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EG&G - ROCKY FLATS PLANT
ENVIRONMENTAL MANAGEMENT

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ROCKY FLATS PLANT
EMD OPERATING
PROCEDURES MANUAL

Manual No.: 5-21000-OPS-GW
Procedure No.: Table of Contents, Rev 2
Page: 1 of 1
Effective Date: 05/12/92
Organization: Environmental Management

THIS IS ONE VOLUME OF A SIX VOLUME SET WHICH INCLUDES:

- VOLUME I: FIELD OPERATIONS (FO)
- VOLUME II: GROUNDWATER (GW)
- VOLUME III: GEOTECHNICAL (GT)
- VOLUME IV: SURFACE WATER (SW)
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ADMIN RECORD

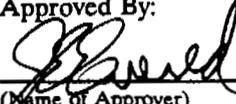
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By [Signature]
Date Feb 19, 1992

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TITLE:
 WATER LEVEL MEASUREMENTS
 IN WELLS AND PIEZOMETERS

Approved By:

 (Name of Approver)

MAY 12 1992
 (Date)

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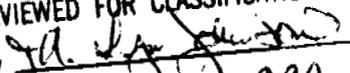
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2.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) describes procedures that will be used at Rocky Flats to measure water levels in wells and piezometers at the Rocky Flats Plant (RFP). Water level data can be obtained from wells, piezometers, or from surface water manifestations of the groundwater systems such as springs, lakes, and streams.

Groundwater level measurements will be recorded to the nearest 0.01 foot and the accuracy of repeated measurements will be within 0.05 foot. Each well will have a permanent, easily identified measuring point (MP) from which the water level measurement is taken. For the purpose of this SOP, the MP is defined as the surveyed point notched on the inner polyvinyl chloride (PVC) casing from which water levels will be measured.

This procedure describes various acceptable methods for measuring water levels in wells and piezometers which will meet regulatory guidelines of accuracy. This procedure is intended to be sufficiently detailed so that conformance will result in reliable data which are collected in a consistent manner.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

All personnel performing these procedures are required to have 40-hour OSHA classroom training which meets the Department of Labor requirements 29 CFR 1910.120(e)(3)(i). Personnel are also required to have a complete understanding of the procedures described within this SOP and receive specific training regarding these procedures, as required. For example, personnel who do not have prior experience in the use and calibration of electric sounders will be given oral instructions and field demonstrations on the use of this equipment.

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Only qualified personnel will be allowed to perform these procedures. Required qualifications vary depending on the activity to be performed. The subcontractor's project manager will document personnel qualifications related to this procedure in the subcontractor's project QA files.

4.0 REFERENCES

4.1 SOURCE REFERENCES

The following is a list of references reviewed prior to the writing of this procedure:

A Compendium of Superfund Field Operations Methods. EPA/540/P-87/001. December 1987.

Freeze, R. Allen and John A. Cherry. Groundwater. Prentice-Hall, Inc. Englewood Cliffs, N.J. 1979.

Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. October, 1988.

National Handbook of Recommended Methods for Water-data Acquisition. Department of the Interior. 1977.

RCRA Facility Investigation Guidance. Interim Final. May 1989.

RCRA Groundwater Monitoring Technical Enforcement Guidance Document. OSWER-9950.1, September, 1986.

The Environmental Survey Manual. DOE/EH-0053. Volumes 1-4. August 1987.

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4.2 INTERNAL REFERENCES

Related SOPs cross-referenced by this SOP are as follows:

- SOP FO.3, General Equipment Decontamination
- SOP GW.6, Groundwater Sampling

5.0 METHODS

Field measurements typically include depth to standing water and the total depth of the well. Water level measurements will be recorded to the nearest 0.01 foot as specified by the RCRA Guidance Document. The method will also be adequate to attain an accuracy of 0.05 foot. In addition, the following conditions must be considered in order to obtain acceptably accurate groundwater level measurements:

- A survey mark will be placed on the inner PVC well casing for use as a permanent measuring point (MP). This will be done by notching the inner well casing with a file.
- Water levels in piezometers will be allowed to stabilize for a minimum of 24 hours after well construction and development, prior to measurement. Water levels require varying time periods to reach static conditions in new wells; therefore, the date and time of construction will be noted along with the initial water level measurement, and the date and time of the initial water level measurement.
- Water level in existing wells should be measured prior to purging and sampling activities.

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- At the RFP multiple sampling events of the same well may occasionally occur over only a few days. If some of these wells are slow recharge wells, water levels may not be representative of static conditions. In order to prevent a misinterpretation of static water levels due to this scenario, the date of the last sampling or well purging event will be documented in the water level measurement database.
- Static water levels will be measured with electric sounders. If non-aqueous phase liquids are potentially present, an interface probe will be used.

5.1 SURVEYING THE MEASURING POINT

Each well must have a permanent, easily identified notched MP on the north side of the inner PVC casing from which the depth to water is consistently measured. The MP should be established by a licensed surveyor and typically is located and marked at the top of the inner well casing. The MP should be established in relation to an established benchmark such as those provided by the U.S. Geological Survey and/or a National Geodetic Vertical Datum (NGVD). The survey will also note the well location coordinates and the coordinates of any temporary benchmark.

For consistency, water level measurements must be referenced to the same datum or elevation. The MP is surveyed with reference to land surface datum (LSD) and must be used each time water levels are taken in a well. The MP is used so that water levels can be converted to water level elevations, expressed in mean sea level (MSL) elevation.

The MP must be as permanent as possible, clearly defined, marked, and easily located. If at all possible, position the point so that a leveling rod can be set on it directly over the well and the measuring tape can hang freely when it is in contact with the MP.

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A reference point (RP) for water level measurements is an additional datum elevation established from a permanent benchmark and surveyed by a licensed surveyor. The RP is usually located on the top of the outer steel casing and is used as a backup to the MP. If a MP is disturbed or destroyed the RP will be used to establish a new MP.

5.2 DETERMINATION OF IMMISCIBLE LAYERS

Currently, no known historical evidence exists to indicate that immiscible layers (i.e., dense or light non-aqueous phase liquids) are present in the RFP groundwater. Observations of the tops and bottoms of the water columns in wells have not shown the presence of non-aqueous immiscible phases. However, because the potential may exist for the presence of immiscible organic compounds at some locations, procedures have been established to detect the presence of these compounds and to sample them, if present. The first step in this process is the determination of a positive response using the organic vapor analyzer in the well head, and then the determination of the presence and thickness of any light/dense non-aqueous liquids by use of an interface probe.

In the areas where a potential may exist for non-aqueous phase organic liquids, this procedure will be implemented along with the measurement of static water elevations in each well prior to each sampling event.

5.2.1 Use of Interface Probe to Detect Immiscible Layers and Measure Static Water Levels

Follow the manufacturer's instructions for utilization of the interface probe. As with other water level measurements, the probe will be sufficiently precise to measure water levels to the nearest 0.01 foot and the accuracy of repeated measurements must agree within 0.05 foot. When lowering the probe, care will be taken to minimize rubbing of the tape against the well casing.

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Typically, the interface probe will have differing sound tones or patterns to distinguish between aqueous and non-aqueous organic layers. When measuring the depth to aqueous or non-aqueous phases, results will be recorded to the nearest 0.01 foot. Results will be measured from the appropriate MP on the inner well casing.

Due to the difficulty in decontamination of the interface probe after passing through a non-aqueous organic phase, the interface probe will not be used to measure total depth to the bottom of the well when light non-aqueous phase liquids (LNAPLs) are present. Instead, a steel tape will be utilized. The procedure for use of the steel tape is given in Section 5.3.2.

Wells containing LNAPLs will be checked for the presence of dense non-aqueous phase liquids (DNAPLs) by lowering the purge pump to the bottom of the well and collecting the first purge water from the bottom of the well in a 1-liter glass container. The container will be initially checked with an organic vapor analyzer (OVA) for the compared background readings. The liquid in the glass container will be allowed to stand for 15 minutes and visually observed for the presence of separate phases. If no DNAPLs have separated out of the solution after 15 minutes, the well will be presumed free of DNAPLs.

The interface probe will be moved up and down to locate the point where the appropriate indicator tone or sound is reproducibly obtained. Measurements from three consecutive readings must not differ more than ± 0.05 foot or three more consecutive readings must be taken. The three readings will be taken by two different individuals, with one person typically taking the first and third readings and another individual taking the second reading. An average of the reproducible readings will be utilized for the determination of the water level. Once the water level has been determined and recorded, the probe will be carefully retrieved, to ensure minimal rubbing of the tape against the inside well casing. The probe and cable will be decontaminated between use at each well following procedures given in Section 6.0 and SOP FO.3, General Equipment Decontamination.

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If either light or dense non-aqueous phase liquids are found to be present, the well will be sampled for these contaminants as described in SOP GW.6, Groundwater Sampling.

5.3 INSTRUMENTS AND ASSOCIATED WATER LEVEL MEASUREMENT TECHNIQUES

Water level measurement instruments are used to determine the water level in boreholes, wells, and other open underground structures. Generally, outside power sources are not required to operate these devices. However, many require that batteries be replaced or recharged periodically. Measurements may be made with a number of different devices and procedures.

Subsection 5.3.1 describes the use of electronic devices in water level measurement. Subsection 5.3.2 describes the use of the steel tape in measuring water levels. Electronic well sounding devices are preferred for use at the Rocky Flats Plant Site. Typically, steel tapes will only be utilized for measuring the depth to the bottom of well when LNAPLs are present. The use of the steel tape in wells containing LNAPLs will help ensure that the interface probe and other electronic water level measuring devices do not become grossly contaminated and will thus aid in the prevention of cross-contamination.

5.3.1 Electric Water Level Sounders

Typically, a solinst water level sounder will be utilized for measuring groundwater levels at the RFP. Before lowering the electric sounding probe into the well, the circuitry can be checked by dipping the probe in clean water and observing the indicator. Contact with the water surface will be indicated by an audible tone. The probe will be lowered slowly into the well until contact with the water surface is indicated. The electric tape is marked at the MP and partly withdrawn; the distance from the mark to the nearest tape band is measured and added to (or subtracted from) the band reading to obtain the depth to water. Three readings will be taken by two different individuals with one person typically taking the first and third readings and another individual taking the second

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reading. If the three measurements do not agree within 0.05 foot, continue to measure until the reason for the lack of agreement is determined or until three consecutive readings are shown to agree within 0.05 foot. An average of the reproducible readings will be utilized for the determination of the water level.

Electric sounders are recommended for measuring the depth to water in wells that are being pumped because they generally do not require removal from the well for each reading. However, if oil is present in the well, if water is cascading into the well, or if the water surface exhibits turbulent behavior, measuring water level with the electric sounder may be difficult. Oil not only insulates the contacts of the probe, but it will also give an erroneous reading if there is a considerable thickness of oil. As discussed previously, if an LNAPL is present a steel tape will be utilized for measuring the total depth to the bottom of the well.

When oil is present, it may be necessary to determine the thickness and density of the oil layer before calculating the true water level. Methods for determining the thickness of a floating immiscible layer, including oil, are discussed in Subsection 5.2.1.

5.3.2 Graduated Steel Tape

Graduated steel tapes will normally only be used for determination of the total well depth for wells containing LNAPLs. The graduated steel tape method is considered an accurate method for measuring the water level in nonflowing wells (National Handbook of Recommended Methods for Water-Data Acquisition, 1977, pp. 2-8). A slender weight will be attached to the end of the tape to create tautness and to permit some feel for obstructions. The bottom two or three feet of the tape is coated with carpenter's chalk. The tape will be lowered to the bottom of the well and the tape read from the MP on the inner well casing.

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Before and after each well measurement, that part of the tape measure, that becomes wetted will be decontaminated. Decontamination procedures are discussed in Section 6.0 of this SOP, Decontamination, and in SOP FO.3, General Equipment Decontamination.

6.0 DECONTAMINATION

Extraneous contaminant materials can be introduced into the water or soil at a site during water level measurements. Trace quantities of contaminant materials thus transported may later be captured in a sample and lead to false positive analytical results and, ultimately, to an incorrect assessment of the contaminant conditions associated with the site. Decontamination procedures for water level measurement equipment and for the personnel who use the equipment are performed for the dual purposes of minimizing cross-contamination and of providing a safe and healthy working environment.

Equipment should be constructed of stainless steel, Teflon™, or other inert materials that have been approved by EG&G. Equipment will be decontaminated after use at each well. Procedures for decontamination are set forth in the site-specific health and safety plan and SOP FO.3, General Equipment Decontamination.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The frequency of measurements depends on the objectives established in the Work Plan or the FSP for a given project and the accuracy desired in measuring changes in water level. The Work Plan or FSP outlines objectives for which water level data will be used, and the frequency of measurements will be guided by the accuracy of changes in water level needed to meet these objectives.

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All data will be recorded on a Water Level Measurement Form (Section 9.0) before leaving the well site.

The electronic sounders will be calibrated quarterly by following the manufacturer's instructions or by suspending the sounder and measuring it against a calibrated steel tape if no other calibration instructions are supplied. Results will be recorded on the Water Level Indicator Calibration form.

8.0 DOCUMENTATION

A permanent record of the implementation of this SOP will be kept by documenting field observations and data. Observations and data will be recorded with black waterproof ink onto a Groundwater Level Measurements/Calculations Form.

The following information should be recorded for each observation-well site:

- The RFP Project Number
- The date and time of the water level measurements
- The names of personnel performing the measurements
- The equipment manufacturer, model, and serial number
- The name of the QC reviewer and the date of the QC review

Individual measurements are entered onto the Groundwater Level Measurements/Calculations Form as the measurements are performed. The information is recorded as follows:

1. Record well number in the first column.
2. Measure and record the depth to water from the measuring point in the second column (WD). The measurement will be taken a total of three times by two

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different individuals, with one person typically taking the first and third readings and another individual taking the second reading. Measurements from the three readings must agree within 0.05 foot. If the three measurements do not agree within 0.05 foot continue to measure until the reason for the lack of agreement is determined or until three consecutive readings are shown to agree within 0.05 foot. An average of the reproducible readings will be utilized for the determination of the water level.

3. Measure the total depth of the well from the MP and record this value in column three (MTD). The measurement will be taken a total of three times by two different individuals, with one person typically taking the first and third readings and another individual taking the second reading. Measurements from the three readings must agree within 0.05 foot. If the three measurements do not agree within 0.05 foot continue to measure until the reason for the lack of agreement is determined or until three consecutive readings are shown to agree within 0.05 foot. An average of the reproducible readings will be utilized for the determination of the total depth.

4. In some devices the length of the probe end may not have been taken into consideration when marking the measuring tape. In this case the length of the probe end will need to be added to the measured total depth in order to determine the total depth of the well from the MP. Record the length of the probe end in column four (Probe end).

5. Determine the total depth of the well from the measuring point by adding the length of the probe end to the measured total depth from the MP and record this value in column four (TD).

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6. In the blank marked "Chk'd by," record the initials of the individual who checks the calculation done in Step 8.

7. In the "Comments" section, record weather conditions and comment such as significant features or activities near the well that could affect the water level. |

GROUNDWATER LEVELS
MEASUREMENTS/CALCULATIONS

ROCKY FLATS PROJECT

Revision 1.2

Project No. _____

Date _____

Personnel 1. _____

2. _____

EQUIPMENT: Manufacturer _____ Model _____ Serial No. _____

CALIBRATION: Date Passed _____ Date Due _____

QC REVIEW: Name _____ Date _____

Well No.					
	WD ^b	MTD ^c	Comments		
Measurement 1					
Measurement 2					
Measurement 3					
	Average WD	Average MTD	+ _____ = _____	Probe End ^d	TD ^e Chk'd by _____
Well No.					
	WD ^b	MTD ^c	Comments		
Measurement 1					
Measurement 2					
Measurement 3					
	Average WD	Average MTD	+ _____ = _____	Probe End ^d	TD ^e Chk'd by _____
Well No.					
	WD ^b	MTD ^c	Comments		
Measurement 1					
Measurement 2					
Measurement 3					
	Average WD	Average MTD	+ _____ = _____	Probe End ^d	TD ^e Chk'd by _____

Footnotes:

- A = TOWC = top of well casing
- b = WD = depth to water from MP
- c = MTD = measured total depth from MP
- d = Probe End = length beyond measuring point on probe
- e = TD = total depth of well from MP

Notes:

- All measurements are relative to Mark Point (MP) = north side of TOWC
- QC review by supervisor is a check of reasonableness
- Measurements 1 and 2 must be within .01 ft or a 3rd measurement must be taken