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JKennedy
SCoplan
RBoyle
RJohnson
RCook
PPrestholt
TVerma
PBrooks & r/f
JGiarratana

109.2/PPB/85/09/11

SEP 13 1985

Ralph Stein, Director
Engineering and Licensing Division
RW-23
Office of Geologic Repositories
U.S. Department of Energy
1000 Independence Avenue
Room 7F091, Forrestal Building
Washington, D.C. 20585

Dear Mr. Stein:

Enclosed is the proposed agenda for the meeting between the DOE and NRC on performance allocation on September 26 and 27, 1985, in Silver Spring, Maryland. The purpose of this meeting is to continue discussion of open items from the NRC/DOE meeting on performance allocation on April 17, 1985. Accordingly, the scope of the meeting includes the utility of stating, for each performance goal, a level of confidence at which the performance goal would be demonstrated and agreement on the definitions of confidence and reliability.

Also enclosed are examples intended to illustrate concepts discussed in previous meetings. We hope that they will facilitate discussions on September 26. If you have any questions, please contact Seth Coplan (427-4728) of my staff.

"ORIGINAL SIGNED BY"
Hubert J. Miller, Chief
Repository Projects Branch
Division of Waste Management

Enclosures:
1. Agenda
2. Examples

cc: Donald Alexander
Charles Head

WM Record File 109.2
WM Project 1
Docket No.
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NAME	:PPBrooks	:SCoplan	:JJLinehan	:HJMiller	:	:	:
DATE	:9/13/85	:9/13/85	:9/13/85	:9/13/85	:	:	:

Enclosure:

AGENDA

September 26-27, 1985

NRC/DOE MEETING ON PERFORMANCE ALLOCATION

Silver Spring, MD
Room 106, Willste Building

o	Introduction	NRC/DOE	September 26, 9:00 AM
o	Utility of Pre-setting Confidence Levels for Target Performance Goals - Discussion	NRC/DOE	
o	Lunch		12:00 Noon
o	Definitions of Confidence and Reliability - Discussion	NRC/DOE	
o	Logic Diagram - Discussion	NRC/DOE	
o	Agreements	NRC/DOE	3:00 PM To be resumed September 27 at 9:00 AM if necessary

EXAMPLES FOR DISCUSSION

NRC/DOE MEETING ON

PERFORMANCE ALLOCATION

SEPTEMBER 1985

(The examples in this paper are intended only to illustrate the concepts of performance allocation and to facilitate discussion. These examples should not be interpreted as specifications by the NRC staff of specific values to be used in a performance allocation for any particular site, nor should the example approaches be construed as being the only approaches that might be used. The applicant must allocate performance for each site based on the individual features of the site and on the applicant's allocation of the resources to be devoted to site characterization.)

Need for performance allocation:

Part 60 sets out performance objectives for three of the major barriers of a repository system, but leaves to the applicant's discretion the proposed means by which compliance with the performance objectives is to be demonstrated. For example, the engineered barrier system release rate specified in Part 60 can potentially be achieved by a low groundwater flux coupled with low solubilities, by a low waste form leach rate, or by reliance on other engineered barriers such as bentonite backfill materials. Part 60 also leaves open (i.e., to the applicant's discretion) the means by which compliance with the EPA standards will be demonstrated. Two general approaches are available: a) better than required performance from one or more of the barriers addressed in Part 60 (provided that a multiple barrier approach is retained), or b) reliance on another characteristic of the disposal system, such as the site geochemistry.

Both DOE's site characterization plans and NRC's reviews of those plans will be significantly affected by the specific approach selected by DOE. In order to determine if the kind and amount of testing and investigation is sufficient -- "how much is enough" -- DOE should specify as early as possible the barriers to be relied on and the level of performance sought from each barrier.

Need for redundancy in initial allocation:

The initial allocation of performance for a repository system will necessarily be made with incomplete information regarding the performance capabilities of the system barriers, and it can be expected that further study will show some barriers unable to to perform as well as first anticipated. The NRC staff therefore considers it prudent to include a degree of redundancy between barriers in the initial performance allocation. The following are two examples of how this could be accomplished:

1) Establish dual goals for each barrier. "Design" goals would be the minimum performance goals needed to assure compliance with regulatory provisions, while "expected performance" goals would be based on more optimistic, but realistic, expectations of barrier performance. The performance allocation would clearly state that any values within the range would produce acceptable repository performance.

2) Keep barriers "in reserve." The performance allocation might initially attempt to achieve compliance with a specific performance objective by relying on only one component of a repository system rather than taking credit for all components. For example, compliance with the waste package containment criterion of Part 60 might be attempted based only on the performance of the canister material. If this were to prove unsuccessful, credit could be taken later for any packing or other waste package materials included in the repository design.

Such provisions for redundancy would help to ensure that regulatory requirements will ultimately be met and will provide a basis for revising the performance allocation through periodic iterations as site characterization proceeds.

Example performance allocation:

For a hypothetical repository site the following performance goals might be established:

Containment time -- 1,000 years design containment time within the waste package (to be achieved through a combination of spent fuel cladding and canister) with the expected failure rate during the first 1,000 years not to exceed X % per year.

Release rate -- 1 part in 100,000 per year from the engineered barrier system (i.e., the waste packages and underground facility, as specified in Part 60) to be achieved by the low leachability properties of the spent fuel pellet material. Bentonite packing and backfill materials will be incorporated into the repository design, but will not be relied on to achieve the release rate goal unless testing of spent fuel leaching properties indicates that spent fuel pellets are unable to achieve the specified release rate goal.

GW travel time -- 5,000 years through the unsaturated zone from the repository horizon to the water table. No credit for travel time through the saturated zone to the environment unless the travel time in the unsaturated zone proves unexpectedly short or difficult to evaluate.

Geochemistry -- An analysis of the overall system, with the parameters listed above, indicates that the following minimum retardation factors will be needed in order to assure compliance with the EPA standards:

Nuclide	Retardation factor
X-63	3.0
Y-127	12.0
Z-249	5.0

Confidence level -- To the extent that uncertainties in determination of the above parameters can be quantified, test programs will be designed to produce an XX % confidence level that the parameter will achieve at least the desired level of performance. Those uncertainties which cannot be quantified (for example, the applicability of models or test methods) will be evaluated by an independent peer review group with the goal of achieving an approximately equivalent, though unquantified, level of confidence.

Importance for test program:

The following example illustrates, for an idealistic case, how specification of both a performance goal and a confidence level can help to determine an appropriate test plan.

Assume: Available information about the site has produced preliminary estimates of the magnitude and spatial distribution of the parameters necessary to calculate the groundwater travel time. (Such information would include that presented in the EA's.) Based on this preliminary information, a test program is to be designed which will produce, during site characterization, the additional information necessary to support a license application.

In order to demonstrate that the GW travel time meets or exceeds its goal at the stated level of confidence, and using the preliminary estimates of gradient, porosity, etc., it is determined that the following criteria need to be met for the effective hydraulic conductivity over the applicable flow path:

Goal -- Conductivity less than 10^{-8}
Confidence level -- 90%

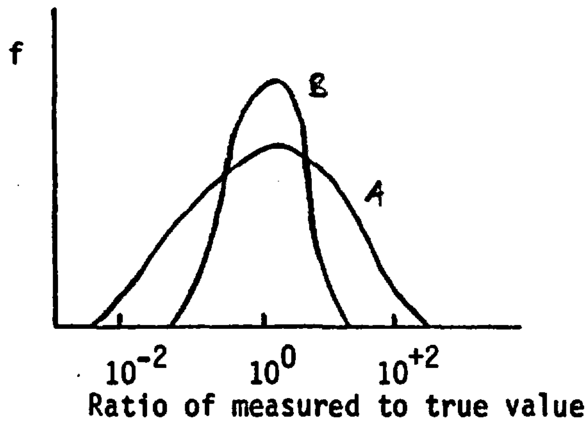
(Here the confidence level addresses both measurement uncertainties and uncertainty in knowledge of the spatial variability of the parameter, as estimated using geostatistical methods.)

The actual confidence level achieved will depend on the stated goal, the measured values, and the test program employed. Suppose two test programs are available. Based on the sensitivity of the test methods used, the number of measurements, and the spatial distribution of test locations, the following can be estimated:

Test program A can measure conductivity values to within 2 orders of magnitude.

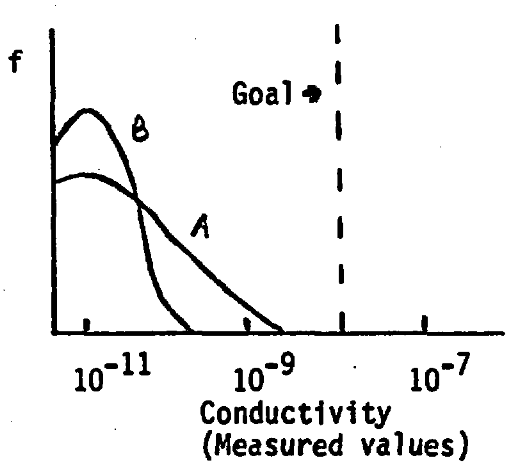
Test program B, a much more extensive and costly program, can measure conductivity values to within one order of magnitude.

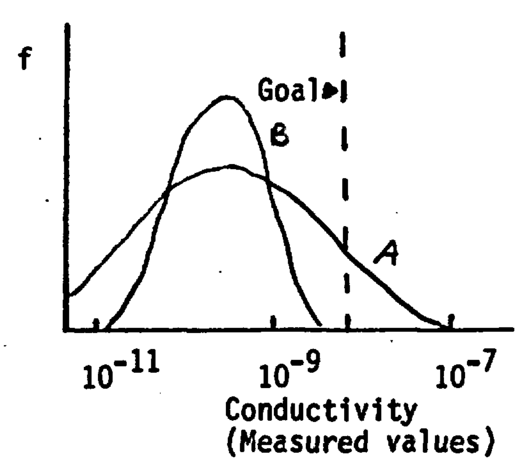
Conceptually, the sensitivities of the two test programs can be illustrated as shown on the following page.



The figure above illustrates only the estimated sensitivities of the test programs -- not any actual measured values. This figure includes two main considerations -- the precision of a testing method and the geostatistical uncertainty in the spatial variation of a parameter after measurements at a specified number of locations. Thus, whatever the true value of a parameter is, and whatever its spatial variation, test program A will be able to provide measurements within two orders of magnitude of the "true" values and program B within one order of magnitude.

The importance of establishing performance goals and confidence levels on selection of a test program can be illustrated for different expectations regarding the measurement results. If the measured value of the conductivity is expected (based on current knowledge) to be about 10^{-11}, then test program A would be appropriate. If the conductivity is expected to be about 3×10^{-10}, then test program B would be needed. Neither test program would be adequate if the conductivity is expected to be only slightly (less than an order of magnitude) less than the goal, requiring either development of more sensitive testing methods or an iteration of the performance allocation. The first two situations are illustrated schematically below.





NRC staff position:

A performance allocation should be developed as early as possible in order to guide development of plans for site characterization. This performance allocation should specify 1) the particular barriers which will be relied upon to provide waste isolation, 2) the level of performance sought from each barrier, and 3) the level of confidence with which DOE will demonstrate that this level of performance is achieved.