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MEMORANDUM FOR: Michael J. Bell, Chief
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FROM: Malcolm R. Knapp
High-Level Waste Licensing
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Tilak R. Verma
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SUBJECT: REPORT ON TRIP TO HANFORD FOR MEETING ON HYDROLOGIC
MODELING OF THE PASCO BASIN

Summary:

A modeling task force meeting was held on 27-28 September at Richland Washington with attendees from the USGS, PNL, RHO, and LBL. James Mercer, Tilak Verma and Malcolm Knapp attended as observers from the NRC. A complete list of attendees constitutes Attachment 1.

RHO appears to have been responsive to the concerns about modeling the groundwater flow in Pasco Basin which were raised in the Lehman-Quinn report comparing modeling studies by RHO and PNL, and to recognize that their present models are preliminary in nature. ✓

During the meeting seven major modeling issues were identified which are:

1. Viability of the assumption that the hydrologic system is at steady state.

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2. Viability of head data obtained during drilling.
3. Viability of the assumption that water in the lower Grande Ronde moves from Pasco Basin into Yakima Valley and Horse Heaven Hills.
4. Viability of lateral hydraulic conductivity values.
5. Utilization of ground-water quality data to interpret the ground-water flow system.
6. What are the numerical values of and what are the spatial variations in the vertical permeability?
7. What are the significant hydrologic boundaries for the RRL site?

The above issues were discussed in a cooperative manner, and led to tentative plans for the task force for FY 83 which include the development of a computer model of the Pasco Basin which all members of the task force can support and which will include areas to the south and west of the Pasco Basin, as shown in Attachment 2.

A four page trip report by James Mercer constitutes Attachment 3. Copies of handouts and viewgraphs distributed during the meeting are available from Verma or Knapp.

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Enclosures:
 As stated

"Pre-Decisional ~~in Nature~~" ^{11/15}

Until Receipt of BWIP SCR

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Attachment 1

HYDROLOGIC MODEL TASK FORCE WORKSHOP
September 28-29, 1982

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MEMORANDUM

To: Douglas K. Vogt, TRI
From: James W. Mercer, GeoTrans *JWM*
Date: September 29, 1982
Subject: Trip Report - BWIP

A modeling task force meeting was held on 27-28 September 1982 at Richland, Washington. Attending were representatives from the USGS, PNL, RHO, and LBL. Also attending as observers were members from a NRC group.

The first discussion was presented by Brian Kanehiro (LBL). LBL's role in the task force is as moderator to help organize and smooth out differences in opinion. Brian's discussion summarized Pasco Basin and Columbia Plateau modeling to date. The three primary groups discussed and their modeling goals were (1) USGS (to evaluate data), (2) PNL (to demonstrate technology), and (3) RHO (to construct preliminary model). It was pointed out that all Pasco Basin models were preliminary because of limited data. Therefore, it is not surprising that different results (flow paths) were obtained. The different results are caused by differences in input data, i.e., boundary conditions and spatial properties. The conclusions of the various groups are (1) USGS - not enough data to calibrate model, (2) PNL - methodology works, and (3) RHO - a preliminary model is possible.

The modeling task force was formed to attempt an understanding of the differences and reasons, and to try to resolve them. The planned approach is summarized as follows: (1) continue regional studies, (2) form data base, (3) review data base, (4) calibrate basin models, (5) document and benchmark models, (6) formulate problems, and (7) update model. The resulting basin models will be used for sensitivity analysis and to guide data collection. In terms of data collection, it was pointed out that RHO has plans or is collecting data (1) associated with spatial variations in hydraulic conductivity ratio, especially at structures, (2) associated with lineament to the west of RRL, and (3) associated with Gable Mountain - Gable Butte.

The second discussion was presented by Bill Meyer (USGS). He discussed the following issues concerning differences in the modeling:

(1) Viability of the assumption that the hydrologic system is at steady state.

- Water level changes outside Hanford Reservation
 - Columbia Basin Irrigation Project
(USGS has been monitoring ground-water mounding that has resulted from surface water diversion since 1952; this area is north and northeast of the Columbia River.)
 - Ground-water pumpage within the Cold Creek Syncline
(there has been up to 200 feet of drawdown since the 1950's; this area is west of RRL and the lineament).
 - Dams on Columbia River
(three dams have been placed on the Columbia River in this area; the result has been a change in river stage).
 - Pumpage in Odessa area
- Water level changes within the Hanford Reservation
 - Development of a ground-water mound as a result of waste-water disposal in the unconsolidated sediments.

[Are these changes greater than those associated with testing?]

(2) Viability of head data obtained during drilling.

- Vertical head data is collected in a single hole during a period of up to two years.
 - USGS has measured in the Columbia Plateau large head changes (8-20 ft) over a time period of months.
 - Comparison of head measurements made in DC-1 during drilling with later head measurements in DC-1 via the nested piezometers shows significant changes.

[Do the pressure transients in the system mask the downhole measurements?]

(3) Viability of the assumption that water in the lower Grande Ronde moves from Pasco Basin into Yakima Valley and Horse Heaven Hills.

- Yakima, Snake, and Columbia are all gaining rivers.

[How does the ground water move under rivers and major structures?]

(4) Viability of lateral hydraulic conductivity values.

- RHO is obtaining lower hydraulic conductivity values than those obtained from specific conductance tests in other parts of the Columbia Plateau.
- RHO only did time-drawdown analysis of aquifer tests in DC-7/8; USGS did distance-drawdown and obtained $T = 10.2 \text{ ft}^2/\text{d}$, which is about twice RHO's value.

[What is the effect of drilling fluid (mud)?]

(5) Utilization of ground-water quality to interpret direction/movement of ground-water flow.

- Water quality data can be used to reinforce flow data, but without heads, chemical data will be of limited value.

The next discussion was made by Rick Bond (PNL), who discussed the extended PNL model. PNL's original model was based on pre-1979 data. Since that time, three new deep wells have been drilled, DC-12, DC-14, and DC-15. Their new modeling effort was designed to (1) incorporate this new data and (2) extend the southwest model boundary to the Yakima River and determine how Rattlesnake and Horse Heaven Hills behave hydraulically. In general terms, there were changes in their potentiometric surfaces and transmissivity distributions as a result of the new data and new interpretations. Rattlesnake and Horse Heaven Hills formed ground-water divides (because of recharge to those topographic highs) in the extended model.

Ron Arnett (RHO) spoke next. They have been in the process of finding additional data. This includes data from the following deep wells: DH-5, Benson Ranch, DC-15, and DDH-3. DDH-3 head data is fairly constant with time (varies about 2 feet over a 2½-year period and one additional measurement about eight years later in September 1982). This plus time-versus-head data from DC-1 tends to support their steady-state hypothesis and the validity of head measurements collected in the more transmissive zones during drilling and testing. Finally, RHO does not plan to abandon their Pasco Basin studies, however, they believe that the more interesting problems are occurring closer to the RRL (within approximately 2 kilometers of repository).

On Tuesday morning, Bill Meyer's issues were revisited and two more were added:

(6) Nature of the vertical permeability.

- Need to understand spatial distribution.
- Do the dense basalts and/or the interbeds control vertical flow?

(7) What are the significant boundaries for the RRL site?

Next, Roy Gephart described head data from DC-6, DC-14, DC-15, DC-7, RRL-2, DC-16A, DC-12, DB-15, and DDH-3. This information will be included in the SCR.

<u>Well Number</u>	<u>Location</u>
DC-6	just on the north side of the Gable Mountain - Gable Butte anticline axis
DC-14	near horn of Columbia River
DC-15	southern portion of Cold Creek Syncline
DC-7	middle of Cold Creek Syncline
DC-12	southwestern flank of Cold Creek Syncline
DC-16	southern border of RRL

It was suggested that heads in DC-14 may be affected by recharge from irrigation to the north. Geochemistry data was also correlated to head data. It seems to indicate vertical (upward) flow in the Gable Mountain - Gable Butte area and stratification elsewhere.

As a result of this meeting, it was decided to do the following: begin to develop a pre-man model using information everyone can agree on. This data includes (1) geometry (RHO's responsibility), (2) river levels, and (3) recharge (PNL's responsibility). It will be a five layer model with (1) one layer for alluvium, (2) one layer for Saddle Mountain, (3) one for the Wanapum, and (4) two layers for the Grande Ronde. The boundaries will be extended to include: (1) western boundary - Yakima River and Rock Creek, (2) southern boundary - Columbia River, and (3) northern and eastern boundaries - same as in earlier Pasco Basin models. Boundary conditions will be no flow except where basalts contact rivers, where heads will be held constant. A model with a mass balance will be used and the heads in the alluvium will not be held constant. Steady-state conditions will be assumed. The purpose of the model will be to test different hypotheses including (1) the effect of structures and (2) the effect of boundaries (e.g., does underflow occur at the Columbia River and Rattlesnake and Horse Heaven Hills?).

The next meeting of the task force will be in mid-December at which time they will try to determine the hydraulic conductivities for the model and the cases to simulate.

cc: B. Ross, GeoTrans, Inc.
B. Lester, GeoTrans, Inc.
D. Fehring, NRC
M. Gordon, NRC
M. Knapp, NRC ✓
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