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AUG 2 1983

MEMORANDUM FOR: Those on Attached List

FROM: Matthew J. Gordon
High-Level Waste Licensing
Management Branch
Division of Waste Management

SUBJECT: DRAFT OF "DRAFT UMBRELLA SITE TECHNICAL POSITION (DUST): PERFORMANCE ASSESSMENT OF BWIP"

Attached for your review is a draft of a DUST which provides NRC guidance to DOE on Performance Assessment efforts at BWIP. This DUST was prepared by myself, Michael Weber (WMHL) and Peter Ornstein (WMHL). This document may also be used as a basis for discussion at the upcoming RHO/DOE/NRC BWIP Performance Assessment Workshop in Richland, Washington (Aug. 29 - Sept. 1).

In order to best address the technical concerns of the various disciplinary groups in the Division of Waste Management, your review of the attached DUST is requested. Please return all comments to me by COB August 9.

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Enclosures:
As stated

AUG 2 1983



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# DRAFT UMBRELLA SITE TECHNICAL POSITION ON

# PERFORMANCE ASSESSMENT OF BWIP

Performance Assessment Section
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U.S. Nuclear Regulatory Commission

## TABLE OF CONTENTS

# DRAFT UMBRELLA SITE TECHNICAL POSITION
## PERFORMANCE ASSESSMENT OF BWIP

The site characterization program currently underway at the Basalt Waste Isolation Project (BWIP), near Hanford, Washington, will investigate the suitability of the site for a high-level nuclear waste repository. Under the Nuclear Waste Policy Act of 1982 (NWPA), a license application for construction of a repository at the site may be submitted to the Nuclear Regulatory Commission (NRC) by the Department of Energy (DOE) subsequent to site characterization. In order to ensure that NRC's informational needs for a licensing application review will be satisfied by DOE by the time of licensing, NRC has prepared a series of Site Technical Positions which provide guidance to DOE in various site characterization efforts.

The following Site Technical Position is intended to serve as guidance for the DOE performance assessment activities which form part of the BWIP site characterization program. This document does not prescribe the exact requirements of performance assessment information to be submitted to NRC, but rather outlines the minimal performance analyses that NRC expects will be necessary to compare the performance of the BWIP site with the pertinent regulatory criteria contained in 10 CFR Part 60 (NRC) and 40 CFR Part 191 (EPA).

Since this document is limited in scope to discussing various aspects of performance assessment, relevant information such as the development of conceptual models and in-situ testing programs, though equally important, will not be covered. Other umbrella technical positions are being prepared to address these topical areas.

Several technical topics related to performance assessment have been identified by NRC as requiring a thorough evaluation by DOE in preparation for a licensing review. These topics are discussed below.

## Identification and Probabilistic Quantification of Radionuclide Release Scenarios

Consistent with the 40 CFR Part 191 and 10 CFR Part 60, assessments of repository performance must consider the probabilities of radionuclide release scenarios. Prior to the licensing review, a complete set of plausible release scenarios from the repository to the accessible environment will be developed through a systematic program. DOE need not evaluate all of the identified events as long as their risks to the general population are small in comparison to the risks that are evaluated. The Quaternary Period should serve as the historical record upon which to base the event probabilities (see definition of anticipated processes and events in 10 CFR 60.2, and siting criteria in 60.122(b)(1)). Events with probabilities greater than 0.0001 in 10,000 years must be evaluated and categorized as being reasonably foreseeable (> 0.01 in 10,000 years) or very unlikely (< 0.01 but > 0.0001 in 10,000 years). These probabilities must be determined through a process that is acceptable to the majority of the technical community.

Once the release scenarios have been identified, numerical simulations or other quantitative analytical techniques will be used to determine their consequences. The consequences will then be weighted by the probability of occurrence, and the predicted releases of radionuclides will be summed over the 10,000 year period following waste emplacement. This probabilistic and quantitative program will serve as the core of the probabilistic risk assessment of the repository in preparation for licensing and comparison with the radionuclide release limits contained in 40 CFR Part 191 as specified in 10 CFR Part 60.112.

Consequences of significant release scenarios may span orders of magnitude because the initiating processes and events may vary in importance. The importance of radionuclide transport by groundwater flowing along a post-emplacement fault, for example, may range from insignificant for a millimeter-scale slippage joint to very significant for a meter-scale fault that is filled with highly conductive rubble. DOE should evaluate the use of extreme scenarios as bounding cases. If this approach is found to be insufficient, alternative approaches for consequence assessment should be proposed, justified, and executed. As DOE is required in 40 CFR Part 191 to assess the cumulative radionuclide releases to the accessible environment, this assessment must include multiple, plausible release scenarios during the first ten thousand years following emplacement. DOE should develop and follow a comprehensive plan that outlines the precise approaches DOE will use to compute scenario probabilities and determine probabilistic consequences.

## Modeling Thermo-Mechanical-Hydro-Chemical Coupled Phenomena

DOE is indirectly required in 10 CFR Part 60 to identify the important coupled thermo-mechanical-hydro-chemical (TMHC) interactions, taking into account the expected range of repository conditions, scale effects, and uncertainties in the characterization data specific to the BWIP site. Examples of process interaction might include thermal effects on the mineralogy of fracture-fill materials and their impact on radionuclide transport, or dissolution and precipitation of mineral phases and their effects on the rock mass, groundwater flow, and radionuclide transport. These analyses will also provide insights into the validity of uncoupled models, as well as the amounts and types of data required from the site characterization program at BWIP.

DOE is required to identify any of the following potentially adverse conditions which may involve process interaction:

° Potential for changes in hydrologic conditions that would affect the migration of radionuclides to the accessible environment, such as changes in hydraulic gradient, average interstitial velocity, storage coefficient, hydraulic conductivity, natural recharge, potentiometric levels, and discharge points [60.122(c)(5)].

° Groundwater conditions in the host rock, including chemical composition, high ionic strength or ranges of Eh-pH that could increase the solubility or chemical reactivity of the engineered barrier system [60.122(c)(7)].

° Geochemical processes that would reduce sorption of radionuclides, result in degradation of rock strength, or adversely affect the performance of the engineered barrier system [60.122(c)(8)].

° Groundwater conditions in the host rock that are not reducing [60.122(c)(9)].

° Rock or groundwater conditions that would require complex engineering measures in the design and construction of the underground facility or in the sealing of boreholes and shafts [60.122(c)(20)].

° Geomechanical properties that do not permit design of the underground opening that will remain stable through permanent closure [60.122(c)(21)].

The consideration of coupled phenomena may also be important in predicting the response of the engineered and natural systems during waste emplacement. The data collected during this period will be compared with predicted responses in the performance confirmation program. If coupled phenomena are important under repository conditions at BWIP, then the systems may not respond as anticipated unless the interactive processes are predicted and considered in repository design [see 60.140(a)(2)]. Performance assessment of the waste packages may also involve analyses of the relative importance of coupled phenomena [see 60.135(a)(1) and 60.135(a)(2)].

The consideration of coupled phenomena is likely to be a function of scale. Many of the interactions important in assessing repository performance may only occur within the disturbed zone. Coupled process interactions on the regional scale, therefore, are not likely to be important, but they will require appropriate evaluation.

Once the important interactions are identified by theoretical, laboratory, and field-scale analyses, the available computer codes required for repository performance assessment should be evaluated for their adequacy in simulating or bounding the effects of coupled process phenomena. Such evaluations should consist of benchmarking against verification problems with solutions, the results of laboratory analyses, and large-scale field analogs (e.g. natural geothermal systems, if demonstrated to be comparable). These computer codes may then be used to simulate repository conditions and predict the extent of the disturbed zone. The results will influence not only repository design, but also the strategy for site characterization by adjusting the plan to test for the important system parameters. NRC staff advises DOE to present early findings in the BWIP-SCP so that the preliminary performance assessments have positive influence on other programs of BWIP.

## Determination and Justification of the Extent of the Disturbed Zone at BWIP

The extent of the disturbed zone at BWIP must be proposed by DOE before the groundwater travel time to the accessible environment can be calculated and defended in the context of 10 CFR Part 60. Specifically,

> Is the pre-emplacement groundwater travel time from the <u>disturbed zone</u> to the accessible environment greater than the numerical criterion proposed by DOE and accepted by the Commission? [10 CFR 60.113 (2)] (emphasis added)

The disturbed zone is defined as the portion of the controlled area where physical and chemical properties have changed as a result of repository construction or the heat generated by the decaying wastes such that the change of properties significantly affects repository performance. It is expected that the delineation of the disturbed zone will require predictive numerical models and other quantitative analyses which incorporate uncertainties in key thermal, mechanical, hydrologic, and chemical parameters within the vicinity of the waste. Bounding estimates of coupled process interactions may suffice to assess the extent of the disturbed zone if these estimates can be supported by more complex analyses ( e.g. predictive computer models that account for the important coupled process interactions). The results of these simulations should be compared with appropriate natural analogs (e.g. hydrothermal systems) and evaluated against sound engineering and scientific judgements of system response.

The disturbed zone will generally be contained within a larger subsurface zone where the repository processes have perturbed ambient conditions without significantly affecting repository performance. Specific examples of the larger zone might include portions of the host rock where the groundwater temperature has increased by not more than five degrees Centigrade above the ambient (pre-emplacement) temperature. Although temperature increases will have effects on substrate chemistry, groundwater chemistry, and rock mass behavior, a change in the mean temperature of the host rock by ±5° C may have negligible impacts on these properties or on overall repository performance. This portion of the host rock would not be included within the disturbed zone if it could be demonstrated that the temperature rise or accompanying perturbations would not significantly affect repository performance.

A specific temperature criterion, or suitable alternative criteria, should be proposed by DOE to delimit the extent of the disturbed zone. After consultation with the NRC on these delimiting criteria, DOE should model or bound the near field response surrounding and including the underground facility at BWIP. Once the results have been evaluated for accuracy and plausibility, DOE will use the outer surface of the disturbed zone as the starting location for pre-emplacement groundwater travel time calculations.

Quantitative analyses of the disturbed zone should also provide guidance to the site characterization program as to what parameters need to be measured and where the measurements should be taken. Repository design should be closely coordinated with the delineation of the disturbed zone because, for example, the extent of the disturbed zone may be influenced by limiting thermal loading and the repository should be designed to accomodate the expected response of the host rock mass within the disturbed zone. Since the delineation of the proposed disturbed zone may significantly affect groundwater travel time calculations, repository design, and site characterization, DOE should perform these studies in the early stages in preparation for licensing.

## Description and Analysis of Radionuclide Source Terms in Transport Models

Since transport modeling will be conducted to determine compliance with the EPA release standards, the radionuclide source term representation(s) chosen for performance assessment should be justified. As in other areas of performance assessment, the degree of model sophistication should be consistent with the completeness and accuracy of the data. DOE should determine whether the source release rates will be controlled by the leach rates of the waste form or solubilities of the radionuclide species as a function of time and temperature. Processes that may have significant impact on the performance of the engineered barrier system (e.g. convection, radiation, radiolysis, etc.) and their representation also require evaluation and justification by DOE if they are included in performance analyses to support the licensing application. Performance assessment of the engineered barrier system should influence design and manufacture of the waste form, as well as design and construction of the underground facility. These analyses must be integrated with experimental, field, and theoretical studies of the waste form, waste packages, engineered barrier system, and coupled process interactions. NRC staff advises DOE to justify the selected models based on the results of the studies mentioned above and on expert judgements. This justification should also provide insight into the limitations and uncertainties associated with the use of more simplified or complex source models. To develop a consistent approach, DOE should integrate source model justifications and evaluations with geochemical transport models by preparing a systems model from the emplaced waste, through the engineered barrier system and the geologic system, to discharge at the accessible environment.

## Validation, Verification, and Benchmarking of Computer Codes for Performance Assessment

Predictive analytical and numerical computer codes will be used to gain insight into repository performance and evaluate the proposed repository against the regulatory criteria contained in 40 CFR Part 191 and 10 CFR Part 60. To assure the accuracy and control the quality of these codes in preparation for licensing, DOE should maintain a rigorous quality assurance program. This quality assurance program should be documented or referenced within the BWIP SCP or SCP updates far in advance of license application so that NRC may provide DOE with timely responses to the proposed program. Quality assurance of performance assessment activities is required by 10 CFR Part 60. Specifically,

> The quality assurance program applies to all systems, structures, or components important to safety, to design, and characterization of barriers important to waste isolation, and to activities related thereto. These activities include site characterization, facility and equipment construction, facility operation, performance confirmation, permanent closure, and decontamination and dismantling of surface facilities [60.151].

This quality assurance program should be based on Appendix B of 10 CFR Part 50 with guidance from ANSI/ASME NQA-1-79 and Revision 3 to Regulatory Guide 1.28, and it should be adapted so as to apply to quality assurance of development, documentation, benchmarking, application, and execution of quantitative analytical techniques. Since the majority of the performance assessment work is performed under contract to DOE, the program should describe QA programs covering performance assessment by DOE and all relevant contractors and subcontractors. As a comprehensive program, it must cover both the administrative plans and detailed implementing (technical) procedures. The QA program will, in addition to the topics mentioned above, include quality control and specific plans for documentation of codes, models, and other quantitative analyses. This documentation program should as a minimum perform the following tasks:

- Demonstrate that the computer codes used for performance assessment accurately represent physical phenomena by verifying the codes against appropriate analytical solutions and validating the codes by predicting experimental or in-situ testing results.

° Fully document the codes and all related models so that independent reviewers will be able to execute the codes to reproduce computational results submitted in support of a license application.

° Document updates to codes with reference to the documentation of the primary code if updated versions of the codes are used in performance assessments.

° Demonstrate that the actual version of the computer code used for a particular application is identical to the fully-documented and benchmarked version.

° Clearly denote in all quantitative analyses which codes or versions of codes are used and transmit these codes to the NRC prior to and/or during the license application process for independent audit.

° Justify decisions to not benchmark code versions when updates to the primary codes, which have already been benchmarked, are purely cosmetic (e.g. changes in output formatting statements).

° Document a thorough and detailed benchmarking plan including the benchmarking strategy, validation and verification problems, appropriate analytical solutions for comparison, and criteria for acceptable levels of comparison errors between the results of numerical and exact codes.

Specific requirements for computer code documentation are provided in NUREG-0856. By completely documenting codes and associated computer models, and benchmarking these codes, DOE will indicate that the performance assessment codes have been evaluated for accuracy and accepted as adequate tools for predicting repository response. Once transmitted to the NRC, these codes may be subjected to independent audit including, but not limited to, benchmarking and execution in an attempt to reproduce the results contained within the license application. This audit will familiarize NRC staff and contractors with particular aspects of the computer codes and attempt to assess the thoroughness of the DOE performance assessment QA program.

## Quantitative Techniques in Performance Assessment

Much of the analytical work being performed by DOE in the area of performance assessment is slightly more advanced than state-of-the-art techniques. New techniques that are relatively untested and not yet accepted by the technical community do not provide reasonable assurance that calculations performed with these techniques are valid. Prior to applying unproven techniques to assess repository performance in preparation for licensing, these techniques should undergo a formal review by the technical community.

Before supporting research into new analytical techniques for performance assessment of HLW repositories, DOE should evaluate the potential worth of the techniques in light of system uncertainties. Uncertainties may mitigate any potential benefits of new techniques. In cases where conventional techniques would be adequate to assess performance, development of new techniques is not warranted. Conventional groundwater flow simulators (e.g. finite element and finite difference codes) have been successfully used to model groundwater basins, watersheds, aquifer responses, and hazardous and sanitary waste facilities. In most situations, where the simulators have been properly applied, the calculated results have approximated observed conditions, so these quantitative techniques have been found to be adequate tools for assessing groundwater systems. If new techniques such as non-linear regression groundwater flow models can be demonstrated to more accurately simulate repository performance, then DOE should expose the techniques to the technical community for thorough review after consultation with the NRC.

## Uncertainties in Calculations of Pre-Emplacement Groundwater Travel Times

Implicit in calculations of groundwater travel time are a host of assumptions designed to minimize the effects of underlying uncertainties. For the purposes of calculating reliable groundwater travel times, generalized assumptions should not be made without first evaluating the underlying uncertainties. The sources of these uncertainties and methods of addressing them are discussed individually below.

- Uncertainties in data collection and analysis. Similar tests may generate dissimilar results because they may employ different methods of data collection and analysis. ~~In the performance of a pump test in a borehole originally drilled with mud, for example,~~

~~residual mud in the borehole may mask the true permeability and effective porosity of the formation being tested.~~ A rigorous quality assurance program, to be agreed upon by DOE and NRC, must be adhered to in all data collection. Questionable data will be considered invalid unless DOE can justify its use to the satisfaction of the technical staff and consultants of both agencies. Similarly, the analytical techniques used to translate the raw data into more useable parameters may introduce their own biases and uncertainties. The assumptions associated with testing methods and analytical data interpretation techniques applied must be justified for each test to the satisfaction of the DOE and NRC technical staff. For example, analysis of pump test data in a dual porosity medium using Theis or Hantush-Jacob analytical interpretation techniques may yield "averaged" values for hydraulic parameters; these average values may produce non-conservative results when applied in a performance assessment of the site. An analysis of such test data should be performed accounting for the possible dual-porosity nature of the medium in addition to the more common techniques. Any parameter value to be used in performance assessment modeling should be accompanied by or reference background information regarding the testing technique, interpretive technique, and assumptions applied in obtaining that value. The uncertainties and errors associated with a measured or calculated value must also be presented in the background information. The pre-interpretation ("raw") test data should be made available to the NRC upon request to support the credibility of the parameter values.

- Uncertainties in the extrapolation of data. Since a complete and definitive characterization of all hydrologic and geologic parameters is not possible, point values at discrete locations are typically extrapolated into regions where the parameter values are not known. Because the extrapolated values may not be representative of the characteristics of the untested regions, extrapolation of the available data to construct models introduces uncertainty. The extrapolated values may not be representative of the characteristics of the untested regions. An assessment of these uncertainties is warranted since large uncertainties may decrease confidence in the calculated groundwater travel times. The methodology for data extrapolation must be developed prior to the application of numerical models. All extrapolation techniques and applications must be thoroughly documented and the documentation made available to the NRC prior to incorporation in performance assessment modeling. Plans for methodology development and documentation of extrapolation techniques should be delineated by DOE in the BWIP SCP.

- Uncertainties in governing principles. Significant error may be introduced into groundwater flow calculations by misapplying the governing principles of the process. The application of the equations that describe flow through porous media to describe fracture flow, for example, may introduce considerable error in the results since the mathematical equations are unrepresentative of the physical system. Depending upon scale, porous flow approximations may or may not be functionally valid. Both the nature and the magnitude of the error introduced by the misapplication of the governing principles are generally not known. Since the calculated results are subject to the error introduced by the misapplication, the uncertainty of the error translates into uncertainty of the results. The potential for misapplication of governing principles and the associated uncertainties should be addressed by the DOE.

- Uncertainties arising from errors or inaccuracies in computer codes and mathematical calculations. Application of specific computer codes, for example, may introduce uncertainty if they are applied to problems they are not specifically designed to solve. Numerical approximation techniques may also contribute uncertainty to the travel time calculations if misapplied.

- Uncertainty in extent of disturbed zone. Since the groundwater travel times are to be calculated from the periphery of the disturbed zone to the accessible environment, the delineation of the disturbed zone is of primary importance. Uncertainty in the extent of the disturbed zone needs to be evaluated by the DOE prior to calculating pre-emplacement groundwater travel times. (This topic is further discussed in the section of this document entitled "Determination and Justification of the Extent of the Disturbed Zone at BWIP".)

## Uncertainties in Analyses of Cumulative Radionuclide Releases to the Accessible Environment during the First 10,000 Years after Emplacement

EPA has proposed standards for the release of radionuclides to the accessible environment ( 40 CFR Part 191). The uncertainties in simulating radionuclide transport through the geosphere to demonstrate compliance to the EPA standards are similar in nature to the uncertainties mentioned above. NRC staff advises DOE to address the following uncertainties in far-field assessments of radionuclide transport: uncertainties in groundwater travel time calculations, quantitative probabilities of release scenarios, the ability of analytical techniques to accurately predict repository performance over long time periods (e.g. 10,000 years), geochemical data (e.g. mineral chemistry, Eh, ionic species, ionic strengths, etc.), geochemical processes (e.g. complexation, precipitation, kinetic effects, colloidal transport, gas transport, etc.), and aquifer dispersivity calculations.

DOE should incorporate these uncertainties into assessments of far-field radionuclide transport models for comparison with the EPA standard. The results of the modeling studies should consist of cumulative distribution functions of the probability of satisfying the EPA standard versus the magnitude of released radionuclides. Evaluations of failure probabilities should include assessments of the consequences of occurrences that exceed the release limits of 40 CFR Part 191.

## Uncertainties in Analyses of the Performance of the Engineered Barrier System

The waste package must resist attack by corrosive agents and by radiolysis for long periods of time. Assessment of performance of the waste package is subject to similar uncertainties to those involved with groundwater travel time. The engineered barrier performance assessment concerns are discussed in more detail in a separate technical position (NUREG/CR-3219). The uncertainties for the engineered barrier system include uncertainties in data collection and analysis, in extrapolation of data, in the governing principles used to predict waste package performance over time, and in the codes used to assess performance. Performance assessment of the waste package is required to determine the source term for the radionuclide transport models as well as determining compliance with requisite requirements.

## Simulation of Significant Geochemical Processes in Modeling Radionuclide Transport

Radionuclide transport in groundwater from the repository to the accessible environment is uniformly recognized as the most likely release scenario. The transport of the radionuclides will be partially controlled by the interactions between the conducting media and the radionuclide species transported by the groundwater. Since numerical and analytical models of radionuclide transport will be used to predict repository performance, the mathematical relationships of the models that describe the relevant geochemical processes should be evaluated and justified by DOE in light of the data and understanding of the geochemistry at BWIP. The representation of processes such as retardation of radionuclide transport may require the use of non-linear sorption isotherms rather than linear distribution coefficients if the latter can not be justified as being sufficient by theoretical, laboratory, and field investigations. These studies should also evaluate the importance of hysteretic sorption and activity effects on radionuclide transport in the far-field groundwater system at BWIP. If activity effects on sorption are found to be significant to far-field radionuclide transport, coupled geochemical equilibrium-transport models may be required to accurately simulate system behavior. Given the uncertainties in the hydrochemical data and the limitations of the site characterization program, however, the coupling of geochemical equilibrium models (e.g. PHREEQE, WATEQF, BALANCE, etc.), which require such data, might just be used to assess the sensitivity of repository performance to variations in water and substrate chemistry.

DOE should integrate the geochemical experimentation and testing program at BWIP with performance assessments of radionuclide transport. Radionuclide transport models should be supported by appropriate studies of BWIP geochemistry to justify the particular techniques used in the assessments. DOE should prepare a detailed position justifying the quantitative techniques used in radionuclide transport assessments and submit this position to the NRC for review and comment during the consulatory period before licensing (e.g. within the BWIP SCP).

## Quantitative Sensitivity Analyses to Determine Key Parameters that Affect Repository Performance

Quantitative sensitivity analyses need to be performed to identify the key parameters that will affect compliance with the 1) groundwater travel time criterion, 2) EPA release standards, 3) the minimum release rate criterion, and 4) the minimum containment criterion. Upon determining the key parameters, DOE should assess the effects of uncertainties associated with these parameters on predicted repository performance. These sensitivity analyses will estimate the impact of parameter uncertainty on overall repository performance. The results of these studies should influence site characterization by indicating which parameters need to be known to a high degree of certainty to reduce uncertainty in estimates of performance. The studies may also indicate conservative ranges of parameters to be used in repository assessments.

## Interaction between Performance Assessment and Site Characterization Activities

Modeling is required to support planning of experimental activities in two ways. Scoping studies using rather simple models provide approximate predictions of system response, thereby establishing bounds for experimental testing. For example, preliminary calculation of temperatures around a simulated waste canister establishes the temperature range over which important physical properties should be determined.

Modeling is used not only to establish ranges for investigation but also to plan experiments so that maximum benefit is gained from their execution. Modeling performed prior to execution of in-situ and laboratory testing can guide BWIP in choosing between alternative experimental designs. The level of modeling sophistication will depend upon the type of experimentation, but simple models will generally support phenomenological testing whereas detailed modeling should be undertaken concurrently with the planning of quantitative field tests.

Similarly, field and laboratory investigations should guide modeling efforts. This is accomplished in two ways. Firstly, the investigations provide data and information necessary for model construction. Secondly, collected information can be compared against model-predicted results in order to calibrate the model. Calibration of models can increase the understanding of the system through hypothesis-testing. Model calibration can also aid in identifying anomalies and informational gaps which should be further investigated by DOE.

Therefore, field and modeling studies must be interactively coupled so as to optimize their utility. The interaction between site characterization and performance assessment should be reflected in the individual studies, and DOE must develop and implement a program to effect this interaction.

## Comprehensive Performance Assessment Plan

A comprehensive plan outlining and integrating each facet of the performance assessment program is necessary to focus diverse performance assessment activities on the licensing requirements contained in 10 CFR Part 60 and 40 CFR 191.

The plan should cover all aspects of performance assessment including a description of specific codes to be used, a plan for coupling those codes, an assessment of the dominant and important physical phenomena which need to be addressed, a plan for quantifying uncertainty, and an outline of the code quality assurance program and code documentation. The interfaces between various disciplinary groups should also be detailed in the plan. In essence, the plan should show the integration of performance assessment activities and planned products.