______
Parameter: **Radionuclides**	Preservative: **HNO_3, pH <2**
Filtered: YES	Bottle Number: **1** of 2
Temperature Requirements:	NONE

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

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***	Results To: ______________________ RES PO Box 2078, MS 452-09 Carlsbad, NM 88221-2078 Phone: ________________ Fax: 575-234-6003 EDD:	
Carrier / Airbill No.:		

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