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Hydrogeology • Mineral Resources Waste Management • Geological Engineering • Mine Hydrology

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(Return to WM, 623-SS)

Mr. Jeff Pohle
Division of Waste Management
Mail Stop 623-SS
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: BWIP

Dear Jeff:

A copy of the review of the following document is enclosed.

1. Brown, W.R., and Jones, R.L., August 1985, Drilling and Completion Specifications for Wanapum (Type W) and Grande Ronde (Type GR) Multi-Level Piezometer Nest Boreholes. Rockwell-Hanford Operations, Richland, WA, SD-BWI-TC-026.

Please contact me if you have any questions concerning this review.

Sincerely,

Gerry Winter

Gerry V. Winter

GVW:sl

3603

WMGT DOCUMENT REVIEW SHEET

FILE #:

DOCUMENT #: SD-BWI-TC-026

DOCUMENT: Brown, W.R., and Jones, R.L., August 1985, Drilling and Completion Specifications for Wanapum (Type W) and Grande Ronde (Type GR) Multi-Level Piezometer Nest Boreholes. Rockwell-Hanford Operations, Richland, WA.

REVIEWER: Williams & Associates, Inc., Gerry Winter

DATE REVIEW COMPLETED: December 15, 1986

ABSTRACT OF REVIEW: APPROVED BY: Roy E. Williams

The document describes multi-level piezometer boreholes that are designed to monitor the Wanapum (Type W) and Grande Ronde (Type GR) basalts. The report contains specifications for drilling, piezometer design, and testing of the boreholes. The report describes the intervals selected for head monitoring and the schedules for drilling and piezometer installation. The report includes specific drilling and piezometer installation specifications for piezometers DC-23W and DC-23GR.

No major problems are evident in reviewing the subject document.

BRIEF SUMMARY OF DOCUMENT:

This document review describes the planned drilling and multiple piezometer completions in future tense. It is our understanding that these activities are nearing completion or have been completed recently. The report contains the specifications for drilling and completing two types of multi-level piezometer nests in fiscal years 1986 and 1987. The objectives of the Wanapum and Grande Ronde multi-level piezometer nests are

- To provide a baseline for hydraulic data outside the reference repository location (RRL).

- To determine horizontal gradients across the Hanford site.

- To evaluate currently available head data.

- To determine vertical head gradients across the Hanford site (p. 7).

The rationale of the piezometer design described in the report is based on the number of piezometer tubes that are placed in a single borehole. The piezometer nest design used previously for the Wanapum and Grande Ronde basalts (DC-19, -20 and -22) consisted of six piezometers in a single borehole. The six piezometers were completed in the Priest Rapids, Sentinel Gap, Ginkgo, Rocky Coulee, Cohassett, and the Umtanum basalt flow tops. The new design described in this report calls for a two-well configuration with three piezometers completed in the Wanapum basalt and four piezometers completed in the Grande Ronde basalt. The new design allows the installation of a seventh piezometer; this seventh piezometer monitors the Grande Ronde No. 5 flow top. The report states that this flow top has been identified as a "horizon of potential high transmissivity" (p. 9). The new design eliminates the added risk of installing seven piezometers in a single borehole. Disturbance of hydraulic heads in the RRL also are minimized.

The report describes the expected subsurface conditions with respect to geology and "hydrology." The report states that a small amount of dissolved gas (primarily methane) may be encountered during drilling in the lower Saddle Mountains basalt and throughout most of the Wanapum and Grande Ronde basalts. The report also states that fluid pressures beyond hydrostatic are not expected.

The Wanapum series piezometer nest will be completed in the Priest Rapids flow top, the Sentinel Gap flow top, and the Ginkgo flow top. The Grande Ronde piezometers will monitor the Rocky Coulee flow top, the Cohassett flow top, the Grande Ronde No. 5 flow top (two flow tops below the Cohassett flow top), and the Umtanum flow top (p. 11).

The Wanapum multi-level piezometer borehole will be drilled in stages. The cased entry hole will be installed by a cable tool drill to a depth of approximately 20 feet using 20-inch ID casing. A mud rotary rig will drill a 17.5-inch hole into the uppermost dense section of the Saddle Mountains basalt. A 13.375-inch OD casing will be installed and grouted in place. A 12.25-inch hole then will be mud rotary drilled into the uppermost dense section of the Wanapum basalt. Centralized 10.75-inch casing will be installed and grouted in place. A 9.875-inch hole will be drilled with water or aerated water to the total depth of the hole. Three 2.062-inch OD piezometer tubes will be installed in the borehole. Sand packs and high density cement seals will be used to isolate the piezometer tubes.

The Grande Ronde multi-level piezometer borehole (23GR) will be drilled to a depth of 20 feet with a cable tool rig. A 20-inch ID casing will be installed in this borehole. A mud rotary rig will be used to drill an 18.50-inch hole into the uppermost dense portion of the Saddle Mountains basalt; sixteen-inch casing will be installed and grouted in place. A 14.75-inch hole will be mud rotary drilled into the Grande Ronde basalt (uppermost dense section). A 10.75-inch centralized casing will be installed and grouted in place. Water or aerated water will be used to drill a 9.875-inch hole to the total depth. Four 2.062-inch OD piezometer tubes will be installed in the borehole using sand packs and high density cement seals installed with a tremie line.

The piezometer string will consist of a tailpipe, one or more screen sections, a seating nipple, a riser pipe to the ground surface, a graded filter pack, and a high density cement seal. The piezometer strings will be placed so that the screen sections will stand-off from the borehole wall and from the adjacent piezometer string(s).

The filter packs will be placed through a tremie line. The graded filter pack will consist of a thick sand pack which will be topped by a finer sand pack. The sand packs will be topped by a thin pea gravel. The fine sand pack on top of the sequence is used to retard downward migration of the high density cement slurry into the monitoring horizon sand pack. The thick sand pack will consist of number 4-8 silica sand; the fine sand pack will consist of number 10-20 silica sand.

The screened sections will consist of a continuous 40 slot wire wound screen jacket over a perforated pipe base. The screen jacket will be type 316-L stainless steel; the pipe base will be type 316-L stainless steel or grade J55 steel. The material will be selected based on the projected estimated program need of approximately ten years and the potential for bi-metallic corrosion. The screen section will be between 5 and 10 feet long.

An API, Class G cement will be used. A low water-to-cement ratio is planned (0.28 to 0.35). A dispersant will be used to reduce the viscosity of the cement slurry.

The boreholes will be developed after drilling. Each borehole will be developed by the use of water or aerated water drilling techniques. A water lubricated line shaft turbine pump will be used to pump from the composite intervals below the grouted casing prior to the installation of the piezometers. A dynamic fluid temperature survey will be run in conjunction with a spinner survey prior to terminating pumping. The surveys will be conducted to identify potential water producing zones. Preliminary groundwater samples will be collected and analyzed to provide an indication of downhole clean-up. The samples will be analyzed for total organic carbon (TOC), major cations and anions, turbidity, tritium, and electrical conductivity.

Each piezometer will be developed after placement in the borehole. The airlift method of pumping will be used to develop the piezometer prior to installing downhole pressure transducers. The piezometers will be airlift pumped for one to two days; less time will be used if the monitored horizons exhibit low hydraulic conductivity. The report states, "In horizons of low permeability, the tubing will be flushed with Hanford system water to cleanup the tubing" (p. 21).

Drilling information that will be collected includes drilling rates, fluid losses or gains, and "other drilling related parameters" (p. 24). Chip samples will be collected.

The borehole geophysical logs that will be run in the boreholes consist of full wave train acoustic (sonic), natural gamma, gamma gamma, neutron-epithermal-neutron, four-arm caliper, fluid temperature, resistivity, spontaneous potential, gyro survey, and borehole television.

Data that will be collected during borehole preparation, completion, and piezometer development include water levels, pumping data, and groundwater samples. The collection of such data during piezometer development will be used to help assess whether each borehole and subsequent piezometers have been cleaned adequately. The data also will provide confirmatory evidence of piezometer operations.

<u>SIGNIFICANCE TO NRC WASTE MANAGEMENT PROGRAM</u>:

This document is important to the Waste Management Program because it describes a modification to the original design of the multi-piezometers completed at the BWIP site. The new design uses two boreholes for seven piezometer completions. The previous design consisted of a single borehole with six piezometer completions. The new design should be more reliable with respect to installation procedures. The new design also provides an additional piezometer for monitoring an additional flow top. This piezometer will be located within the Grande Ronde No. 5 flow top which is suspected of being a high transmissivity unit. The report is important because it describes the procedures that will be used to collect additional hydraulic head data at the BWIP site.

PROBLEMS, DEFICIENCIES OR LIMITATIONS OF REPORT:

No major problems are apparent from our review of the document. A minor problem may occur based on the description of the piezometer tubing cleanup operations described on page 21. The report states that "In horizons of low permeability, the tubing will be flushed with Hanford system water to cleanup the tubing." This description implies that piezometers completed in horizons of high to moderate permeability will not be flushed with Hanford system water. This change could lead to a problem in interpreting the hydraulic head data that will be derived from these piezometers. A consistent approach should be used in that the fluid within the piezometers should have the same density water based on total dissolved solids (TDS) content. The approach described in the report will not result in the piezometer tubes being filled with water of equal density. This deficiency may be accommodated by obtaining detailed measurements of the fluid densities within each piezometer. This density measurement would facilitate the conversion of the hydraulic head data to that reflecting a standard density.