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REVISION/CHANGE LOG

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FR0	Initial FRNP release	All	10/20/17
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FR1A	Added the word Sampler as the performer under Prerequisites	4	1/2/19

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure describes the standard method and equipment required to measure water levels in open boreholes, cased wells, or piezometers.

1.2 Scope

This procedure applies to the Deactivation & Remediation Contractor personnel and subcontractors that obtain required water level measurement information at the U.S. Department of Energy – owned Paducah Site.

2.0 REFERENCES

2.1 Use References

- CP2-HS-2000, *Worker Safety and Health Program*
- CP2-SM-1000, *Activity Level Work Planning and Control Program*
- CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*
- CP4-ES-2700, *Logbooks and Data Forms*
- CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*
- Job Hazard Analysis (JHA)-10903
- Transducer operating manual provided by manufacturer

2.2 Source References

None

3.0 COMMITMENTS

None

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

4.1.1 The sampling team performing the task of water level measurement shall comply with the requirements of the CP2-HS-2000, *Worker Safety and Health Program,* and any JHA(s) that address safety and health.

4.1.2 The sampling team shall also comply with additional requirements as described in the JHA, if applicable; and the radiological work permit (RWP) if required, required training, personal protective equipment (PPE) requirements, and hazard controls, etc.

4.2 Limitations

4.2.1 JHA-10903, *Well Sampling*, RWP, and task specific WP, as applicable, should be referred to for detailed limitations and other requirements associated with the work environment.

4.2.2 Ensure that a minimum of two people are always present and within visual range of each other at all times during any sampling activity.

4.2.3 Comply with all posted requirements pertaining to any given sampling location, if applicable.

5.0 PREREQUISITES

Sampler Chg A

5.1 Perform planning and coordination of work activities in accordance with CP2-SM-1000, *Activity Level Work Planning and Control Program.*

5.2 Notify RADCON personnel before initiating work to determine required surveys and monitoring requirements for RWP. Prior to beginning work, read **and** sign off on the RWP, if required, **and** review task-specific JHA.

NOTE:
The items listed may be used as a guide, but may **NOT** be a complete list.

5.3 Refer to the task-specific JHA(s) and WP, and the RWP (if one is required) to determine what instruments, supplies, materials, and equipment are needed to safely execute the activities comprising the water level measurement event.

- Sample data forms generated from Project Environmental Measurements System (PEMS) database
- Electronic water level indicator or oil/water interface probe, as required
- Pressure transducer and data logger or self-contained data logger and pressure or level sensor (for example, miniTROLL® or equivalent)
- PPE and safety equipment as specified by the task-specific RWP (if required) and JHA
- Traffic control vests, cones and signs
- Plastic sheeting
- Clamps or cable ties, as appropriate, to secure cable to well casing
- Duct tape
- Ruler and tape measure
- Utility knife
- Black indelible ink pens

NOTE:

Water level measurement instruments and equipment will be decontaminated and ready for use and shall be protected from sources of contamination (for example, wrapped in aluminum foil, sealed in plastic or other storage containers, placed on plastic sheeting in staging area) during transport to the location and during field activities.

5.4 Assemble the necessary equipment, tools, and supplies to ensure that sufficient material and equipment are available for the field activity so as **NOT** to interrupt the water level measurement task.

5.5 Verify that equipment has current calibration records.

5.6 Ensure water level instruments and equipment is decontaminated and ready for use according to CP4-ES-2702, Decontamination of Sampling Equipment and Devices.

6.0 INSTRUCTIONS

6.1 General Requirements

Sampler

6.1.1 Review the task specific WP for reference to any photos, maps and figures that indicate or show proposed water level measurement well locations, methods to be used, and required notifications and permits needed prior to starting water level measurement event.

6.1.2 Record the location where water level measurements will be taken on the appropriate PEMS generated data form.

NOTE:

Use caution to prevent equipment from contacting potentially contaminated surfaces. Plastic sheeting may be used to stage equipment and materials around the open borehole, well, or piezometer to protect equipment from cross contamination.

6.1.3 **If** field decontamination is required by the task specific WP, **then** set up temporary decontamination area(s).

NOTE:

Water level recovery may take longer in wells completed in tight, low permeability units.

6.1.4 Allow a minimum of 24 hours after piezometer, well or open borehole construction, sampling, or development or redevelopment for water level stabilization before measurements are taken.

6.1.5 Repeat measurements periodically to determine whether a static water level has been achieved.

6.1.6 Measure floating product if known to be present or encountered, using an oil/water contact sensor probe.

6.1.7 Record on appropriate PEMS generated data form, factors that may affect water level measurements (for example, active recharge due to a precipitation event, saturated zone being stressed due to nearby pumping, drastic atmospheric pressure changes, etc.).

Supervisor and Sampler

6.1.8 Prior to any deviations from the requirements specified in the approved, task specific WP or this procedure, authorize **and** revise requirements in accordance with CP2-SM-1000.

6.1.9 Additionally, document any deviations or difficulties encountered in the field concerning sample collection or related activities on the sample data form or during data assessment.

6.2 Electronic Water Level Indicator

Sampler

6.2.1 Check to ensure that batteries are new or fully charged on electronic water-level indicator and alarm prior to mobilizing to the field.

6.2.2 Ensure that the electronic water-level indicator is decontaminated prior to use.

6.2.3 Check cable for damage. Do **NOT** use if damage is discovered during inspection.

6.2.4 Check the accuracy of the decontaminated water-level indicator periodically against a surveyor's tape or other measurement device to verify marks on the cable.

6.2.5 Record field information in the appropriate logbook in accordance with CP4-ES-2700, *Logbooks and Data Forms* and document measurement on appropriate PEMS generated data form.

6.3 Pressure Transducer and Data Logger (Separate or Self-Contained)

Sampler

CAUTION:

Over pressuring by submersing to a depth outside that range, or by hitting the water surface too fast as the transducer is lowered into the well, may damage the transducer. Pressure transducers shall not be submerged beyond their rated depth or lowered at too rapid of a rate.

NOTE:

Most pressure transducers are pre-calibrated by the manufacturer. Pressure transducers are manufactured to measure pressure over a specific range of submergence. Measurements will **NOT** be accurate outside the manufacturer's specified range.

It is recommended that the manufacturer's specifications be consulted concerning maintenance and chemical compatibility of the pressure transducer to be used to ensure compatibility with expected contaminants. Expected contaminants and concentrations of those contaminants may be found in the task specific WP.

6.3.1 Check to ensure that batteries are new or fully charged prior to field mobilization.

6.3.2 Ensure that the cable and transducer or self-contained data logger and pressure or level sensor are decontaminated prior to use.

6.3.3 Check cable for damage. Do **NOT** use if damage is discovered during inspection.

6.3.4 Review the manufacturer's operating manuals and installation instructions to ensure proper operation of the electronic data logger and pressure transducer or self-contained data logger and pressure or level sensor.

6.3.5 Use the procedure(s) in the manufacturer's operating manual to set the transducer's depth, reference elevation, scale factor, and test number.

6.3.6 Record field information in the appropriate logbook in accordance with CP4-ES-2700 and document measurement on appropriate PEMS generated data form.

6.4 Manual Water Level Measurement

Sampler

NOTE:

Cascading water within a borehole can cause false readings with some types of water level measurement devices.

All water level measurements will be made to the nearest 0.01 foot, and recorded on the appropriate PEMS generated data form.

6.4.1 Use an electronic water level indicator to manually measure water level.

NOTE:

Use extreme caution when unlocking and opening wells that are known or suspected (check task specific WP) to be under pressure or to contain insect nests. Special methods may be required to open those wells.

6.4.2 Record well (such as, open borehole, well, or piezometer) identification number, date, time, and other pertinent information, as applicable, on the appropriate PEMS generated form.

6.4.3 Prior to water level measurement, inspect the surface condition of the wellhead, pad, and guard posts (if present) **and** record conditions on the appropriate PEMS generated data form.

6.4.4 Check the calibration of the electronic water level indicator.

NOTE:

Generally the reference point is a permanent marker mark or a "V" notch filed into the inner well casing and is located on the north side of the inner casing.

6.4.5 Locate the reference point (measurement point) at the top of the inner well casing.

6.4.6 Record the location of the reference point used on the appropriate PEMS generated data form.

6.4.7 Record all readings from the top of the inner well casing from the reference point.

6.4.8 **If** a reference point is **NOT** present, **then** establish a reference by filing a "V" notch on the north side of the well casing with a file or suitable marking instrument, being careful that cuttings do **NOT** fall into the well.

6.4.9 Notify the Environmental Monitoring Manager and Supervisor (or designee) **and** note actions taken on the appropriate PEMS generated data form.

NOTE:

Historic water level measurements from the same well or piezometer, if available, should be checked to preclude measurement error and recognize changing water level conditions.

6.4.10 Slowly lower the electronic water-level-indicator probe (or oil or water interface probe, as applicable) into the open borehole, well or piezometer, making sure that the cord or the probe does **NOT** scrape the sides of the well casing or borehole wall.

6.4.11 **When** the alarm sounds **and/or** the red light illuminates, stop lowering the probe.

6.4.12 Pull up the probe until alarm no longer sounds.

6.4.13 Lower probe again slowly. Stop at the instant the alarm sounds and/or the light illuminates and remains illuminated.

6.4.14 Hold the cord to the side of casing where reference point is etched or permanently marked.

6.4.15 Mark cord with thumb where it touches reference point.

6.4.16 Use a measuring device to determine distance from last marked increment on the cable to the thumb marked point on the cable, **or** read the depth directly from the imprinted cable.

6.4.17 Record field information in the appropriate logbook in accordance with CP4-ES-2700 **and** record measurement to within 0.01 foot as depth to water on the appropriate PEMS generated data form.

NOTE:

Measurements should remain constant.

6.4.18 Repeat Step **6.4.10** through Step **6.4.17**, two times to check for accuracy.

NOTE:

Sounding the well to determine the total depth may be required by the task specific WP. Always determine the depth to water before sounding the well.

6.4.19 **If** sounding the well is required, **then** determine the total depth by lowering a weighted measuring tape or a water-level indicator probe to the bottom of the well.

6.4.20 **If** a measuring tape with a weighted end is used for sounding a well, **then** ensure that the weight is stainless steel or an inert material.

6.4.21 Reel electronic water-level indicator in from well **and** decontaminate as specified in the task specific WP or in CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*.

6.4.22 Restore area around the open borehole, well or piezometer by removing all materials and equipment used to measure water level.

6.4.23 Close **and** lock the well cap.

6.5 Pressure Transducer and Data Logger or Self-Contained Data Logger and Pressure/Level Sensor Sampler

6.5.1 Use a pressure transducer, data logger (or self-contained data logger), and pressure or level sensor to measure water level continuously.

6.5.2 Record well (such as, open borehole, well, or piezometer) identification number, date, time, and other pertinent information, as applicable, on appropriate sample data form.

6.5.3 Prior to placing pressure transducer or self-contained data logger and pressure or level sensor, inspect the surface condition of the wellhead, pad and guard posts (if present) **and** record conditions on the appropriate PEMS generated data form.

6.5.4 Check the calibration of the Pressure Transducer or Data Logger.

6.5.5 Record the transducer or self-contained data logger and pressure or level sensor serial number on appropriate sample data form.

NOTE:

Use extreme caution when unlocking and opening wells that are known or suspected (check task specific WP) to be under pressure or to contain insect nests. Special methods may be required to open those wells.

6.5.6 Take an initial manual water-level measurement from the well to be monitored by using a water-level sounder using the steps outlined in Section **6.4**.

6.5.7 Cover sharp edges of the well casing with duct tape to protect the cables.

NOTE:

Transducer self-contained data logger must be installed at the appropriate depth in the well so the water level occurs within the measurement range of the transducer.

Rapid water- level fluctuations may be missed if they occur between the programmed water-level measurement times.

6.5.8 Slowly lower the unit **and** secure at the desired depth following manufacturer's instructions.

6.5.9 **If** separate transducer and data logger are used, **then** first secure the cable in place. Attach the service grip (or Kellum's grip) to the well casing using a clamp, locking clip and installation ring, or cable tie to prevent slippage of the cable into the well.

6.5.10 Attach cable to logger before commencing the test.

6.5.11 Begin continuous water-level measuring task by referring to task specific WPfor direction on data needs **and** follow manufacture's instruction(s) to set up instruments for collecting that data.

NOTE:

Be sure to save data, using manufacturer's instruction(s), before shutting down and leaving the well location.

6.5.12 Retrieve data following the manufacturer's instruction(s).

6.5.13 Record field information in the appropriate logbook in accordance with CP4-ES-2700 and document data on appropriate PEMS generated data form.

6.5.14 Restore area around the open borehole, well, or piezometer by removing all materials and equipment used to measure continuous water-level measurements.

6.5.15 Close **and** lock the well camp.

7.0 ACCEPTANCE CRITERIA

None

8.0 POST PERFORMANCE WORK ACTIVITIES

Sampler

8.1.1 Decontaminate any non-disposable water level measure equipment, tools, or supplies in accordance with CP4-ES-2702. Contact the transportation specialist prior to transporting radiologically contaminated equipment, tools or supplies.

8.1.2 Collect **and** label any waste generated by the decontamination process.

8.1.3 Dispose of non-fissile waste or material generated during this work activity according to CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*.

8.1.4 Prior to transporting waste, contact the transportation specialist.

9.0 RECORDS

9.1 Records Generated

The following records may be generated by this procedure:

- Annual Water Level Data Form
- Quarterly Water Level Data Form

9.2 Records Disposition

The records are to be maintained in accordance with CP3-RD-0010, *Records Management Process*.

Appendix A – Acronyms/Definitions

ACRONYMS

JHA – Job Hazard Analysis

PEMS – Project Environmental Measurements System

PPE – Personal Protective Equipment

RADCON- Radiological Control

RWP – radiological work permit

SAP – Sampling and Analysis Plan

WP – work package

DEFINITIONS

Electronic Data Logger – An electronic device that can be programmed to receive electrical impulses, which are stored as data. Pressure transducers are designed to be used with automatic data-logging instruments and send a current to the data logger. The current is proportional to the pressure and can be converted to meaningful units by the data logger.

Pressure Transducer - An electronic probe connected to a wire cable that is lowered into the water column of a well to measure pressure. The pressure measured is the total pressure, which includes both the hydrostatic pressure of the fluid column above the transducer and the atmospheric pressure at the fluid surface. Changes in head are proportional to changes in the height of the water column or water-level.