Nez Perce

ENVIRONMENTAL RESTORATION & WASTE MANAGEMENT
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July 21, 1999

Mr. Rich Holten
U.S. Department of Energy,
Richland Operations Office, MS HO-12
P.O. Box 550
Richland, Washington 99352

Re: Sitewide Groundwater/Vadose Zone Integration Project

Dear Mr. Holten:

The Nez Perce Tribe's Environmental Restoration and Waste Management Program (ERWM) considers the protection of the Columbia River and its ecosystem to be of the utmost priority. ERWM considers the Groundwater/Vadose Zone Integration Project a positive step in the protection of the Columbia River and fully supports the mission and vision of this project.

Since 1855, reserved treaty rights of the Nez Perce Tribe in the Mid-Columbia have been recognized and affirmed through a series of Federal and State actions. These actions protect Nez Perce rights to utilize their usual and accustomed resources and resource areas in the Hanford Reach of the Columbia River and elsewhere. Accordingly, ERWM has support from the U.S. Department of Energy (DOE) to participate in and monitor relevant DOE activities. The federal trust responsibility to the Indian Tribes means that resources must be protected on behalf of tribes and that cleanup must occur so that their rights can be safely exercised.

At this time, ERWM has identified several recommendations for your consideration that should aid DOE-RL in fulfilling the mission and vision of the project. Our recommendations are as follows:

1. We recommend the development of a sitewide geologic model. A sitewide geologic model is needed for the same reasons that a sitewide groundwater model is needed and the basis for a sitewide groundwater model is a sitewide geologic model. There is duplication of effort and a lack of consistency in determining a geologic model for the

Hanford Site. For example, the groundwater modeling program is preparing a geologic model for the site and the 200 Area while TWRS (*A Summary and Evaluation of Hanford Site Tank Farm Subsurface Contamination and the Immobilized Low Activity Waste project*) and Environmental Restoration (*200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program, DOE/RL-98-28, Draft B)* have each prepared a geologic model for the 200 Area. A sitewide geologic model would form the basis for the sitewide groundwater and vadose zone model and ensure consistency and compatibility between the two models. A group of site experts such as Dr. Steve Redial, PNNL, Mr. Karl Fecht, BHI, and Dr. Kevin Lindsey, Daniel B. Stevens & Associates would review the existing data, develop the model, document the model, and periodically update the model. The model would be developed with the participation of the Tribes, regulators, and stakeholders. This sitewide geologic model would serve as the basis for all Hanford characterization activities and vadose zone and groundwater modeling ensuring sitewide integration. The Hanford Site geologic model is fundamental to the sitewide integration process.

2. We are recommending the geophysical logging of the laterals under the tanks and the boreholes in the 200 Areas' cribs, ponds, and trenches as the current distribution of gamma ray emitters under the 200 Areas is not known. Geophysical logging of the laterals under the tanks and the boreholes in the 200 Areas' cribs, ponds, and trenches is a necessary component of a project which will "*define the sources, nature, and extent of contamination*" as outlined in the Federal Facility Agreement and Consent Order (TPA) proposed Change Number M-45-98-03. "*DOE also has a limited understanding of the behavior of contaminants placed in hundreds of cribs, trenches, and other waste sites above the groundwater. For example, DOE has not routinely monitored waste sites other than the tank farms since 1988, and earlier monitoring of these waste sites was limited and sporadic*" (**Nuclear Waste: Understanding of Waste Migration at Hanford is Inadequate for Key Decisions**, letter report, 03/13/98, GAO/RCED-98-80). Some of these boreholes have been logged in the past, but "*For much of the older data, however, quantitative or semiquantitative comparisons probably will not be possible because associated errors, calibration information, and detection limits are generally not available*" (Horton, D.G., Reidel, S.P., and Last, G.V., 1998, **Proposal for Fiscal Year 1999 Vadose Monitoring and Guidance for Subsequent Years for Liquid Waste Disposal Facilities**, PNNL-11958, Rev. 1). A new logging campaign of the existing tank farm laterals and 200 Areas' cribs, ponds, and trenches should be initiated under the supervision of the DOE-Grand Junction Office (GJO) to ensure that the problems associated with geophysical logging performed in the past (Horton, D.G., Reidel, S.P., and Last, G.V., 1998) are avoided.

The logging of the existing laterals under the tanks and boreholes in the cribs and trenches in the 200 Areas will be the basis for:

- Estimating the nature, extent, and location of contamination.
- Development of a rational and well thought-out remediation strategy.

- Estimating the cost of the various remediation options.
- Establishment of a baseline for future comparison.
- Determining lithologic contacts.
- Estimating the effects of retrieval losses during tank clean out.
- Estimating rate of contaminant migration and mobility under a wide variety of circumstances.
- Developing credible long term risk predictions (assessments).
- Validating modeling assumptions and results.
- Design of infiltration barriers.

These existing boreholes should be the first place that we go to gather more information on the vadose zone. Geophysical logging is the only practical and economic method available to assess the extent of gamma ray emitters under the 200 Areas. Without a sufficient understanding of the distribution of contamination in the vadose zone, migration rates and preferred pathways are unknown and risks can not be accurately predicted. This logging is relatively inexpensive as no new drilling is required. There are hundreds of boreholes totaling ten of thousands of linear feet. The cost of new drilling continues to be prohibitive in highly contaminated areas and worker exposure is a serious concern. Geophysical logging of existing boreholes and laterals is relatively inexpensive and additional vadose zone information could be acquired with minimal worker exposure. The opportunity exists to develop a database of quantitative data that is repeatable and comparable. This information could be used in place of new characterization boreholes, to optimize the placement of new characterization boreholes, and to fulfill milestones encompassed by the TPA M-45 change package. The logging would occur in previously disturbed areas and probably would not further damage cultural resources. Calibration of the instruments and analysis of this data should meet the standards set by DOE-GJO for the borehole logging program in the Tank Farms. The value of the current logging in the Tank Farms is readily apparent. The use of geophysical logging at the Hanford site has also had the support of the U.S. Environmental Protection Agency (letter attached, **dated 3/7/91, from Paul Day, EPA, to Steven Wisness, DOE-RL, regarding borehole geophysics review**).

Regardless of DOE's assignment of waste site responsibility to Environmental Restoration or the Office of River Protection, ERWM is recommending geophysical logging of all laterals under tanks and boreholes in the 200 Areas' cribs, ponds and trenches as well as development of a sitewide geologic model. Both are necessary components of the System Assessment Capability to enable credible risk predictions (assessments). Knowledge gaps exist due to the lack of sufficient characterization data to define the three-dimensional extent and distribution of contamination and hence contaminant mobility. Enacting these recommendations are necessary steps to address the concerns outlined in the recent GAO report (1998).

We look forward to working with DOE-RL in a cooperative manner to move forward in the protection of the Columbia River and its ecosystem Accordingly, we are willing to

discuss these and other issues with DOE-RL and DOE-RL's contractors. If you wish to discuss Nez Perce ERWM's comments further please contact Stan Sobczyk at (208) 843-7375, (208) 843-7378 (fax) or *stans@nezperce.org* (email).

Sincerely,

Patrick Sobotta

Patrick Sobotta
Interim ERWM Director

cc: Kevin Clarke, DOE-RL, Indian Programs Manager
K. Mike Thompson, DOE-RL
Marv Furman, DOE-RL
R. Doug Hildebrand, DOE-RL
Jim Poppiti, DOE-RL
Mike Wilson, Ecology, Nuclear Waste Program Manager
Douglas Sherwood, EPA, Hanford Project Manager
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March 7, 1991

Steven H. Wisness
Hanford Project Manager
U.S. Department of Energy
P.O. Box 550, A6-95
Richland, Washington 99352

Re: Borehole Geophysics Review

Dear Mr. Wisness:

A meeting was held December 12, 1990 to review and evaluate the capabilities of Westinghouse Hanford Company (WHC) and Battelle Pacific Northwest Laboratories (PNL) to perform the geophysical logging activities described in the 200-BP-1 RI/FS work plan and all other past-practice work plans. In addition, a panel of experts from outside of the Hanford Community were also assembled to identify other nuclear logging capabilities not currently in use at Hanford and to determine their applicability for various site characterization and monitoring activities.

The results of the one day session are enclosed for your use. The current on-site capabilities will not provide data of sufficient quality to meet the requirements in the 200-BP-1 work plan, but we believe certain on-site capabilities would be valuable for other uses.. The U.S. Environmental Protection Agency (EPA) considers the use of down-hole geophysical logging to be an important tool for meeting the long-term goals of Hanford cleanup. These techniques are extremely well suited to the investigation of the unsaturated zone at Hanford, since much of the radioactive and hazardous substance inventory remains in the soil column above the water table. EPA believes that the use of geophysical logging can yield significant reductions in the overall cost of site characterization, operational monitoring, and post-closure monitoring. This capability is especially attractive since thousands of boreholes were installed to monitor liquid disposal sites and tank leaks as a standard practice. These boreholes provide access to valuable information on stratigraphy, moisture distribution, and hazardous substance and radionuclide distributions without additional drilling. Used in conjunction with core sampling, down-hole geophysics can enhance our understanding of contaminant mobility and focus sampling and analysis plans on selected constituents.

EPA believes application of commercially available techniques to the Hanford Site characterization and monitoring projects would help to focus development of these capabilities at Hanford without the initial capital costs associated with procurement of equipment. EPA would like to work with the DOE and the Washington State Department of Ecology to enhance the role of borehole geophysics in both site characterization and monitoring at Hanford.

If you have questions on the enclosed review, please feel free to call Doug Sherwood of my staff on (509) 376-9529.

Sincerely,

Paul T. Day
Hanford Project Manager

Enclosure

cc: E. Bracken, DOE
G. Bracken, DOE
M. Buckmaster, WHC
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G. Hofer, EPA
T. Nord, Ecology
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REVIEW OF HANFORD-SITE BOREHOLE GEOPHYSICAL CAPABILITIES AND THEIR APPLICATION FOR PAST-PRACTICE REMEDIAL INVESTIGATIONS

BACKGROUND

Borehole geophysical techniques are commonly used in hydrogeologic and hazardous waste investigations to provide site characterization information. Geophysical logs can be interpreted in terms of the lithology, thickness, and continuity of aquifers and confining beds; permeability, porosity, bulk density, and moisture content of the soil and aquifer matrix; and the chemical characteristics of soil and groundwater including the distribution of selected radionuclides. These data are required to evaluate the distribution of contaminants in the subsurface, to understand the groundwater flow system, and to quantify the potential for contaminant transport.

Geophysical logs are generally run to augment and complement borehole sampling programs. The logs usually are run continuously down a borehole. They provide a continuous record of physical properties with a high degree of spatial resolution and fill in data gaps left between discrete borehole sampling points. The logs often times measure the properties of a volume of rock many times larger than core or cuttings that have been extracted from the hole, and the data they provide are objective, repeatable, and comparable unlike descriptive logs written by a driller or geologist, which are limited by their author's experience and purpose. Logs can also be run repeatedly down the same hole allowing measurement of changes in the groundwater system or in contaminant distribution over time. For instance, spectral-gamma logs can periodically measure the distribution of selected radionuclides in the subsurface and thereby measure their rate of movement.

Most importantly, the cost benefit ratio for recording geophysical logs usually is quite favorable when compared to the alternative of installing boreholes. A major advantage of borehole geophysics as a site characterization technique is that it permits the relatively inexpensive lateral extrapolation of quantitative data from test or core holes. Using geophysical logs, a measured value at a point in a borehole can be extrapolated in three dimensions thereby increasing its value. This is particularly significant at Hanford where there are so many existing boreholes in which geophysical logs can be run and where the costs of installing new boreholes are so great. Because of the large site characterization effort being undertaken at Hanford, it is critical that this work be carried out in the most cost effective manner possible. The proper application of borehole geophysics has the potential to maximize the amount of information provided by new and existing Hanford Site boreholes and reduce the total amount of drilling required and, therefore, the total cost of site characterization.

It should be noted, however, that geophysical logging cannot replace borehole sampling completely. Detailed borehole sample data are needed for each study area to aid log analysis. The borehole samples provide a precise analysis of physical properties, and logs--when correlated with the samples--give a high resolution vertical

distribution of these properties along the borehole and a horizontal distribution of the properties in adjacent boreholes. The combination of samples and logs provides superior results that cannot be obtained by either method alone.

TECHNICAL REVIEW

Borehole geophysics have been proposed for use in many of the Hanford Site RI/FS work plans reviewed and approved to date. Due to the unconsolidated nature of the suprabasalt sediments at the Hanford site, boreholes are cased (normally with carbon steel casing) during drilling and as a permanent installation to prevent the collapse of the borehole. The nearly uniform existence of carbon steel casing limits the geophysical techniques applicable to Hanford to nuclear logging. The carbon steel casing interferes with techniques such as electric and acoustic logging.

Westinghouse Hanford Corporation and the Pacific Northwest Laboratories have been identified as the organizations to do the nuclear logging at Hanford. The U.S. Environmental Protection Agency and the Washington State Department of Ecology requested a meeting to review the nuclear logging capabilities of the Hanford Site contractors to determine their ability to carry out the work in a manner that meets the data quality objectives of the RI/FS work plans. The meeting was held on December 12, 1990, in Richland. The review team consisted of hydrogeologists and geophysicists from the U.S. Geological Survey, Geologic and Water Resources Divisions, the Washington State Department of Natural Resources, and the Washington State Department of Ecology. The purpose of the review was (1) to evaluate the potential for successful application of borehole geophysics as a site characterization tool in the Hanford environment; (2) to evaluate existing capabilities of Hanford Site contractors and their ability to meet RI/FS data quality objectives; (3) to make recommendations to correct any deficiencies found; and (4) to provide suggestions for the application of additional or innovative geophysical techniques appropriate for use at Hanford. Although the review was directed to the application of borehole geophysics to the Hanford Site as a whole, the review focused on the 200-BP-1 remedial investigation as a representative example.

During the review, presentations were made by representatives of the Westinghouse Geosciences and Environmental Engineering groups and the Pacific Northwest Laboratory Geosciences group describing (1) the geology of the Hanford Site; (2) the 200-BP-1 geophysical logging program goals; (3) PNL logging equipment and procedures; and (4) WHC logging equipment and procedures. It should be noted that representatives of the PNL Nuclear Chemistry Department did not attend the meeting. This group is also equipped with certain down-hole geophysical logging capabilities which were not subject to review by the panel.

CONCLUSIONS AND RECOMMENDATIONS

After one day of presentations and discussions, the review panel has the following observations and recommendations.

(1) Geophysical logging has a strong potential for providing important site characterization and monitoring information in a cost effective manner at Hanford. Nuclear logging should be successful in measuring the critical physical properties of porosity and moisture content by neutron-neutron logging and the distribution of selected radionuclides in the subsurface by spectral-gamma logging. Gross-gamma logs should be useful for identifying confining layers and for stratigraphic correlation. Measuring bulk density by gamma-gamma logging is less assured and will likely require some degree of development and demonstration work.

The review panel further concluded that the Hanford logging environment with air filled, large diameter, carbon steel cased boreholes presents some difficulties not normally encountered in conventional geophysical logging applications and that existing technology may need to be adapted to meet Hanford Site specific requirements. The panel stresses that the appropriate technology exists within the industry, but that it needs to be properly configured to provide the best results for the Hanford environment. The panel recognizes that some inhouse development work may be necessary, but notes that this is not a research activity. It is a technology transfer activity, and the panel strongly recommends full use of the technical expertise available from commercial "production logging" companies.

(2) The gamma-gamma and neutron-neutron tools fielded by PNL were designed for logging slim, uncased holes typical of those installed in bedrock for the mineral exploration industry. These tools do not represent current technology and were not designed for use in the large diameter, carbon steel cased boreholes installed in the suprabasalt sediments. The tools have not been calibrated nor in past applications at Hanford have they been shown to provide a correlation between log signals and the properties of the formation being logged. These PNL tools will not provide quantitative data, nor do we believe that they will provide even useful qualitative data. The PNL tools will not meet the data quality objectives of the 200-BP-1 remedial investigation, and we, therefore, recommend that they not be used for this application and, further, that the use of the PNL gamma-gamma and neutron-neutron probes in carbon steel cased boreholes in alluvium be discontinued at all Hanford facilities.

The PNL gross-gamma tool has been calibrated and shown to provide defensible logs for lithologic studies and continued use for this purpose should be appropriate. It should be noted that the PNL ~~gross-gamma tool can~~ become saturated in contaminated zones with high nuclear activity. A shielding system should be developed for this tool if it is to be used to measure the distribution of radionuclides in the subsurface.

WHC has apparently successfully developed a state-of-the-art spectral-gamma-ray logging system employing dual NaI and GeLi HPGe detectors. This system is well suited for quantifying total gamma radiation and identifying specific gamma-ray emitting radionuclides in the vicinity of the borehole. The spectral-gamma logs should provide valuable site characterization information on the present distribution of radionuclides in the subsurface and should be one of the few techniques capable of providing insitu data for post-closure

monitoring of remedial-action performance assessment. Post-closure monitoring is likely to be an important component of most operable unit RODs, and developing and demonstrating the capability to conduct post-closure monitoring within both the saturated and unsaturated zones should be a very high priority and fully supported activity. We, therefore, recommend that the WHC spectral-gamma tool be used at 200-BP-1 boreholes and at other Hanford facilities.

Our primary concerns with the WHC spectral-gamma system are: (i) the spectral-gamma tool has no shielding system. Although less easily saturated than the PNL gross-gamma tool, the WHC spectral-gamma tool may saturate in zones of very high nuclear activity and therefore should have a shielding system as well. (ii) WHC does not have a proven field monitoring capability. Only a limited number of actual spectral-gamma logs have been taken in Hanford boreholes and little information was supplied about the WHC capability to perform characterization, as well as routine monitoring; (iii) WHC possesses no backup detector. If the detector becomes contaminated or otherwise inoperable, the spectral-gamma logging system will be inoperable for potentially long periods, making it impossible to meet remedial investigation commitments and milestones. We recommend procurement of a backup detector.

In light of the development of the WHC spectral-gamma system, the PNL gross-gamma system appears to be outdated and somewhat redundant and may be phased out in the near future. Before phasing out the PNL tool, we recommend that both the WHC and PNL tools be run sequentially in a series of boreholes so that the logs can be compared and a link developed between the old logs run by the PNL system and new logs to be run by the WHC system.

(3) The Hanford Site contractors appear to presently lack the capabilities to provide technically defensible neutron-neutron and gamma-gamma logs as required by the approved 200-BP-1 RI/FS work plan. It is likely that commercial contractors using dual detector neutron-epitheral-neutron probes have the capabilities to provide technically defensible neutron-neutron logs for Hanford Site conditions. However, there may be difficulties in bringing a contractor on site for routine borehole logging due to scheduling and logistical difficulties and uncertainties in the areas of decontamination, possible tool abandonment, and certification of proprietary data reduction algorithms. These uncertainties were not clearly understood by the review panel and should be explained and documented before accepting or rejecting the use of outside contractors for providing routine logging services at Hanford. Neutron-neutron logs are expected to provide very necessary site characterization information, and if outside contractors are not available or are unacceptable, Hanford Site capabilities should be developed.

It was agreed by the review panel that it is unlikely that outside contractors have the ability to provide defensible gamma-gamma logs in typical Hanford Site boreholes. There was some question by the panel whether defensible gamma-gamma logs run for bulk density measurements could be successful at Hanford at all due to the likelihood of air gaps occurring outside the casing. The review panel agreed that if defensible gamma-gamma logs are able to

be produced at Hanford, they will provide valuable site characterization information, particularly when used in conjunction with the neutron-neutron logs. The panel concluded that the best commercially available neutron-neutron and gamma-gamma logging technology should be tested and evaluated at Hanford. If demonstrated to be successful, the commercial technology should be used, and if found lacking, onsite development work should be initiated in association with experienced commercial logging companies.

(4) The review panel repeatedly stressed the need to develop an exact understanding of the geophysical log response to the physical properties of the sediments on the Hanford site. The panel was particularly concerned that the geophysical response on nuclear logs associated with variations in hydraulic properties measured through large diameter carbon steel casings may be very subtle, and the ability to quantify or interpret these responses has not been demonstrated at Hanford. The panel concluded that detailed collateral geologic studies were needed to quantify the log responses to parameters such as grain size, porosity, water content, etc., and that this work should be done under optimum conditions for log response (such as small diameter plastic cased holes) to get a firm handle on the things that will be measured in less than ideal conditions (such as large diameter carbon steel cased holes). The panel does not consider this a research activity as such, but rather a type of calibration activity that is a logical and necessary step in the development and application of a defensible borehole logging program. This activity should also conclusively determine the type and quality of data that borehole geophysics are able to yield at Hanford, and in which areas of the site we can expect successful results, thereby providing guidance to the authors and reviewers of RI/FS work plans as to how borehole geophysical techniques should be included as a site characterization tool.

(5) We recommend that a field testing, demonstration, and development program be undertaken to address the issues raised in items 3 and 4. The purpose of the testing program is (a) to develop a detailed understanding of the physical properties of sediments at selected locations representative of typical Hanford waste sites, (b) to quantify the log response of commercially available nuclear logging tools to these physical properties, (c) on the basis of b, to either select appropriate commercial tools or optimize the design of Hanford Site custom gamma-gamma and neutron-neutron logging tools, and (d) to conclusively demonstrate the applicability of the final logging system proposed for use in Hanford Site remedial investigations.

To accomplish these goals, we recommend that one or more dedicated paired boreholes, representative of waste disposal sites yet remote from any contamination, be drilled and cased. One of these paired boreholes should be located in the vicinity of the 200-West Area, where borehole geophysics is likely to have its greatest utility. A continuous core should be taken during drilling to provide a complete geologist's log and samples for laboratory measurements of physical and mineralogic properties. One borehole should be cased with ABS plastic, which should provide a minimum of interference and allow optimum logging tool response, and the second

borehole should be an existing carbon steel cased borehole with no annular seal representative of the "typical" Hanford borehole environment. Commercially available tools designed for logging large diameter cased boreholes should be used to log the test boreholes, and the results should be compared with the measured physical formation properties. If the commercially available tools do not provide adequate quantitative results, a modeling study should be undertaken to determine optimum design specifications for the gamma-gamma and neutron-neutron logging tools. Once these tools have been designed and built, they should be run in the paired test boreholes to again compare their logs with the measured physical properties. If the logs from these custom tools match the physical formation properties measured in the paired test boreholes, they should provide acceptable and defensible results for Hanford Site remedial investigations.

(6) Neutron-activation logging also has a strong potential to provide useful site characterization and monitoring information at Hanford, but to the best of our knowledge, has not yet been proposed for use. Neutron-activation logging can provide information on the distribution of non-gamma emitting radionuclides and stable isotopes in a similar fashion as spectral-gamma logging provides information on the distribution of gamma-ray emitting radionuclides in the subsurface. Many contaminants of concern to the Hanford Site remedial investigation are non-gamma emitting radionuclides, such as uranium 238, carbon-14, strontium-90, and technitium-99. These radionuclides cannot be detected by spectral-gamma logging, and their distribution and transport cannot be monitored by existing Hanford Site logging capabilities. Characterization of these radionuclides must rely on expensive drilling programs that have no potential for long-term monitoring. If neutron-activation logging can be shown to provide defensible data on the distribution of these radionuclides and other radionuclides of concern in the Hanford subsurface environment, a significant data need will be fulfilled. Similarly, this technique has great potential as a site characterization and monitoring tool for nonradioactive contaminants of concern. Many contaminants of concern at Hanford including nitrate, chromium, cadmium, copper phosphates, cyanides, as well as many other substances can be identified and quantitied using neutron-activation logging. Application of this tehnicque for mineral exploration is analogous to the problem of measuring the extent of contamination beneath a hazardous waste site or a single-shell tank. We recommend that the feasibility of using neutron-activation logging at Hanford be tested and aggressively pursued if successful.

In conclusion, the review panel would like to point out that borehole geophysics has a proven record of providing conclusive, defensible geologic data not readily measurable by alternate techniques. However, it should be recognized that nuclear logging is not off-the-shelf, cookbook technology that can be applied in a simplistic or haphazard fashion and still yield satisfactory results. Successful use of this technology requires a competent staff equipped with logging tools designed for specific applications and calibrated to yield predictable and quantifiable responses to variations in physical properties. This technology is analogous to that used in chemical analytical laboratories and requires a similar degree of support for instrument calibration and demonstration of performance

against known standards. Without such support, borehole geophysics cannot expect to yield defensible results, just as chemical analytical laboratories do not yield acceptable results without a data validation program.

If borehole geophysics is to be included in the Hanford Site hazardous waste investigations, as we think it should, a well thought out and well organized approach, including the recommendations noted above, should be developed and funded. These activities should also be periodically reviewed by outside experts to assure that the geophysical program goals are appropriate to site characterization and monitoring needs, and that the work is being conducted in a timely and efficient manner.