Department of Energy
Washington, DC 20585
December 23, 1993

Mr. C. William Reamer, Acting Director
Repository Licensing & Quality
Assurance Project Directorate
Division of High-Level
Waste Management
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

References: (1) Ltr, Shelor to Linehan, dtd 12/14/90
(2) Ltr, Bernero to Bartlett, dtd 7/31/91

Dear Mr. Reamer:

On December 14, 1990, the U.S. Department of Energy (DOE) transmitted its responses to objections, comments, and questions presented in the U.S. Nuclear Regulatory Commission's (NRC) Site Characterization Analysis (SCA) (Reference 1). The NRC staff evaluated these responses, closing some of the items and creating open items of the remainder (Reference 2). Two of the open items, identified above, have been addressed through actions and progress in the program.

Enclosures 1, 2 and 3 summarize the administrative records with respect to SCA Comments 99, 102, and 103, and on this basis, DOE believes that these open items should be closed.

Attn: Jim McKnight July 14, 1994
Please reenter this document.

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It was previously processed with above numbers, but some 14? pages of the enclosure were missing. Pauline Brooks T7-J9 415-

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If you have any questions, contact Chris Einberg of my staff at (202) 586-8869.

Sincerely,

Linda J. Desell

for Dwight E. Shelor
Associate Director for
Systems and Compliance
Office of Civilian Radioactive
Waste Management

Enclosures:
1. Administrative Record for SCA Comment 99
2. Administrative Record for SCA Comment 102
3. Administrative Record for SCA Comment 103

cc w/ enclosures:
R. Nelson, YMPO
R. Loux, State of Nevada
W. Offutt, Nye County, NV
T. J. Hickey, Nevada Legislative Committee
D. Bechtel, Las Vegas, NV
Eureka County, NV
Lander County, Battle Mountain, NV
P. Niedzielski-Eichner, Nye County, NV
L. Bradshaw, Nye County
C. Schank, Churchill County, NV
F. Mariani, White Pine County, NV
V. Poe, Mineral County, NV
J. Pitts, Lincoln County, NV
J. Hayes, Esmeralda County, NV
B. Mettam, Inyo County, CA

Enclosure 1

SCA Comment 99 and DOE Response (12/14/90)
(DOE Response to Comment 95 also provided due to cross-reference to Comments 99, 102, and 103)

NRC Evaluation of DOE Response (7/31/91)

DOE Supplemental Response to SCA Comment 99

ENCLOSURE 1

Section 8.3.5.13 Total System Performance

COMMENT 99

For some scenario classes in which a particular release mode is thought to dominate or, at least, dominate for a particular time period, the consequences that are calculated may not be adequately represented unless all the release modes are quantified, especially the residual part of the inventory continuing to participate in the nominal or undisturbed mode(s) of release. Premature and inappropriate limiting of the consequence analysis in this way may distort the performance allocation process so that insufficient priority is placed on some data or important data acquisition activities may be omitted from site characterization.

BASIS

- Page 8.3.5.13-25 (first paragraph) states "... for some scenario classes, such as drilling scenarios, the direct-pathways mode may be considered to dominate." Although the direct pathway mode may dominate at the time of excavation of some waste during drilling, the remainder of the waste not excavated by drilling will continue to release radionuclides to the accessible environment in a manner that prevailed prior to drilling, as modified by the effects on liquid and gas pathways by the drilling. Although the excavated waste may provide a substantial "spike" of releases at the time of excavation, the waste released in a less disturbed fashion may still be considerable and make a substantial contribution to the CCDF.

- Page 8.3.5.13-53. "Some of the scenario classes result in direct discharge of radionuclides to the surface. Others result in indirect releases; that is they produce movement of radionuclides through the barriers of the repository system to the accessible environment. The table labels the scenario classes according to these modes of release." In fact, virtually all scenarios produce releases by several modes. If the intention is to classify scenarios by the "featured" mode of release, that may be appropriate for certain applications. Recognize, however, that the "featured" mode of release may not be the same as the dominant mode of release because without a calculation to support the assertion it is not clear that specifically a particular featured mode of release, such as direct exposure to a small fraction of the emplaced waste, may be smaller than the ongoing mode(s) of release from the unaffected waste. Therefore, use of a single mode of release to calculate consequences for a given scenario is acceptable only when calculations show that the release by modes that have been omitted do not contribute to the CCDF in a substantial fashion, either individually or aggregated over the entire range of scenarios.

RECOMMENDATIONS

- Plan to include all appropriate modes of release in calculating the consequences of every scenario class; these modes should not be eliminated unless an analysis is provided that shows that leaving them out of the analysis has no significant effect on the CCDF.

- In calculating consequences of a scenario it is acceptable to partition the waste inventory according to the mode of release, but the release from all modes should be calculated. It is not acceptable to partition the waste and not account for the ultimate fate of part of the waste.

- The confidence and goals in the performance allocation process should be determined by considering all modes of release from each scenario with appropriate consideration of the magnitudes of release from different modes.

RESPONSE

The U.S. Department of Energy (DOE) agrees with these recommendations and believe they are incorporated in the planned work. In general, disruptive scenarios are treated as perturbations to the nominal flow case. The response to Comment 95 further discusses DOE's approach to scenario development.

Section 8.3.5.13 Total System Performance

SCA COMMENT 99

For some scenario classes in which a particular release mode is thought to dominate or, at least, dominate for a particular time period, the consequences that are calculated may not be adequately represented unless all of the release modes are quantified, especially the residual part of the inventory continuing to participate in the nominal or undisturbed mode(s) of release. Premature and inappropriate limiting of the consequence analysis in this way may distort the performance allocation process so that insufficient priority is placed on some data or important data acquisition activities may be omitted from site characterization.

EVALUATION OF DOE RESPONSE

- NRC commented that DOE might be distorting the performance allocation process by ignoring undisturbed release modes when considering dominant release modes. NRC recommended that all appropriate modes of release should be included in the consequence analysis unless they can be eliminated as being insignificant. Furthermore, all modes of release should be calculated, and the performance allocation process should include all modes of release.

- DOE replied that it agreed with all NRC recommendations and believes that they were already incorporated into the planned work. They stated that disruptive scenarios are treated as perturbations to the nominal cases. In making the comment the NRC staff considered that the SCP did not reflect this approach. Accordingly, the issue will be resolved when DOE provides the NRC staff with information indicating how various release pathways enter into performance allocation and the calculations of the CCDF.

- The NRC staff considers this comment open.

Section 8.3.5.13 Total System Performance

COMMENT 95

The underlying methodological logic that is used to develop and screen scenarios and its implementation in the SCP appears to be deficient for the generation of a CCDF representative of total system performance; therefore, this approach is unsuitable for guiding the site characterization program, even if allowances are made for the current lack of knowledge about the site and the expediencies required to develop the site characterization program.

BASIS

- Comment 94 on the CDSCP was addressed by providing more detail in additional text. However, as discussed in the points below, the new text does not resolve the comment. Although Question 46 on the CDSCP was answered in part, the text does not address important issues of mathematical robustness and does not provide confidence that site characterization will obtain data needed to analyze all the scenarios that need to be treated in the CCDF.

- With regard to the recommendation in CDSCP Comment 94: (1) the scenario selection and screening procedures articulated in the SCP do not contain explicit criteria or the justification for them; (2) the scenario selection and screening procedures are not systematic, nor do they provide assurance of completeness; and (3) the inappropriate formal use of expert judgment is discussed in comment 3.

- The five scenario classes listed in Table 8.3.5.13-3 are used to develop the performance allocation for total system performance (Table 8.3.5.13-8) that guides the site characterization program for resolution of Issue 1.1. Table 8.3.5.13-2 correlates the five scenario classes with 49 other scenario classes of unspecified origin (in column 2 of the Table), some of the 99 Ross scenario sequences, and some of the scenarios considered in the Decision Aiding Methodology. Neither the Tables nor the accompanying text provide a suitable relationship among the various sets of scenarios and scenario classes to show: (1) how these scenario classes relate to the discussions of construction the CCDF, and (2) how the particular set chosen is adequate for the purposes of site characterization.

- The "scenario classes" listed in Table 8.3.5.13-3 are used as the basis for performance allocation; however, because one scenario may fit into more than one of these groupings, they are not mutually exclusive and, therefore, not appropriate for development of a CCDF. Also, it is not clear that these groupings include all significant scenarios (another requirement of the CCDF). For example, the SCP adds 15 scenarios to the set of scenarios developed by Ross. Clearly, then, the Ross analysis was deemed incomplete; however, no analysis is provided to assure that the current set of scenarios is complete.

- As defined in the SCP, the "nominal scenario class" is so improbable as to be of marginal significance. It does not seem appropriate to plan site characterization based on a set of "scenarios" which are unlikely to even occur.

- As a practical matter it does not appear that DOE will be able to generate the joint distribution function F(V), or that the site characterization program will provide any input to define this distribution function given that the five "scenario classes" (A-E) which form the basis of performance allocation are defined in a manner inconsistent with the mathematical definitions of this text. Equation 8.3.5.13-6 defines the conditional CCDF for a "scenario." Equation 8.3.5.13-4 defines the basis of calculating the CCDF as the expectation integral given by equation 8.3.5.13-3. The expectation integral is defined in terms of the joint distribution function F(V), which is defined as the distribution over the entire set of state variables and their range for all eventualities. It does not appear that the use of the expectation integral as implied in equation 8.3.5.13-6 has a precise mathematical meaning, since the expectation integral has not been explicitly defined for a "scenario."

- The approach to defining scenarios used in the Ross report is to begin with a comprehensive list of events and processes that could contribute to release of radioactivity from a repository and screen these entities and their combinations for significance toYucca Mountain. An alternative approach is to look at the Yucca Mountain repository, to determine which subsystems are critical to waste isolation, and to define conditions or events that will compromise these subsystems; this is the central focus of most PRA. At the bottom of page 8.3.5.13-25 and in Table 8.3.5.13-2 the idea is articulated that some combination of these two approaches is being used to define scenarios for the purpose of guiding the site characterization effort. (Table 8.3.5.13-2 attempts to relate the Ross scenarios to scenarios defined on the basis of major barrier affected.) It is not clear how consistency, completeness, and mutual exclusivity of scenarios is achieved where a combination of approaches is used since this is conventionally assured by consistent use of one approach or another.

- The nominal scenario class, E, is cited Table 8.3.5.13-3 as: "Undisturbed and nominal performance of all barriers" and "Undisturbed performance of all natural barriers." However, on page 8.3.5.13-8 the text indicates that Ross scenarios related to flooding, geochemical change, undetected features, faulty waste emplacement, increase in recharge due to climate control, differential elastic response to heating, nonelastic response to heating, temperature-driven fluid migration, local mechanical fracturing, corrosion, chemical reaction of waste package with rock, geochemical alteration, and microbial activity are all included in the nominal scenario class. The text broadly states that aggregating such diverse scenarios into the "nominal" scenario class is justified because site characterization will investigate a large range of conditions, features, and parameters sufficient to include these scenarios.

- The various processes and events, that form the bases of scenarios and sequences by which they can cause failure of barriers to the release of radionuclides, used in the Ross report are based on a list of 57 events and processes published by the International Atomic Energy Agency (IAEA, 1983). Although this listing is useful for some purposes, the NRC staff does not believe that this is an appropriate basis for developing scenarios pursuant to demonstrating compliance with 40 CFR 191. Unlike the European approaches to regulating a repository, the US approach is deeply rooted in the systems approach, wherein the term scenario has a very specific and constrained meaning. In particular, scenarios should not represent the response of the repository system to anticipated or unanticipated external events of environments; rather, scenarios should be limited to descriptions of the external constraints, in time, on the system.

- Page 8.3.5.13-44. Five "undetected features" are included in the set of "agents" used to estimate how many independent scenario classes must be considered. The NRC staff does not advise treating undetected features as scenarios. Instead, undetected features should be treated as uncertainties in the conceptual model or as alternative conceptual models to be resolved during site characterization.

RECOMMENDATIONS

- The approach to scenario analysis and how it is being employed to guide the site characterization program should be clarified or redone. In particular, as stated in the first Recommendation from CDSCP Comment 94, the methodology for scenario development and screening should (1) be systematic, and (2) provide assurance of completeness.

- In particular, the following aspects require correction:

  - Performance allocation and consideration of alternative conceptual models should be performed in the context of a reasonable number of real, mutually exclusive, important scenarios or scenario classes - not the objects listed in Table 8.3.5.13-3.

  - Consideration of sets of scenarios, sets of scenario classes, and sets of other objects derived in various references and other sources should be used considering their derivation and logical consistency.

REFERENCES

Ross, Benjamin. A First Survey of Disruption Scenarios for a High-Level Waste Repository at Yucca Mountain, Nevada, SAND85-7717. December 1987. Sandia National Laboratories.

IAEA. Concepts and Examples of Safety Analysis for Radioactive Waste Repositories in Continental Geological formations, Safety Series No. 58, Vienna, Austria, International Atomic Energy Agency, 1983.

RESPONSE

Several U.S. Nuclear Regulatory Commission (NRC) comments indicate concern related to incompleteness of the preliminary set of scenarios issued in Ross (1987) and included in the Site Characterization Plan (SCP). The example set of classes was also questioned. The logic discussion (SCP pages 8.3.5.13-125 and 126) points out the interdependence of site investigations and scenario development. The preliminary set of scenarios (Ross, 1987) should be viewed as a beginning. It is a list of possible release avenues based on evidence available at the time of writing, but is by no means comprehensive or final. Since publication in 1987, Ross has extended the list by adding scenarios related to gas-phase release. The U.S. Department of Energy (DOE) continues to work on scenario development and will do so as long as reasonable questions arise from site investigations or public concern.

The scenario course now being followed is derived from the SCP 8.3.5.13 information needs and activities. DOE believes scenarios have the potential to be the coordinating and integrating tool for site investigations, providing the statement of all known, credible potential release problems at the site. The scenario course also would serve as a guide to establish a record of technical arguments used to eliminate unimportant scenarios. The work is responsive to site investigation findings that DOE is familiar with and actively seeks input from Project Participants regarding other observations and insights into possible failure pathways.

Several methods were considered to assist in scenario construction. The event tree was selected for performing the detailed identification and screening of events and processes; these tasks are indispensable steps in scenario development. Eight basic initiating events or processes were identified as the (amendable) set important to postclosure performance assessment. The topics to be developed using event trees are:

1. Nominal Flow
2. Human Intrusion
3. Basaltic Volcanism
4. Tectonics
5. Climate Change
6. Other Human Activities
7. Gas Release
8. Closure of Repository.

Other issues have been identified that require resolution but that may require less extensive treatment.

Current strategy is implemented as follows: Using all information on site characteristics and investigations DOE is aware of, a "strawman" event tree is constructed. The tree for nominal flow includes processes and events to describe the entry of water through the surface, possible travel modes to the region of influence of the repository, mechanisms for releasing radionuclides from the engineered barrier system (EBS), and subsequent transport to the accessible environment. The disruptive trees include processes and events resulting in increased release by perturbations to nominal flow and by additional routes to the accessible environment. The tree, with an

explanation of its components, is distributed to project participants with a request for feedback to make the tree comprehensive, to eliminate insignificant portions (references requested), and to identify what is being worked on. Key participants, knowledgeable on the topic of the tree, are also consulted. The "strawman," expanded by the feedback, will produce a quasi-comprehensive event tree, containing nearly all known problems which need to be addressed during site characterization. Furthermore, since arguments for each cut on the tree will be documented, this methodical approach should prove valuable for license-application preparation. At this stage, a formal document containing the remaining scenarios (the surviving portions of the event tree) would be issued. The tree will continue to be updated as site characterization progresses, and to act as an outline of work left to be done and information needed.

The working set of scenarios will guide model development. As models are developed, they are used to screen the remaining scenarios on the basis of very low probability of occurrence or insignificant consequence. The current approach complies with the recommendations to be systematic and to provide assurance of completeness. As pointed out in this comment, the example set of classes in SCP Table 8.3.5.13-3 cannot be proved exhaustive, and the classes are not necessarily mutually exclusive. DOE believes rigorous classification of scenarios can be accomplished only after much of the modeling and much of site characterization has been done. Classification requires understanding of the controlling parameters of the models and the ranges of these parameters.

Hopefully these remarks respond meaningfully to this comment; this somewhat general discussion is provided because many of the concerns expressed in the comment have to do with the overall process of developing scenarios. The developments reported in the SCP guide site characterization, and the list of scenario classes is not the list that will eventually form the basis for a demonstration of compliance. To produce that final, exhaustive list is one of the tasks that requires site characterization, and it cannot be available to guide site characterization. The list in the SCP is thought to be reasonably complete, in that it covers releases currently thought to be potentially important. The scenario classes are not rigorously exclusive, but the object in guiding site characterization is to identify the phenomena that should be investigated, a task for which strict exclusivity of scenario classes is not absolutely necessary.

Several statements in the basis section of this comment ask for separate responses. The statement that the nominal scenario class is highly improbable does not agree with DOE expectations, because the sequences on which it is built are those that may be expected at the site. DOE would appreciate seeing the NRC analysis on which the statement is based. The SCP text is describing a different set of methods At Equation 8.3.5.13-6, from those described at Equation 8.3.5.13-4. The statement that "scenarios should be limited to descriptions of the external constraints, in time, on the system" is not consistent with DOE's use of the term "scenario." It also appears to be inconsistent with the use of the term in publications sponsored by the NRC: see, for example, the listing by Cranwell et al. (1982) of a scenario consisting of "reference site with repository but without other disruptions," a description of which must contain responses of the repository if the scenario is to be modeled. It is not clear whether this comment

reflects merely a matter of how the commenter uses the term "scenario" or whether it reflects a feeling that responses of the repository do not need to be modeled. The reference to a "very specific and constrained meaning" in the U.S. program, in contrast to the European program, may be valid, but the meaning that seems to be implied in this comment does not appear to be a consensus of the U.S. waste-management community. The presence or absence of undetected fractures is, of course, a matter for site characterization to resolve; the program will attempt to find the feature that could significantly affect releases of radionuclides.

REFERENCES:

Cranwell, R.M., R.V. Guzowski, J.E. Campbell, and N.R. Ortiz, 1982. Risk Methodology for Geologic Disposal of Radioactive Waste: Scenario Selection Procedure, SAND80-1429, Sandia National Laboratories, Albuquerque, New N.

Ross, B, 1987. A First Survey of Disruption Scenarios for a High-Level Waste Repository at Yucca Mountain, Nevada, SAND85-7717, Sandia National Laboratories, Albuquerque, New Mexico, December 1987.

Additional Information on SCA Comment 99

The DOE is in the process of constructing a very detailed flow chart that addresses events and processes that define scenarios. The first result of this work is a report, near DOE approval, by Barr et al. "Scenarios Constructed for Basaltic Igneous Activity at Yucca Mountain and Vicinity" (SAND91-1653). This report is briefly discussed in Site Characterization Progress Report 8 under Subactivity 1.1.2.1.2 (p. 2-212). The report will show that the systematic approach being taken is more inclusive than the approach originally described in the SCP. When approved, the NRC will receive SAND91-1653 as a routine transmittal, as is the case for all of DOE's site characterization technical reports.

Expectations about the degree to which these scenarios are quantitatively evaluated must be faced with the knowledge that close examination of the details in many scenarios from Barr et al. are not necessary because, 1) the probability of occurrence is likely to be so low, 2) the consequences, when qualitatively or semi-quantitatively evaluated, appear insignificant in terms of the regulatory performance measure being addressed. In order to arrive at these conclusions DOE will need to do preliminary screening analyses.

The NRC comment basis suggests a course of extraordinary rigor. It suggests that data gathering and analyses must be pursued that would allow substantially complete sets of calculations to be performed before a branch can be safely dropped from a scenario tree. For minor contributors to performance, data may be difficult or expensive to obtain and this approach places DOE in the position of expending major resources to determine very small probabilities or quantifying consequences that are very minor in comparison. The detailed quantification of events shown by preliminary evaluations to be less likely or less consequential than significant is an excessive expectation.

The NRC staff observed that "Premature and inappropriate limiting of consequence analysis . . . may distort the performance allocation process so that insufficient priority is placed on some data or important data acquisition activities may be omitted from site characterization." The words "premature" and "inappropriate" are used. DOE decisions regarding the prioritization of site work, are based on a partial and preliminary understanding of site performance. These decisions are neither premature or inappropriate. It is, in fact, the only way for the site characterization program to proceed.

DOE believes that the performance assessment program does faithfully act upon the spirit of comment 99 recommendations. For this reason, this open item should be resolved.

Enclosure 2

SCA Comment 102 and DOE Response

NRC Evaluation of DOE Response

DOE Supplemental Response to SCA Comment 102

ENCLOSURE 2

Section 8.3.5.13 Total System Performance

COMMENT 102

The model for Ross sequences number 10 (p. 8.3.5.13-29), 14 and 15 (p. 8.3.5.13-30) seems to be at variance with the hydrologic model of flow at Yucca Mountain; because (as in this case) the basis for developing scenarios to guide the site characterization program appears to be inconsistent, site characterization may fail to provide the information needed for licensing.

BASIS

- In discussing conceptual models for the site p. 8.3.5.8-7 states, "The most probable water flow path from the repository to the accessible environment is currently thought to be vertically downward through the unsaturated Topopah Spring, Calico Hills, and Crater Flat units to the water table, and then horizontal below the water table."

- In discussing Ross sequence number 10 the text states, "Occasional major floods provide sufficient infiltration to overcome the the capillary barrier that usually diverts flow laterally,..."

- In discussing Ross sequence number 14 the text states, "...The fault thus forms a 'trap' for laterally moving moisture in the Tiva Canyon welded unit..."

- In discussing Ross sequence number 15 the text states, "Fracturing along a newly mobilized fault creates a permeable pathway through the flow barrier north of the repository block. The magnitude of the resulting change in the flow system is sufficient to raise the water able under the repository..." This assumes a significant horizontal groundwater gradient and induced lateral flow.

RECOMMENDATIONS

- Events in scenarios can certainly change the prevailing conceptual model of the site; however, the effect of events should not be predicated on differing conceptual models, except in an exhaustive and systematic fashion.

- The discussion of Ross sequences should be consistent with the current conceptual model of site hydrology or, if non-vertical flow is anticipated near the ground surface, the description of Ross sequence number 10 should be clarified; any added text in 8.3.5.8 and the hydrology chapter should be cross-referenced.

RESPONSE

The response to Comment 95 discusses the U.S. Department of Energy (DOE) approach to scenario development. An advantage to the event tree as DOE uses it, is that the complexity of nature can be recognized; e.g., during heavy rainfall, considerable run-off to Drill Hole Wash might occur. For this water to infiltrate and reach the repository, lateral flow must occur. The

conservative approach is to include this potential waterway until evidence indicates it should be eliminated. DOE defines a scenario as a path through the tree, from initiating event or process to release of radionuclides to the water table. Using this definition, not only are the conceptual models for lateral and vertical flow considered in scenarios, the models may be in effect at the same time, e.g., some water may be infiltrating uniformly over the surface at the same time run-off is infiltrating at Drill Hole Wash.

As stated, the comment seems to be implying that scenarios must be developed only from sequences that incorporate the most probable water flow path. Such a restriction would limit the list of events and processes so severely that it would be unsatisfactory for the development of scenarios. See also the response to Comment 95.

Section 8.3.5.13 Total System Performance

SCA COMMENT 102

The model for Ross sequences number 10 (p. 8.3.5.13-29), 14 and 15 (p. 8.3.5.13-30) seems to be at variance with the hydrologic model of flow at Yucca Mountain; because (as in this case) the basis for developing scenarios to guide the site characterization program appears to be inconsistent, site characterization may fail to provide the information needed for licensing.

EVALUATION OF DOE RESPONSE

- In DOE's response to Comment 95 (referred to in the response to this comment), the DOE states that "[t]he statement that 'scenarios should be limited to descriptions of the external constraints, in time, on the system' [from NRC staff Comment 95] is not consistent with DOE's use of the term 'scenario.'"

- Under DOE's definition of a scenario, the conceptual models for vertical and lateral flow conditions may be in effect at the same time, i.e., within the same scenario. DOE feels that to develop scenarios from only those sequences incorporating the current conceptual model of infiltration and flow at Yucca Mountain would place undue severe restrictions on the event and processes lists and therefore on DOE's overall scenario development methodology.

- The NRC staff considers that alternative conceptual models, e.g., only vertical flow downward versus vertical plus lateral flow at the site, should be separated from the events and processes used to develop the scenarios. Further, a systematic exhaustive approach to scenario development should be followed separately for individual alternative site conceptual models.

- The NRC staff considers this comment open. The staff considers that an interaction is needed in order to come to a resolution regarding a mutually acceptable definition for a "scenario" and methodology for scenario development.

Additional Information on SCA Comment 102

The comment is concerned with the apparent confusion of alternative conceptual models and scenarios in the SCP's approach. The SCP approach is being superseded by an approach that is designed to be "exhaustive and systematic," as suggested by the NRC staff recommendation in their July 31, 1991, evaluation of the response to Comment 102. This approach was discussed at a DOE/NRC technical exchange on April 28, 1992. DOE believes this approach, when completed, will separate conceptual model considerations from scenario definitions, even though the occurrence of a scenario may invoke an alternate conceptual model.

DOE believes that the SCP's approach to scenario identification and screening has been much further developed and expanded by more recent work and that the concern in Comment 102 has been addressed because a defensible analysis is applied in the screening of scenarios. On this and the basis explained herein, Comment 102 open item should be resolved.

A technical exchange was held to discuss a mutually acceptable definition for scenario as well as a methodology for scenario development as advocated by the NRC in their evaluation of DOE's December 1990 response.

Enclosure 3

SCA Comment 103 and DOE Response

NRC Evaluation of DOE Response

DOE Supplemental Response to SCA Comment 103

ENCLOSURE 3

Section 8.3.5.13 Total System Performance

COMMENT 103

Ross sequence numbers 59-62 and 64-69 appear to characterize either anticipated conditions or alternative conceptual models, rather than scenarios.

BASIS

- **Ross sequences 59-62 characterize the effect of heat from the emplaced waste on the hydrologic environment (the movement and chemistry of the water) near the repository.**
- **Ross sequences 64-69 characterize different types of corrosion or different manifestations of corrosion.**

RECOMMENDATIONS

- **Such effects should be included in the model of repository behavior or proposed as alternative conceptual models and investigated during site characterization.**
- **These should not be classed as scenarios or sequences.**

RESPONSE

The U.S. Department of Energy (DOE) response to Comments 95 and 102 on scenario development and alternative conceptual models also apply to this comment. Some categories of events and processes for the nominal-flow-system event tree are (a) repository influence, which includes two-phase convection and alteration of hydraulic conductivity and storativity; (b) flow system response to presence of repository, which includes thermal and hydraulic conditions; (c) engineered barrier system interactions, which include barrier degradation; and (d) mobilization of contaminants, which includes failure and leaching. DOE cannot describe release modes without including the effect of the repository on the site and the accompanying effects of heat, water, and chemicals on the repository contents. When using event trees to construct scenarios, DOE defines a scenario as a path through the tree from initiating event to radionuclide release to the water table; consequently, the scenarios would include these types of processes and events. Studies to investigate corrosion and the effects of heat are, of course, included in plans described in the Site Characterization Plan.

As stated, the comment seems to imply that "anticipated conditions" do not contribute to descriptions of scenarios. If "anticipated" means "expected," such conditions need to be investigated in site characterization and included in the complementary cumulative distribution functions (CCDFs).

Section 8.3.5.1 Total System Performance

SCA COMMENT 103

Ross sequence numbers 59-62 and 64-69 appear to characterize either anticipated conditions or alternative conceptual models, rather than scenarios.

EVALUATION OF DOE RESPONSE

- The NRC staff commented on the DOE characterization as scenarios of some anticipated conditions or alternative conceptual models. The NRC staff recommended that DOE include anticipated conditions and alternative conceptual models in its plans to characterize the site, and not call them scenarios. DOE responded that, in using event trees to construct scenarios, DOE defines a scenario as a path through the tree from initiating event to radionuclide release to the water table. Consequently, the scenarios would include these types of processes and events, even if they differed from scenario to scenario.

- It is not clear that the DOE approach is consistent with probability theory or the NRC staff interpretation of 40 CFR 191. The NRC staff interprets 40 CFR 191 as incorporating parameter uncertainty and future states uncertainty into the CCDF. Attempts to include other uncertainties may confound decisions regarding acceptability of the repository.

- The NRC comment remains open. It should be addressed in a future NRC/DOE interaction.

Additional Information on SCA Comment 103

The comment is concerned with the apparent confusion of alternative conceptual models and scenarios in the SCP's approach. The SCP approach is being superseded by an approach that is designed to be "exhaustive and systematic," as suggested by the NRC staff recommendation in their July 31, 1991, evaluation of the response to Comment 102. This approach was discussed at a DOE/NRC technical exchange on April 28, 1992. DOE believes this approach, when completed, will satisfy the intent of the concerns expressed in this comment about the need to separate conceptual model considerations from scenario definitions, even though the occurrence of a scenario may invoke an alternate conceptual model.

DOE believes that the SCP's approach to scenario identification and screening has been much further developed and expanded by more recent work and that the concern in Comment 103 has been addressed because a defensible analysis is applied in the screening of scenarios. On this and the basis explained herein, Comment 103 open item should be resolved.

A technical exchange was held to discuss a mutually acceptable definition for scenario as well as a methodology for scenario development as advocated by the NRC in their evaluation of DOE's December 1990 response.