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MEMORANDUM FOR: Ronald Ballard, Chief
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SUBJECT: POTENTIAL USES OF ENVIRONMENTAL MONITORING DATA IN HYDROLOGIC SITE CHARACTERIZATION AT HANFORD

Since 1983 I have been assigned, among other duties, to the review of DOE's hydrogeologic site characterization activities at Hanford. During these past several years I have received a considerable amount of Hanford site environmental monitoring data. Specifically, this has included information about radioactive and non-radioactive contaminants that have been introduced to the groundwater flow system. As described below, this kind of information has the potential to provide insight about the nature of the overall groundwater flow system. The extent to which the DOE can quantitatively use this environmental monitoring data in studies of site hydrogeology and hydrochemistry will depend on the relative quality of the data collection and analysis procedures used at Hanford over the past several decades. The DOE may attempt to qualify this existing hydrochemistry data through the peer review process.

As defined in 10 CFR 60.2, "groundwater" means all water which occurs below the land surface. During the past four decades, groundwater at the Hanford Site has been contaminated to varying degrees by a suite of radioactive and non-radioactive chemical constituents. Some examples of contaminants that have been detected in Hanford Site groundwater include nitrates, Tc-99, I-129, and tritium. These contaminants have been introduced through various means, including the discharge of wastewaters via infiltration cribs, trenches and ponds, injection wells, leaks from defense waste storage tanks, and accidental releases. Many of these releases have occurred within or in proximity to the 200 Areas (East and West). It is noted that the 200 West Area would lie entirely within the "Controlled Area" of a proposed repository centered around borehole RRL-2A. Natural sources of I-129 may exist in the geologic environment at Hanford, and groundwater recharge from meteoric sources introduced varying levels of bomb-pulse radionuclides over four decades.

The contaminants discussed above (and others) are being detected within the groundwater flow system and are migrating or sorbed to varying degrees within the flow system on the basis of their chemical properties. The presence of these radioactive and non-radioactive contaminants in groundwaters of the Hanford Site presents unique opportunities for evaluating the groundwater flow system. In this sense, the contaminants are perceived to function as

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anthropogenic environmental tracers that can give insight about conceptual models of the groundwater flow system.

Staff of the Hydrology Section recognize the importance of defensible conceptual models of groundwater flow in evaluating proposed sites with respect to groundwater travel times. The pre-waste-emplacement groundwater travel time criterion (10 CFR 60.113 (a)(2)) reads as follows: "The geologic repository shall be located so that pre-waste-emplacement groundwater travel time along the fastest path of likely radionuclide travel from the disturbed zone to the accessible environment shall be at least 1,000 years ...." An improved understanding of the groundwater flow system is needed to reach defensible conclusions regarding the nature of the "fastest path of likely radionuclide travel...." In this regard, the available data derived from environmental monitoring of groundwater contaminants at Hanford may prove useful in evaluating the vertical isolation potential of the basalt formations. Data obtained from cluster wells DC-19, -20, and -22 show evidence that hydraulic gradients in the Saddle Mountains Formation in the vicinity of the Reference Repository Location (RRL) are downward, indicating recharge conditions. If this is correct, it may be possible to estimate the downward flux of water and contaminants by collecting and analyzing groundwater samples from basalt and interbed aquifers of the Saddle Mountains and Wanapum Formations. In addition, hydrochemical studies may shed light on the nature and locations of recharge and discharge in the groundwater flow regime.

An improved understanding of the groundwater flow system would enable the DOE to prepare a more focused hydrologic testing program. At present the DOE has proposed a program of testing that concentrates on basalt units of the Grande Ronde Formation. This reasonable approach is consistent with guidance provided by NRC in the form of STP 1.1. On page 4 of the STP it is stated that "....the hydraulic testing program for the Hanford site should begin by testing the Grande Ronde Formation. Testing of the Wanapum and Saddle Mountains Basalts should follow testing of the Grande Ronde and should be concentrated along important potential pathways that have been suggested by earlier stages of the testing program."

The repository performance objectives described under 10 CFR 60 include a general objective for post-emplacement groundwater quality protection with respect to EPA standards. Predictions about long-term repository performance with respect to groundwater protection will require the use of numerical models that incorporate groundwater flow and solute transport. The value of these predictions will depend to a large extent on the success of model validation efforts. The introduction of anthropogenic tracers to the groundwater flow system over a period of four decades at Hanford provides the basis for studies of the in situ fate of released contaminants (i.e., solute retardation effects). From a regulatory perspective, as discussed in 10 CFR 60.21 (c)(1)(ii)(F), "Analyses and models that will be used to predict future conditions and changes in the geologic setting shall be supported by using an appropriate combination of such methods as field tests, in situ tests, laboratory tests which are representative of field conditions, monitoring data,

and natural analog studies." This information would be required when a license application is submitted as part of the Safety Analysis Report. Finally, with respect to long-term assessments of groundwater quality protection (i. e., EPA standards), it may be necessary for the DOE to provide information about present-day groundwater hydrochemistry for the Hanford Site.

To summarize briefly, the available data derived from environmental surveillance studies of groundwater contaminants at Hanford may prove useful to:

- gain insight about flow paths and conceptual models of the groundwater flow regime, and accordingly aid in the design of future hydrologic tests;
- provide field data for use in attempting to validate or partially validate computer models to be used in the prediction of long-term repository performance (i. e., assessment of the fates of various radioactive and non-radioactive chemical constituents within the geologic regime); and
- obtain data about present-day groundwater hydrochemistry, and water quality within the controlled area with respect to EPA's groundwater protection standards.

ORIGINAL SIGNED BY

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