



Department of Energy  
Washington, DC 20585

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Office of Administration  
U.S. Nuclear Regulatory Commission  
Mail Stop T-6D59  
Washington, DC 20555-0001

Subject: U.S. Department of Energy Comments on the Yucca Mountain Review Plan (NUREG-1804, Draft Revision 2)

Dear Mr. Lesar:

Enclosed are the Department of Energy's (DOE) comments on the Yucca Mountain Review Plan (YMRP), NUREG-1804, Draft Revision 2. As the future applicant, DOE places great importance on the YMRP for guiding preparation of the license application and providing the Nuclear Regulatory Commission (NRC) staff an efficient and effective method for reviewing the license application.

Although the YMRP states that it provides guidance rather than new requirements, review plans generally set the standard for NRC staff review of a license application. As such, the applicant may deviate from the guidance as it deems appropriate but with the expectation the deviation should be justified. With this observation in mind, DOE has the following five general comments on the YMRP.

*Risk-Informed, Performance-Based Principles*

A risk-informed, performance-based rule, such as 10 CFR Part 63, relies on the applicant's technical analyses to determine those structures, systems, and components that are important to safety and natural and engineered barriers that are important to waste isolation. The YMRP should provide sufficient information to guide the reviewer while not presupposing design solutions or the items that affect performance. Key sections of the YMRP presuppose what is important to performance, and do not give NRC staff clear guidance for conducting a risk-informed, performance-based review.

*Information Required for Each Licensing Step*

The NRC recognizes in 10 CFR Part 63.3 and Part 63.102(c) that repository licensing will occur in steps and that the level of detail in support of proceeding with each licensing step would increase as the repository progressed through construction and operation. In developing its approach to repository licensing, the NRC drew upon decades of experience licensing nuclear reactors in discrete steps under its Part 50 regulations. As stated in 10



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CFR 63.21(a), the initial license application for CA "must be as complete as possible in light of information that is reasonably available at the time of docketing."

The YMRP should clearly acknowledge the stepwise licensing process that is applicable to the repository. The fundamental principle for the licensing process, and the associated NRC review process, should be that adequate information has been provided to the NRC to allow DOE to proceed into the next licensing step with confidence. The YMRP does not clearly and consistently "differentiate" the information needed for these different steps and does not delineate how the application of Areas of Review, Review Methods, and Acceptance Criteria should vary by step. The YMRP should explicitly recognize that at the time of application for CA, the repository design and associated safety analyses will be at the preliminary phase of development, in contrast to the essentially complete nature of the design and analyses (and increased level of detail) that will be available at the time of application for the license to receive and possess.

#### *Organization and Structure*

Traditionally, Safety Analysis Reports accompanying license applications for reactors are organized in terms of structures, systems, and components (SSC). Issues are addressed in the context of their relevance to those SSCs. The YMRP is organized with primary emphasis on issues rather than SSCs. In DOE's judgement, the YMRP would benefit from a reorganization to more closely model the approach used for reactor Safety Analysis Reports. Such reorganization would ease preparation, maintenance, and review of the license application by providing a more recognizable format and a technical presentation that facilitates the presentation of structures, systems, and components important to safety and barriers important to waste isolation.

#### *Consistency with Regulations*

The requirements set forth in 10 CFR Part 63 define the content of any license application and form the basis for the associated guidance in the YMRP. In many instances, DOE notes that the YMRP guidance extends beyond or is otherwise inconsistent with the applicable regulations. One example used throughout the YMRP is the term "safety case". Safety case is not defined in the YMRP nor described in 10 CFR Part 63. This term generally addresses more than a compliance demonstration and it is likely to have different meanings. The inconsistent use of this term is subject to confusion by preparers and reviewers of DOE's license application. To maintain consistency between the regulations and the review plan, a direct reference to appropriate regulations should be made in the YMRP when possible, rather than paraphrasing the regulatory text.

#### *Quality Assurance Program*

In DOE's judgment, the YMRP unnecessarily goes beyond the statement of performance objectives for the quality assurance program by prescribing specific techniques and methodologies, effectively reducing the DOE's flexibility to meet regulatory requirements, but providing no commensurate increase in protection for worker and public health and safety. The acceptance criteria for the quality assurance program go

beyond the regulatory requirements of 10 CFR 63.142 and exceed the accepted precedents from consensus standards, such as NQA-1, other nuclear facility review plans, and standard nuclear industry practice, as implemented under 10 CFR Parts 50, 70, and 72.

The general comments provided above are expanded in Enclosure 1. Enclosure 2 provides 161 detailed comments, which should be given full consideration in the next revision to the YMRP. The detailed comments are largely examples of the general comments in Enclosure 1 and include specific changes that DOE proposes for the YMRP. In addition, there are 35 editorial comments for your consideration. DOE's comments are intended to improve the effectiveness and efficiency of the review of a license application.

In closing, DOE requests that the final YMRP reflect our comments and be issued as expeditiously as possible to ensure that an application responsive to the YMRP can be completed by the end of 2004. DOE notes that the YMRP mentions the role of the NRC Project Manager in the licensing process and anticipates that appointment of this individual will facilitate this process. If you have any questions on DOE's comments, please contact Nancy Slater-Thompson at 202-586-9322 or Joseph Ziegler at 702-794-5567.

Sincerely,



Dr. Margaret S.Y. Chu, Director  
Office of Civilian Radioactive  
Waste Management

Enclosures (2):

Department of Energy's General Comments on the Yucca Mountain Review Plan  
Department of Energy's Detailed Comments on the Yucca Mountain Review Plan

cc:

D. D. Chamberlain, NRC, Arlington, TX  
J. A. Ciocco, NRC, Rockville MD  
R. M. Latta, NRC, Las Vegas, NV  
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Irene Navis, Clark County, Las Vegas, NV  
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Andrew Remus, Inyo County, Independence, CA  
Mickey Yarbrow, Lander County, Battle Mountain, NV  
Lola Stark, Lincoln County, Caliente, NV  
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Josie Larson, White Pine County, Ely, NV  
Arlo Funk, Mineral County, Hawthorne, NV  
R. I. Holden, National Congress of American Indians, Washington, DC

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**Department of Energy's General Comments on the Yucca Mountain Review Plan  
Risk-Informed, Performance-Based Principles**

A risk-informed, performance-based (RIPB) rule, such as 10 CFR Part 63, relies on the applicant's technical analyses to determine those structures, systems, and components that are important to safety and natural and engineered barriers that are important to waste isolation. A review plan for a license application (LA) based on a RIPB rule should provide sufficient information and guidance for the reviewer to perform a review while not presupposing what items contribute to performance. The following examples are provided to illustrate areas of the draft Yucca Mountain Review Plan (YMRP) that deviate from a risk-informed, performance-based approach for the review.

- (1) The degree of specification in review methods varies substantially across the sections of the YMRP. In some sections, presumptions are made as to what is important to safety or waste isolation by including discussion of specific design solutions (e.g., backfill). These presumptions are not consistent with the risk-informed, performance-based approach for review of the preclosure and postclosure evaluations as discussed in the introductions to Sections 4.1 and 4.2 of the YMRP. It is, therefore, recommended that the YMRP be revised to clarify that the applicant will specify structures, systems, and components important to safety and natural and engineered barriers important to waste isolation, compatible with the risk-informed, performance-based approach embodied in 10 CFR Part 63 and the intent of the YMRP. As these presumptions occur throughout the document, a general discussion in the introductory sections could address this issue.
- (2) The YMRP states that each subsection of Section 4.2.1.3 provides enough review methods and acceptance criteria to allow for a detailed review of each model abstraction, but the actual level of detail to be employed will depend on the risk significance of a model. However, there is no clear guidance to reviewers on how to reduce the scope of their review based on risk significance (other than to employ "a simplified review focusing on the bounding assumptions" if the model has a minor impact on risk). It is recommended that the YMRP include additional guidance for how the scope of the review for those models having a minor impact on risk could be reduced (e.g., less confirmatory analyses, fewer audits of calculations, etc.). Further, it is recommended that qualitative guidance regarding the definition of "minor impact" be included. Previously, a 10 percent change was considered to be the threshold between minor and significant.
- (3) In Section 4.4, Performance Confirmation Program, the YMRP often prescribes specific testing, monitoring, and procedural requirements that are to be included in the performance confirmation program that are either not identified in the regulations or pertain to design bases and assumptions rather than the performance confirmation program. It is also prescriptive with regard to requirements for particular barriers, making it more in line with the approach in 10 CFR Part 60 than with the RIPB approach in 10 CFR Part 63, Subpart F. It is recommended that acceptance criteria be revised to reflect the regulatory requirements for performance confirmation to allow verification of the performance assessment and that other specifications imposed in the YMRP be deleted. The applicant will determine the

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parameters, measurements, and observations that are appropriate for inclusion in the performance confirmation program based on their importance to confirming repository performance and to the uncertainties in that performance. It is also recommended that Section 4.4 be revised to allow flexibility for the applicant to determine appropriate procedures needed for the performance confirmation program based on these determinations.

- (4) The discussion in Section 4.2.1.2.2.2 (Review Methods 2 and 3 for Identification of Events with Probabilities Greater than  $10^{-8}$  Per Year) specifies details of the inputs to the probability models and is based on preconceived ideas of what is important to the probability estimates. For example, time periods of past igneous activity, distances from the site for which igneous activity is to be considered, and the types of data to be input to the probability assessments are specified. These issues are subject to expert technical evaluation, and should not be prescribed in the YMRP. It is recommended that the YMRP generalize the discussion to allow the applicant flexibility to develop technical arguments that support its own probability models and that the YMRP be modified to focus the review on the submitted technical evaluations.
- (5) Section 4.2.1.2.2.2 advocates the use of independent models to estimate the probabilities of igneous activities (Review Method 3, 2<sup>nd</sup> paragraph, 2<sup>nd</sup> sentence). It should be noted that the reviews of other disruptive processes, such as seismicity and criticality, do not specify the use of independent models. The general concern is that NRC reviewers will conduct independent work that focuses on conservatism and then use the results of this work, rather than the risk-informed, performance-based approach, as criteria for the acceptability of DOE's work. In addition, there is no guidance to the reviewer on how to use independent models to determine whether DOE's probabilities are acceptable. Although reviewers may have independently developed models as part of developing regulatory expertise, the review should determine whether DOE has considered an acceptable range of models using an appropriate process. It is recommended that the sentence advocating the use of independent models be deleted.
- (6) The review methods and acceptance criteria provided in the draft YMRP Section 4.1.1.8 presuppose design features needed to implement the ALARA principles. Thus, they create excessive expectations for features the reviewer should find regardless of any explanation by the Applicant. This approach is also a disincentive for consideration of alternative designs that might further reduce doses.

DOE recommends an approach similar to NUREG-0800. This approach would permit reviewers to determine if the applicant is using, "...to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are... ALARA." (10 CFR 20.1101(b))

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- (7) The YMRP, in many instances, refers to codes and standards that are not compatible with the risks of a geologic repository facility. It is recommended that the YMRP be revised to clarify the applicant's flexibility in implementing a RIPB approach for the preclosure safety analysis. Not only should the applicant have the flexibility to use any codes, standards, and methodologies it demonstrates to be applicable and appropriate, but also the flexibility to grade the level of applicability and detail (e.g., depending on Quality Level) in any regulatory guide, code, standard, methodology or other regulatory guidance identified in the YMRP.

**Department of Energy's General Comments on the Yucca Mountain Review Plan****Information Required for Each Licensing Step**

The NRC recognizes in 10 CFR Part 63.3 and Part 63.102(c) that repository licensing will occur in steps and that the level of detail in support of proceeding with each licensing step would increase as the repository progressed through construction and operation. In developing its stepwise approach to repository licensing, the NRC drew upon decades of experience licensing of nuclear reactors in discrete steps under its Part 50 regulations (10 CFR Part 50.35(a)), which provide that reactor construction may proceed even though design information is insufficient to complete a safety analysis of the reactor, and further research may be needed for safety-related systems.

As stated in 10 CFR 63.21(a), the initial license application for CA "must be as complete as possible in the light of information that is reasonably available at the time of docketing." The YMRP should clearly acknowledge the stepwise licensing process that is applicable to the repository. It should be stated that the license application not only includes a description of the robustness of the system and an assessment of performance, but also an acknowledgement that additional information will continue to be developed as appropriate. The fundamental principle for the licensing process, and the associated NRC review process, should be that adequate information has been provided to the NRC to allow DOE to proceed into the next licensing step with confidence.

Although the YMRP appears to address information needed at different steps of the licensing process, likely to occur over a period exceeding 100 years (e.g., Construction Authorization (CA), a license to receive and possess source, special nuclear, or by-product material (LR&P), and an amendment for permanent closure), the YMRP does not clearly and consistently "differentiate" the information needed for these different steps. The YMRP does not delineate how the application of Areas of Review, Review Methods, and Acceptance Criteria should vary by step. Other NRC review plans, such as NUREG-0800, utilize the concept of differentiation to inform the applicant and reviewer of the information expected to be submitted and available for each licensing step. This differentiation is critical for both preparation and review of the LA.

The YMRP should explicitly recognize that at the time of application for CA, the repository design and associated safety analyses will be at the preliminary stage of development, in contrast to the essentially complete nature of the design and analyses (and increased level of detail) that will be available at the time of application for LR&P.

It is recommended that the YMRP explicitly recognize this distinction in level of detail (several of the specific DOE comments in Enclosure 2 address this distinction) and note that DOE will propose and justify the level of detail appropriate for each step. There should be a general statement added on how the Areas of Review, Review Methods, and Acceptance Criteria will be applied for CA versus for LR&P.

- For preclosure design, the level of detail in the LA for CA describing structures, systems, and components important to safety, identifying potential hazards, and analyzing initiating events and event sequences and their consequences needs to

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be sufficient to demonstrate reasonable assurance of compliance with the regulations, taking into consideration the CA stage of licensing. The level of detail necessary for different licensing steps can be based on a graded approach and licensing precedent.

- For the postclosure evaluation, the description in the LA for CA of the natural and engineered barriers important to waste isolation and their capabilities and the total system performance assessment needs to be sufficient to demonstrate reasonable expectation of compliance with the regulations, taking into consideration the CA step of licensing. Data and analyses obtained through the performance confirmation and research and development programs will provide additional information appropriate for inclusion in documents supporting later steps of licensing.

The discussion in the YMRP of plans and programs oriented towards operations, such as those specified in the General Information section and the Administrative and Programmatic section, acknowledges, in only some sections, that there is information related to these plans and programs that is neither expected nor necessary to be available at the time of LA for CA. However, the associated Review Methods and Acceptance Criteria are, in some cases, very detailed, and because of this detail, reviewers could interpret that the LA would need to address each element. It is recommended that for information not required to be available at the time of submittal of the LA for CA, the introduction to these Review Methods and Acceptance Criteria acknowledge in all appropriate sections that the detailed program descriptions are not necessary for CA. By differentiating what the license application should contain at the CA step, the applicant and reviewer can understand the expectations for the initial review and not focus resources on details of plans and programs that are potentially several years away. For example, the Department of Energy (DOE) will describe monitoring plans in the initial license application, but specific activities will be covered in a hierarchy of plans, procedures, and work instructions that will be developed and submitted at appropriate steps in the licensing process.

DOE is expected to develop a sufficiently robust and well-documented license application that would permit the NRC to independently determine whether DOE can develop a geologic repository at Yucca Mountain without undue risk to public health and safety. However, DOE is not expected to have resolved all design and long-term repository performance issues at the construction authorization step. The distinction in level of detail needed at each licensing step should be emphasized in the YMRP to the greatest extent possible to avoid confusion during the licensing proceedings.

**Department of Energy's General Comments on the Yucca Mountain Review Plan****Organization and Structure**

The YMRP will be used by NRC reviewers to evaluate any license application submitted for Yucca Mountain, so having the license application structure correspond to the review methods identified in the YMRP is important. However, an additional consideration is that the Safety Analysis Report (SAR) will be used by the DOE to present and maintain the safety case throughout the lifetime of the facility, so the SAR having a structure and organization that, in DOE's judgment, is the most efficient way to present this information is also important. The reorganization of some of the YMRP sections to be more consistent with reactor license applications could facilitate ease of license application preparation for DOE, review of the license application by NRC staff, and DOE's maintenance of the SAR during the repository lifetime. DOE also believes that some structural changes in the YMRP, such as in the area of performance assessment, would enhance transparency and traceability to DOE's supporting technical documentation. The following paragraphs illustrate some areas of the YMRP where restructuring would allow more effective preparation and review of the LA. DOE recommendations are included with each example. Regardless of whether the final YMRP adopts this restructuring, the DOE suggests that the NRC recognize in the YMRP that the DOE can use a format different from that given in the YMRP in its license application.

- (1) In DOE's judgment, a logical format of the LA for the preclosure safety assessment would present design information followed by the preclosure safety analysis. This format would allow the design information relevant to each structure, system, and component for surface and subsurface design and for waste package design areas to be presented in its own subsection, rather than being split into several areas as in the YMRP.
- (2) The model abstraction structure provided in the YMRP for the postclosure performance assessment (Section 4.2.1.3) differs from that used previously by DOE (e.g., in Site Recommendation documents) and could make it difficult to tell a cohesive story regarding the total system performance assessment while at the same time clearly demonstrating compliance with the five acceptance criteria for each model abstraction. DOE recognizes that the YMRP may need to be comprehensive, in terms of types of models, to provide instruction to reviewers for whatever models DOE may propose. To address this difficulty, however, it is recommended that Section 4.2.1.3 be rewritten to generally state that the five review methods are to apply to the model abstractions as DOE chooses to discretize them. DOE can then present descriptions of the model components as used in its total system performance assessment and described in the documents supporting the safety case. In previous documents, the project has communicated its postclosure safety approach in terms of describing the movement of water from the surface through the mountain to the accessible environment, which differs from the structure currently presented in the YMRP.

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- (3) Maintaining operational radiation exposures as low as is reasonably achievable (ALARA) is typically addressed as a design requirement for normal operations and is not addressed as a consequence of hazards. It is recommended that the ALARA review methods and acceptance criteria, currently included in Section 4.1.1.8 of the YMRP, be addressed in a new subsection of YMRP Section 4.5 that would provide a comprehensive review of the Radiation Protection Program. The review should cover the ALARA design aspects as well as the commitment to ALARA principles during operations. This approach is consistent with other NRC review plans such as Chapter 12 in NUREG-0800 and Chapter 9 in NUREG-1718.
- (4) General Information, as discussed in Section 3.1.1, is presented in the YMRP as being at a level of detail similar to that in an "executive summary." However, in later subsections (e.g., Section 3.5.1), the YMRP appears to request more detail than would typically be expected in an executive summary-type document, such as the inclusion of site characterization results which are more appropriate for discussion in the SAR. DOE proposes that YMRP Section 3.5.1 be revised to only include descriptive information to avoid the need to present and review the same information in separate parts of the LA.

**Department of Energy's General Comments on the Yucca Mountain Review Plan****Consistency with Regulations**

The regulations define the content requirements of a license application and, therefore, form the basis for any associated guidance in the YMRP. DOE is concerned with the use of terms, concepts, or methods that are inconsistent with the applicable regulations governing the licensing process. Where inconsistent, it is recommended that the language in the YMRP be revised to reflect the applicable regulations. To maintain consistency between the regulations and the review plan, a direct reference to appropriate regulations should be made in the YMRP when possible. This would serve to minimize questions of interpretation, as opposed to paraphrasing the regulations, which has introduced minor discrepancies in the YMRP text.

The following paragraphs provide some examples illustrating areas where the YMRP has either been inconsistent with applicable regulations or is internally inconsistent. Other specific examples are provided in Enclosure 2.

- (1) Section 4.2.1.3.12 appears to inappropriately mix concepts of water demand for the Postclosure Individual Protection Standard (IPS) and representative volume for the Ground-Water Protection Standards (GPS). The regulatory language for IPS in 10 CFR 63.312 regarding the reasonably maximally exposed individual (RMEI) specifies an annual water demand for the RMEI as 3,000 acre-feet. The requirements for demonstration of compliance with the IPS do not use the term "representative volume" and do not use the slice-of-the-plume or well-capture methods that are specified for demonstrating compliance with the GPS. DOE suggests that this section be divided into a review relevant to the IPS and a review relevant to the GPS since the concepts for IPS and GPS on the amount of water to be used can be applied independently. For these reviews, the Review Methods and Acceptance Criteria should be clarified to reflect the requirements of 10 CFR 63.312(c) for water demand in the discussion of individual protection and 10 CFR 63.332 for representative volume in the discussion of groundwater protection. The section also needs to be revised to ensure that the term "representative volume" is used consistently with the definition in 10 CFR 63.332(a).
- (2) One example used throughout the YMRP is the term "safety case". Safety case is not defined in the YMRP nor described in 10 CFR Part 63. This term generally addresses more than a compliance demonstration and it is likely to have different meanings. The inconsistent use of this term is subject to confusion by preparers and reviewers of DOE's license application.
- (3) In some cases, terms used in the review plan were confused with common industry terms. For example, Section 1.1.2, uses the term "technical specifications," which is a common industry term, but elsewhere in the text, the term "license specifications" is used. The term "license specifications" is used and defined in 10 CFR Part 63 and the use of this term in the YMRP should be consistent with the regulation. In another example, the review plan, (e.g., Section 4.5.10.1) sometimes uses the term "license conditions" interchangeably with the term "license specifications." In 10 CFR 63.43, license specification is defined in terms of license conditions, but the

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YMRP does not provide sufficient distinction between the two terms to understand the difference. It is recommended that this section be revised to clarify the use of these two terms with respect to what is to be included in the LA for CA (see Enclosure 2 for additional background information on this). It is DOE's understanding that license conditions are high level "conditions" on the license based on commitments made by DOE and accepted by NRC. License specifications, on the other hand, would be proposed by DOE, based on the assumptions of the safety analysis, and would be maintained in a separate document.

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Quality Assurance Program

*Consistency with Regulations and Precedent*

The Yucca Mountain Review Plan (YMRP) applies acceptance criteria that seem to exceed or certainly expand the requirements in 10 CFR Part 63 and relevant regulatory guidance such as NRC-endorsed consensus standards, American Society of Mechanical Engineers Standard NQA-1, "Quality Assurance Requirements for Nuclear Facility Applications," other nuclear facility review plans, and standard industry practice as implemented under 10 CFR Parts 50, 70, and 72.

It is DOE's judgment that the YMRP, as currently written, unnecessarily constrains the DOE's ability to determine quality assurance (QA) program implementation methods by setting expectations for specific compliance or implementation methods that are quite rigid and differ significantly from or, in some cases, exceed those of other nuclear facilities regulated by the NRC. This approach reduces the DOE's available options in applying appropriate methods to meet regulatory requirements, while providing no commensurate increase in protection to worker and public health and safety.

In particular, the application of detailed Acceptance Criteria 19 through 22 to activities associated with software, control of physical samples, scientific investigations, and field surveys can be adequately captured within the first 18 acceptance criteria developed pursuant to the regulatory requirements of 10 CFR Part 63, Subpart G. In analogous regulatory programs, these details are implemented by either commitment in the QA program document to NQA-1 or other appropriate consensus standards or regulatory guidance documents that are further developed in implementing procedures and instructions that are evaluated as part of the NRC's inspection program. The activities addressed by the additional acceptance criteria are activities that are routinely conducted throughout the nuclear industry under the criteria set out in NQA-1 and that have been successfully implemented over many years. Elimination of the additional, detailed acceptance criteria would result in a QA format and level of detail that is consistent with the regulation, NQA-1, and existing regulatory guides.

- Activities related to software, Acceptance Criterion 19, are performed by other nuclear facilities under the requirements analogous to 10 CFR 63.142 and regulatory guidance analogous to NQA-1. Examples would include analytical and process control software for commercial nuclear power plants. The QA criteria from 10 CFR Part 63 provide a sufficient and comprehensive framework for software development, documentation, control, and verification/validation over its life cycle. Furthermore, the YMRP provides a broad definition of software that appears to extend its requirements beyond software used for scientific or engineering analyses, digital process controls, and other similar applications that directly affect or support items important to safety or waste isolation. To assure comprehensive control of software consistent with NQA-1 criteria, the YMRP should allow the DOE to differentiate among the various types of software (e.g. off-the-shelf programs, project-developed analytical models, business management software), their complexity, and their intended uses.

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- Similarly, activities related to the control of physical samples covered in Acceptance Criterion 20 are routinely conducted by nuclear facilities. For example, nuclear power plant site suitability evaluations, environmental and radiological monitoring, radiochemical analyses, and related activities are directly analogous to the Yucca Mountain activities and are adequately managed under the fundamental QA criteria.
- Acceptance Criterion 21 is inconsistent with the regulation's risk-informed approach, does not appear to permit application of QA grading principles endorsed by the YMRP, and does not adequately distinguish between generally accepted engineering and scientific models and those which are first-of-a-kind and uniquely site-specific. Further, activities related to scientific investigation (e.g., site characterization activities, including field and laboratory testing, data acquisition and reduction, and scientific and engineering modeling and analysis, such as accident analysis, nuclear core management, and dynamic piping and structural analyses) have been successfully conducted at other NRC-licensed facilities in accordance with concise programmatic requirements in the QA program description and applicant/licensee commitment to more detailed implementation guidance.
- Acceptance Criterion 22, which is related to field surveys, is another example of other licensed activities that have been adequately managed under the basic NQA-1 criteria by other licensed nuclear facilities. Field surveys, similar to surveys for the geologic repository, are used at commercial nuclear plants to locate and establish records regarding boreholes, trenches, and geologic formations during site characterization. In addition, design documents specify locations that survey teams locate in the field for construction for placement of structures, systems, and components. These field survey data are also included as a part of as-built data just as will be done for the geologic repository facilities.

*Risk-Informed, Performance-Based Principles*

Throughout the introduction to Section 4.5.1, the YMRP states that the review plan guidance is based on risk-informed, performance-based principles. However, many of the individual review methods and acceptance criteria prescribe the QA program features more narrowly than is consistent with risk-informed, performance-based principles. For example, the YMRP section for graded QA programs prescribes a single, detailed approach and process for developing and implementing a graded QA program. This approach limits the DOE to a program that is not based on common nuclear industry practice and would place an unnecessary burden on the DOE to justify any deviation from the specified approach. Also, the YMRP provides a similarly prescriptive approach to statistical sampling that does not provide the ability to apply sound alternatives to accommodate realistically expected situations.

Some of the Acceptance Criteria of Section 4.5.1 require the QA program to meet explicit and prescriptive criteria that exceed NRC regulations in Subpart G and that are not consistent with available regulatory guidance. This approach would result in a

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description of implementation details in the QA program description that may be more appropriate for inclusion in the detailed implementing procedures. Many of the more prescriptive acceptance criteria appear to be direct or modified excerpts from references that could be more simply identified as NRC-endorsed sources, allowing DOE to maintain some degree of flexibility in its implementation method, consistent with risk-informed, performance-based principles. Specific examples are included in Enclosure 2. DOE's general recommendation is that the inclusion of acceptance criteria, such as those in NUREG-0800, combined with appropriate references to applicable NRC regulations (such as 10 CFR Part 21 and commercial grade item dedication), other applicable regulatory guidance, or NRC-endorsed industry consensus standards, should be sufficient to address Subpart G while remaining faithful to risk-informed, performance-based principles. The YMRP could be further revised to specify that the QA program description include general provisions for implementation of specific commitments or requirements, but that specific implementation methods and details can be included in program procedures and instructions that are subject to NRC inspection.

**Enclosure 2 – Department of Energy’s Detailed Comments on Draft Yucca Mountain Review Plan**

No.	Page, Section, Para.	Comment
<b>All sections</b>		
1.	General - all sections	<p>The YMRP should recognize that at the time of application for a CA, the repository design and associated safety analyses will be at the preliminary stage of development, in contrast to the essentially complete nature of the design and analyses (and increased level of detail) that will be available at the time of application for a license to Receive and Possess (LR&amp;P). This two-stage process for construction authorization and license to receive and possess reflects 10 CFR 63.3 and is described in 10 CFR 63.102(c). As stated in 10 CFR 63.21(a), the initial license application for CA "must be as complete as possible in the light of information that is reasonably available at the time of docketing."</p> <p>DOE recommends that the YMRP explicitly recognize this distinction in level of detail (several of the specific DOE comments address this distinction) and note that DOE will propose and justify the level of detail appropriate for each stage. There should be a general statement added on how the Areas of Review, Review Methods, and Acceptance Criterion will be applied for CA versus LR&amp;P.</p> <p>For preclosure design the level of detail in the LA for CA describing structures, systems, and components important to safety, identifying potential hazards, and analyzing initiating events and event sequences and their consequences needs to be sufficient to demonstrate reasonable assurance of compliance with the regulations. The level of detail necessary for CA can be based on a graded QA approach and licensing precedent.</p> <p>For postclosure the description in the LA for CA of the engineered and natural barriers important to waste isolation, their capabilities, and performance assessment needs to be sufficient to demonstrate reasonable expectation of compliance with the regulations, taking into consideration the CA stage of licensing. Data and analyses obtained through the performance confirmation and research and development programs will provide additional information appropriate for later stages of licensing.</p>
2.	General - all sections	<p>The use of bullets and dashes in listings of review methods and acceptance criteria make use of these listings in LA preparation and review difficult. DOE suggests that bullets be replaced with numbers and that alphabetic designators be used for sublists.</p>
3.	General – sections 3 & 4	<p>Many of the "Evaluation Findings" sections in the YMRP contain the words "The staff has reviewed the [specific information in the LA] and other docketed material...." This statement could imply that any material not on the docket cannot satisfy any review needs. However, there are some areas where it appears that the detailed information required by the review methods and/or acceptance criteria would only appear in analyses, calculations, procedures, etc., which would not typically be docketed but which would be available in the Project records. Therefore, DOE suggests that the "other docketed material" to be reviewed be changed to just "other material."</p>
<b>Section 1</b>		
4.	Page 1-2, 1st full paragraph	<p>The YMRP states this information is to include a final environmental impact statement for the Yucca Mountain site, together with any U.S. Nuclear Regulatory Commission comments on such statement. 10 CFR 63.21(a) states an environmental impact statement must be prepared in accordance with the Nuclear Waste Policy Act of 1982, as amended, and must accompany the application. DOE recommends that the statement in the YMRP be modified to clarify that the EIS being discussed is the EIS prepared in accordance with the NWPA. Also, DOE recommends clarifying that the NRC comments being discussed are those comments required under NWPA Section 114.</p> <p>Also, the discussion of the EIS seems to be beyond the scope of the YMRP and inconsistent with the explanation in the prior paragraph that "The Yucca Mountain Review Plan is not a staff guidance document for an environmental evaluation."</p> <p>To avoid this confusion, DOE recommends tailoring the EIS discussion by deleting the second and third sentences in the second full paragraph on page 1-2; that is, DOE recommends deleting "This information is to include a final environmental impact statement..." through "...with the issuance of a construction authorization and license for a geologic repository."</p>
5.	Page 1-2, 2nd full paragraph	<p>This paragraph states that "use of this Yucca Mountain Review Plan will begin in the preclicensing consultative phase of the program." While DOE agrees with this statement, DOE suggests that the following clarifying sentence be added:</p> <p>"However, any requests for information made during the pre-license application consultation phase are not part of the acceptance review and related RAI's discussed in Section 1.1.2 of this Review Plan. Any failure to fully respond to such preclicensing consultative requests within the recommended time frame would not be considered as grounds for denial of the future application."</p>
6.	Page 1-6, Section 1.1.2, 2nd paragraph	<p>The paragraph following the last bullet (describing a request for additional information) should explain that requested information needs to be reasonably available to be consistent with the concepts in 10 CFR 63.21 (a).</p>
7.	Page 1-8, Section 1.2.2	<p>The YMRP appears to distinguish between the licensing terminology of open and confirmatory items and the preclicensing designations for KTIs of open, closed, and closed pending. DOE suggests that footnote 1 (page 1-9) clearly state this distinction. DOE also recommends that the YMRP state that the KTI nomenclature or status will not be applicable to or during the license application process.</p>

No.	Page, Section, Para.	Comment
8.	Page 1-15, Section 1.3.3, 1st paragraph, 2nd sentence	To be consistent with the NRC regulations concerning postclosure, the sentence should be revised to read, "The performance assessment quantifies repository performance to demonstrate reasonable expectation of compliance with the postclosure public health and environmental standards...."
9.	Page 1-15, Section 1.3.3, 1st para, 3rd sent	To clarify how the language in the triplet of risk questions relates to the regulation, DOE suggests that a sentence be added stating that the focus of performance assessment and analyses is on the range of defensible and reasonable parameter distributions, as stated in 10 CFR 63.304(4).
10.	Page 1-18, Section 1.3.5, 3rd sentence	DOE recommends replacing the phrase "thousands of years" with "10,000 years" to be consistent with the regulatory compliance period specified in 10 CFR 63.
<b>Section 2</b>		
11.	Page 2-1, Section 2.1, 3rd para	The YMRP states that the letter to DOE on the LA acceptance review "will also provide a request for additional information to make the application complete." DOE suggests changing "will also provide" to "may also provide" since the need for a request for additional information has not been established.
12.	Page 2-1, Section 2.2, 2nd para	To reflect 10 CFR 63.21 (a), the concept of "reasonably available" information needs to be included in the acceptance review. DOE recommends adding "in light of reasonably available information" to the end of the 5th sentence, second paragraph.
13.	Page 2-2, Section 2.2	There should be a general acknowledgement in Section 2.2 that some of the requested information may not be available at submittal of the License Application for CA, similar to the statements at Sections 4.5.2, 4.5.3, 4.5.5, 4.5.6, and 4.5.7 for administrative and programmatic requirements. For example, detailed procedures for the physical protection and material control and accounting plans will not be needed at the time of the License Application for CA.
14.	Page 2-5, Section 2.2, last bullet on page	We recommend replacing the phrase "for the period after permanent closure" with "10,000 years after disposal" to be consistent with 10 CFR 63.
15.	Page 2-6, Section 2.2, second bullet on page	This bullet concerning human intrusion is inconsistent with the regulations at 10 CFR 63.321 because the assessment of dose is not necessarily required in the LA. The regulation provides that DOE must determine the earliest time after disposal that the waste package would degrade sufficiently that human intrusion could occur without recognition by the drillers. If complete waste package penetration could occur at or before 10,000 years after disposal, then DOE must show that there is a reasonable expectation that the RMEI would not receive an annual dose exceeding 15 mrem within the 10,000-year regulatory compliance period. DOE recommends adding to the beginning of the bullet: "A determination of the earliest time after disposal that the waste package would degrade sufficiently that a human intrusion could occur without recognition by the drillers, and, if complete waste package penetration is projected to occur at or before 10,000 years after disposal,".
16.	Page 2-8, Section 2.2, second bullet on page	The wording in the acceptance review criterion is inconsistent with the regulatory requirement at 10 CFR 63.21(c)(22). We recommend deleting the word "including" at the end of the bullet and inserting "The following" at the beginning of the bullet.

No.	Page, Section, Para.	Comment
	<b>Section 3</b>	
17.	General Section 3.5	DOE agrees with the NRC discussion in the introduction of Section 3.1.1 that the "General Information" section should present a level of detail similar to that of an "executive summary". However, it appears that the current version of the YMRP requests more detail than would be typically associated with an executive summary type document. 10 CFR 63.21(b)(5) requires a description of the work done to characterize the site in the general information, which is the subject of this section of the YMRP. However, the review methods describe the results of the activities rather than the work activities themselves. The results will be described in the Safety Analysis Report (SAR) as outlined in Section 4 of the YMRP and as required by 10 CFR 63.21(c)(1). DOE recommends avoiding duplication between the general description and the SAR by limiting the information in the general information to a description of the work and not the results. For example, Review Method 2 (Page 3-30, Section 3.5.2) includes an item addressing "the extent to which uncertainty in geologic data, models, or system states affects the compliance with performance objectives." This same element addressing uncertainty is found throughout this section (last dash of each bullet). DOE recommends that this bullet be deleted. The uncertainties that affect compliance will be discussed in the SAR and are included in Section 4.
18.	Page 3-2, Section 3.1.2, RM 2, 5th bullet (retrieval)	DOE recommends adding "should retrieval be necessary" at the end of the sentence (before the parenthetical) to clarify that retrieval may not be necessary.
19.	Page 3-2, Section 3.1.2, RM 2	The level-of-detail described in this review method is sometimes inconsistent with "summary description" or is beyond the regulatory requirements. DOE notes that Section 4.1.3 acknowledges that "plans submitted at the time of initial licensing will be prospective in nature and will not reflect knowledge gained over the course of facility operation...". Examples: 1. DOE suggests changing "Plans" to "Description of plans" in the 3rd, 5th, 7th, and 9th bullets. 2. DOE suggests deleting the 4th bullet on inventory within sealed containers. This information belongs in Section 3.4.2 (MC&A plan). 3. DOE suggests deleting bullet 6 on criteria for deciding when, and under what conditions, waste retrieval would be necessary. This bullet exceeds regulatory requirements concerning retrieval in 10 CFR 63. 4. DOE suggests adding "If proposed," to the 8th bullet (other possible uses of the GROA) since other uses may not be proposed.
20.	Page 3-3, Section 3.1.2, 7th bullet	Mitigation of environmental impacts (such as a Mitigation Action Plan under NEPA) and environmental monitoring other than for radiological effects are outside the scope of 10 CFR Part 63 and are not part of the general information required by 10 CFR 63.21(b). DOE recommends deleting these aspects of the review method.
21.	Page 3-3, last bullet of Section 3.1.2, RM1	The YMRP states that the general description of the geologic repository operations area includes several items, including "information that is consistent with the U.S. Department of Energy Final Environmental Impact Statement for Yucca Mountain." DOE recommends that this reference be modified by adding at the end of the bullet: ", and relevant updated information, if any."
22.	Page 3-4, Sectn 3.1.2, RM3; also page 3-5, AC 3	The YMRP goes beyond the applicable 10 CFR Part 63 requirement by asking for a listing of applicable regulations and an affirmation that none have been left off the list. 10 CFR 63.21(b)(1) requires that the General Information include, among other things, "... the basis for the exercise of the Commission's licensing authority." DOE recommends deleting the portion of RM3 and AC3 that requires confirmation that no regulatory citations have been omitted.
23.	Page 3-7, Section 3.2.2, 1st bullet	The review of Proposed Schedules for Construction, Receipt, and Emplacement of Waste at Subsection 3.2 of the General Information should be limited to coordination of the NRC staff's review and licensing activities with the proposed activities related to engineering, procurement and construction of the repository. Verifying the adequacy of the applicant's planning tools and confirming that they are complete, consistent, reflect a logical sequence, or allocate sufficient time for completion is inappropriate for a RIPB NRC review. DOE suggests changing this bullet to "Verifying that the schedules, time-scaled charts, or work progress flow charts are provided."
24.	General Section 3.3	In Section 3.3.1, the second sentence states, "Although the U.S. Department of Energy is not expected to submit a physical protection plan with the license application, the U.S. Department of Energy should commit to developing and implementing a physical protection system that meets or exceeds the acceptance criteria, in Section 3.3.3, before receipt of waste at the geologic repository operations area." DOE agrees that the details of the physical protection system need not be available at the time of the LA for CA. DOE suggests that the YMRP clarify how the review methods and acceptance criteria will be used in the evaluation of information appropriate for the LA for CA, rather than focus on the detailed criteria for the physical protection system.

No.	Page, Section, Para.	Comment
25.	General Section 3.3	<p>In several Review Methods, referenced requirements have been supplemented with additional requirements. For example, in Section 3.3.2:</p> <p>(1) 10 CFR 73.51(d)(4) requires daily random patrols for the protected area. The YMRP goes beyond the requirement and adds that a minimum of two patrols per security duty work shift should be conducted, unless the facility is in a remote area where more patrols may be necessary.</p> <p>(2) 10 CFR 73.51(d)(8) requires redundant communications capability. The YMRP adds that diverse systems should be used to ensure communications.</p> <p>Reference to these previously established regulatory requirements should not be supplemented with additional requirements. DOE recommends that the YMRP simply state that the DOE should commit to implementing the requirements of 10 CFR 73.51. The detailed acceptance criteria for the plan itself can be located in an inspection manual or other appropriate document.</p>
26.	Section 3.3-all; also, page 1-12, Section 1.3.1, ref to Section 3.3	<p>The level of detail required in the YMRP for the Physical Protection Plan should not be provided in the license application, but should be submitted under separate cover and withheld from public disclosure. This method of submittal is for security reasons and is provided for in applicable NRC regulations. DOE suggests that the YMRP explicitly state that this plan will be submitted under separate cover.</p>
27.	Page 3-15, Section 3.3.2, RM 8, 1st and 2nd bullets; page 3-20, Section 3.3.3, AC 8, 1st bullet	<p>For consistency with the cited regulation, DOE suggests adding "or designated response force" after "local law enforcement authority."</p>
28.	Page 3-21, Section 3.4, 3rd para	<p>The statement "the reviewer should consider that emplaced waste is stored until the repository is closed" implies (because of requirements in 10 CFR 72.72) that physical inventory will be required at least yearly for waste packages in the subsurface. DOE suggests deleting this statement. 10 CFR 63.2 defines disposal as meaning "the emplacement of radioactive waste in a geologic repository with the intent of leaving it there permanently," which distinguishes disposal from storage operations (as defined in 10 CFR 63.2). DOE believes that the intent of the inventory aspect of the MC&amp;A program would be met by controlling access to the subsurface, in conjunction with the use of Material Status Reports and the requirements in 10 CFR 63.71(b) for a record of movement of wastes within the Geologic Repository Operations Area. Physical inventory (even by item accounting) of emplaced wastes would not be necessary or may not be feasible as part of normal subsurface operations.</p>
29.	Page 3-10, Sectn 3.3.2, para 4	<p>Review Method 2 includes the statement, "This verification should be conducted on-site by the reviewer before plan approval." On-site verifications cannot be performed at the licensing stage for construction authorization. This statement is inconsistent with Acceptance Criterion 2, which addresses only how the system "will be designed, tested, and maintained..." DOE recommends that this statement be deleted.</p>
30.	General Section 3.4	<p>Similar to the Physical Security Plan, the detailed procedures of the Material Control and Accounting Plan will, appropriately, not be submitted at the time of the license application for CA. The license application should describe the program and contain the commitment to have a program that meets the requirements of 10 CFR 63.78. DOE recommends that the YMRP clarify that the NRC expects the license application to describe the program and contain these commitments, but not include the detailed MC&amp;A Program.</p> <p>This approach is consistent with the physical protection plan requirements in Section 3.3 and with the Commission statement regarding the physical protection plan published in 66 FR 55738-9 to provide "sufficient information at each stage of the licensing process to support that stage .."</p>
31.	Page 3-30, Section 3.5.2. RM 2, 1st bullet (hydrology), 1st dash	<p>To be consistent with the regulatory language, "Receptor" should be changed to "reasonably maximally exposed individual."</p>
32.	Page 3-31, Section 3.5.2, RM 2, 7th dash on page (hydrology)	<p>The concept in this dash (concerning possible measures "necessary" to prevent future development of ground-water resources) is not included in 10 CFR Part 63 and is contrary to 10 CFR 63.305 (b), which provides that DOE should not project changes in society or the biosphere, but rather must assume that all such factors remain constant as they are at the time of license application. DOE recommends deleting this statement.</p>
33.	Page 3-32, Section 3.5.2, RM 2, 2nd bullet (climatology)	<p>The reference to the Environmental Impact Statement is inappropriate and unnecessary in this context. The reference should be deleted or, at a minimum, preceded by the phrase "such as that [found in the U.S. Department of Energy Final Environmental Impact Statement]."</p>

No.	Page, Section, Para.	Comment
34.	Page 3-34, Section 3.5.3, AC 3	The Plan calls for a general description of limitations that would qualify the descriptions of the Yucca Mountain site and its environs, including information on: "features and process that may exist, but not be detected" (3rd bullet) and "additional site characterization work necessary to increase basic scientific understanding of any significant feature, event and process." (4th bullet) These statements go beyond the 10 CFR 63.21(b)(5) requirement for a description of site characterization work. DOE recommends deleting these statements.
<b>Section 4</b>		
35.	General - Section 4	Maintaining operational radiation exposures as low as is reasonably achievable (ALARA) is typically addressed as a design requirement for normal operations and is not addressed as a consequence of hazards. It is recommended that the ALARA review methods and acceptance criteria currently included in Section 4.1.1.8 of the YMRP, be addressed in a new subsection of YMRP Section 4.5 that would provide a comprehensive review of the Radiation Protection Program. The review should cover the ALARA design aspects as well as the commitment to ALARA principles during operations. This approach is consistent with other NRC review plans such as Chapter 12 in NUREG-0800 and Chapter 9 in NUREG-1718.
36.	General - Section 4	<p>The YMRP in many instances refers to outdated codes and standards or to codes and standards that are not compatible with the risks of a MGR facility. DOE recommends that the YMRP clarify DOE's flexibility in implementing a risk-informed, performance based (RIPB) approach for preclosure. DOE suggests that after the sentence "The DOE has flexibility to use any codes, standards, and methodologies it demonstrates to be applicable and appropriate" (Page 4.1-3 Section 4.1.1.1), the following should be added: "This flexibility is necessary when implementing a risk-informed, performance-based approach. DOE, therefore, has the flexibility to grade the level of applicability and detail (e.g., depending on Q-level) in using any regulatory guide, code, standard, methodology or other regulatory guidance identified in the YMRP."</p> <p>Further, DOE recommends that the YMRP state that DOE should not have to defend not using the YMRP's guidance on codes and standards in the LA.</p> <p>Examples where DOE believes that the cited codes and standards are not applicable:</p> <p>(1) Pgs 4.1-60 and 4.1-71, Sections 4.1.1.7.2.3 I, RM1 and 4.1.1.7.2.3 III, RM1. Specific reference to 1993 version for applicability of ASME B&amp;PV. This is inconsistent with 10 CFR 63.21(c)(2) and (3) which allows U.S. Department of Energy to propose the use of codes and standards (including versions) to apply to design and construction.</p> <p>(2) In RM 1, the second bullet recommends the use of ACI 359. ACI 359 is inappropriate since it is a code specifically developed for concrete reactor vessels and containments at nuclear power plants. The MGR will not have a structure that requires the kind of containment found at nuclear power plants.</p> <p>(3) Pg 4.5-65, Section 4.5.3.3.5, para 1 - the YMRP refers to an out of date version of ANSI/ANS 3.1 (1981 version). Regulatory Guide 1.8 invokes revision 3 of ANSI/ANS 3.1; this paragraph should be consistent with the intent of ANSI/ANS 3.1, Revision 3;</p> <p>(4) Pg 4.5-65, Section 4.5.3.3.5, 6th item - Reference for Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As is Reasonably Achievable (ALARA)" is a draft - Draft OP-618-4. Second Proposed Revision 4.</p>
37.	General - Section 4	<p>The meaning of the term "safety related" is ambiguous. DOE suggests substituting the terms "important to safety," and "important to waste isolation," as appropriate. This suggestion applies to the whole YMRP document.</p> <p>Examples: Pgs 4.1-60 through 4.1-82, Sections 4.1.1.7.2.3 I, II, III and 4.1.1.7.3.3 I, II, III</p>

No.	Page, Section, Para	Comment
<b>Section 4.1</b>		
38.	General Section 4.1.1	<p>Many references have been made to systems that are important to safety based on the current DOE Q-List (e.g. in sec. 4.1.1.6 and 4.1.1.7). This prescriptiveness is inconsistent with the statement on 4.1-2 that says "No prescriptive design criteria are imposed in the Yucca Mountain Review Plan, because 10 CFR Part 63 allows the U.S. Department of Energy to develop the design criteria and demonstrate their appropriateness." The current, preliminary DOE Q-List and SSC Classification will be evolving as the design matures and may change. Such changes to the SSC Classification are inherent in the exercise of flexibility by DOE in selecting applicable codes, standards, and methodologies that are commensurate with the relative safety significance of the SSC.</p> <p>DOE recommends that references to specific important to safety systems (such as fire protection, ventilation, etc.) be deleted. Examples:</p> <p>(1) Page 4.1-68, Sectn 4.1.1.7.2.3, RM 7 - RM 7 implies that the design of the subsurface ventilation system shall be based on design criteria, codes and standards that are consistent with that used by underground mining industry or with those specifically developed by DOE. However, the remaining portion of the RM is inconsistent since it requires compliance with Regulatory Guide 3.32 and other nuclear-related standards and equipment: The RM and its companion AC should be revised to indicate that the design of subsurface ventilation is based on the QA classification and the selection of appropriate codes and standards that are commensurate with the safety classification of the ventilation system. This methodology is truly representative of the risk-informed, performance-based approach in embodied in 10 CFR 63.</p> <p>(2) Page 4.1-69, Sectn 4.1.1.7.2.3, II, RM 7, 3rd paragraph - The statement "confirm that subsurface ventilation equipment important to safety has backup or standby equivalents" seems to prejudice the design criteria and is not risk-informed.</p> <p>(3) Page 4.1-70, Sectn 4.1.1.7.2.3, II, RM 8 and Page 4.1-80, Sectn 4.1.1.7.3.1,II, AC 7 - The statement "ensure that the design has sufficient emergency backup power..." seems to prejudice the design criteria and is not risk-informed.</p>
39.	Page 4.1-3, Section 4.1.1.1, RM 2	The NRC states that demographic information is based on current census data and should be projected for the operational period. DOE suggests clarifying that changes to current demographics are to be projected only for the emplacement period, to avoid speculation about future demographics after the emplacement period.
40.	Page 4.1-4, Section 4.1.1.1.2, RM 4 & RM 5, bulleted items	The level of detail contained in these review methods of geologic and hydrologic parameters is too prescriptive. Also, some of the parameters do not apply to the environment at and around Yucca Mountain. Further, the RMs do not allow for non-standard testing (e.g., in situ compression tests) that are needed to determine certain rock properties such as strength and deformability properties. DOE believes that it should propose what specific features and tests are important to the analysis of preclosure safety. DOE suggests that the RMs should contain more general language, such as in the associated AC4.
41.	Page 4.1-6, Section 4.1.1.1.2, 3rd para from bottom and 4.1-9, Section 4.1.1, AC 5, 6th bullet	The references to "capable faults" should be replaced by "Type I faults." The former terminology is specific to 10 CFR Part 100, Appendix A, which is not applicable to a repository. The latter terminology is consistent with NUREG-1451, Staff Technical Position on Investigations to Identify Fault Displacement Hazards and Seismic Hazards at a Geologic Repository.
42.	Page 4.1-12, Section 4.1.1.2.1, para 2	DOE suggests adding after "...using the review methods and acceptance criteria in Sections 4.1.1.2.2 and 4.1.1.2.3," the phrase ", with the review focused on the design of the SSCs important to safety in the context of the design's ability to meet the performance objectives." This revision is more consistent with a risk-informed, performance-based approach.
43.	Sections 4.1.1.2 and 4.1.1.7	<p>The DOE believes that a logical format of the LA would present design information with the safety analysis following. This format would allow all design information relevant to each system, structure, and component for surface and subsurface design and for waste package design areas to be presented in its own subsection, rather than split into several areas, as in the YMRP. DOE suggests that the YMRP recognize that DOE can use a format different than that in the YMRP and that DOE need not defend using a format different than that provided in the YMRP.</p> <p>The YMRP outline in Section 4.1 and its subsections is problematic for DOE in ensuring that the design information presented is complete, in accordance with the regulations.</p> <p>For example, design information is expected to be provided in Sections 4.1.1.2 and 4.1.1.7. That is, this design information would be presented before and after the information related to the preclosure safety analysis that is to be provided in Sections 4.1.1.3, 4.1.1.4 and 4.1.1.5.</p> <p>Additionally, the information in Section 4.1.1.7, through a series of Review Methods and Acceptance Criterion, addresses all aspects of repository design, which is duplicative of some information called for earlier in the plan.</p> <p>The YMRP structure would require duplication of information. In addition, it may require more staff review time.</p>

No.	Page, Section, Para	Comment
44.	Page 4.1-15, Section 4.1.1.2.2, RM 4, 2nd bullet	The meaning of and need for "cask type" in this RM (which deals with spent fuel and waste characteristics) is unclear. DOE suggests deleting this bullet.
45.	Page 4.1-16, section 4.1.1.2.2, RM 5; page 4.1-71, section 4.1.1.7.2.3 III, RM 1	The requirement to provide the results of nondestructive examination and inspection of the waste package in Section 4.1.1.2.2 should not be in the LA or YMRP. These results will not be available when the LA for construction authorization is submitted. These results for WPs will be available starting with the first fabrication and continuing until well after a license is granted to receive waste. Similarly, the requirement to assess deficiencies or variations in waste packages in Section 4.1.1.7.2.3 and the corresponding AC in Section 4.1.1.7.3.3 is also an inspection activity that will continue through waste package fabrication.
46.	Page 4.1-22, Section 4.1.1.3.2, RM 3, 3rd para, 1st & 2nd sent	The use of only bounding values for probabilities of occurrence is too prescriptive; other methods may be appropriate. DOE suggests replacing first two sentences to read as follows: "If relevant frequency or probability data are insufficient or not available, verify that appropriate probability estimates are used and defensible technical bases are provided. Also, evaluate the adequacy of the associated probability estimation method (e.g. bounding, Bayesian, expert elicitation)."
47.	Page 4.1-26 & 27, Section 4.1.1.4.2, RM 2, 2nd para	The sentence "To the extent practical, ... (ATHEANA) ... can be used to assist the review" is too prescriptive. Other techniques are available, and DOE suggests changing the language to: "Ensure that the analysis has applied methods for human reliability analysis such as those that have been shown to be acceptable in reviews of other facilities, e.g., methods such as ATHEANA and THERP."
48.	Pages 4.1-31, 39, & 63, Sections 4.1.1.5.1.2, 4.1.1.5.2.2, 4.1.1.7.2.3	The YMRP lists the 1977 version of ANSI Standard on Neutron and Gamma Ray Flux-to-Dose Rate factors on pages 4-1.32 and 39 and the 1991 version on page 4.1-63. The NRC has accepted the 1977 version (the calculated values of rem/hr per neutron/cm <sup>2</sup> -sec in ANSI-1977 have been used for Table 1004(b).2 in 10 CFR Part 20). DOE recommends that the reference to ANSI-1991 on page 4.1-63 be changed to ANSI-1977.
49.	Page 4.1-48, Section 4.1.1.6.2, RM 3	Under Acceptance Criterion 3, the Plan specifies elements of review of the methodology for categorization of structures, systems, and components important to safety, including a risk significance categorization that is "consistent with regulatory framework," and the identification of structures, systems, and components important to safety are "consistent with the governing regulation and applicable policy and guidance" and the categorization method duly considers uncertainty and sensitivity analyses in a manner consistent with "applicable portions" of existing NRC policy and guidance. DOE suggests that "applicable" should be changed to "appropriate" in these and other similar phrases in the YMRP. This change would recognize DOE's responsibility to select and defend its selection of appropriate policy and guidance.
50.	Page 4.1-56, Section 4.1.1.7.2.1, RM 1, 1st full para on page	The requirement to determine that design criteria are adequately developed so that designs "...do not result in any degradation of the capabilities of the geologic repository operations area to protect radiological health and safety" is very prescriptive and likely impossible to meet. Designs could degrade somewhat between maintenance/replacement periods, but this would be considered in the design so that the design functions related to radiological health and safety would be assured at all times. This aspect is captured in the 3rd bullet of this paragraph and, therefore, DOE suggests that the quoted phrase be deleted. Similarly, the 1st and 2nd bullets should be revised by adding "Design basis" at the beginning of each bullet.
51.	Page 4.1-57, Section 4.1.1.7.2.1, RM 1	The RM states "Confirm that designs for fixed-area radiation monitors and...are consistent with references..." DOE suggests that "designs" be changed to "design criteria" to avoid being prescriptive in how to implement design bases and criteria.
52.	Page 4.1-59 & 4.1-63, Section 4.1.1.7.2.2, RM 1 & 4.1.1.7.2.3 I RM 4	Section 4.1.1.7.2.2 states "If the design methodologies depend on site-specific test data, confirm that such data are available", "ensure that any analytical or numerical models used to support the design methodologies have been verified, calibrated, and validated", and "Verify that any assumptions...and that their implications...have been documented." This would involve inspection of actual data sets; model verification, calibration, and validation documentation; and design calculations and analyses. A similar situation exists in 4.1.1.7.2.3 with the requirement for all analyses to validate models and document models, data, assumptions, and results. It exists in other sections of the YMRP as well. A summary or reference to such information would be in the SAR, but the actual data sets and documentation would be available in the project records.
53.	Page 4.1-61, Section 4.1.1.7.2.3 I, RM 1, 1st dash	Codes and standards for cranes include NUREG-0554. NUREG-0554's deterministic methodology is not appropriate guidance to use in the context of the risk-informed, performance-based 10 CFR Part 63. The selection of an appropriate code and standard is DOE's responsibility.

No.	Page, Section, Para.	Comment
54.	Page 4.1-62, Section 4.1.1.7.2.3 I, RM 2, para 4	DOE suggests adding language to Review Method 2 that will clarify how margin (related to fracture mechanics) can be applied to stress limits. DOE suggest revising the fourth paragraph by adding, after ".....to perform their safety function," the language: ", as appropriate. For components governed by ASME BP&VC, inclusion of only margin to stress limits may be appropriate."
55.	Page 4.1-64, Section 4.1.1.7.2.3 I, RM 4, 1st bullet	The issue of application of burnup credit for criticality margin determination is not addressed. DOE suggest adding a 4th dash as follows: "Burnup credit may be applied for criticality margin determination, as appropriate." DOE also suggests adding "as appropriate" after "Analyses are consistent with those for similar facilities" in the 3rd dash, since all design issues at similar facilities may not be applicable.
56.	Page 4.1-68 through 70, Section 4.1.1.7.2.3 II, RM 7	The 3rd paragraph essentially places prescriptive requirements for ventilation of surface fuel reprocessing facilities on a subsurface waste disposal facility. These are very different situations as fuel reprocessing not only handles, but mechanically and chemically processes bare fuel, and subsurface waste disposal operations involve waste in a robust, sealed container. Paragraph 7 specifically calls out high-efficiency particulate air filters for the geologic repository operations area exhaust shafts, ramps, or other high radiation areas (in that it requires that inspection, test, and maintenance programs include replacement of these filters): This is overly prescriptive in that the Yucca Mountain repository design may not require HEPA's to meet preclosure performance objectives. Also, most of the paragraphs of this review method apply to "subsurface ventilation equipment important to safety." However, this term is not included in all the paragraphs. DOE recommends that the prescriptive requirements be deleted and that RM.7 be clarified to state that it applies, in total, only to subsurface ventilation systems, structures, and components that are important to safety.
57.	Page 4.1-70, Section 4.1.1.7.7.3, subsection II, RM 7, next-to-last para	This paragraph says reviewers will "verify that the waste package design has considered the potential effects of unavailability of subsurface ventilation because of failure of the system on both preclosure and postclosure performance, if any." DOE suggests that this statement should be moved to subsection III, Review Method 1, on page 4.1-71.
58.	Page 4.1-72, Section 4.1.1.7.2.3 III, RM1; & page 4.1-82, Section 4.1.1.7.3.3 III, AC1	Some of the designs discussed in bullets in RM1 and AC1 do not reflect a risk-informed, performance-based approach and should not be discussed in this section. Examples: (1) Cladding. DOE suggests deleting bullet 6 on page 4.1-82. (2) Drip shields. DOE suggests deleting first sentence of bullet 8 on page 4.1-82. (3) Bullet 9 on page 4.1-82 and the 1st bullet on page 4.1-83 make reference to water contacting the waste package, backfill, and sorptive layers. DOE suggests that these references should be deleted.
59.	Page 4.1-77, Section 4.1.1.7.3.3 (subsection II), AC4; 5th bullet, 2nd line	DOE's Seismic Topical Report #2 ("Preclosure Seismic Design Methodology for a Geologic Repository at Yucca Mountain", Revision 2, August 1997, U. S. Department of Energy, Office of Civilian Radioactive Waste Management, Las Vegas, NV), Section 3.3.2.2 establishes that consideration of repetitive seismic loading is not required for preclosure seismic design. Seismic Topical Report #2 has been reviewed by NRC and accepted as the preclosure seismic design methodology that will be implemented for the proposed geologic repository at Yucca Mountain. DOE recommends that this portion of the bullet be removed.
60.	Page 4.1-78, Section 4.1.1.7.3.3, AC 5, bullet 8	This bullet on rock mass degradation may not be applicable if test data indicate that rock mass degradation during the preclosure period is not credible under anticipated environmental conditions. DOE suggests that "if applicable" be added to the front of this bullet.
61.	Page 4.1-80, Section 4.1.1.7.3.3 II AC 7, 1st bullet on page	This bullet (vent systems continue to function under Cat 1 and 2 event sequences) is not consistent with the 3rd and the 5th bullets, which recognize that the continued functionality of a system and its power source may be determined not to be required by the PSA to meet the performance requirements. Suggest deleting the 2nd bullet and revising the 5th bullet to "...continue operating under Category 1 and 2 event sequences and in case of a main subsurface power outage, if necessary."
62.	Page 4.1-80, Section 4.1.1.7.3.3, subsection II, AC 7, bullet 9	In AC 7, bullet 9 refers to the need for an analysis to assess the impact of lack of subsurface ventilation on waste package design. DOE suggests that this AC should be moved to the Waste Package/Engineered Barrier System section in Subsection III, Section 4.1.1.7.3.3, AC1 on page 4.1-81.

No.	Page, Section, Para.	Comment
63.	Pages 4.1-88 to 90, Section 4.1.1.8.2, all RMs and AC	<p>The review methods and acceptance criteria provided in the draft YMRP Section 4.1.1.8 presuppose design features needed to implement the ALARA principles. Thus, they create excessive expectations for features the reviewer should find regardless of any explanation by the Applicant. This approach is also a disincentive for consideration of alternative designs that might further reduce doses. DOE recommends an approach similar to NUREG-0800. This approach would permit reviewers to determine if the applicant is using, "...to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are... ALARA." (10 CFR 20.1101(b))</p>
64.	Pages 4.1-88 to 90, Section 4.1.1.8.2, RMs 2 & 3 and AC 2 & 3	<p>If the recommendations in the previous comment are not accepted, the current draft Review Method and Acceptance Criterion for two of the three parts of meeting ALARA contained in Section 4.1.1.8 of the draft YMRP should be carefully reconsidered. DOE recommends these changes:</p> <p>(1) In Review Method 2 and Acceptance Criterion 2, Considerations of As Low As Is Reasonably Achievable Principles in the Geologic Repository Operations Area Design, the following changes are recommended:</p> <p>(a) at the beginning of the list of bullets in Review Method 2 and at the beginning of the list of dashes in Acceptance Criterion 2, revise "...to the extent possible..." to read "...to the extent practical..."</p> <p>This change is necessary to correctly reflect the ALARA approach and to be consistent with the wording in 10 CFR 20.1101(b). Excessive expectations would be included if the listed items must be performed to the extent "possible."</p> <p>(b) delete the third bullet in the Review Method on possible blockage of cooling air and in the corresponding item in the Acceptance Criterion. This item is at an inappropriate level of specificity for this facility.</p> <p>(c) delete the fourth bullet in the Review Method and the corresponding item in the Acceptance Criterion. Expecting the design to permit remote control placement of temporary shielding and equipment, is an excessive expectation. This is especially so when it would be required in any application "where possible."</p> <p>(d) delete the sixth bullet in the Review Method and the corresponding item in the Acceptance Criterion. This review item concentrates on distance from radiation sources as the sole method for accomplishing ALARA in the specified facilities and areas.</p> <p>(e) in the seventh bullet in the Review Method and the corresponding item in the Acceptance Criterion, the first sentence should be deleted. This portion of the review item concentrates on distance as the sole method for accomplishing ALARA in the specified facilities.</p> <p>(f) delete the eighth bullet in the Review Method and the corresponding item in the Acceptance Criterion. This review item concentrates on distance as the sole method for accomplishing ALARA in the specified area.</p> <p>(g) reword the ninth bullet in the Review Method and the corresponding item in the Acceptance Criterion. As stated in the draft, "multiple" restricted areas is undefined and could create excessive expectations. Reword to match 10 CFR 20 by stating "Restricted areas, that is, high radiation areas and very high radiation areas, within the controlled area provide control of access..."</p>

No.	Page, Section, Para.	Comment
64 (cont.)		<p>(2) In Review Method 3 and Acceptance Criterion 3, Incorporation of As Low As Is Reasonably Achievable Principles into Proposed Operations at the Geologic Repository Operations Area, the following changes are recommended:</p> <p>(a) at the beginning of the list of bullets in Review Method 3 and the list of dashes in Acceptance Criterion 3, delete the words "...including the consideration of items such as". This language may lead to open-ended expectations that would hinder review for demonstration of compliance. This third part of the review should use a closed end list of appropriate expectations, as is the case for the other two parts reviewed in Section 4.1.1.8.</p> <p>(b) the first bullet specifies implementation of the broad operations ALARA program. The remaining bullets specify selected portions of the operations ALARA program. These bullets seem to be partially redundant to the first (broader) specification, and the rationale for selecting these portions and not others for partially redundant treatment is unclear. This approach, that is, a broad bullet followed by redundant portions, is not used in Review Methods 1 and 2 and Acceptance Criteria 1 and 2. Removal of this redundancy should be considered. DOE's previous comment proposes the approach of using broad expectations only and removing expectations that are redundant and vary in level of specificity.</p> <p>(c) delete the third bullet in the Review Method and the corresponding item in the Acceptance Criterion. This item is at an inappropriate level of specificity for this facility and creates an excessive expectation. This sequencing of emplacement to maximize shielding may not be compatible with facility operation and may result in placing the hottest packages in the center of each emplacement drift. This expectation would deny the DOE the flexibility it needs to operate the facility.</p> <p>(d) change the sixth bullet in the Review Method and the corresponding item in the Acceptance Criterion. This review item prescribes facilities whose experience is to be used for ALARA operational alternatives. This is excessively detailed. Recommend rewording to "Operational alternatives to support achieving doses that are ALARA should include pertinent experience at relevant facilities, for example, fuel storage installations."</p> <p>(e) bullets 2 and 5 on GROA operational procedures in Acceptance Criterion 3 are redundant. Delete Bullet 2.</p>

No.	Page, Section, Para.	Comment
	Section 4.2	
65.	General 4.2.1.3	<p>The current YMRP structure makes it difficult to tell a cohesive TSPA story while at the same time clearly demonstrating compliance with the five acceptance criteria for each model abstraction. DOE recommends that Section 4.2.1.3 be rewritten to generally state that the five review methods are to apply to all model abstractions as DOE chooses to discretize them.</p> <p>DOE may modify the YMRP discretization to more closely resemble the division of model components used in the Site Recommendation suite of documents. In these documents, the project has communicated its postclosure safety approach in terms of describing the movement of water from the surface through the mountain to the accessible environment. DOE suggests that the YMRP recognize that DOE can use a format in the LA different than that in the YMRP without obligation to defend its choice.</p> <p>For example, DOE may make the following modifications to the YMRP discretization to more closely resemble the division of model components used in the SR suite of documents:</p> <p>The first model abstraction would combine in the first Model Abstraction section the YMRP's "Climate and Infiltration" and "Flow Paths in the UZ" and call it "UZ Flow". The second Model Abstraction section would stay as the YMRP calls for it, as "Quantity and Chemistry of Water". The third Model Abstraction would merge two of the YMRP's Model Abstractions "Degradation of EBS" and "Mechanical Disruption of EBS" and be called "Degradation of EBS and the Waste Package".</p> <p>The fourth Model Abstraction would be what the YMRP calls "Radionuclide Release Rates", but would be called "Waste Form Degradation and RN Release". The fifth Model Abstraction would be what the YMRP calls "RN Transport in the UZ", and would be called "UZ Transport".</p> <p>The sixth Model Abstraction would merge two of the YMRP Model Abstractions "Flow Paths in the SZ" and "RN Transport in the SZ", and would be called "SZ Flow and Transport". The seventh Model Abstraction would merge two of the YMRP Model Abstractions "Volcanic Disruption" and "Airborne Transport", and would be called "Disruptive Events (Volcanic Disruption)".</p> <p>The eighth and final Model Abstraction would merge the YMRP's Model Abstractions "Representative Volume", "Redistribution of RNs in Soil" and "Biosphere", and would be called "Biosphere".</p>
66.	Section 4.2 -General	<p>The word "conservative" has been used in the Review Methods and Acceptance Criteria of Section 4.2, Repository Safety after Permanent Closure. In a RIPB evaluation, this word tends to be subjective in its implementation and does not support the spirit of a performance analysis. The reviewer should check for adequacies of models and their input parameters and compare the results of performance assessments with regulatory limits.</p> <p>As examples, "conservatively" or "conservative limit" – page 4.2-68, Acceptance Criterion 5, second bullet; page 4.2-115, Acceptance Criterion 3, third bullet; page 4.2-123, Acceptance Criterion 3, 4th bullet. DOE suggests that the words "appropriately" or "appropriate limit" be substituted.</p>
67.	Section 4.2.1.3 -all	<p>The YMRP states that each section provides enough review methods and acceptance criteria to allow for a detailed review of each model abstraction, but the actual level of detail to be employed will depend on the risk significance of any particular model. However, there is no clear guidance to reviewers on how to reduce the scope of their review based on risk significance (other than to employ "a simplified review focusing on the bounding assumptions" if the model has a minor impact on risk).</p> <p>DOE recommends that the YMRP include additional guidance for how the scope of review could be reduced when risk significance is shown to be low, e.g., less confirmatory analyses, fewer audits of calculations, etc.</p>
68.	Page 4 2-2, Section 4.2.1, para 2 through 4	<p>These paragraphs discuss the issue of uncertainty in the context of the "risk-informed process for performance assessment." This discussion only concerns the issue of risk dilution and the use of conservatism to address uncertainties. However, throughout the subsequent guidance for Model Abstraction (4.2.1.3), the issues of data, parameter, and model uncertainties are raised repeatedly.</p> <p>DOE suggests that the discussion of uncertainty should be expanded beyond that of risk dilution to include uncertainties in models, parameters, and scenarios. Also, the term "risk dilution" is not clearly defined and is not part of common usage in performance assessment; DOE suggests that this term be replaced with "inappropriate representation of uncertainty."</p>
69.	Page 4.2-4, Sections 4.2.1.1.2 & 4.2.1.1 2.3	<p>These sections describe barrier capability in terms of preventing or delaying the movement of water or radioactive materials. The rest of the definition of a barrier in 10 CFR 63.2, the capability to prevent the release or substantially reduce the release rate of radionuclides from the waste, should be added to the description of barrier capability.</p>

No.	Page, Section, Para.	Comment
70.	Pages 4.2-10 to 4.2-16, Section 4.2.1.2.2	<p>There is no mention of the concept of a risk-informed, performance-based (RIPB) review in this section on event probability. DOE recommends that this section should follow the RIPB approach discussed in Sections 4.2.1, 4.2.1.2.1, and 4.2.1.3. Also, this section should recognize that events need not be considered if they have limited effect on the radiological exposures to the reasonably maximally exposed individual or radionuclide releases to the environment. Further, DOE suggests that this section could logically be combined with Section 4.2.1.2.1 on scenario analyses.</p> <p>DOE understands that the identification of scenarios (Section 4.2.1.2.1) is comprehensive and not RIPB. But once events/scenarios have been identified with probabilities greater than one chance in 10,000 in 10,000 years, the degree of consideration of these events by DOE and review by NRC should follow the RIPB approach.</p>
71.	Pages 4.2-7 to 10, Section 4.2.1.2.1, RM 2 & 4 and AC 4	<p>To more closely reflect the regulatory language of 10 CFR 63.114(e), DOE suggests the following changes:</p> <p>(1) from "their limited effect on the magnitude and time of the average annual dose." to "having no significant change on the magnitude and time of the radiological exposures to the reasonably maximally exposed individual, or radionuclide releases to the accessible environment." (RM 2, last para)</p> <p>(2) from "the magnitude nor time of the average annual dose" to "the magnitude and time of the radiological exposures to the reasonably maximally exposed individual, or radionuclide releases to the accessible environment." (RM 4, first para)</p> <p>(3) from "of the average annual dose." to "of the radiological exposures to the reasonably maximally exposed individual, or radionuclide releases to the accessible environment." (AC 4; 5th bullet)</p>
72.	Page 4.2-10, Section 4.2.1.2.2, Title and Section 4.2.1.2.2.1, first & second para	<p>To more closely reflect the regulatory language of 10 CFR Part 63, DOE suggests changing the words "10<sup>-8</sup> per year" to "one chance in 10,000 of occurring over 10,000 years" in the three cited places on this page and all other places where it is used. This language comes from 10 CFR 63.114(d), which DOE recommends citing in the first paragraph of 4.2.1.2.2.1.</p>
73.	General, Page 4.2-10, Section 4.2.1.2.2	<p>DOE believes that the discussion in this section on probabilities and associated models is overly prescriptive in its specification of the details of the inputs to the probability models and assumes aspects that are important to the probability estimates. For example, time periods of past igneous activity are specified, distances from the site for consideration of igneous activity are specified, and the types of data to be input to the probability assessments are specified. DOE recommends that NRC generalize the discussion to allow the applicant flexibility to develop technical arguments that support its own probability models. Specific recommendations are included in other DOE comments.</p> <p>DOE believes that all of these inputs will be determined through expert technical evaluation and should not be prescribed in the YMRP.</p>
74.	Page 4.2-11, Section 4.2.1.2.2.2, RM 2, 1st para, 1st sent	<p>To avoid overly prescribing how probabilities are estimated, DOE suggests replacing the sentence with "Evaluate the adequacy of the technical basis for the probability estimates for events applicable to Yucca Mountain, such as the relation to past patterns of natural events in the Yucca Mountain region and to analogous areas." This revision is more in line with the associated AC2.</p>
75.	Page 4.2-11, Section 4.2.1.2.2.2, RM 2, 2nd para	<p>The second paragraph on reviewing igneous activity is too prescriptive. DOE suggests replacing the paragraph with the following:</p> <p>"Verify that probability estimates for future igneous events have adequately considered past patterns of igneous events in the Yucca Mountain region. Evaluate the adequacy and sufficiency of the U.S. Department of Energy characterization and documentation of past igneous activity to the extent that it is important to estimates of future activity.</p> <p>This should include uncertainties about the distribution, timing, and characteristics of past igneous activity. Confirm that the documentation includes a discussion of the applicable time periods of past igneous activity and the applicable region that is considered.</p> <p>Give particular attention to the documentation of the key observations and interpretations important to the DOE's probability models, including such features as the locations, ages, volumes, geochemistry, and geologic settings of basaltic igneous features, such as cinder cones, lava flows, igneous dikes, and sills. Verify that the U.S. Department of Energy considered geological and geophysical information relevant to past igneous activity contained in the literature."</p>
76.	Page 4.2-11 & 12, Section 4.2.1.2.2.2, RM2, 3rd & 4th para	<p>To avoid being overly prescriptive in specifying how seismicity and criticality are studied, DOE suggests replacing "are based on" with "have considered" in the first sentence of both paragraphs. Also, in second sentence of the third paragraph, replace "since 2 million years ago" with "over applicable time periods, such as the Quaternary period."</p>
77.	Page 4.2-12, Section 4.2.1.2.2.2, RM3, para 2, last sentence	<p>The review criterion carries the assumption that igneous activity is related to other geologic processes (seismicity, groundwater flow) by certain tectonic processes. This is not necessarily true. These processes may not be linked by any common tectonic process. DOE suggests adding ",if appropriate," between "assess" and "whether."</p>

No.	Page, Section, Para.	Comment
78.	Page 4.2-12, Section 4.2.1.2.2.2, RM3, 2nd para, 1st and 2nd sentences	To avoid being overly prescriptive in specifying how igneous activity is studied, DOE suggests, in first and third sentences, replacing "are consistent with" with "have considered." Also, delete "less than 12-million-year-old" and replace "magmatic system" with "region"
79.	Page 4.2-12, Section 4.2.1.2.2.2 RM 3, last sentence of the 2nd paragraph and Page 4.2-15, Section 4.2.1.2.2.3 AC 3, 3rd subbullet	The last sentences (on consistency of probability and tectonic models) in the subject paragraphs are overly prescriptive, as the probability models for igneous and seismic activity are based on expert elicitations. It was left to the experts in each case to determine to what extent different tectonic models were important in the determination of their probability models. DOE recommends that the sentence that begins "Assess whether igneous-activity probability models ..." be deleted, and that the subbullet in AC 3 be rewritten as follows: "The U.S. Department of Energy probability models for natural events, to the extent appropriate, use underlying geologic bases (e.g., tectonic models) that are consistent with other relevant features, events, and processes evaluated, using Section 4.2.1.2.1."
80.	Page 4.2-12, Section 4.2.1.2.2.2, 1st full para on page	In the second sentence, replace "all fuel types to be disposed of" with "the various fuel types to be disposed." The word "all" in this sentence could preclude various bounding analyses that may be conducted on fuel where detailed characterization of certain waste forms may be unrealistic and not necessary to assess criticality.
81.	Page 4.2-13, Section 4.2.1.2.2.2, RM4, 2nd para	To avoid overly prescribing how comparable non-YM volcanic systems are considered, DOE suggests inserting ", if appropriate," before "confirm that" and "comparable."
82.	Page 4.2-14, Section 4.2.1.2.2.2, RM5, 2nd para, last sent	This paragraph provides guidance to the staff on independent assessments that they plan to conduct, but does not provide guidance on what the implications might be to the uncertainties submitted by the applicant, which is the focus of this review method. That is, there is no guidance to the NRC reviewers on how to use independent models to determine whether DOE's probabilities are acceptable. DOE's general concern is that NRC reviewers will conduct independent work that focuses on conservatism and then use the results of this work, rather than the risk-informed, performance-based approach, as criteria for the acceptability of DOE's work. Although reviewers may have independently developed models as part of developing regulatory expertise, DOE recommends that the YMRP clearly state that the review process should focus on determining whether DOE has considered an acceptable range of models in an appropriate process. The discussion on independent assessments should be deleted. An example of this concern is in the first sentence of paragraph 2 of RM 5, Section 4.2.1.2.2.2, page 4.2-14, which states that assessments of probability values will be developed by considering the range of values available in the literature for the Yucca Mountain region and comparable volcanic fields outside of the Yucca Mountain region. It is not clear how these assessments will be used to evaluate the applicant's assessment of uncertainty. Another example is in the second sentence of RM3, 2nd paragraph, which states that independent evaluations of probability models will be conducted "to confirm that probability models are sufficiently robust." These independent evaluations will "test the sensitivity to uncertainties about past distribution of volcanic vents, recurrence rates of volcanism, and relationships between igneous activity and tectonism." It is unclear how these evaluations will be conducted, what data they will be based on, or how the results will be used to evaluate the adequacy of the applicant's uncertainty in event probability. Also, DOE believes that the direct relationships between tectonism and igneous activity implied in this section are speculative and were not considered significant by experts in the PVHA expert elicitation. DOE recommends deleting the phrase on this relationship. Further, DOE believes that this concern is also reflected in Review Method 3 on probability model support (page 4.2-12, section 4.2.1.2.2.2., paragraph 4 ) with the statement: "Use independent models to estimate the probabilities of igneous activities." DOE suggests deleting this sentence. The reviews of other disruptive processes such as seismicity and criticality do not specify the use of independent models.
83.	Page 4.2-14, Section 4.2.1.2.2.3, AC 2, 1st para, 1st sent	To avoid prescribing how probabilities are determined, DOE suggests replacing "are based on" with "have considered, as appropriate,"

No.	Page, Section, Para.	Comment
84.	Page 4.2-15, Section 4.2.1.2.2.3, AC3, 1st bullet, 1st dash, 1st sent and 2nd dash, 1st sent	Replace "to the extent possible" with "to the extent appropriate" to avoid being overly prescriptive in how much analog systems should be used.
85.	Page 4.2-15, Section 4.2.1.2.2.3, AC3, 1st bullet, 1st dash, 2nd sent and Page 4 2-13, Section 4.2.1.2.2.2, RM3, last para, 1st sent	This sentence in RM 3 presumes that, when events are infrequent, there are always insufficient numbers of events in the "Yucca Mountain system" to develop technically-defensible probability models. This sentence in AC 3 states that analog systems should contain significantly more events than the YM system. These statements are overly prescriptive and not necessarily accurate. DOE recommends deleting or, at a minimum, qualifying these statements.
86.	Page 4.2-15, Section 4.2.1.2.2.3, AC 3, 2nd dash	To avoid being overly prescriptive in how models reproduce characteristics of past events, DOE recommends that NRC change "reproduce" to "produce results consistent with."
87.	Page 4.2-18, Section 4.2.1.3.1.1, 4th bullet	This statement says that modeling uncertainty and its effects will be propagated through the total system performance assessment model abstraction. This implies that alternative conceptual models will be included in the TSPA. However, in discussing model uncertainty in Review Method 4 (Page 4.2-21), it is stated that the staff will "examine and evaluate the bases for excluding alternative conceptual models." Acceptance Criterion 4 (Page 4.2-24) calls for alternatives to be "considered" and for conceptual model uncertainties to be "defined and documented." This implies that alternative models be defined, evaluated relative to available data, and one or more models selected for propagation through the TSPA. DOE suggests that the YMRP resolve this inconsistency by stating that a risk-informed, performance-based approach should be used to determine where alternative models should be included. DOE also suggests inserting ", if appropriate," between "and" and "propagate."
88.	Page 4.2-41, Section 4.2.1.3.3.3, 3rd bullet on page, 2nd sent	This sentence says "data are adequate to constrain the probability for microbially influenced corrosion and microbial effects." This wording implies a pre-determined conclusion as to the role of microbes. DOE recommends NRC substitute this language: "...data are adequate to support determination of the probability for microbially-induced..."
89.	Page 4.2-80, Section 4.2.1.3.8.2, RM 4, 1st para, last sent; also pg 4.2-106, Section 4.2.1.3.12.2, RM4, 1st para, last sentence	This portion of Review Method 4 states that reviewers should "Confirm that the U.S. DOE has adequately addressed comments from external reviews of the model abstraction". It unclear what type of external reviews are being referred to (e.g., only formal peer reviews) or how adequacy is determined. Further, it is unclear how this review of DOE responses is part of the regulatory requirements. DOE recommends that this sentence should be deleted or, at a minimum, qualified in both sections.
90.	Page 4.2-103, Section 4.2.1.3.12, entire section	This section appears to inappropriately mix concepts of water demand for the individual protection standard (IPS) and representative volume for the groundwater protection standard (GPS). DOE suggests that this section be divided into a review relevant to the individual protection standard and a review relevant to the groundwater protection standard. The concepts for IPS and GPS on amount of water can be applied independently. The reasonably maximally exposed individual (RMEI) regulatory language (in 63.312) specifies the annual water demand for the RMEI as 3000 acre-feet, does not use the term representative volume, and does not use the slice-of-the-plume or well-capture methods that specified for groundwater protection. For these reviews, the RMs and ACs should be clarified to reflect to requirements in 63.312(c) for water demand in individual protection and 63.332 for representative volume in groundwater protection. The section also needs to be revised to ensure that the term "representative volume" is used consistently with the definition of "representative volume" in 10 CFR 63.332(a). DOE currently employs a simplified approach for using the output from the saturated zone model to determine the concentration of radionuclides in 3000 acre-feet. The YMRP should recognize that a simplified approach may not require the use of the YMRP's review methods and acceptance criteria.
91.	Page 4.2-125, Section 4.2.1.3.14.4, 5th and 7th bullets on page	In the fifth bullet, the regulatory citation should be changed to 10 CFR 63.305(d); and the seventh bullet should be changed to read: "Society, the biosphere (other than climate), human biology, and the state of human knowledge and technology are assumed constant from the time of the license application onward, consistent with 10 CFR 63.305(b)".

No.	Page, Section, Para.	Comment
92.	Page 4.2-126, Section 4.2.1.4.1.1, 1st para	<p>Section 4.2.1.4.1.1 is for review of the analysis of repository performance that will demonstrate compliance with the postclosure individual protection standard, but inappropriately cites reviews required for ground-water protection. This section directs that the information required by 10 CFR 63.21(c)(11) and (12) will be evaluated</p> <p>However, while 10 CFR 63.21(c)(11) does address the individual protection standard, 10 CFR 63.21(c)(12) does not; it addresses ground-water protection standards, and in the next sentence, the YMRP states that standard will be reviewed using Section 4.2.1.4.3.</p> <p>DOE suggests moving the requirement to evaluate the information required by 10 CFR 63.21(c)(12) to Section 4.2.1.4.3.1, which discusses ground-water protection standards.</p>
93.	Page 4.2-127, Section 4.2.1.4.1.2, 2nd paragraph	<p>To clarify how the dose curve is calculated, DOE recommends adding to the first sentence, "consistent with the probability of each scenario class." For comparison to the individual protection standard, Section 4.4.1 of the Issue Resolution Status Report Key Technical Issue: Total System Performance Assessment and Integration, Rev. 3, has provided guidance on the method for combining the expected annual doses from the nominal and disruptive scenarios to the reasonably maximally exposed individual.</p> <p>That guidance states that the dose for each scenario is weighted by the scenario probability, so the summed expected annual dose includes both consequence and probability and, therefore, represents the expected risk for the repository.</p>
94.	Page 4.2-131, Section 4.2.1.4.2.2, RM1	<p>The YMRP calls for analyses of the time to which the engineered barrier system has degraded to the point at which a driller can intercept the repository but not recognize it. This statement differs from regulatory language. 10 CFR 63.321 requires that "DOE must determine the earliest time after disposal that the waste package would degrade sufficiently that a human intrusion could occur without recognition by the drillers." 10 CFR Part 63 defines human intrusion in terms of drilling through a waste package without driller's recognition, while the YMRP defines human intrusion in terms of intercepting the repository without driller's recognition. These two events are quite different, and could happen at very different times. It is estimated that the waste package will not degrade to the point that it could be drilled through without the driller's recognition for tens of thousands of years after closure.</p> <p>DOE recommends that NRC change the language to read more like the regulation. The paragraph should read:</p> <p>"Verify . . . human intrusion (by drilling through a degraded waste package without recognition by the drillers) are adequate and appropriate. For example, . . . degraded to the point at which a driller could drill through a degraded waste package but not recognize it."</p>
95.	Pages 4.2-131 to 133, Section 4.2.1.4.2, AC2, 2nd bullet	<p>Contrary to the statement in AC 2, the TSPA done for evaluation of the Individual Protection Standard and the TSPA done for evaluating the Human Intrusion Scenario are not identical, above and beyond the HI stylized scenario issue. 10 CFR Part 63.114(d) requires that the TSPA done for evaluating postclosure compliance with the Individual Protection Standard consider only FEPS that have at least one chance in 10,000 of occurring over 10,000 years. This would include "unlikely" events (as defined by the Commission).</p> <p>On the other hand, 10 CFR 63.343 requires that unlikely FEPS shall be excluded from the assessments for the human intrusion and groundwater protection standards. Therefore, the two scenarios are not identical. The TSPA done for evaluating postclosure compliance with the Individual Protection Standard will include all FEPS with a probability of occurrence of greater than 1 in 10,000 in 10,000 years.</p> <p>The TSPA done for evaluating postclosure compliance with the Ground-Water Protection Standard and the Individual Protection Standard with a human intrusion will not include unlikely FEPS. DOE requests that NRC add to the end of the bullet "and excludes the consideration of unlikely (as defined by the Commission) natural features, events and processes."</p> <p>Another difference between the TSPAs done for evaluating the Human Intrusion scenario and that for evaluating compliance with the Individual Protection Standard is that, for Human Intrusion, only releases attributable to the human intrusion need to be considered, whereas all releases must be included in the calculation of dose for comparison to the IPS.</p>
96.	Page 4.2-135, sec. 4.2.1.4.3.2, RM3, 1st para	<p>The words "no more than" should be deleted from the phrase "no more than 3,000 acre-feet" for representative volume (here and elsewhere in this section). Part 63.332(a)(3) specifies 3,000 acre-feet of water for the representative volume, and the YMRP should be consistent with the regulatory language.</p>

No.	Page, Section, Para.	Comment
<b>Section 4.3</b>		
97.	Section 4.3 - General	The activities in Section 4.3 (Research and Development Program to Resolve Safety Questions) and Section 4.4 (Performance Confirmation Program) overlap to some extent because both address ensuring the adequacy of structures, systems, and components important to safety and natural barriers important to waste isolation. DOE believes that items in the Performance Confirmation program are confirmatory in nature, i.e. the testing and monitoring is confirming the expected performance. The items in the Research and Development program are generally understood, but still have open questions or issues and further research is needed to fully understand or quantify their behavior. DOE recommends that these sections reflect this philosophy to clarify in which program a particular item should be.
98.	Page 4.3-1, Section 4.3.1, 1st para, last sent	For consistency with 10 CFR Part 63, DOE suggests changing "adequacy of site characterization, design or natural barriers" to "adequacy of design." The basis for this YMRP section (10 CFR 63.21(c)(16)) requires an R&D program to resolve safety questions pertaining to engineered and natural barriers, and does not pertain to site characterization, per se.
<b>Section 4.4</b>		
99.	Section 4.4 - General	The YMRP text goes beyond the requirements of 10 CFR 63.131 through 63.134. Section 4.4, Performance Confirmation Program, is very prescriptive with regard to requirements for particular barriers and is more in line with the approach in 10 CFR Part 60 than with the RIPB approach and health-based regulations in 10 CFR Part 63. DOE will use a RIPB approach to determine specific PC tests, in accordance with earlier sections of the YMRP. Examples of the YMRP being prescriptive: (1) DOE recommends NRC delete bullet 1 dash 2 ("Verify that experiments ...") and bullet 2 ("Verify adequate testing of fabrication ...") on page 4.4-10, and also delete dash 2 ("Experiments will incorporate ...") and bullet 1 ("An adequate testing of fabrication ...") on page 4.4-19. In a RIPB-based regulation, Section 4.4 activities would be tied directly to the LA development described in Sections 4.1, 4.2, and 4.3. (2) In Section 4.4.3, 1st bullet on page 4.4-16, the wording should be changed to "...used in the design are considered in the design testing program." The RIPB process will select appropriate effects to test.
100.	Section 4.4 - General	10 CFR 63.132 (Performance Confirmation Program) uses the terms "design bases and assumptions". Therefore, DOE recommends the term "performance limits" be replaced with "design bases" when pertaining to engineered systems and "natural system PA assumptions and inputs" when pertaining to natural barrier systems. For example, see Page 4.4-4, 10th dash; Page 4.4-6, 10th dash; Page 4.4-8, 3rd & 7th dashes; Page 4.4-9, 3rd & 7th dashes; Page 4.4-9, 1st bullet, 4th dash; Page 4.4-12, 1st dash; Page 4.4-13, 3rd, 4th and 6th dashes; Page 4.4-14, 1st bullet, 3rd, 4th and 6th dashes; Page 4.4-14, 2nd dash; Page 4.4-16, 1st dash; 4.4-17, 4th dash; and Page 4.4-18, 1st dash. DOE also recommends changing "baseline value(s)" to "baseline." The term "baseline" is all-inclusive in that it includes parameters with single values and others with acceptable ranges of values. For example, see page 4.4-6, dash 4, page 4.4-13, dashes 3 & 4, and page 4.4-14, dashes 3 and 4.

No.	Page, Section, Para.	Comment
101.	Section 4.4 - General	<p>The YMRP is more prescriptive than 10 CFR Part 63 regarding procedures supporting the Performance Confirmation Plan. DOE should have the flexibility to determine the context in which confirmation procedures need to be developed. Such procedures may be developed after an LA for Construction Authorization is submitted, and activities will be covered in a hierarchy of plans, procedures, and work instructions, some of which may apply Project-wide.</p> <ul style="list-style-type: none"> <li>- DOE recommends deleting Section 4.4.1, bullet 1, dash 4 ("Administrative procedures") as a general requirement.</li> <li>- DOE recommends changing Section 4.4.2, RM1, bullet 3, dash 1 to read "Provisions ..." rather than "Procedures ...", to permit DOE the flexibility to document its methods in the plan or in cited procedures.</li> <li>- DOE recommends changing the last bullet in Section 4.4.2, RM1 to read "Verify that the U.S. DOE's Performance Confirmation Plan cites administrative procedures related to records, reports, deficiencies, and tests".</li> <li>- DOE recommends changing Section 4.4.2, RM2, bullet 4, all three dashes to read "Verify ... includes provisions to ..."</li> <li>- DOE recommends changing Section 4.4.3, AC1, last bullet, to read "The Performance Confirmation Plan cites procedures to meet the requirements for records and reports, reports of deficiencies, and tests, as specified at 10 CFR 63.71, 63.73, and 63.74."</li> <li>- DOE recommends changing Section 4.4.3 AC2 similarly: <ul style="list-style-type: none"> <li>* Dash 1: "It includes comparison of measurements ..." instead of "It includes procedures ...".</li> <li>* Dash 2: "It includes provisions to ..." instead of "It includes procedures for ...".</li> <li>* Dash 3: "It includes reporting significant differences ... These provisions meet the requirements ..." instead of "It includes procedures to report significant differences ... These procedures meet the requirements ..."</li> </ul> </li> </ul>
102.	Page 4.4-8, Section 4.4.2, 1st bullet on page	<p>The regulation 10 CFR 63.133(a) makes no reference to chemical interaction." DOE recommends that NRC delete the phrase "and chemical interaction."</p>
103.	Page 4.4-15, Section 4.4.3, AC 2, 4th bullet on page (surveillance of subsurface conditions)	<p>Second dash, second sentence. DOE recommends adding the word "significant" before "adverse impact." As written, the sentence goes beyond the regulation at 10 CFR 63.132.</p>
104.	Pages 4.4-10 & 4.4-18, Section 4.4.2, RM 4 and Section 4.4.3 AC 4	<p>The requirement that the environment for monitoring and testing waste packages include "variations in environmental factors that encompass the range of expected uncertainties" is not required by 10 CFR 63.134, and DOE recommends deleting it. 10 CFR 63.134(a) requires that the environment be representative of the environment in which the waste packages will be emplaced, not to cover the full range of uncertainties for all parameters.</p>
105.	Page 4.4-10, section 4.4.2, RM 4 and page 4.4-19, section 4.4.3, AC 4, and Page 4.4-16, section 4.4.3, 2nd bullet, 2nd sentence	<p>The 10 CFR 63.134 requirements for monitoring and testing waste packages do not include the gathering of "data needed to design the waste package." Waste package design activities can begin before the performance confirmation testing. DOE recommends deleting this aspect of the "review method" and "acceptance criteria" or clarifying that such data would be used to confirm the adequacy of design of the waste package. Also, there is no requirement in the regulations indicating that design testing is a prerequisite for design. Testing is only required to start "during the early or developmental stages of construction" [10 CFR 63.133(a)] DOE recommends deleting the sentence in this bullet on page 4.4-16 that links testing to design.</p>
106.	Page 4.4-16 and 17, Section 4.4.3, AC 3, 4th and 5th bullets (backfill, design testing program).	<p>Second dash, both bullets. The last sentence states that "An acceptable justification factor is the certainty that the backfill and compaction can perform its intended function." The use of the word "certainty" seems inconsistent with "reasonable assurance" and "reasonable expectation" concepts. DOE recommends that the sentence be deleted for this reason, and also because backfill should only be addressed if it is important to safety or waste isolation, and then only in terms of its importance to safety and waste isolation.</p>

No.	Page, Section, Para.	Comment
107.	Page 4.4-19, Section 4.4.3, AC 4, 4th bullet (waste packaging) and Page 4.4-21, Section 4.4.4	The last sentence states that "Monitoring and testing will continue up to the time of permanent closure." As written, the sentence is not consistent with 10 CFR 63.134(d). The sentence should be revised by inserting "as long as practical," after "continue."
108.	Section 4.4.4 - General	DOE suggests that NRC change the term "reasonable assurance" to "reasonable expectation" in this section. 66 FR 55375, III-1-4, established that "reasonable expectation" will be used for postclosure performance, and Section 4.4.4. addresses confirmation of anticipated postclosure performance.
<b>Section 4.5.1</b>		
109.	Section 4.5.1.3, Acceptance Criteria, general comment	DOE recommends revising the YMRP to be consistent with the 18 acceptance criteria prescribed in 10 CFR Part 63. In addition, the YMRP should be consistent with industry practice, which allows the applicant/licensee to adopt and implement QA-related guidance (e.g., Regulatory Guides, NQA-1) to ensure that quality-affecting activities are adequately identified, controlled, and documented.
109 (cont.)		<p>The following are examples of areas that could be affected if the above general comment were adopted:</p> <ul style="list-style-type: none"> <li>- AC-6, 1st bullet, 2nd sentence, page 4.5-18 - qualify the term "computer software" by changing it to read "quality-affecting analytical and process control computer software." Use this terminology throughout when addressing "computer software."</li> <li>- AC-8, 2nd bullet, page 4.5-23 - delete the word "software" from this bullet. The identification and control of software is accomplished under AC-3. AC-8 may apply to an SSC that may contain control software, but the software itself will be controlled under AC-3.</li> <li>- AC-11, 1st bullet, 2nd sentence, page 4.5-26 - this bullet is requiring that software be tested under the controls of AC-11. The Yucca Mountain Project (YMP) controls software operability and qualification testing under AC-3; this is also done at most commercial power plants. When software is a part of an SSC, the SSC testing will include the process control attributes of the associated software, and such testing is accomplished under the controls of AC-11.</li> <li>- AC-11, last bullet, page 4.5-26 - delete the statement "including computer software and supporting data." Computer software "acceptability" (if used in testing) should not be determined during the review of test results. The software used should be identified in the test plan and its appropriateness determined at that time. The software used should be from the software configuration management system and must be qualified prior to its use (AC-3). The term "and supporting data" need not be included because test results usually include "data." It appears that an assumption is made that site investigation activities are accomplished under the controls of AC-11. At YMP, these activities have been and will be controlled under AC-3.</li> <li>- AC-14, 1st, 2nd, &amp; 3rd bullets, page 4.5-28 - delete the words "and software" from these bullets. The only way that software would fall under AC-14 controls is as an integral part of an SSC (i.e., process control such as a part of installed instrumentation or control devices). The qualification status and version control of quality-affecting analytical and process control computer software is accomplished as part of the software configuration management system under the requirements of AC-3.</li> <li>- AC-15, 1st bullet, page 4.5-29 - delete the words "including computer software." Similar to AC-14, AC-15 would not apply to computer software unless it were an integral part of an SSC. Incomplete or defective software will be controlled as a part of the software configuration management system as a part of AC-3.</li> <li>- AC-16, 2nd bullet, page 4.5-30 - delete the words "or samples" from the first sentence. Deficient or incorrect samples are documented and dispositioned according to AC-15; only sample processing or use issues are handled according to AC-16.</li> </ul>

No.	Page, Section, Para.	Comment
110.	Section 4.5.1.3, <u>General Acceptance Criteria</u> , general comment	<p>Since there are no "general" QA requirements identified in 10 CFR Part 21 and 10 CFR 63.21(c)(20), 63.44, 63.73, or 63.141-144 as they relate to the quality assurance program, it is inappropriate to have general acceptance criteria. In most cases, no specific correlation to these parts of the regulation can be determined that aren't already covered in specific acceptance criteria. Some of the discussion contained in this section could be retained, but moved to Section 4.5.1.1 when discussing areas of review and could be subdivided, as in NUREG-0800, into pre-docketing and post-docketing topics. Where there is correlation to the regulations, it is difficult to distinguish whether the acceptance criteria to be met should be that identified in the general acceptance criteria or that identified in other specific acceptance criteria that appear to cover the same subject.</p> <p>For example, the second sentence in the fifth paragraph in this section beginning at the bottom of page 4.5-4 sets forth a requirement to pass the DOE's QA program requirements on to principal contractors, as appropriate, to their respective scopes of work. AC-4 requires the same thing in the first bullet, but is done using different wording. Therefore, coverage of this in the general acceptance criteria area seems redundant and unnecessary. Those topics that shouldn't be moved to Section 4.5.1.1 should be deleted along with the heading for the General Acceptance Criteria.</p>
111.	Section 4.5.1.3, <u>Specific Acceptance Criteria</u> , general comment	<p>There are a number of instances in the Specific Acceptance Criteria where criteria are included that are not found within 10 CFR Part 21, or 10 CFR 63.21(c)(20), 63.44, 63.73, and 63.141-144; not found in the NUREG-0800 Review Plan applicable to power plants for the same activities; not found in industry consensus standards; or not found in other regulatory precedence. Inclusion of these criteria should be reconsidered. It is suggested that most of these be deleted from the Review Plan, as listed below, for the above reasons. Some of the criteria should also be relocated to different, more appropriate acceptance criteria while others should remain where they are, as they are important to ensuring an adequate QA program due to one or more of the unique attributes of the geologic repository program. Those criteria that DOE suggests relocating are identified in individual comments that follow.</p>

No.	Page, Section, Para.	Comment
111 (cont.)		<p>Those that DOE suggests deleting are as follows:</p> <ul style="list-style-type: none"> <li>- AC-1, 10 th bullet, page 4.5-7 - delete the words "procedures for reporting are described;" this is not contained in NUREG-0800.</li> <li>- AC-2, 8th bullet, page 4.5-10 - with the exception of the first paragraph, the entire bullet and its subelement dashed items should be deleted; this is not industry consensus nor is it based on regulatory precedence.</li> <li>- AC-2, 11th bullet, page 4.5-12 - delete the words "and observations," as this is a non-standard and undefined term. Suggest the use of the term "surveillance" instead.</li> <li>- AC-2, 17th bullet, bottom of page 4.5-13 - delete the entire bullet on readiness reviews. This is not contained in NUREG-0800, regulatory guidance, NQA-1, or other regulatory precedence.</li> <li>- AC-3, 2nd bullet, page 4.5-14 - delete the entire bullet that provides details for design definition or scope. This is not in NUREG-0800, regulatory guidance, NQA-1, or other regulatory precedence. Some of the words are found in NQA-1, but the bullet goes beyond NQA-1.</li> <li>- AC-3, 18th bullet, top of page 4.5-17 - delete the entire bullet on sampling. This is not contained in NUREG-0800, regulatory guidance, NQA-1, or other regulatory precedence. While the 95/5 scenario may be adequate in some cases, it may also be inadequate in others.</li> <li>- AC-18AC-5, 3rd bullet, page 4.5-18 - delete the entire bullet. This item is redundant with other items in AC-5 and AC-6 and contains a requirement for procedures to be "verified" that does not appear in NUREG-0800, regulatory guidance, NQA-1, or other regulatory precedence.</li> <li>- AC-8, 3rd bullet, page 4.5-23 - delete all words that were added to the original NUREG-0800 language. Traceability of structures, systems, and components (SSCs) to technical reports (assuming these are intended to be scientific investigation technical reports), drilling locations and logs, and test records (assuming these are field tests in support of scientific investigations) will most likely not be necessary as all of these documents will likely not be used directly in the design of SSCs, with the possible exception of some technical reports that may be cited as design input sources.</li> <li>- AC-9, 6th bullet, page 4.5-24 - delete the entire bullet. Prior practice on this project (with NRC concurrence of the QARD) has been that this criterion did not apply to scientific investigation and has no other regulatory precedence. These are deemed to be AC-3 activities.</li> <li>- AC-11, 1st bullet, pages 4.5-25 &amp; 26 - delete the language that is not found in NUREG-0800. Prior practice on this project (with NRC concurrence of the QARD) has been that this criterion did not apply to acquiring data from samples nor other site characterization work and has no other regulatory precedence. These are deemed to be AC-3 activities.</li> <li>- AC-16, 5th (last) bullet, page 4.5-30 - delete entire bullet as this is not found in NUREG-0800, NQA-1, or other regulatory precedence.</li> <li>- AC-18, 6th bullet, 2nd sentence (and all of the following dashes), pages 4.5-33 &amp; 34 - delete the entire element as this is copied incorrectly from NUREG-0800 and is no longer true in the industry. These items are no longer omitted or not emphasized within the industry.</li> </ul>

No.	Page, Section, Para.	Comment
112.	Section 4.5.1.3, <u>Specific Acceptance Criteria</u> , general comment	<p>There are a number of instances in the Specific Acceptance Criteria where criteria are included that are found verbatim (or nearly verbatim) in referenced CFRs, Regulatory Guides, or consensus standards. A number of examples are found throughout 4.5.1.3. The source documents for each of these examples are listed in the references in Section 4.5.1.5. This provides a level of prescriptiveness that has not been found in power plant regulatory precedence and is not appropriate in the YMRP. Each of these documents, if committed to by DOE in total or in part (or alternatives are provided and found acceptable to NRC), will be implemented within the DOE QA program implementing procedures. The Review Plan should only reference these documents (if they are an acceptable means to implement NRC's QA regulations) and should not include specifics from any of them.</p> <p>Specific examples include:</p> <ul style="list-style-type: none"> <li>- AC-7, 8th bullet, pages 4.5-20, 21, and top of 22 - delete all but a reference to 10 CFR Part 21. These words are all repeated from Part 21 and are not needed.</li> <li>- AC-7, 11th, 12th, &amp; 13th bullets, page 4.5-22 - delete all three of these bullets and make a reference to U.S. Nuclear Regulatory Commission Information Notice 86-21. All other aspects of these bullets are contained in NQA-1.</li> <li>- AC-8, last four bullets of criterion - delete the last four bullets as this provides details covered in NQA-1.</li> <li>- AC-12, 11th (last) bullet - delete the last bullet of this criterion as this provides details covered in NQA-1.</li> <li>- AC-13, last two bullets of this criterion - delete these two bullets as this provides details covered in NQA-1.</li> <li>- AC-16, 4th bullet, page 4.5-30 - delete the entire bullet as this provides details covered in NQA-1.</li> <li>- AC-17, 1st, 4th, 5th, 7th, 8th, 10th, 12th, &amp; 13th bullets, pages 4.5-30, 31, &amp; 32 - except for making references to NQA-1-1983/9 and NQA-1-2000 for electronic media records, all of these review elements should be deleted as they are either contained/covered in NQA-1 or Reg Guide 1.28. In addition, the use of the words from Reg Guide 1.28 is not consistent with DOE and industry practice. The only element of Reg Guide 1.28 that should be included is Table 1.</li> </ul>
113.	Page 4.5-1, Section 4.5.1, 1st para.	10 CFR 63.141 provides a definition of quality assurance. This review plan provides a slightly different definition. Revise the Review Plan to be consistent with the 10 CFR 63.141 definition.
114.	Page 4.5-3, Section 4.5.1.2, 1st bullet	DOE suggests changing the 1st sentence to read ". . . has been acceptably addressed (by the quality assurance program describing in a summary form, how the applicable criteria are satisfied or by a commitment to comply with the NRC's quality assurance requirements along with identification of the responsible organizational element or position) . . .", to clarify how the criteria may be addressed. Delete the entire 2nd sentence as it is redundant with the 1st sentence.
115.	Page 4 5-5, Section 4.5.1:3, top para , next to last sent."	This comment applies only if the " <u>General Acceptance Criteria</u> " is retained (see earlier comment on this). Graded quality assurance controls are . . . more appropriately controlled in the implementing procedures based upon the potential variability in both the activities and items being controlled and the control measures available. DOE recommends that the identified text be revised to indicate that the requirements and a general description of the procedures to be used for implementing graded quality assurance controls be specified in the quality assurance program description. The method described in this bullet is one method that could be used, but there are other methods that could be used as well. There is no industry consensus standard on graded QA.
116.	Page 4.5-8, Section 4.5.1.3, AC-1, 14th bullet	While the program implementation principles represented by this criterion are appropriate, the criterion as stated would provide inappropriate implementation detail in the quality assurance program document. DOE recommends revision of the criterion to read: "The quality assurance program description provides for policies that result in day-to-day involvement of quality assurance staff in facility activities important to safety or waste isolation ...."
117.	Page 4.5-13, Section 4.5.1.3, AC-2, 16th bullet	Suggest this review criterion be revised to better reflect wording of 10 CFR 63.142(s). The criterion should also differentiate the qualification/capability requirements for those that are "verifying" by performing such activities as design verification or independent design reviews from those that "verify" by performing oversight and acceptance activities such as audit, surveillance, or inspection. The criterion should require the identification of those positions/functions that require certification of qualifications. The seventh and eighth dashed subelements should be deleted. These items are not contained in NUREG-0800, and no other regulatory precedence can be found for these items.
118.	Page 4.5-18; Section 4.5.1.3, AC-6, 3rd bullet	The criterion as written does not provide for the multi-organizational aspects of the Yucca Mountain Project with respect to development and use of controlled documents. Change to read as follows: "Procedures are established to assure that changes to controlled documents are reviewed by affected organizations and are approved by the same authority that approved the original document or by other qualified organizations designated and approved by the U.S. Department of Energy."

No.	Page, Section, Para.	Comment
119.	Page 4.5-29, Section 4.5.1.3, AC-14, 7th (last) bullet	Delete the entire bullet as this is covered in the other review elements.
120.	Page 4.5-29, Section 4.5.1.3, AC-15, 1st bullet	Delete the words "and services (as applicable)". "Services", as such, cannot be controlled the way nonconforming items are; non-hardware work products from services may not meet requirements, but this is usually documented and controlled under criterion 7, 8, 14, and/or 16, as appropriate.
121.	Page 4.5-29, Section 4.5.1.3, AC-15, 7th (last) bullet	Delete the entire bullet as this is redundant with the 5th bullet.
122.	Page 4.5-30, Section 4.5.1.3, AC-16, 2nd bullet	Procedures are required to be established to implement all quality assurance program requirements in AC-5; there is no need to repeat the requirement here. Records are also required to be established to document the performance of quality-affecting activities, including corrective actions. The earlier part of this sentence already requires those quality-affecting activities to be documented.
123.	Page 4.5-33, Section 4.5.1.3, AC-18, 1st bullet	This bullet should be deleted as all of these items are covered in the other review elements that follow.
124.	Page 4.5-35, Section 4.5.1.3, AC-18, last 3 bullets (10th, 11th, & 12th)	The last three bullets become unnecessary if reference is made to the requirements of AC-15 and AC-16 for documenting, correcting, trending, and following up on deficiencies (including nonconforming items) identified during audits.

No.	Page, Section, Para.	Comment
125.	Pages 4.5-41 & 42, Section 4.5.1.3, AC21	<p>The data and model criteria in 4.5.1.3 AC21 appear to be redundant to the technical requirements in 4.2.1.3, Model Abstractions. The requirements for these activities are adequately addressed in the technical requirements of Section 4.2.1.3 and are sufficient to allow for detailed review of data and models that support model abstractions. With the exception of NUREG-1636, applicable guidance associated with peer reviews, expert elicitations, and qualification of data (i.e., NUREG-1297, NUREG-1563 and NUREG-1298, respectively) are referenced in Section 4.2.1.3. For consistency, DOE recommends adding NUREG-1636 for Model Validation to Section 4.2.1.3.15, References. DOE recommends deletion of the following model, data, and expert elicitation requirements of AC21:</p> <ul style="list-style-type: none"> <li>• Data are identified in a manner that facilitates traceability to: (i) associated documentation and (ii) qualification status of data</li> <li>• Requirements for data reduction are described in sufficient detail to permit independent reproducibility by another qualified individual</li> <li>• Data that are directly relied on to address safety or waste-isolation issues must be qualified from origin or classified as accepted data. Procedures are established describing methods of reviewing and qualifying data that were collected without a fully implemented 10 CFR Part 63 quality assurance program [NUREG-1298 (U.S. Nuclear Regulatory Commission, 1988)]</li> <li>• Unqualified data directly relied on to address safety or waste-isolation issues must be qualified or it cannot be used in the license application</li> <li>• Model development and approaches to validation are planned, controlled, and documented. Procedures are established for model validation [NUREG-1636 (U.S. Nuclear Regulatory Commission, 1999)]</li> </ul> <p>In addition, AC21 seems to be inconsistent in that:</p> <ul style="list-style-type: none"> <li>• In Section 4.2.1.3, the NRC acknowledges that all model abstractions do not have the same risk significance and therefore, the degree of technical support needed for data and models should be commensurate with their contribution to risk. Specific criteria are included in Section 4.2.1.3 that ensure the data and models used have adequate technical bases and that the uncertainties are appropriately captured, the outputs of models are supported by objective comparisons, and procedures are in place to construct and test models</li> <li>• Section 4.5.1.3 AC2 allows for a graded QA program for activities important to safety and important to waste isolation. The Section acknowledges a range of quality controls (e.g., full application vs. reduced quality controls) based upon the safety-risk-significance of the activity. As written, AC21 would require adherence to the data and model requirements specified without consideration of a graded QA approach which could be less stringent for activities that have minimal contribution to risk.</li> <li>• The validation strategy in NUREG-1636 acknowledges that many physical processes have been previously modeled, validated and are available. Thus, consideration is given in the validation strategy to the degree that additional validation is needed, if any. The NUREG specifies conditions under which additional validation would be required when using generally accepted scientific and technical models. As written, AC21 does not seem to differentiate between models that are generally accepted in industry and models that are first-of-a-kind.</li> </ul>
126.	Pages 4.5-45, 46, & 47, Section 4.5.1.5	<p>This section on the review of DOE's proposed QA program makes a distinction between LA reference documents with guidance on subjects that DOE's QA program description is expected to make "commitments" on and other "noncommitments" documents on subjects that the program description should consider as "noncommitments." The rationale for this distinction is not clear, nor is the regulatory authority for requiring DOE QA "commitments" outside the scope of 10 CFR Part 63 presented. If DOE is expected to make "commitments" to some QA guidance documents, DOE recommends that the YMRP state the rationale and authority. Otherwise, the reference documents should be listed together in a single set of QA-related LA reference documents.</p>
127.	Page 4.5-45, Section 4.5.1.5, 3rd para	<p>Throughout Section 4.5.1.5 text, revise the reference to NQA-1-1983 to NQA-1-1989, which is the version used by DOE. In addition, revise other subsections of 4.5.1, as appropriate, where the presentation is influenced by substantive differences between these two editions</p>
128.	Page 4.5-46, Section 4.5.1.5, 4th & 6th paragraphs, pages 4.5-45 & 46	<p>The two references to Regulatory Guide 1.8 (May 2000) differ from the reference to Regulatory Guide 1.8 (1996) specified in Section 4.5.3.3.2, Review Method 2. The current version should be cited.</p>

No.	Page, Section, Para.	Comment
<b>Section 4.5.2</b>		
129.	General - Section 4.5.2	In this subsection on records, reports, tests, and inspections, only Review Method 1 and the associated acceptance criteria are required by 10 CFR 63.21. DOE recommends deleting Review Methods 2, 3, and 4 and the associated acceptance criteria, as they do not relate to the LA. If kept, the YMRP should clarify that they refer to activities that are not part of the review of the LA.
130.	Page 4.5-51 & 52, Section 4.5.2.3, AC 2	Acceptance Criterion 2 is addressing 10 CFR 63.73. If retained, change 10 CFR 50.55 (e) to 10 CFR 63.73, consistent with Evaluation Findings (Sectn 4.5.2.4).
131.	Page 4.5-52, Section 4.5.2.3, AC 3	Acceptance Criterion 3 is addressing 10 CFR 63.74. If retained, change 10 CFR Part 63 to 10 CFR 63.74 consistent with Evaluation Findings (Sectn 4.5.2.4).
132.	Page 4.5-53, Section 4.5.2.3, AC 4	Acceptance Criterion 4 is addressing 10 CFR 63.75. If retained, change 10 CFR Part 63 to 10 CFR 63.75, consistent with Evaluation Findings (Sectn 4.5.2.4)
<b>Section 4.5.3</b>		
133.	Page 4.5-59 & -62, Section 4.5.3.3.2, RM 2 and Page 4.5-62, Section 4.5.3.3.3, AC 2	These sections address NRC review of the training program and its procedures. This review is an example of where the YMRP should differentiate what is to be reviewed for the license application and what will be reviewed later. In this case, the review of the training program may be part of inspection activities.
<b>Section 4.5.4</b>		
134.	Page 4.5-65, Section 4.5.4, also Figure 1-2, page 1-11	Section 4.5.4 calls for DOE's justification/explanation of how it used expert elicitation in a separate section of the LA, but DOE suggests that providing this justification/explanation is more appropriate in the relevant technical LA sections where DOE has chosen to use expert elicitation, which are covered by Sections 4.1 and 4.2 of the YMRP. Therefore, DOE suggests that Section 4.5.4 is redundant and should be deleted.
<b>Section 4.5.10</b>		
135.	General - Section 4.5.10	<p>In Section 4.5.10; License Specifications, the term license condition is used repeatedly when referring to license specifications. 10 CFR 63.21(c)(18) requires that variables, conditions, or other items that are probable license specifications (not license conditions) be included in the LA.</p> <p>Part of the confusion results from the definition in 10 CFR 63.43, License Specifications, that states "(a) A license issued under this part includes license conditions derived from the analyses and evaluations included in the application, including amendments made before a license is issued, together with any additional conditions the Commission finds appropriate."</p> <p>Similar language can be found in 10 CFR 50 but it uses the term technical specifications. 10 CFR 50.36(b) states "...The technical specifications will be derived from the analyses and evaluation included in the safety analysis report, and amendments thereto, submitted pursuant to 10 CFR 50 34. DOE believes that license specifications are the equivalent of technical specifications in the context of both being defined in terms of being based on safety analysis evaluations. In fact NRC used the term "technical specifications" on page 1-9 in section 1.2.2. However, DOE believes the terminology should be consistent throughout the YMRP and since license specifications are defined in the regulations, the term license specifications should replace "technical specifications."</p> <p>If further breakdown is needed when referring to license specifications, DOE recommends that the NRC model in 10 CFR 50.36 be adopted. For example, individual items within the technical specifications are called limiting conditions for operations (LCO). An individual assumption of the safety analysis is an LCO. In fact 10 CFR 50.36(c)(2)(ii) provides criteria for technical specification limiting conditions of operations. Perhaps license conditions were intended to be the equivalent of limiting conditions for operations. However, to avoid confusion with the Conditions of License defined in 10 CFR 63.42, which are high level conditions placed on the license, DOE believes that the use of the term "license conditions" in Section 4.5.10 should be replaced with "license specifications." If a subset of license specifications is being discussed DOE recommends the term limiting condition for operation be used rather than license condition.</p>
<b>Glossary</b>		
136.	Page 5-2	The definition of "breach" should also include condition of loss of confinement of radionuclides so as to permit airborne releases. Further, add "may" to the current definition as follows " ... environment and may eventually permit radioactive release "

-137.-	Page 5-2	The definition of "calibration" should add "(3) In operations, ensure accuracy of instruments and any setpoints for automatic actuations of items important to safety."
138.	Page 5-3	The definition of "carbon steel" and a few other definitions refer to the "current waste package." These definitions should be modified to "a waste package."
139.	Page 5-3	Add: cask – A large, shielded container for shipping or storing spent nuclear fuel and/or high-level radioactive waste that meets all applicable regulatory requirements.
140.	Page 5-3	The definition of "chain reaction" should be modified to include all potential locations/conditions where fission might occur; i.e., not only "within the fuel of a nuclear reactor."
141.	Page 5-4	Add: confinement (confinement barrier) [see also containment] - The containment of radioactive waste to prevent the release of radioactive substances from areas containing radioactive substances to areas not containing radioactive substances and, ultimately, to the environment. [NUREG-1567, p. xxviii]
142.	Page 5-4	The definition of "consequence" should be changed to "a measurable or calculated outcome of an event or process."
143.	Page 5-4	Add: Containment -The confinement of radioactive waste within a designated boundary. [10 CFR 63.2 definition]
144.	Page 5-4	The second definition of "criticality" definition (4th line) should replace "nuclear fuel" with "a fissile material."
145.	Page 5-6	The definition of "enrichment" should include other fissile isotopes in addition to U-235.
146.	Page 5-6	The definition of "events" addresses only postclosure performance assessment. A new definition for "event sequence" from 10 CFR 63.2 as used in preclosure safety analysis should be provided.
147.	Page 5-8	The term "frequency" should include a second definition "(2) the annual probability of occurrence of an initiating event or an event sequence."
148.	Page 5-9	The terms "inner barrier" and "outer barrier" refer to the "current design of the waste package." These definitions should be modified, as appropriate, to "a waste package." Also, these definitions refer to specific materials as "preferred" by DOE; these sentences should be deleted.
149.	Page 5-9	The definition of "mean (arithmetic)" should include a second definition or a companion definition such as "mean, or mean value: The first moment (or expectation value) of a probability distribution function of a random variable."
150.	Page 5-9	The definition of "median" should include a second definition: "(2) The value of a cumulative distribution function of a random variable at which the probability is 0.5."
151.	Page 5-12	The definition of "probabilistic risk assessment" should be expanded to include preclosure safety applications, and should be consistent with definitions used in such documents as Regulatory Guide 1.174 and NUREG-2300.
152.	Page 5-12	In the definition of probability, the term "exact probability" seems inappropriate. Suggest replacing "knowing the exact probability" with "knowledge of the probability."
153.	Page 5-13	Add: radiochemical characteristics – A description of the isotopic composition and chemical and physical form of a radioactive substance.
154.	Page 5-13	Add a definition of "risk-informed, performance-based" that is consistent with the NRC usage (e.g., in Regulatory Guide 1.174, Rev.2).
155.	Page 5-13	Regarding the term "risk", while the product of probability time consequence is often used as one expression of risk, it is not the only definition. The definition should be revised to be consistent with that used in such documents as Regulatory Guide 1.174.
156.	Page 5-14	Add: shipping cask, also transport cask – Rugged confinement barriers used to transport spent nuclear fuel or other radioactive substances from sites where the radioactive substances are generated to sites where they are processed or disposed. Shipping casks received at the MGR are licensed in accordance with 10 CFR 71.
157.	Page 5-15	Add: thermal characteristics – A description of the heat generation rate of a radioactive substance such as spent nuclear fuel.
158.	Page 5-15	Add: transient criticality - a critical condition attained through some relatively rapid (seconds to hours) shift in the geometric arrangement that increases the fissionable mass participating in a reaction to a critical size, decreases neutron absorber efficiency, or alters neutron reflection. Transient criticality includes both slow and relatively rapid reactivity insertion mechanisms. The reactivity insertion rate is determined by sudden initiating events affecting the waste package. Such events may include, but are not limited to, seismic shaking, rock fall, or volcanism.
159.	Page 5-16	The definition of "uncertainty" should be more precisely defined. It should address both qualitative and quantitative means of expressing and dealing with uncertainties, and should include uncertainties in modeling as well as uncertainties in "calculated or measured values." Both aleatory and epistemic uncertainties should be addressed.
160.	Page 5-16	The definition of "variability" should be expanded to address randomness (aleatory uncertainty) in measured or calculated parameters.
161.	Page 5-16	Add: waste package – The waste form and any containers, shielding, packing, and other absorbent materials immediately surrounding an individual waste container. [10 CFR 63.2 definition]

Editorial		
162.	General	There are numerous places within the document where reference citations are incomplete. For example: - Page 1-21, Section 1.5. The final reference is incomplete. - Page 3-21, Section 3.3.5. The final reference is incomplete. - Page 3-27, Section 3.4.5. The second and third references are incomplete. - Page 4.1-11, Section 4.1.1.1.5. The third reference is incomplete. - Page 4.1-25, Section 4.1.1.3.5. The second through fifth references are incomplete. Sections with references should be checked for completeness and the missing information should be added.
163.	Page xvi, ES, para 4	Rephrase the sentence "A performance confirmation program ... results from addresses uncertainties ..."
164.	Page 1-1, 2nd para, 3rd sent.	Rephrase the text that states that the Energy Policy Act of 1992 refers to a 1995 report by the National Academy of Science. The report could not post date the Energy Policy Act and yet be referenced within it.
165.	Page 1-10, Section 1.3, 1st para, 1st sent.	Change "five major Yucca Mountain Review Plan sections" to "five major Yucca Mountain Review Plan subsections found in Section 4."
166.	Page 4.1-2, Section 4.1.1, 1st full para, line 8	"Performance based" should be "risk-informed, performance-based."
167.	Page 4.1-10, Section 4.1.1.1.3, AC 7	The geologic terminology is inaccurate as stated. DOE suggests substituting: "the license application adequately considers the extent of erosion of the land surface and the likelihood that mass wasting, such as landslides or rock avalanches, or rapid fluvial degradation in channels or interflaves, ...."
168.	Page 4.1-13, Section 4.1.1.2 2, RM2, bullet 2	Revise "building and facility structure floor plans and drawings" to read "General arrangement drawings of buildings" to generalize the information to be provided.
169.	Page 4.1-13, Section 4.1.1.2.2, RM2, bullet 12	The term "transportation system" should be qualified to include only systems that are part of the repository, per se, and to specifically exclude descriptions of rail or truck systems that haul transport casks, except for those features or dimensions that come into play in on-site interfaces and cask unloading. Revise bullet to read "on-site transportation systems."
170.	Page 4.1-15, Section 4.1.1.2.2, RM4, bullet 3	Delete "and number" since fuel assembly serial numbers are not expected to be available during the License Application process.
171.	Page 4.1-28, Section 4.1.1.4.3, AC 2, 4th bullet	Revise the bullet to read "Category 1 event sequences are identified on the basis that they <u>could</u> will occur one or more times ... " Except for normal operations, there is no certainty that they occur, only probability.
172.	Pages 4.1-30, 33, 38, and 40, Section 4.1.1.5.1.2, RM 1; Section 4.1.1.5.1.3 AC 1; pg 4.1-37, Section 4.1.1.5.2.2, RM1, & Section 4.1.1.5.2.3 AC 1	DOE suggests modifying the phrase "as well as factors that allow an event sequence to propagate" to "and description of controls that are relied upon to prevent or mitigate event sequences" in the titles of the two Review Methods and the two Acceptance Criteria. The current phraseology implies that event sequences will be allowed to propagate. The suggested modification is more in agreement with the bullets in the respective Review Methods and the Acceptance Criteria.
173.	various pages, 4.1.1.7 x.x	Throughout the text, the terms "Safety Related" and "Safety-Related" (in the italicized titles I, II, etc.) should be replaced with "Important to Safety."
174.	Page 4.1-57, Section 4.1.1.7.2.1, RM 1	Review Method 1 refers to Regulatory Guide 1.120 for fire protection. This guide was withdrawn by the NRC in 8/01 and replaced by Regulatory Guide 1.189. The cite needs to be updated in this section, page 4.1-87, and in other places where Regulatory Guide 1.120 was referenced for fire protection systems.
175.	Page 4.1-63, Section 4.1.1.7.2.3, RM 4, 4th dash	Assumptions are not necessarily conservative in risk-informed, performance-based analyses. Change dash to read "Assumptions have adequate technical justifications or bases are provided."

176.	Page 4.1-64, Section 4.1.1.7.2.3, 3rd para after bullets	Delete ", and are properly benchmarked" since methods and models are not necessarily benchmarked.
177.	Page 4.1-65, Section 4.1.1.7.2.3, RM 2, para 4	DOE recommends that "the design thermal load" be changed to "satisfies the design thermal criteria", since there may not be a single, fixed thermal load.
178.	Page 4.1-66, Section 4.1.1.7.2.3, II, Review Method 3, last para.	This section requires that emplacement drifts must withstand the effects of "sudden blast cooling." If "blast cooling" is utilized to cool a drift down to allow access for equipment or human entry into a drift, it will not be "sudden" but will take several weeks of higher than normal air flow rates to cool the drifts 10 or 20 degrees C to achieve temperatures below 50°C for access. DOE recommends that RM3 be amended to delete the word "sudden."
179.	Page 4.1-71, Section 4.1.1.7.2.3, III, RM 1, par 3, 3rd sent; also, Pg 4.1-81, Section 4.1.1.7.3.1, III AC 1, 3rd bullet	The use of the term "discrepancies" in "discrepancies or uncertainties related to the corrosion..." is unnecessary and confusing. DOE recommends deleting "discrepancies or" from the sentence.
180.	Page 4.1-74, Section 4.1.1.7.3.2, AC 1, bullet 4, line 2	Insert "and preclosure design criteria" following "hazard assessment", since both topics are addressed.
181.	Page 4.1-78, Section 4.1.1.7.3, AC 5, 5th bullet	The fifth bullet regarding discontinuum rock-mass modeling states that the modeling results should adequately consider the "effects of simplification" of the characteristics of the modeled fracture network, compared with those of the in situ fracture network. DOE suggests that "representativeness" is a more appropriate term rather than "effects of simplification."
182.	Page 4.1-82, Section 4.1.1.7.3.1, III AC 1	In second bullet, delete "that may lead to premature failures;" all failures are included without prescribing consideration of premature failures.
183.	Page 4.1-83, Section 4.1.1.7.5	NUREG-1567, Standard Review Plan for Dry Storage Facilities, should be added to the list of references.
184.	Page 4.1-93, Section 4.1.1.8.3, AC 3	Bullets 1 and 4 on this page 3 are effectively redundant. Delete one of these bullets.
185.	Page 4.1-96, Section 4.1.2.2, RM4; see also pg 4.1-97, AC 4	The time to retrieve should be about the same time duration as to construct and emplace and not "consistent with" this period. Specifically, per 10 CFR 63.111(e)(3): "For purposes of paragraph (e) of this section, a reasonable schedule for retrieval is one that would permit retrieval in about the same time as that required to construct the geologic repository operations area and emplace waste." Request that NRC replace "consistent with that" with "that is about equal to the time required."
186.	Pages 4.2-7 and 4.2-14, Section 4.2.1.2.1.2; RMs 1 and 2, ACs 1 and 2	The review methods and acceptance criteria refer to an initial FEP list. However, the subsequent text indicates that the list should be comprehensive and complete. "Initial" implies that the list is incomplete and would be finalized at a later time. The DOE recommends that the NRC delete "initial" when referring to the FEPs list.
187.	Page 4.2-9, Section 4.2.1.2.1.3, AC 2	The first sentence in the second bullet of Acceptance Criterion 2 should be changed. It currently states "The U.S. Department of Energy has justified excluding each feature, event, and process." It is recommended that the wording be changed to "The U.S. Department of Energy has provided justification for those features events, or processes that have been excluded."
188.	Page 4.2-12, Section 4.2.1.2.2.2, RM 3, 3rd para, 5th line	"Seismic" is used here and elsewhere in the YMRP to be synonymous with "ground motion.". When the term "seismic" is used, it should include ground motion, fault displacement, and other hazards. Therefore, at this and other appropriate locations, NRC should replace "seismic" with "ground motion."
189.	Page 4.2-14, Section 4.2.1.2.2.3, AC 2, 1st para, 1st sent	Replace "are based on" with "have considered, as appropriate," since the probabilities may be based on additional considerations.

190.	Page 4.2-41, Section 4.2.1.3.3.3, AC 2, 3rd bullet on page, 2nd sent	The wording "data are adequate to constrain the probability for microbially influenced corrosion and microbial effects" implies a pre-determined conclusion on the role of microbes. DOE recommends NRC substitute this language with "...data are adequate to support determination of the probability for microbially-induced. . ."
191.	Page 4.2-125, Section 4.2.1.3.14.4, 5th and 7th bullet on page	In the fifth bullet, the regulation citation should be changed to 10 CFR 63.305(d). The seventh bullet should be changed to read: "Society, the biosphere (other than climate), human biology, and the state of human knowledge and technology are assumed constant from the time of the license application onward, consistent with 10 CFR 63.305(b)." The current wording is subject to misinterpretation.
192.	Page 4.5-14, Section 4.5.1.3, AC-3, 1st bullet	The words "compatibility of materials" is used twice in this bullet. Delete one of the uses of the term.
193.	Page 4.5-14, Section 4.5.1.3, AC-3, 3rd, 4th, & 5th bullets	These three bullets on design control are redundant with the first bullet and should be deleted.
194.	Page 4.5-33, Section 4.5.1.3, AC-18, 2nd bullet, 2nd dash	The bracketed NOTE should be removed because it is redundant with the second bullet's lead-in and the following bullet.
195.	Page 4.5-85, Section 4.5.6.3	Acceptance Criteria 1, 2, and 3 all require that: "Appropriate industry or U.S. Nuclear Regulatory Commission standards are used as the basis ...." DOE suggests substituting "Appropriate industry standards or U.S. Nuclear Regulatory Commission guidance are used as the basis ...," since NRC does not issue "standards."
196.	Pages 4.5-100 through 104, Sections 4.5.8.2 & 4.5.8.3	Throughout these pages, "...Master Title Plan..." should be replaced with "...Master Title Plat..."