0049422

RECEIVED

JUN 2 2 1998

DOE-RL/DIS

MANAGER'S ACTION
D198101646
DUEDATE: 6/12

*WSD
MGR
TWR
AME
MSD
OEA
RP

2106 Lee Boulevard
Richland, WA 99352-3658
May 29, 1998

059753

Mr. John Wagoner, Manager
Richland Operations Office
U. S. Department of Energy
Federal Building
Richland, WA 99352

RECEIVED EDMC JUL 1 1998

Subject: Transport of Radionuclides to the Ground Water Table

Dear ~~Mr. Wagoner:~~ John

I believe that the public has been misinformed (ill informed?) regarding the transport of radionuclides to the saturated ground water system at the Hanford site in the vicinity of the high level waste storage tanks.

Apparently your staff and site contractors need to be reminded of J. Isaac Newton's *RULE IV OF REASONING*: *"In experimental philosophy we are to look upon propositions inferred by general induction from phenomena as accurate or very nearly true, notwithstanding any contrary hypotheses that may be imagined, until such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions."*
"This rule we must follow, that the argument of induction may not be evaded by hypotheses." (From the *Principia*, 1686.)

Moisture migration in partially saturated and unsaturated media has been studied extensively and intensively. Many systems have been characterized physically and analytically (mathematically.) In all cases, whether it be idealized spheres, silica sand, laminar clay particles or samples of soil (earth), a certain amount of water is retained in the interstices of the sample by capillary action. This retained water can only be removed by applying energy to the system. Laminar flow of liquids (e.g., water) in such a system can only occur if an additional amount of water is added in excess of that retained by forces of capillary attraction. The relative volume of water retained by capillarity is a function of particle size and shape factor (sphericity/non-sphericity.) Thus, a layer of clay (finely divided laminar particles) will retain more water than a layer of coarse sand. A corollary principal is that in a layered system, water will not flow downward from a layer of fine soil (sediment) into a layer of coarse soil, but will spread laterally, unless the capillary retention has been exceeded in the layer of fine soil, or, unless a by-pass route has been installed, such as drilling a test well to the water table within or adjacent to a tank or tank farm. Laminar flow of water down the outside of a well casing can cause contamination to reach the water table unless precautions are taken to prevent such laminar flow.

The layering of soils (sediments) in all of the tank farms has been characterized to the depth (bottom) of the monitoring "dry" wells. (Data may be found in drawings in the series from DWG. 23512 to DWG. 23609, for example.) Copies of these drawings are included in Appendix G of Document RHO-RE-EV-4P, Supporting Information for the Scientific Basis for Establishing Dry Well Monitoring Frequencies, by R. E. Isaacson, Rockwell International, September 1982.

Moisture retention in the sediments was measured in each of five dry wells below each tank farm in August 1980. Data are provided in Appendix F of the reference cited above. Variations in capillary retention caused by different particle size distribution in the intercalated layers of sediments that were deposited by glacial meltwater floods of different magnitudes and velocities is well characterized by these data. A review of the data reveals that the moisture content exceeded the limit of capillary retention at the bottom of four dry wells. Standard practice was established to avoid use of water in all tank farms for any reason to preclude inadvertent flushing of radionuclides further down into the soil column toward the water table. (I understand that this practice has been violated on a number of occasions in recent times. For example, was the backfill over the new cross country pipelines hydraulically compacted? How much water was introduced in or near tank farms in that operation?)

When the "slant drilled" borehole was drilled at the behest of the Hanford Advisory Board, what precautions were taken to maintain the integrity of the layered sediments? What effort was made to characterize the particle size and capillary retention capacity of the various layers of sediments encountered during drilling? What effort was made to determine the soil moisture content of the sediments as a function of depth? Did the "slant drilled" borehole reach the water table? Is a final report available to the public? How many test boreholes have penetrated the caliche layer in the 200 West Area? What are their locations? (Surveyed coordinates.) What new information was discovered as a result of the test drilling? What are the future plans for characterizing the Hanford sediments beneath the tank farms in more detail? Particularly with respect to the anisotropic flow of soil moisture under partially saturated conditions?

Mr. Wagoner I am remiss for not completing this letter long ago, however I have had my own priorities and believed that the wealth of detailed information in Document RHO-RE-EV-4P, especially equations 4 and 5, their derivation and support by an independent mathematical test using diffusion theory and the success in their application to establish dry well monitoring schedules, was available for general use by capable people. Equation 4 has broad applicability in determining water transport in the vadose zone. The key to its successful application is in the factor "g", the

geometry of fluid flow in intercalated sediments of uniquely different particle size distribution, which results in (causes) anisotropic flow of administered water in the vadose zone beneath the tank farms.

In as much as I do not have ready access to the staffs of DOE-Richland, Hanford contractors, and your consultants/advisers, I would appreciate it if you would distribute this letter to those involved with the vadose zone fluid flow issues and advise me of who the principal contacts should be.

Thank you for your interest and response to this letter.

Sincerely,

Ray

Raymond E. Isaacson

RL COMMITMENT
CONTROL

JUN 01 1998

RICHLAND
OPERATIONS OFFICE