APPENDIX A

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February 23, 1982 Our ref: 813-1176A

U.S. Nuclear Regulatory Commission
Division of Waste Materials
Washington, D.C. 20555

Attention: Dr. R. Wright

RE: VISIT TO ROCKWELL HANFORD OPERATIONS
January 12 and 13, 1982

Dear Bob:

This letter follows my trip to Hanford on January 12 and 13, 1982 as a member of the NRC's BWIP Review Team. As requested in our telephone discussion of January 21, 1982, the letter concentrates on the major observations made on the visit, and is limited to a few pages.

GENERAL OVERVIEW

The general impression which I developed during the January visit was that outstanding progress has been made in program definition as the project moves from a reconnaissance phase to a site characterization phase.

Specific recent changes in the program plan and approach which I believe to be excellent include:

(1) Use of existing data to develop an understanding of the likely effectiveness of proposed future tests.

(2) Use of modellling results to guide future location and types of tests.

(3) Proposals to conduct higher stress, wide area tests of relevant units.

(4) Proposals to perform vertical permeability tests based on large scale pumping.

(5) Proposals to conduct hole-to-hole tracer tests in existing holes.

(6) De-emphasis of spot testing in single holes.

(7) Proposals to vastly reduce the time which elapses between testing and circulation of results to all interested parties.

If these changes are followed through, my general impression is that the current program direction has every prospect of producing necessary licensing information at the appropriate time.

REMAINING AREAS OF CONCERN

There are several areas which were covered in the January trip which still cause me concern, and the remainder of this letter will discuss these aspects.

Conceptual Hydrology Model for Hanford

There would appear to be a degree of confusion among the various Rockwell groups and in my own mind about the general nature of the geohydrologic system at Hanford. After four days of intensive review in the September 1981 visit to Hanford, this reviewer was left with the impression that conceptually the Hanford site was an interlayered system of very high permeability "aquifers" separated by lower permeability "aquitards," the aquifers being interbeds and flow tops, the aquitards being entablature and collonade sections, plus some of the interbeds.

In the January visit, it became clear that this conceptual model was inappropriate. Instead, the system appears to comprise essentially four layers. They are in increasing depth, the alluvium, the Saddle Mountain unit, the Wanapum unit, and the Grande Ronde unit. These units appear to exhibit rapidly decreasing horizontal hydraulic conductivity with depth, with the Umtanum being an exceedingly low hydraulic conductivity section within the generally low conductivity Grand Ronde unit.

The difference between the previous concept and the newer insight is significant in terms of site suitability for a repository. two examples of the significance follows:

(1) Testing Approach--Under my September 1981 concept, the vertical permeability of the Umtanum unit could be directly tested by pumping the high permeability unit above the unit to be tested and observing the response in the lower high permeability unit. This is more difficult to achieve if my newer concept proves to be correct.

(2) Shaft Inflow--Based on my previous concept, the shaft inflow was likely to be high if the shaft were sunk without water control of some kind. Based on my newer concept, the inflow would be modest, particularly in the Grand Ronde unit. This has definite implications for site suitability and shaft sinking technology.

It is important to note that I am not sure whether this problem existed within the Hanford group, or whether it was a communication problem in the September 1981 meeting. However, the existence of the different interpretations by a presumably knowledgable geohydrologist is at least an illustration of the need for the Hanford group to be continually aware that they have a difficult job in conveying to reviewers that the Grand Ronde basalt, which is highly permeable elsewhere in the Columbia basin, happens to have a low permeability in the Cold Creek area.

Accessible Environment

A problem which relates to the conceptual model is that of the definition of the accessible environment. Clearly, the investigation required to characterize any repository host rock depends heavily upon the point at which release standards must be met. The type, location, and intensity of information required must depend on the definition of accessible environment.

There seems to me to be too little attention paid to this consideration in the planning of the test and analysis program at Hanford. It would seem prudent for the Hanford program to specifically define the likely range of choices for accessible environment definition and design a program which will accommodate all of them (see my handwritten note of January 12, 1982 for details on this concern).

Data Integration

I see a significant unresolved problem in the continuing integration of data and the dissemination of the results to all interested groups. Two examples of failure in this area are cited.

(1) Shaft Inflow Calculations--A number of calculations of unimpeded inflow from the entire basalt section can be made using various sets of data available to the project as follows:

- hydraulic conductivities used by Rockwell Hanford Operations (RHO) in modelling studies reported to date (flow = 30 gpm)
- hydraulic conductivities used by Pacific Northwest Laboratories (PNL) in modelling studies reported to date (flow = 30,000 gpm)
- transmissivities measured in DC 12 (as an example) and used in shaft design by Kaiser (flow - 175,000 gpm)

Clearly, this range indicates that the different groups who need to draw conclusions are using totally different concepts of the groundwater system at Hanford. The implications of each concept for investigation program selection is major.

(2) Integration of All Relevant Hydraulic Data--One slide shown at the presentation showed a potentially interesting relationship between temperature and depth, specifically the differences between DC 12, DC 6, and DB 15. Discussion demonstrated that no analysis of why these differences occur had been performed. This is significant because it became clear during the discussion that there is presently little integration between geochemistry, hydrology, and modelling.

It would appear that there is not sufficient integration of all the information available on an ongoing basis. This task, while extremely difficult, is critical to timely input of results into the total program. Without such integration, rational planning of the program is severely compromised.

Perhaps this problem may stem from having too few generalists and too many specialists. This also leads people to discard potentially useful data because it is not "pure." This phenomenon was illustrated in a discussion of the artificial mound in head in the alluvium which has been created by surface radioactive fluid disposal. The Hanford hydrology staff saw this as a "problem," whereas it could be seen as a large scale perturbation which could be modelled to provide insight on system behavior.

In a complex system like this, integration is essential. It appears to be occurring only slowly.

Approach to Testing

The general comment on this topic is that there has been a dramatic change in approach since my last visit, which is applauded. Two specific potential problem areas are identified, however.

(1) Use of Packers--In low permeability materials, the use of packers has severe limitations, at least in this writer's experience. This is particularly true in two areas: testing for heads (pressures), and in testing for vertical permeability. Data collected during oil shale field investigations show that the open interval above (and below) packers can often dominate induced pressure changes, leading to incorrect (and unconservative) interpretation of tests.

(2) Large Sale Tests--Large scale tests, particularly of the critical parameters (vertical hydraulic conductivity and porosity) may be difficult or impossible in the low permeability material in the Grand Ronde unit. Pre-analysis information presented at the meeting did not appear to fully address this issue. It is believed that accurate generic modelling should be used to show that each proposed test will indeed be sensitive to the important ranges of the tested parameters. This does not seem to have yet been fully achieved in the Hanford program.

SUMMARY

In summary, it is believed that the substantial progress in program definition achieved since September is outstanding. The above comments are intended to indicate that there remain some important areas where further progress would be beneficial, specifically:

(1) Conceptual model development
(2) Accessible environment considerations
(3) Integration of all data
(4) Pre-validation of testing approach

Respectfully submitted,

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TRIP REPORT

FROM: Mark Reeves
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TO: Robert J. Wright
Nuclear Regulatory Commission
Nancy C. Finley and R. M. Cranwell
Sandia National Laboratories

SUBJECT: Visits to NRC (Silver Spring), PNL (Richland), RHO (Richland), and USGS (Tacoma), 1/7-14/82.

The primary focus of this trip was a response by the BWIP+ team at RHO to criticisms raised by an NRC-written trip report. This report was based on the findings of an earlier visit in September, 1981 and emphasized as its primary concern the hydrological investigations of the site. Consequently a team composed mainly of hydrologists and modelers was assembled.++ This team first met in Silver Spring for two days to develop concensus and focus before traveling to Richland.

One aspect of the above-mentioned concern was the divergence of views between RHO, PNL, and USGS regarding the general pattern of groundwater flow within the Columbia Plateau and the Pasco Basin. In an effort to resolve this issue, the NRC has begun some modeling studies of its own, which have involved consultation with both PNL and USGS. Both of these organizations were visited on this trip, as well.

RHO MEETING

The meeting at Rockwell went quite smoothly. Rockwell had specific program plans to meet the most important criticisms raised by the NRC trip report. Specifically, these plans may be summarized as follows:

+ Acronyms are given below.
++ See Attachment 1.

- Three clusters of wells will be drilled to test for K_H, K_V, and ϕ_{eff}[+++] over an extended volume of rock within and above the Grande Ronde.

- One cluster will be placed to the immediate west of the RRL. Another is tentatively planned immediately to the south of the RRL. The third one is tentatively planned for a principal flow path as determined by the modeling.

- RHO agrees that the data are insufficient for determination of the flow path. Members of the NRC team argued in favor of a conservative modeling approach to interpreting the sparse hydrogeologic data. The extent to which RHO will adopt such an approach, however, is uncertain at this point.

- RHO will collaborate with PNL, USGS and, possibly, LATA to resolve modeling issues. A workshop is to be held at the end of FY82.

- Working documents falling under engineering control may be released directly to the NRC.

- Future meetings will occur at a frequency of about one meeting per six weeks. The purpose of these meetings will be to review the contents of individual chapters of the SCR.