



Mr. Everett A. Wick  
February 16, 1984  
Page 2.

For example, see Oversby's comments and the discussions and evaluations of backfill research and data given in "Review of DOE Waste Package Program," NUREG/CR-2482, Vol. 4, BNL-NUREG-51494, pages 88-89 and pages 74 to 136, in general. In general, the authors have ignored a great deal of literature bearing on this DSTP that often contradicts or offers alternative views to those presented.

(3) The draft, in many areas, appears to be more of a partial literature summary without evaluation, than a DSTP. As such it is uncritical, incomplete and inappropriate.

(4) An appreciable portion of the introductory text deals with the history and politics of waste management. Aside from being repetitive and out of place it contains naive mistakes such as (page 1-4) "The Department of Energy (DOE) is primarily responsible for developing national policy on disposal of HLW...."

(5) The sections on thermodynamics and kinetics are vague and confusing. It is not clear what the authors are recommending that the DOE develop as needed information.

(6) In some cases (pages 3-3, 3-5, 3-6, 3-7, 3-10, 3-11) the authors recommend complicated and difficult measurements from the DOE without connecting their relevance to evaluation of a repository license (i.e., gamma and alpha radiation spectra, multigroup gamma ray attenuation, absorption, cross sections, etc.).

Some additional specific comments follow:

(1) The discussions on doses to the thyroid, organs and whole body on page 1-5 are inappropriate for an NRC DSTP.

(2) The discussion (page 1-6) on waste package providing "a major basis for compliance in cases involving intermediate times and distances..." is confusing.

(3) In contrast to the discussion on page 1-6 the NRC is not likely to give credit for waste package containment for as long as ten thousand years.

(4) The statement on page 1-7 "...compliance with this section which will require continuation of the waste package containment analysis for times well beyond 1000 years..." is not obviously true. Since the authors state in several places (including the first sentence in the introduction) that this draft represents an NRC staff position such claims are potentially embarrassing unless the NRC modifies its past positions.

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(5) Statements on page 1-10 (item 4) assume future policy changes for the NRC -- they are not appropriate.

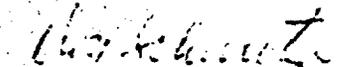
(6) The statement on page 2-7 that a certain assumption made by the authors "...is the position of the NRC staff..." should be deleted.

(7) The first sentence on page 3-1 uses quantitatively instead of reasonable assurance. The last sentence uses underground facility where engineered barrier system should be used.

Additional comments are included in the enclosed memo.

We wish to stress that our reviews only touch on some of the salient points. We believe much more time is necessary to go over the document page by page.

Sincerely,

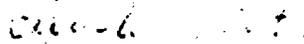


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C. Sastre,  
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C. Pescatore, Nuclear Waste Management Div.



DGS:CS:CP:gfs

Enclosure

cc: M. S. Davis  
W. Y. Kato  
H. J. C. Kouts  
P. Soo  
Docket Control Center, NRC

BROOKHAVEN NATIONAL LABORATORY  
MEMORANDUM

DATE: February 16, 1984  
TO: Files  
FROM: C. Sastre and C. Pescatore  
SUBJECT: Review of "Draft Staff Technical Position on Repository Environmental Parameters Relevant to Assessing the Performance of HLW Packages"

1. INTRODUCTION

The document under review intends to communicate the NRC position on (a) which are the waste package system variables relevant to waste package performance and (b) on acceptable ways to determine them. Recommendations about the first item were reached after reviewing DOE's waste package characterization efforts for the BWIP site. Recommendations about the second item were reached on consideration of present EPA and NRC criteria on the release of radionuclides from a nuclear waste repository and from high-level waste packages, respectively.

The document consists of a review of the state-of-the-art of waste package analysis at BWIP and of a main text of considerations and recommendations. The BWIP review constitutes all of the appendices to the document and part of the main text. Because of the evolving position of the BWIP project on waste packages, the BWIP review part should not appear in the DSTP which should offer guidance on less volatile subjects. The considerations of the main text are appropriate for inclusion in the DSTP.

Our comments to the document are presented in Section 2 for the main text of the DSTP (Chapters 1 through 4), and in Section 3 for the BWIP review (Appendices A through D). Conclusions are drawn in Section 4.

## 2. COMMENTS TO THE MAIN TEXT

### 2.1 Comments to Chapters 1 through 3

The use of certain terminology throughout the document and in the document title, in particular, is misleading. Since the authors identify waste package system variables as repository environmental parameters, the reader is led to think that the document will deal with properties external to the waste package. On the contrary, the DSTP deals with the determination of internal, waste package system variables, such as the temperature profile within the package, the pH of the groundwater in the packing materials, etc.

A closer look at the document reveals that it is actually a document on waste package modeling, where the authors give their own prescription on which system variables are important and how modeling should be accomplished. They do so without taking into account the NRC position on the subject as presented in the following documents:

- [1] DTP on Waste Package Performance After Repository Closure, NUREG/CR-3219, Vol. 1, August 1983.
- [2] DTP on Waste Package Reliability, NUREG-0997 R, September 1983; also C. Pescatore and C. Sastre, "Waste Package Reliability Analysis," NRS Meeting, Boston, November 1983.
- [3] DTP on Documentation of Models, NUREG-0856, December 1981.

The DTP's [1] and [2] already indicate the variables of environmental concern to be groundwater composition, temperature, radiation, and pressure. Indeed, they are being considered relevant to all sites. The BWIP review of these authors simply confirms this position. An original contribution by the authors of the DSTP should have been to expand on the available NRC documentation by offering further specifications in order to limit the level of details requested of DOE for repository licensing. However, the model requirements which are suggested offer little guidance as they cover all possible grounds by being at times very specific and very vague at other times. For instance,

as an input to the temperature model it is specified that the initial distribution of the heat source in the waste form should be specified. The effect of the heat source distribution in the waste form has always been considered unimportant in previous analyses. Which is the basis for such a detailed requirement? Besides, how should DOE interpret the requirements that a thermodynamic data base should be "complete" for "many" radionuclides, or that "some information" should be supplied on the formation rate of "colloids"?

Furthermore the document demonstrates no continuity with the DTP on Waste Package Reliability and with the DTP on the Documentation of Models. The authors propose a reliability methodology which implements fault and event trees to perform a quantitative analysis. This methodology has never been demonstrated, is not pursued by any DOE program, and its applicability is highly controversial. The document could place the NRC in the embarrassing position of giving guidance to DOE on a methodology for which no basis has been established.

## 2.2 Comments to Chapter 4

Chapter 4 should comment on the adequacy of DOE-BWIP waste package models, but it falls short of its goal. It is more a colloquial assessment of code development status than a critical review of codes. As such it should not belong to the main body of the DSTP. As an example, the WAPPA code is not reviewed in enough detail to offer guidance to either DOE or NRC. The statement that "the WAPPA approach... is a rational attempt to model..." reads as an endorsement of the code, which is not warranted by the level at which the review has been performed.

Also, it would appear from Section 4.7 on Sampling Techniques, that Monte Carlo simulation and Latin Hypercube Sampling are not compatible. This is not necessarily the case as demonstrated in Ref. [2].

## 3. COMMENTS TO APPENDICES A THROUGH D

As a general comment these appendices do not present detailed reviews supportive of a DSTP document. They are a summary of readings of DOE and NRC

documents and do not add new details. The tone is colloquial, and it is seldom clear which of the statements made are the authors' opinion, DOE's opinion, or the NRC's position. No supportive analyses are provided. Since these appendices have been proposed for inclusion in a DSTP, it should be made clear constantly what is being accepted by the NRC staff and what is suggested by the authors. This is especially true of the "descriptive" Appendices A, B and C.

Additional comments on Appendices B, C, and D are as follows:

As a minor point, it should be noted that in B.3.1.5 the intense radiation field in the packing material is due to Cs-137 and not Cs-135 and Sr-90 as stated in the text.

In Appendix C the environmental parameters are ranked on importance. The listing represents closely the general consensus but the relative ranking of radiation field and pressure could be arguable, and the broad class of groundwater characteristics could be broken down in finer detail. It could be helpful if it were clarified what importance means. In the form used by the authors, importance depends on sensitivity of performance to a parameter and on uncertainty of prediction of the parameter.

The Appendix D gives "credible ranges" for the parameters. It is useful to use the concept of credible ranges to channel the limited research resources away from areas judged to be not representative of potential repository conditions. Selection of such ranges, as the authors acknowledge, is somewhat subjective and judgemental and perhaps there is more danger in trying to formalize something not quite quantifiable than in recognizing the difficulties and limitations. However, the concept is being used or proposed for use "to limit the possible range of environmental parameters for use in package performance analysis and limit access of research." At this point we begin to take the numbers seriously, and the danger starts.

The first Table D.1.1 in a sense serves to test what "credible ranges really mean." We find that a sulphate ion concentration larger than 200 mg/L is by implication incredible on the basis of experiments in which concentrations of 197 mg/L have been observed. We remember that in the body of the

DSTP it was stated that the thermal transient can result in concentration of the salts by evaporation. Then in this usage "credible range" means something a small departures from the norm assuming that we did not overlook anything.

In other words, the authors use to define the range that an expert practitioner in the field would when presented with a value say "so what?" For safety the credible range should be more the range outside of which the expert practitioner would say "you must have made a mistake."

#### 4. CONCLUSIONS

The document under review falls short of its goal. It represents no improvement on previous NRC positions and cannot be relied upon to give DOE's further guidance on how to narrow down its selection of important issues.