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**Date:** 8/12/02 9:08AM  
**Subject:** Yucca Mountain Review Plan

3/29/02  
 67 FR 15257  
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The following information was submitted by  
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recipient\_displayed\_as: Public Affairs Location

comments: Requests, Questions, and Comments on the draft  
 Yucca Mountain Review Plan  
 NUREG-1804, Revision 2  
 Sierra Club, Florida Chapter  
 Mark P. Oncavage, Energy Committee

#### Requests

1. Establish a Category 3 component to the review plan. Category 3 should encompass natural and man-made events that have a 1 in 10,000 occurrence probability for the 10,000 year operational life of the Yucca Mountain Repository. Examples would be climate change, nuclear war, volcanism, flood, seismic destruction, and glaciation. Reviews may include atmospheric dispersion of radionuclides, water-borne dispersion of radionuclides, area of contamination, dose rates, mitigation, a post closure plan of retrieval, and a plan to keep the next 400 generations informed of the repository contents.

2. Define and add to the glossary the following terms that have been used in the text but not defined:

pyroclastic	tensile	risk informed
performance based	backfill	subcritical neutron flux
assumptions	adequate descriptions	adequate discussion
preclosure	sufficient information	safety analysis report
closure	performance objectives	safety evaluation report
0.15 mSv	flux-to-dose	consequence analysis
15 mrem	Q-List generation	semi-quantitative methods
off-gas	unacceptable releases	unacceptable radiation doses
moderators	interim storage	failure of repository
alternative storage	fill gas	fuel baskets
creep	brittle fracture	running ground conditions
Young's modulus	Poisson's ratio	intact-rock-scale
performance confirmation program		vitriified high-level radioactive waste
post closure performance objectives		numerical radiation protection requirements

#### Questions

1. Will the NRC ignore mistakes in the DOE's license application ?
2. Does the DOE license application exist ?
3. Will the NRC hold the DOE to the same standards that produced the failures of high level waste storage at Hanford, INEEL, and West Valley ?
4. Due to the lack of experience in storage for thousands of years, where applicable the term " performance-based" needs to be replaced with the word "experimental."
5. When do the 293 unresolved issues get resolved ?

Template = ADA1-013

E-RIDS = ADA1-013  
 Add - H. Beane (AFB)  
 S. @wood (SAC3)

6. Will the public be a party to the proceedings for the acceptance review ?
7. Will NRC rules be rewritten to accommodate the Yucca Mt. Application ?
8. What is the role of the NRC after the license has been granted ?
9. Does the repository receive its license even if the 293 unresolved issues are answered with negative findings ?
10. What will be the process if the repository receives breached fuel rods from a utility ?
11. Are performance bases expected to change as waste is processed and interred at the repository ?
12. Will the licensee (DOE) be allowed to transfer responsibilities and liabilities to corporate vendors\*?
13. Will a government entity stage mock attacks on the repository as a test for security measures\*?
14. What are all the scenarios possibly resulting in a criticality accident in surface storage, operations, or permanent storage ?
15. What are the procedures for mitigating a criticality accident ?
16. What are all the scenarios possibly resulting in a zirconium fire of zirconium clad fuel rods ?
17. What are the procedures for mitigating a zirconium fire at the repository ?
18. What is the plan for mitigating unexpected failures, such as the failures that occurred at Fermi\*#1, Browns Ferry, TMI-2, and Davis-Besse ?
19. What is the complete history of alloy-22, from the date it was invented to its uses, it's successes, and its failures ?
20. What are the penalties for exceeding dose rate maximums ?
21. What are the time limits and volume limits for surface storage of high level waste at the repository ?
22. What constitutes repository failure ?
23. What is the plan for responding to and recovering from repository failure after closure ?
24. What is the length of time estimated for the first failure of a civilian or military storage container ?
25. What is the length of time estimated for failure of 50 % of the military or civilian storage containers ?
26. What are the parameters by which Yucca Mt. will be denied a license by the NRC ?
27. What is the plan for keeping records over the 10,000 year life-span of the repository ?
28. What is the minimum amount of time between taking military/civilian waste out of a reactor and sending the waste to the repository ?
29. What changes need to be made to the repository if the waste capacity is increased to 130,000 metric tons ?

Comments

## Abstract

1. The public needs to be an active party during all phases of the licensing process.
2. Usage of the phrases "risk-informed" and "performance-based" presents many problems. Risk should mean probability times consequences, yet this concept appears to be disregarded in lieu of expediency. "Risk-informed" over a period of thousands or millions of years needs a formal, workable definition. Likewise, "performance-based" suggests that there is a body of knowledge derived from thousands or millions of years of engineering experience. Formal, workable definitions are needed.

## Executive Summary

1. The summary mentions maximally exposed individuals, human intrusion, and groundwater protection. Mistakenly, it fails to mention volcanic events which have the possibility of contaminating vast areas of land and causing large numbers of lethal and non-lethal cancers to the population. This threat remains constant for the millions of years it takes for the radionuclides to decay into harmless elements.
2. The principal purpose of the review plan should not be uniformity and quality, as stated, but should be the health and safety of the American people. The NRC staff is beginning the review process with a wrongheaded mindset.
3. The staff sets an unreasonable limit of 90 days for the acceptance review. This apparently means that the public is completely shut out of the acceptance review process. The time limit has to be eliminated and the public needs to be invited to participate so that all reasonable voices can help determine if the information presented by the DOE is adequate. The public is at risk.
4. The summary mentions "detailed process-level modeling efforts." These need to be made available to the public for independent scientific verification before and licensing activities start, including the acceptance review.

## Introduction

1. The introduction mentions using the review plan in a flexible way. This gives an indication that staff is already willing to compromise the health and safety of the American people. This is unacceptable.
2. The introduction mentions that the staff will perform very limited in-depth, detailed analyses. This stated unwillingness by the staff encourages the DOE to submit incomplete and deceiving analyses knowing of the staff's reluctance to ensure completeness and accuracy.
3. The introduction states that if a proposal meets applicable regulations, there is no basis for requiring anything different or additional. This concept encourages the applicant to fine the least conservative formula/model for demonstrating a proposal. For a repository that's supposed to keep Americans safe for 10,000 years, this approach is unacceptable. The licensee needs to be required to utilize the most conservative model for demonstrating proposals.
4. The staff must have the power to reject any proposal if NRC formulae/models disagree with formulae/models the licensee submits.
5. The introduction wrongly states, "A licensing review is not intended to be a detailed evaluation of all aspects of facility operations." First, the operations appear to be extremely simple. A detailed evaluation would also be simple to perform. Second, considering the radionuclide inventory at stake, details are incredibly important due to the consequences of an accidental or intentional release. The staff's unwillingness to evaluate operational details is unacceptable.
6. It is unacceptable for the staff to impose on itself and the public the limit of only one round of RAIs

(requests for additional information). The staff has poorly chosen a licensing procedure to initiate this limitation, considering the immensity and complexity of the repository. RAIs need to continue until the amount of information is adequate to satisfy the staff and reasonable members of the public.

7. It would be extremely premature for the staff to publish a draft safety evaluation report before the licensee has produced the information necessary for a license. The staff is admitting a rush to completion before necessary information becomes available. The staff needs to be constantly reminded that their mission is to ensure the health and safety of the American people.

8. Given the mandatory 3 year time frame in the Nuclear Waste Policy Act, the license applicant needs to be prepared for one or more license rejections if the application is inadequate due to incompleteness or inaccuracy. The granting of the license could require several 3 year cycles.

9. The NRC needs to set a timely deadline for resolving unresolved issues. These issues need to be answered before a safety evaluation report can be written.

10. The general description needs to study volcanic activity related to Crater Lake, Mt. Shasta, Mt. Lassen, Mt. Hood, Mt. St. Helens, and the possibilities that similar activity could occur at Yucca Mt. For the millions of years lethal wastes will be interred.

11. The plan for the postclosure safety evaluation, degradation of barriers over a 10,000 year period needs to have public input. The staff only focusing on those items "most important" to performance invites disastrous results from biased information or biased modeling.

12. The concept of granting a repository license for 10,000 years appears to have no bases in fact. Considering the longevity of the isotopes in the waste, 10,000 years appears to be an artificial time period and may be way too short of a time span to do any real good. What are the factual bases for a 10,000 year license ?

13. If scenario analysis and model abstraction, in the absence of data, are keys to performance assessment, the assumptions become critical. For all computer models, data, assumptions, formulae, and calculations need to be published for public comment long before the models are used for safety predictions.

14. For differences in risk significance, who decides the weighting and how is the decision reached\*?

15. Figure 1-3 "Components of Performance Assessment Review" does not show any component with public participation. This is unacceptable.

16. The staff can perform a simplified review or a detailed review of an issue. What's the difference, who decides, and how is the decision reached ?

17. The Performance Confirmation Program needs to have meaningful public participation.

18. Meaningful public participation is required to invent performance objectives.

19. What appeals process is available to the public in the creation of administrative and programmatic requirements ?

20. The introduction states the staff will resolve issues using its technical understanding. This wording blatantly advertises that all issues will be resolved and all resolutions will be acceptable.

#### Acceptance Review

1. Public participation is essential in acceptance review processes.

2. Since the staff does not determine the technical adequacy of information for the acceptance review, the staff is therefore willing to accept biased and erroneous information. This is wholly unacceptable. The staff needs to be directed to all their technical skills to ensure that submitted information is technically accurate.
3. The staff has imposed on itself a limit of 90 days to complete the acceptance review. This artificial limitation needs to be discarded. By creating short deadlines, the staff forces itself to accept information that would be normally rejected if adequate timelines were established.
4. The DOE must be required to present the resolution to all 293 unresolved issues before an acceptance review starts.
5. The staff has written confusing language saying it will use expertise it develops in precicensing activities to determine the adequacy of information in precicensing activities. What does this mean\*?
6. When individuals of different disciplines form a team to decide acceptance, dissents need to be made public.
7. The general description of the geologic repository must include detailed descriptions of surface and interim storage areas
8. The security measures need to plan for insider sabotage as well as outside threats.
9. For site characterization work, all assumptions need to be made public.
10. Site characterization needs to include possible changes of hydrologic gradients over 10,000 years.
11. Site characterization needs to include the location and amounts of corrosive fluoride in the tunnels and drifts of the repository.
12. Site characterization needs to include seismic and volcanic trends over 10,000 years.
13. What aggressive/corrosive chemicals will military wastes contain ?
14. What temperatures will be generated inside the fuel capsules, inside the fuel rods, inside the storage containers, and inside the drifts and tunnels ?
15. What gases will be generated from military/civilian wastes and how much pressure will these gases create ?
16. How will damaged fuel elements be handled ?
17. For retrieval and alternate storage, how will damaged/corroded storage containers be handled ?
18. For preclosure and postclosure will nearby nuclear bomb testing be allowed to resume ?
19. The assessment of maximally exposed individuals must include an assessment of food producing areas.
20. In assessing the ability of the repository to limit radioactive releases, who is financially responsible ?
21. What is the plan for monitoring ambient radiation in the drifts and tunnels after closure ? How long will this monitoring be in effect ?
22. What is the plan for retrieving and repackaging defective storage containers ?
23. Will the license include an option to store wastes temporarily ?

24. In identifying and justifying variables, conditions, or other items that will contribute to license specifications, public participation is needed.

25. Quality assurance for natural and engineered barriers appears to be highly experimental. Backup plans are needed for barrier systems that fail.

26. For controlling access to the repository, is the government absolutely sure that the land does not belong to Native American tribes ?

27. Missing from the acceptance review are the following components:

- \* a definition of repository failure,
- \* a description of the plan for responding to and recovering from failure of the repository before closure,
- \* a description of the plan for responding to and recovering from failure of the repository after closure,
- \* a plan for handling leaking transportation casks arriving at the repository,
- \* a plan for protecting storage containers from acid rain, man-made and natural contaminants, and synergistic processes before being interred in storage drifts, and
- \* a study of the relationship between bomb testing and seismic/volcanic activity.

#### Review Plan for General Information

1. General information needs to especially focus on the natural threats to repository integrity such as fault lines, bomb testing fissures, epicenters, volcanoes, zircon crystals, recent and ancient earthquakes, tectonic activity, and the interaction among all these threats.

2. As a separate category, equipment, instrumentation, and infrastructure in the repository must be upgraded to survive corrosion for a very long time period, through closure and beyond.

3. General information mentions "inspections and testing of waste forms and waste packages." For what is this testing ? What's the procedure if the waste forms fail the test ?

4. It is unacceptable that the DOE will not inspect Naval reactor fuel. Either inspect and process these wastes as all other wastes or prohibit these wastes from the repository. This mystery fuel may endanger the public and the environment by introducing fuel elements more prone to criticality accidents or may introduce corrosives to the storage drifts and tunnels.

5. General information mentions deciding on criteria for waste retrieval operations. What assumptions are in place ? Public participation is necessary for these decisions. Once retrieval criteria are established, they must not be watered down or abandoned. What is the time frame for retrieval after closure ? How many years after closure will it be possible to retrieve wastes ?

6. Plans for emergency responses should include a high speed, fast and dirty retrieval just in case sudden, catastrophic events occur.

7. On NRC authority, what will be the continuing role for the NRC after licensing ? Will there be permanent inspectors, self-regulation, regular reports, frequent license amendments, enforcement activities, judicial activities, public participation, and whistle blower protection ? How long will the NRC be involved ? Will contractors enjoy the same rights and privileges as the DOE enjoys ?

8. Licensing needs to consider grave dangers to the public that can occur beyond 10,000 years.
9. What is the length of the license the NRC will grant ? Will there be licensing renewal ?
10. General information needs to state criteria for corroding packaging. How much leakage or corrosion is acceptable ? What will be the criteria for abandoning alloy-22 for a more durable canister material ?
11. Will liquid radioactive wastes be interred ? Will low-level or intermediate wastes be interred ? Will contaminated operations equipment be interred ? Will radioactive chemical wastes be interred ? Will contaminated soil be interred ? Will contaminated mine tailings be interred ?
12. What will be the criteria for the revocation of the repository's license ?
13. If construction falls behind schedule, will the transportation of wastes fall behind schedule commensurately ?
14. For the physical protection plan, how many thousands of years will the plan be in operation\*?
15. The physical protection plan should include a resident military encampment, wartime footing, continuous satellite surveillance, aircraft defense, missile defense, and a 20 mile no-fly zone.
16. For planning physical protection public participation, military participation, and homeland defense participation is needed.
17. Records on private shippers of waste to the repository need to include liability information, accident records, breached or leaking cask records, judgements, accusations, and penalty records.
18. Is theft of special nuclear material the responsibility of the DOE or the NRC ?
19. For site characterization, special attention needs to be given to the consequences of a volcanic eruption equal in force to eruptions at Mt. Mazama, Mt. Shasta, Mt. Lassen, and Mt. St. Helens occurring in the near proximity of Yucca Mountain.
20. A complete history of flooding in the area is needed. The presence of zircon crystals indicates that flood waters were present in the repository area at some point in time.
21. A model of the repository and associated consequences of climate change is needed. Since arid conditions now exist, temperate and wet conditions are likely results of climate change. Plans for mitigation and/or retrieval need to developed.

#### Review Plan for Safety Analysis Report

1. What are the penalties for radiation doses in excess of stated limits ?
2. The site map needs to indicate the fault lines that are a result of nuclear bomb testing.
3. The site map needs to include locations and distances to nearby cinder cones.
4. All models used in or relied on for the Safety Analysis Report need have the data, assumptions, formulae, and calculations publicly published for independent verification or challenges.
5. The meteorology/ climatology model needs to be extended for the length of the license, 10,000 years.
6. The hydrology model needs to include water temperatures and chemical analysis of all known water sources in the study area.

7. The site geology study needs to include the location, depth, temperature, volume and chemical makeup of all magma chambers within 50 miles of the site.
8. The geomorphology study needs to include the effect of elevated temperatures from the waste containers on rock and soil mechanics.
9. The geochemical study needs to show all corrosives and potential corrosives from waste canisters present in the repository.
10. What minimum temperature from a lava intrusion could breach a storage canister ?
11. How many 5.0 magnitude earthquakes would it take to initiate repository structural damage ?
12. After capacity has been reached but prior to final closure, is structural damage to the drifts and tunnels repairable ?
13. What is the plan for, remotely, dealing with transportation accidents in the repository ?
14. What equipment is available for handling criticality accidents ?
15. What are the aging management systems that will maintain remote systems and equipment ?
16. How are waste canisters and drip shields to be relocated after major seismic events ?
17. What are the time limits and volume limits on surface storage of wastes ?
18. What is the plan to repair capsule leakage and cladding leakage in the spent fuel rods arriving at the repository ?
19. What is acceptable capsule leakage and cladding leakage in spent fuel rods ?
20. Public participation is needed for the determination of "adequate descriptions" of design information submitted by the DOE.
21. The technical bases and assumptions for identifying initiating events needs to include acts of terrorism, sabotage, and acts of war.
22. Considering the very long time frame, intensive research needs to be done on lava intrusion as a compactor and moderator for criticality events.
23. For models showing the probability of initiating events, data, assumptions, formulae, and computations need to be published publicly.
24. For showing the probability of occurrence of hazards, several models need to be published publicly. Reliance on one or two models is unacceptable.
25. Risk equals probability times consequence. If the consequences are extremely high and the probability is extremely low, this is still risk that needs to be mitigated, no exceptions, no artificial limitations.
26. Using only "credible natural events" as a way of excluding mitigation is unacceptable. The determination of "credible" over a very long period of time depends on semantics, speculation, and opinion. If the consequences are extremely high, then the risk is genuine and mitigation must be in place, regardless of the current definition of "credible".
27. The NRC needs to take great care in studying initiating events that rely more on assumptions rather

than a proven technical basis. All opposing opinions need to be given equal consideration. Public participation is essential. The NRC must demand the safest and most conservative standards for the protection of the public and the environment. This may be the single most important issue of the entire licensing procedure.

28. For determining the probability of occurrence for initiating events scientific disagreement needs to be encouraged and conflicting conclusions from differing models need to be examined.

29. All assumptions are suspect.

30. The NRC's determination that the license application provides "sufficient information" must be able to withstand public and scientific challenges.

31. Human actions as initiators of dangerous events need to consider the NRC's own history in this area. Behaviors that created dangerous situations such as Fermi #1, Browns Ferry, Ft. St. Vrain, Three Mile Island #2, and Davis-Besse are to be expected at the repository.

32. Consequence analysis needs to include the premature release of radioactive gases from waste containers due to corrosion, accidents, faulty workmanship, natural events, etc.

33. How many lethal and non-lethal cancers, genetic mutations, suicides, and related health impacts are acceptable within the rules of numerical radiation protection requirements ?

34. Identify, describe, and quantify all routine releases of radioactivity.

35. Factors that allow an event sequence to propagate must also include poorly designed safety equipment, safety equipment easily compromised, ineffective aging management of safety equipment, easily compromised waste canisters, multiple breakdowns, and cascading errors.

36. In evaluating members of the public most likely to receive the highest doses, differentiate between external doses and ingested doses for these individuals.

37. When calculating radioactive releases from normal operations, leaking fuel capsules, leaking fuel cladding, leaking waste casks and canisters, and leaking Naval Reactor fuel need to be included in the calculations.

38. In calculating doses to workers, radon, carbon-14, ingested radiation, skin absorption, breaks in skin, absorption through eyes and mucous membranes, faulty ventilation, faulty breathing masks, improperly worn breathing masks, non-usage of breathing masks, sweat, lack of sanitary equipment and procedures, exceeded filter parameters, and unfilterable radionuclides need to be included in the calculations.

39. For airborne public doses, seismic activity, volcanic activity, steam venting, snow, rain, dust storms, climate change, flood, premature corrosion, fires, spills, accidents, and breached transportation casks and storage canisters need to be included in the calculations.

40. For analyzing event sequences within the repository, faulting, cave-ins, multiple earthquakes, fires, spills, accidents, human error, stupidity, cascading failures, incapable equipment, and dangerous repairs need to be included in the analysis.

41. The dose to real members of the public especially neighboring farmers and ranchers must include direct exposure, airborne contamination, cross contamination by birds, insects, animals, plants, ingested foods, ingested water resources, rain drainage, and long-term cumulative effects.

42. No credit can be taken for temporary radiation shielding that may or may not be in place. It may also be dislodged or damaged by seismic events, accidents, human error, administrative failure or fire.

43. Credit taken for ventilation and filtration systems is highly suspect due to many factors that can compromise the systems.
44. Which work areas do not require inhalation protection ?
45. What are the radiological exposure rates for workers performing normal operations ?
46. Only having one method to aggregate annual worker doses is insufficient. Multiple methods as cross-checks are needed.
47. What is the penalty to the operator and what is the compensation for a member of the public receiving a dose in excess of 0.15 mSv ?
48. For Category 2 designation, 1 chance in 10,000 over 300 years is illogical and unconservative considering the trillions of curies that will be sequestered at the repository. If the criteria for excluding events from Category 2 is based on opinion and speculation then obvious suspicions will include bias, deception, human error, and expedience. Category 2 must be broadened to overcome these inadequacies. The NRC needs to be overly conservative when excluding catastrophic events from Category 2.
49. For calculating consequences of Category 2 event sequences, sabotage in the repository, acts of war directed at the repository, sabotage in the operations area, acts of war in the operations area, accidental criticality, intentional criticality, dirty bombs, and permanent contamination of the operations area need to be considered.
50. List non-safety related equipment.
51. What equipment will be subject to thermal loading, high humidity, radiation, flux, fluoride, airborne drift material, or dust ?
52. What is the DOE's ability to replace all safety-related equipment ?
53. Under what circumstances will workers no longer be allowed to enter drifts or tunnels ?
54. When re-evaluating significant risks, the public must be kept informed.
55. When re-evaluating risk or safety significance, independent verification is needed.
56. For each safety related design, what is the smallest earthquake capable of inflicting damage on each design ?
57. Considering the significance of the Davis-Besse corrosion, what metals in the storage canisters will be in contact with boron compounds during normal and abnormal conditions ?
58. What is the lowest temperature at which fuel cladding damage can occur ?
59. What is the temperature of the water in the aquifer directly beneath the repository ?
- 60 List and describe all the gases that may seep into the repository during operations, preclosure, and postclosure.
- Sierra Club, Florida Chapter requests to receive all available future publications relating to the Yucca Mountain Review Plan.

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SUBMIT2: Send Questions or Comments

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