



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

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### MANUAL WATER LEVEL MEASUREMENTS

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SUPERCEDES: SOP #2043; Revision 0.0; 10/03/94; U.S. EPA Contract 68-C4-0022.



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#### 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water and separate phase chemical product (i.e., gasoline, oil, PCE, TCE) in an open borehole, cased borehole, monitor well, or piezometer. These standard operating procedures may be varied or changed as required, dependent on site conditions, and equipment limitations. In all instances, the actual procedures employed will be documented and described in an appropriate site report. Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

Generally, water-level measurements taken in boreholes, piezometers, or monitor wells are used to construct water table or potentiometric surface maps and to determine flow direction as well as other aquifer characteristics. Therefore, all water level measurements at a given site should preferably be collected within a 24 hour period. However, certain situations may produce rapidly changing groundwater levels that necessitate taking measurements as close in time as possible. Large changes in water levels among wells may be indicative of such a condition. Rapid groundwater level changes may occur due to:

- ! Atmospheric pressure changes
- ! Tidal influences
- ! Changes in river stage, impoundments levels, or flow in unlined ditches
- ! Pumping of nearby wells
- ! Precipitation

#### 2.0 METHOD SUMMARY

A survey mark should be placed on the top of the riser pipe or casing as a reference point for groundwater level measurements. If the lip of the riser pipe is not flat, the reference point may be located on the grout apron or the top of the outer protective casing (if present). The measurement reference point should be documented in the site logbook and on the groundwater level data form (Appendix A), if used. All field personnel must be made aware of the measurement reference point being used in order to ensure the collection of comparable data.

Before measurements are made, water levels in piezometers and monitor wells should be allowed to stabilize for a minimum of 24 hours after well construction and development. In low yield situations, recovery of water levels to equilibrium may take longer. All measurements should be made to an accuracy of 0.01 feet. Water level measuring equipment must be decontaminated and, in general, measurements should proceed from the least to the most contaminated wells.



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Open the well and monitor the headspace with the appropriate air monitoring instrument to determine the presence of volatile organic compounds. For electrical sounders lower the device into the well until the water surface is reached as indicated by a tone or meter deflection. Record the distance from the water surface to the reference point. Measurement with a chalked tape will necessitate lowering the tape below the water level and holding a convenient foot marker at the reference point. Record both the water level as indicated on the chalked tape section and the depth mark held at the reference point. The depth to water is the difference between the two readings. Remove measuring device, replace riser pipe cap, and decontaminate equipment as necessary. Note that if a separate phase is present, an oil/water indicator probe is required for measurement of product thickness and water level.

#### 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This section is not applicable to this standard operating procedure (SOP).

#### 4.0 POTENTIAL PROBLEMS

1. Cascading water, particularly in open-hole or rock wells, may interfere with the measurement.
2. Some older types of electric sounders are only marked at five-foot intervals. A surveyor's tape is necessary to extrapolate between the 5-foot marks.
3. Oil or other product floating on the water column can insulate the contacts of the probe on an electric sounder and give false readings. For accurate level measurements in wells containing floating product, a special oil/water level indicator is required.
4. Tapes (electrical or surveyor's) may have damaged or missing sections, or may be spliced inaccurately.
5. An airline may be the only available means to make measurements in sealed production wells but the method is generally accurate only to approximately 0.2 foot.
6. When using a steel tape, it is necessary to lower the tape below the water level in order to make a measurement. This assumes knowledge of the approximate groundwater level.

#### 5.0 EQUIPMENT

The electric water level indicator and the chalked steel tape are the devices commonly used to measure water levels. Both have an accuracy of 0.01 feet. Other field equipment may include:

- Air monitoring instrumentation



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- Well depth measurement device
- Chalk
- Ruler
- Site logbook
- Paper towels and trash bags
- Decontamination supplies as outlined in Section 7.2 or the current approved site specific work plan
- Groundwater level data forms

#### 6.0 REAGENTS

No chemical reagents are used in this procedure; however, decontamination solutions may be necessary. If decontamination of equipment is required, refer to ERT/REAC SOP #2006 Rev 0.0 08/11/94, *Sampling Equipment Decontamination*, and the current approved site specific work plan.

#### 7.0 PROCEDURES

##### 7.1 Preparation

1. Determine the number of measurements needed, the methods to be employed, and the equipment and supplies needed.
2. Decontaminate or pre-clean equipment, and ensure that it is in working order.
3. Coordinate schedule with staff, clients, and regulatory agency, if appropriate.
4. If this is an initial visit, perform a general site survey prior to site entry in accordance with the current approved site specific Health and Safety Plan.
5. Identify sampling locations.



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#### 7.2 Procedures

Procedures for determining water levels are as follows:

1. If possible, and when applicable, start at those wells that are least contaminated and proceed to those wells that are most contaminated.
2. Clean all the equipment entering the well(s) by the following decontamination procedure:
  - Triple rinse equipment with deionized water.
  - Wash equipment with an Alconox solution which is followed by a deionized water rinse.
  - Rinse with an approved solvent (e.g., methanol, isopropyl alcohol, acetone) as per the work plan, if organic contamination is suspected.
  - Place equipment on clean surface such as a teflon or polyethylene sheet to air dry.
3. Remove locking well cap, note well ID, time of day, and date in site logbook or an appropriate groundwater level data form.
4. Remove well cap.
5. If required by site-specific condition, monitor headspace of well with a photoionization detector (PID) or flame ionization detector (FID) to determine presence of volatile organic compounds, and record results in site logbook.
7. Lower water-level measuring device into the well. Electrical tapes are lowered to the water surface whereas chalked steel tapes are lowered generally a foot or more below the water surface. Steel tapes are generally chalked so that a 1- to 5-foot long section will fall below the expected water level.
8. For electrical tapes record the distance from the water surface, as determined by the audio signal or meter, to the reference measuring point and record in the site logbook. For chalked tapes, an even foot mark is held at the reference point, once the chalked section of the tape is below the water level. Both the water level on the tape and the foot mark held at the reference point is recorded. The depth to the water is then the difference between the two readings. In addition, note the reference point used (top of the outer casing, top of the riser pipe, ground surface, or some other reproducible position



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on the well head). Repeat the measurement.

9. Remove all downhole equipment, replace well cap and locking steel caps.
10. Rinse all downhole equipment and store for transport to the next well. Decontaminate all equipment as outlined in Step 2 above.
11. Note any physical changes, such as erosion or cracks in protective concrete pad or variation in total depth of well, in field logbook or on groundwater level data form.

#### 8.0 CALCULATIONS

To determine groundwater elevation above mean sea level, use the following equation:

$$E_w = E - D$$

where:

$E_w$  = Elevation of water above mean sea level (feet) or local datum  
 $E$  = Elevation above sea level or local datum at point of measurement (feet)  
 $D$  = Depth to water (feet)

#### 9.0 QUALITY ASSURANCE/QUALITY CONTROL

The following general quality assurance/quality control (QA/QC) procedures apply:

1. All data must be documented on field data sheets, groundwater level data forms, or within personal or site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan.
3. Each well should be tested at least twice in order to compare results. If results do not agree to within 0.02 feet, a third measurement should be taken and the readings averaged. Consistent failure of consecutive readings to agree suggests that levels are changing because of one or more conditions as indicated in Section 1.

#### 10.0 DATA VALIDATION

This section is not applicable to this SOP.



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#### 11.0 HEALTH AND SAFETY

The results of monitoring the well head and breathing zone with a FID or PID, as per section 7.2, may indicate the need to upgrade the personal protection level according to the current approved site Health and Safety Plan.

#### 12.0 REFERENCES

Driscoll, F.G. 1986. Groundwater and Wells. Second Edition. Chapter 16. *Collection and Analysis of Pumping Test Data*. pp 534-579. Johnson Filtration Systems Inc. St. Paul, Minnesota.

U.S. Environmental Protection Agency, 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document, pp. 207.

U.S. Environmental Protection Agency, 1987, A Compendium of Superfund Field Operations Methods. EPA/540/p-87/001 Office of Emergency and Remedial Response Washington, D.C. 20460.



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APPENDIX A  
Groundwater Level Data Form  
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FORM 1. Groundwater Level Data Form

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SITE NAME: \_\_\_\_\_

LOGGER NAME: \_\_\_\_\_

LOG DATE: \_\_\_\_\_

WBS #: RIA

Well I.D.	Time	Elevation of well <sup>(1)</sup> (T.O.C.)	Depth to bottom of well (ft)	Depth to water (ft)	Depth to product (ft)	COMMENTS (pH, temperature, specific conductance)

TOC: top of casing (1) feet above mean sea level

MEASUREMENT REFERENCE POINT FROM \_\_ GROUND SURFACE OR \_\_ TOP OF CASING

Weather Conditions: Temperature(°C): \_\_\_\_\_ Rain: Heavy Medium Light (Circle one)

Other significant observations: