

ROCKY FLATS PLANT  
EMD OPERATING  
PROCEDURES MANUAL

Manual No.: 5-21000-OPS-GW  
Procedure No.: Table of Contents, Rev 2  
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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

A-SW-00107B

REVIEWED FOR CLASSIFICATION/UCM

By [Signature]

Date Jan 19, 1992

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**SLUG TESTS**

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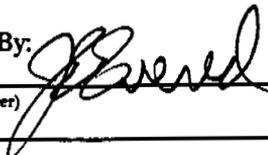
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**TITLE:  
SLUG TESTS**

Approved By:



**MAR 12 1992**

(Name of Approver)

(Date)

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By J. B. Reed

Date March 12, 1992

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### 2.0 PURPOSE AND SCOPE

The purpose of this standard operating procedure (SOP) is to provide the technical guidance and methods for performing slug tests on piezometers at the Rocky Flats Plant (RFP).

The procedures in the following section will be implemented for conducting the slug tests.

### 3.0 QUALIFICATIONS

Personnel performing slug test procedures will be geologists, hydrologists, hydrogeologists, engineers, or field technicians with an appropriate amount of applicable field experience or on-the-job training under supervision of a qualified person. All personnel performing this procedure are required to have 40-hour OSHP classroom training which meets Department of Labor regulation 29-CFR 1910.120 (e)(3)(i).

### 4.0 REFERENCES

#### 4.1 SOURCE REFERENCES

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

Cooper, H.H., Jr., J.D. Bredehoeft, and I.S. Papadopoulos, 1967, Response of a Finite Diameter Well to an Instantaneous Change of Water. Water Resources Research, 3(1).

Hazardous Waste Management Practice Site Investigation Baseline Procedures, Woodward-Clyde Consultants, August 1982.

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Hvorslev, M.J., 1951, Time Log and Soil Permeability in Groundwater Observations, Bulletin No. 36, Waterways Experiment Station, Corps of Engineers, Vicksburg, Miss.

### 4.2 INTERNAL REFERENCES

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

- SOP FO.3, General Equipment Decontamination
- SOP GW.1, Water Level Measurements in Wells and Piezometers

### 5.0 PROCEDURES FOR SLUG INJECTION/WITHDRAWAL TEST

A falling head slug test shall be performed by "instantaneously" introducing a solid slug below the water level into piezometers, or monitoring wells. Slug tests will not be performed simultaneously in adjacent piezometers (i.e., within 50 feet vertically or horizontally).

### 5.1 PRETEST DATA RECORDING

A Slug Test Data Form (Form GW.4A, see Section 6.0 - Documentation) will be completed prior to conducting each test. The following information will be obtained in the field or from existing well logs prior to performance of the slug test and will be recorded on the Slug Test Data Form.

- Casing diameter (check in field)
- Borehole diameter
- Location of surveyed measuring point
- Total casing depth (check in field)
- Static water level,  $H_0$  (prior to introducing slug) (measure in field)
- Screen depth and interval

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- Location of gravel pack
- Lithology of screened interval

For 4-inch diameter wells, a 5-foot-long, 3-inch diameter, stainless steel slug will be used to provide the "instantaneous" head change. For 2-inch diameter wells, a 5-foot-long, 1.5-inch diameter, stainless steel slug will be used.

### 5.2 FIELD PROCEDURES FOR SLUG INJECTION TEST

An excess head, large enough to provide meaningful data for slug test analysis, will be created in each piezometer or well tested during the slug injection test. Before use at each piezometer, all equipment and cables will be decontaminated according to SOP FO.3, General Equipment Decontamination.

The static water level will be measured in accordance with SOP GW.1, Water Level Measurements in Wells and Piezometers. The measuring point shall be the survey point where the surface elevation was measured, otherwise the point of reference will be the rim of the top of casing. Water levels will be recorded to the nearest 0.01 foot.

The total casing depth will be determined with a weighted measuring tape.

Water levels during the slug test will be measured with the Hermit Environmental Data Logger, Model SE1000B, or a similar measuring device. The operations manual for the measuring device will be available in the field for reference. Using the manufacturer's operation manual, the appropriate transducer probe will be selected for the piezometer or well to be tested.

The transducer probe will be set in the piezometer at the appropriate depth as determined by the sensitivity of the transducer, height of the water column in the well, and length of the slug to be

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introduced into the piezometer. The probe cable will be secured to the outside of the piezometer casing. Initially, the transducer probe pressure readout (reference level) will be set to zero while the probe is in the water. The depth to water on the data logger from static water level to transducer probe will be checked with the known depth of submergence to verify that the probe is working properly. The probe will then be referenced to appropriate datum. A pre-run checkout test will be performed by setting the data logger to the appropriate parameters (as outlined in the owner's manual), initiating recording of measurements on the data logger, and raising and lowering the transducer probe in the well to simulate water level changes. The measurements of the changing water levels will continue for 10 minutes. The data will then be reviewed to verify that equipment is operating properly.

After completion of the initial pre-run checkout, the solid slug will be lowered into the piezometer so that the bottom of the slug is approximately 2 to 3 feet above the initial static water level.

Immediately prior to introduction of the slug below the water level in the piezometer, water levels will be recorded with the data logger. The slug will then be quickly lowered so that it is positioned 1 to 2 feet below the static water level in the piezometer or well and above the transducer probe. If there is insufficient water in the piezometer or well to allow complete submergence of the slug, the slug will be immersed as fully as possible without disturbing the transducer probe. The transducer probe shall remain stationary during and after the process of lowering the solid slug. The test will continue until water levels return to 10 percent of their static water level or until 48 hours have elapsed.

The water level recording interval will be set to the logarithmic mode. The frequency of measurement will be approximately as follows:

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Elapsed Time(after lowering slug)	Log Sample Interval
0-2 sec.	0.2 sec.
2-20 sec.	1.0 sec.
20-120 sec.	5.0 sec.
2-10 min.	3.0 sec.
10-100 min.	2 min.
100-1000 min.	10 min.
1E3-1E4 min.	100 min.

The water level in the piezometer or well will be checked periodically with the water level indicator to verify that the data logger is functioning properly. The test completion time required will depend upon the hydraulic conductivity of the surrounding formation.

If a printer is available, all data generated by the pressure transducer and recorded by the data logger shall be printed out in the field. The printout of the slug test data shall be stapled to the corresponding Slug Test Data Form (Form GW.4A).

Slug tests performed in piezometers or wells that are expected to exhibit slow pressure falloff (as indicated by piezometer development records) will be measured with a water level indicator. Changes in water levels are expected to be slow enough that a sufficient number of water level measurements can be recorded manually using the water level indicator.

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### 5.3 SLUG TEST METHOD OF ANALYSIS

The slug test data will be analyzed using the appropriate analytical method. Methods will include Hvorslev (1951), or Cooper, Bredehoeft, and Papadopoulos (1967).

### 6.0 DOCUMENTATION

Information required by this SOP will be documented on the Slug Test Data Form (Form GW.4A). Borehole dimensions and other information required on this form can be found on applicable borehole log sheets.

Use of field logbooks to supplement the data form documentation is optional. Logbooks may be used to describe field conditions, instrument readings, and other event specific information.



