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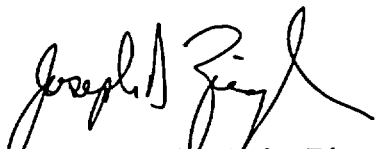
Annette Vietti-Cook, Secretary  
 Attention: Rulemaking and Adjudications Staff  
 U.S. Nuclear Regulatory Commission  
 Washington, DC 20555-0001

U.S. DEPARTMENT OF ENERGY (DOE) COMMENTS ON PROPOSED RULE CHANGE ON SEISMIC SITING AND DESIGN CRITERIA IN 10 CFR PART 72, FEDERAL REGISTER, V. 67, PP. 47745-47755

On July 22, 2002, the U.S. Nuclear Regulatory Commission (NRC) published a proposed rule change on seismic siting and design criteria in 10 CFR Part 72, which affects dry cask independent spent fuel storage installations and monitored retrievable storage installations. The DOE supports the NRC's proposal to allow probabilistic seismic hazard analyses instead of requiring deterministic analyses. This change reflects experience gained in the licensing of existing facilities and advancements in the earth sciences and earthquake engineering.

The NRC also requested comments on the accompanying draft regulatory guide, DG-3021, in particular, on the annual probability of exceedance value for the design earthquake ground motion. The DOE believes that the reference value of  $5 \times 10^{-4}$  used in the draft regulatory guide is well justified by the arguments presented, and represents an appropriate implementation of the Commission's policy to promulgate risk-informed regulations.

Enclosed are technical comments on the proposed rule, the supplementary information, and the draft regulatory guide. If you have questions, please contact Claudia M. Newbury at (702) 794-1361 or Steven E. Gomberg at (202) 586-6497.

  
 Joseph D. Ziegler, Acting Director  
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OLA&S:CMN- 0172

Enclosures:

1. U.S. Department of Energy Comments on the Proposed Rule and Supplementary Information
2. U.S. Department of Energy Comments on Draft Regulatory Guide, DG-3021

OCT 29 2002

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## ENCLOSURE 1

### U.S. DEPARTMENT OF ENERGY (DOE) COMMENTS ON THE PROPOSED RULE AND SUPPLEMENTARY INFORMATION

1. In Part 72.103, the DOE suggests removing the distinction between the western United States (US) and eastern US. The characterization of "areas of known seismic activity" east of the Rocky Mountain Front as including three specific areas is misleading. The entire region of the US east of the Rocky Mountain Front is subject to earthquake occurrence, and one area should not be treated differently from another for the purpose of assessing seismic sources. Moreover, Part 100, Appendix A, does not allow for less stringent alternatives for any area. Rather, the fundamental requirements of that regulation apply uniformly to all regions of the US, independently of variations in the local rate of seismicity.
2. The first sentence in Part 72.103(a)(1) is incomplete, missing the subject. If this sentence is retained, insert ", sites" after "NY" for consistency with Part 72.102(a)(1).
3. The supplementary information for the final rule should cite the U.S. Nuclear Energy Commission's policy for promulgating risk-informed regulations as a primary motivation for the rule change. The supplementary information for the proposed rule could have addressed this motivation in the background, objectives, and discussion sections.

## ENCLOSURE 2

### U.S. Department of Energy (DOE) Comments on Draft Regulatory Guide, DG-3021

1. Lines 85 – 88: The U.S. Nuclear Regulatory Commission's (NRC) intent is unclear in the sentence "In performing this evaluation, the applicant should evaluate whether new data require re-evaluation of previously accepted seismic sources and potential adverse impact on the existing seismic design bases of the nuclear power plant." The DOE understands the intent is that evaluation of new data developed since an existing Probabilistic Seismic Hazard Analysis (PSHA) was done will be assessed to determine whether the basis for the existing PSHA has materially changed. The DOE suggests clarifying the sentence. Since the NRC has determined that existing nuclear plants for which seismic design bases were determined by applying the requirements of 10 CFR 100, Appendix A, are safe, there appears to be no need for the last part of this sentence – ". . . potential adverse impact on existing seismic design bases of the nuclear power plant". Moreover, the NRC has determined that these units may continue to be licensed under Part 100, Appendix A.
2. Line 92: Consider changing "methodology with" to "results based on".
3. Line 93: Consider changing "methods" to "results".
4. Line 94: Consider changing "identified" to "evaluations".
5. Lines 102-103: Following "and" insert "may"; consider changing "correlation with" to "response to".
6. Line 104: Consider changing "models" to "seismotectonic interpretations".
7. Line 108-112: The sentence "In tectonically active areas of the CEUS . . . using procedures similar to those normally applied in the WUS." should be deleted. In fact, procedures for evaluating seismic sources are the same independent of whether a site is in stable continental crust such as the central and eastern United States (CEUS) or in tectonically active crust such as the western United States (WUS). Only the information base is different. The DOE believes that this sentence makes an inappropriate distinction.
8. Line 122: Consider replacing "tectonic structures" with "faults that have experienced repeated movements at or near the ground surface during the Quaternary".
9. Line 124: Consider changing "be" to "have experienced displacements"; "blind" should be deleted here and elsewhere. It is inappropriate to use such technical slang in regulatory guidance.
10. Line 129: "blind" should be removed.
11. Line 130: "blind faulting" should be replaced with "these structures".
12. Line 139: "subduction zones" should be replaced with "subducting plate".

13. Line 144: "central" should be replaced with "southwestern".
14. Lines 146-147: "Temporal clustering should be considered . . ." does not provide guidance that can reasonably be implemented. Additional guidance is needed about aspects of the seismic hazard modeling should be potentially modified and specific references should be given.
15. Line 151: "Comprehensive" should be changed to "Appropriate", as requirements for investigations of the site region vary depending on distance from the site.
16. Line 159: "Another" should be "An".
17. Lines 160-161: "are not adequately incorporated into the existing PSHA data bases" should be replaced with "would potentially warrant a change in the seismotectonic interpretations that formed the basis for the existing PSHA for the site."
18. Line 162-163: "in the context of the PSHA" should be replaced with "assess its impact on existing PSHA results".
19. Line 173: Experience with PSHA has shown that for the western United States, seismic sources at distances greater than about 125 miles are unlikely to contribute to the ground motion hazard within the band of structural frequencies of concern for nuclear facility design. For the central and eastern United States, the New Madrid Seismic Zone may contribute to the hazard at sites at distances greater than 200 miles. The region of a site that must be investigated should be variable depending on whether the site is located in stable continental crust or active tectonic crust. The key is whether sources at a given distance significantly contribute (say > 1.0 %) to the hazard at a site.
20. Line 181: "of these structures" should be inserted following "analyses".
21. Line 186: "transmission" should be deleted; "soils and rocks" should be replaced with "rock".
22. Line 189: Consider changing "should" to "may".
23. Line 210: "SEISMIC HAZARD" should be "PSHA".
24. Lines 211-215: For clarity, consider replacing this long sentence with the following. "For sites in the CEUS for which EPRI or LLNL PSHA results are available, either of these results may be used to determine the design basis ground motions for the site after appropriate evaluations have demonstrated that new data since these assessments were done do not change the bases for the results."
25. Line 220: "methods are not used" should be "PSHA results are not available".
26. Line 231: Consider changing "identified" to "described".

27. Lines 233-241: This guidance is not clearly stated. Consider replacing it with: "An adequately complete characterization of epistemic uncertainty in earthquake occurrence in a seismic source requires four equally important evaluations:
- a. An assessment of the recurrence rate of earthquakes.
  - b. An assessment of alternative earthquake recurrence models that are considered to be potentially applicable for the source.
  - c. An assessment of the maximum earthquake magnitude for the source.
  - d. An assessment of the spatial stationarity of earthquake activity within the source.

These four assessments provide a complete characterization of epistemic uncertainty in earthquake occurrence in the source."

28. Lines 243-248: This example is misleading and should be removed. Spatial stationarity of earthquake occurrence within a source need not be assumed; indeed, the Electric Power Research Institute (EPRI) methodology permits nonstationary spatial characterization of earthquake occurrence in a seismic source.
29. Lines 247-248: Consider replacing "evaluating the earthquake . . . uncertainty" with "evaluations for characterizations of earthquake occurrence in a seismic source".
30. Line 249-251: The first sentence of Section 2.3.1 is misleading and should be removed. The guideline must be applicable at all sites, including those located in or near to the New Madrid, Charleston, and Clarendon-Linden sources. Moreover, EPRI or Lawrence Livermore National Laboratory (LLNL) seismic source interpretations should be accepted for hazard computations at sites for which PSHA results do not currently exist, if they are found to be acceptable based on application of this guideline. This is necessary in order to maintain consistency of seismic sources site-to-site.
31. Line 258: "observed seismicity" should be replaced with "historic earthquakes".
32. Line 259: "it is difficult to obtain reliable estimates of the rate of activity" should be replaced with "the rate of earthquakes in a source normally will have high uncertainty".
33. Line 261: "seismic potential" should be replaced with "earthquake occurrence".
34. Line 263: Following "magnitude" insert "which normally is characterized by a distribution,".
35. Lines 265-267: This sentence does not provide useful perspective and should be removed. The 2<sup>nd</sup> sentence should begin with "Primary methods . . .".
36. Line 274: The EPRI study (ref #8) should be cited here as a useful data set and approach.

37. Lines 254-256: These two sentences lack proper focus and should be deleted.
38. Line 276: Following “structures” add “with a high degree of certainty”.
39. Line 293: Memory models have generally not been used in either the WUS or the CEUS. If this statement is to be retained in the guideline, then guidance as to the conditions that would require use of memory models must be given.
40. Lines 294-295: Guidance about how temporal clustering should be considered must be given or this sentence should be removed.
41. Lines 316-323: The sentences beginning with “The PSHA” in line 316 and ending with “estimate” in line 323, should be deleted. Appendix E contains the proper guidance and no elaboration here is needed.
42. Lines 324-329: The comments, beginning with “In genera?”, about updating the LLNL and EPRI PSHA studies do not provide relevant guidance and should be deleted.
43. Line 331: This guideline should identify the level of PSHA that is required for Independent Spent Fuel Storage (ISFS) and Monitored Retrievable Storage (MRS) installations. Considering the NRC’s Risk-Informed Regulation Policy, we strongly recommend that a Senior Seismic Hazard Advisory Committee (SSHAC) Level 2 PSHA is appropriate for these facilities.
44. Lines 332-333: “by assuming hypothetical rock conditions” is misleading and should be removed. The guidance is complete and clear without this expression.
45. Line 339: “characterization” should be deleted.
46. Lines 342-345: This alternative is not understandable or applicable as written. It either should be clearly stated or removed from the guideline.
47. Lines 350-355: This Section should reference and make appropriate use of NUREG/CR-6728 and NUREG/CR-6769 rather than the badly out dated Revision 3 of Reference 21.
48. Lines 361-365: This section should reference and make appropriate use of NUREG/CR-6728 and NUREG/CR-6769 to perform site response analysis.
49. Lines 474-480: Consider replacing the definition of intensity with: “Intensity is a general term for the strength of any measure of ground motion – Peak Ground Acceleration, Peak Ground Velocity, Peak Ground Displacement, or a spectral measure. Subjective intensity scales measure the effects of ground motion as evidenced by observed effects on humans, the built environment, and on the ground surface and near surface materials. The Modified Mercalli (MM) scale is the commonly used subjective intensity scale for United States earthquake catalogs. The MM scale categorizes intensity by type and degree of severity of effects from I to XII.”

50. Line 471: "having various magnitudes" should be replaced with "as a function of magnitude".
51. Line 493-495: This definition should be replaced with: "Mean annual probability of exceedance is the mean annual probability that a given ground motion level will not be exceeded in a year."
- [Note that it is not useful nor informative to attempt to relate return period to annual probability of a given ground motion level, as this requires assumptions that do not necessarily hold for modern PSHA methodologies.]
52. Lines 499-500: Consider the following definition of reference probability. "The reference probability is the target annual hazard level that the NRC considers appropriate for developing seismic design basis ground motions for nuclear facilities that provide reasonable assurance of protecting the public health and safety. The reference probability for determining seismic design ground motions for ISFS and MRS facilities is established in consideration of the NRC's Risk-Informed Regulation Policy, at a mean annual probability of  $5 \times 10^{-4}$ ."
53. Line 503: "its" should be "their"; "a specified" should be deleted.
54. Line 504-505: This definition is not needed for this guideline and should be deleted.
55. Line 506: Replace "certain" with "important to radiological safety".
56. Line 510: "Seismic Potential" is not commonly used in seismic hazard assessment. It is a potentially useful term, but "source earthquake potential" would be more descriptive. Consider the following definition. "The Source Earthquake Potential is a complete characterization of earthquake occurrence in a Seismic Source, including uncertainty assessments for 1) the rate of earthquakes of engineering interest, 2) alternative earthquake recurrence models, and 3) maximum earthquake magnitude."
- The additional comments about Poisson processes are not relevant to the definition and should be deleted.
57. Line 518: "assumed" should be "interpreted".
58. Line 519: "(some . . . frequency)" should be deleted.
59. Line 520: "the seismicity of surrounding regions" should be replaced with "that of surrounding sources."
60. Line 521: Suggest replacing this line, beginning with "will" in line 520, with "are seismic sources that are evaluated to have negligible potential for earthquakes that could cause fault displacement at or near the earth's surface."
61. Line 522: "possibilities" should be "seismotectonic conditions".



62. Lines 523-526: The material following “. . . province)” on line 523 through “. . . years)” on line 526 should be deleted, as the characterization of the earthquake potential of a seismic source can involve weighted alternative recurrence relationships. “A seismogenic source is also characterized . . .” is not sufficiently clear to provide regulatory guidance.

Lines 556-573: Consider replacing this paragraph with the following. “Currently, design bases ground motions (DBGM) for ISFI and MRS are developed following the deterministic procedures given in 10 CFR 100, Appendix A. The mean annual probability of exceeding the DBGM is, therefore, not known. As part of the process of amending Part 72 and developing associated guidance, an appropriate target hazard level for developing DBGM for these facilities has been established. The appropriate target hazard level takes into account the nature of the ISFI and MRS facilities and the risk they pose to the public health and safety. Given these considerations, the NRC’s Risk-Informed Regulation Policy has been applied to establish a target hazard level that reasonably assures that the risk these facilities pose to the public health and safety is consistent with risks posed by other nuclear facilities. Based on these considerations the NRC Staff considers 5.0E-4 to be an appropriate reference hazard level for determining DBGM for ISFI and MRS facilities. The rationale and basis for this target hazard level are described in Section B.3 of this Appendix.”

63. Lines 575-579: This material should be deleted and the Section should begin with the material starting with line 281.
64. Line 581: Consider replacing “classify” to “require classification of”.
65. Line 586: “earthquake” should be changed to “seismic initiated”.
66. Lines 587-594: Consider moving this paragraph to become the 1<sup>st</sup> paragraph in Section B.3.2.
67. Line 596: Should insert “, Appendix A,” following “100”.
68. Lines 604-605: Consider replacing “to consider lower and more appropriate” with “ for establishing an appropriate target hazard for developing”
69. Lines 605-607: Consider replacing this sentence with the following. “The NRC intends to consider the low risk to the public health and safety posed by ISFSI and MRS facilities, compared to nuclear power generation plants, and apply the NRC’s Risk-Informed Regulation Policy in establishing the appropriate reference probability for determining Disruptive Events (DE) for these facilities.”
70. Line 638: Consider changing “During a seismic event” to “Earthquake ground motion”.
71. Line 643: “is” should be “would”.
72. Line 644: “postulated” should be deleted.

73. Line 645: "seismic event" should be "DE". [NOTE THAT SEISMIC EVENT MEANS SEISMIC INITIATED FAILURE OF AN STRUCTURE, SYSTEM, OR COMPONENT (SSC), NOT THE OCCURRENCE OF EARTHQUAKE GROUND MOTION.]
74. Line 647: "a seismic event" should be "earthquake ground motion"; "proposed" should be deleted.
75. Line 648: The DOE suggests quantifying these "design margins" in terms of a risk reduction factor.
76. Line 650: "seismic event" should be changed to "earthquake ground motion".
77. Line 656: "seismic event" should be "earthquake ground motion".
78. Lines 664-666: The intent of this sentence is unclear. The DOE suggests clarification, such as, "The reference probability that NRC is proposing for determining DE for ISFSI and MRS facilities is consistent with that used in DOE Standard DOE-STD-1020."
79. Lines 667-669: The sentence should be written more clearly; it does not have a parallel structure.
80. Line 676: Consider changing "a" to "an appropriate".
81. Lines 692-699: For this step, a distinction should be made between sites for which LLNL or EPRI PSHA results are available and those for which those results are not available. Either LLNL or EPRI PSHA results may be used when those results are determined to be applicable by the evaluation procedures given in Appendix E.2. For sites in the CEUS for which neither EPRI nor LLNL PSHA results are available, the EPRI or LLNL seismic source characterizations for the CEUS, after a determination following the procedures given in Appendix E.2 that new data does not require that they should be updated, may be used together with either the EPRI or LLNL computational packages to compute hazard at the site. For sites in the WUS for which an existing PSHA accepted by the NRC is not available, a SSHAC Level 2 PSHA must be done.
82. Line 705: "Perform a complete PSHA" should be replaced with "Deaggregate the hazard".
83. Lines 706-707: The selection of magnitude distance (M-D) bins is not dependent on the PSHA methodology used. Rather, it depends on the detail that one wishes to display the deaggregated hazard results. In fact, for purposes of computing site response transfer functions the requirement of deaggregation is to determine the mean M-D and its deviation.
84. Line 742: "event" should be "earthquake source".
85. Line 749: "2" should be "2-2".

86. Line 783: "events" should be "earthquakes". [NOTE THAT THESE ARE NOT INTERCHANGABLE TERMS AS USED IN NRC REGULATION.]
87. Lines 956-966: The extensive study of maximum earthquakes in stable continental regions (EPRI TR-102261) should be referenced here as an approach for assessing maximum earthquakes in the CEUS.
88. Lines 998-1004: Should reference EPRI TR-102261 as an acceptable approach.
89. Lines 1011-1012: Should remove "1989 Loma Prieta", as the displacement in this earthquake was largely strike-slip and there was displacement at the surface.
90. Line 1048: Delete "blind".
91. Line 1049: Delete "1989 Loma Prieta".
92. Line 1056 and elsewhere: With knowledge that has been gained from PSHA studies, the NRC should revisit and redefine the radius of the site region. Two Hundred miles is too large by the order of 40% for sites located in the WUS and likely, is too large also for sites in the CEUS that are not within the influence of the New Madrid Seismic Zone.
93. Lines 1073-1075: This sentence is misleading. Both the LLNL and EPRI seismic source evaluations covered the entire CEUS and the EPRI database specifically included the entire region east of the Rocky Mountains, including relevant parts of Canada and Mexico. Moreover, the purpose of the regional investigations is to capture all seismic sources that contribute non-negligible hazard to the site. There is no reason to extend the studies to a larger region.
94. Lines 1078-1080: This discussion is misleading. Rates of earthquake occurrence and assessments of recurrence model parameters are seismic source specific.
95. Lines 1080-1089: All of this material is loose guidance that can not be reasonably implemented and should be removed from the guideline.
96. Lines 1108: This sentence should start "The extent of site area (8 km) and site vicinity (40 km) investigations may . . .". There is no reason for extending the size of the site region; indeed, it should be smaller than a 320-km radius for most sites.
97. Lines 1132-1141: Site, Site Area, Site Vicinity, and Site Region should be defined at this location.
98. Line 1144: Consider inserting "necessarily" following "not".
99. Line 1148: Consider using the title "Surface Investigations of the Site Area".

100. Lines 1340-1362: This section should reference and adopt the response analysis methods described in NUREG/CR-6728.
101. Line 1363: Should replace "Motion" with "Failure".
102. Line 1527: We suggest that "significant" should be defined in this guideline. The preferred approach would be to define a "significant increase" as a change in the DE. Several considerations suggest that as much as a 20 percent increase in the DE should be considered acceptable. The natural or inherent variability in earthquake ground motions is typically greater than 60 percent at one standard deviation. In comparison with the range of variation of ground motion at two to three standard deviations, a 20 percent change is small. A 20 percent change in the DE corresponds to a change of about 0.04g in peak horizontal ground acceleration for the typical DE in the CEUS. From an engineering design perspective, a change in ground motion loads of 0.04g is negligible. Also a 20 percent change in the DE, considering the capacity of ISFSI and MRS, has a negligible effect on the risk of nuclide release.
103. Line 1538: "SSE" should be "DE".
104. Line 1582: Consider changing "predicted" to "estimated".
105. Lines 1629-1638: The key requirement here is to determine whether interpretations implied by new data fall within the uncertainty ranges of the EPRI and LLNL experts' characterizations. It would be clearer to state this directly without hypothetical examples.
106. Line 1648: "event" should be changed to "earthquake".