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RULEMAKINGS AND
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Secretary
U.S. Nuclear Regulatory Commission
Washington DC 20555-0001

Attention: Rulemakings and Adjudications Staff

Nuclear Energy Institute (NEI) Comments on Proposed Amendments to 10 CFR Part 63, *Implementation of a Dose Standard after 10,000 Years*, 70 Fed. Reg. 53313 – September 8, 2005

The Nuclear Energy Institute (NEI),[1] on behalf of the nuclear energy industry, is pleased to submit these comments to the Nuclear Regulatory Commission (NRC) on the 10 CFR Part 63 rulemaking, *Implementation of a Dose Standard After 10,000 Years*. The nuclear industry commends the NRC for developing a timely response to the July 9, 2004, U.S. Court of Appeals decision vacating the 10,000-year compliance period in NRC's existing Yucca Mountain repository regulation.

Industry recognizes that under the Energy Policy Act, NRC is required to conform its 10 CFR Part 63 regulation to the Environmental Protection Agency's (EPA) Yucca Mountain radiation protection standards (40 CFR Part 197). The subject NRC proposal is, accordingly, a follow-on to EPA's August 22, 2005, proposal to extend the Yucca Mountain compliance period to one million years. Industry *opposes* a one-million-year compliance period as inconsistent with sound public policy and counter to the National Academy of Public Administration principles, cited by EPA, for balancing risks, costs, and benefits fairly across generations. In our letter of November 21, 2005, submitted to EPA Docket ID No. OAR-2005-0083, we have stated this opposition and recommended that EPA follow the roadmap provided by the court for reasserting the 10,000-year standard. We recommend that the NRC review and consider industry's comments on the EPA standards in finalizing this proposal, therefore; we have chosen not to repeat those comments in detail herein. Rather, these comments will be limited to addressing the specific measures that NRC has proposed to implement the EPA standards, our opposition to those standards notwithstanding.

[1] NEI is the organization responsible for establishing unified nuclear industry policy on matters affecting the nuclear energy industry. NEI's members include all utilities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, nuclear material licensees, and other organizations and individuals involved in the nuclear energy industry.

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NRC has proposed to accomplish the following five issues with this rulemaking:

1. Adopt the limit EPA sets for peak dose after 10,000 years;
2. Adopt the criteria EPA has specified for performance assessments after 10,000 years;
3. Adopt the "weighting factors" that EPA has proposed for calculating individual radiation dose to the public;
4. Require that the calculation of radiation doses to workers also use the same "weighting factors" that EPA has proposed for public dose calculations; and
5. Specify a value that DOE must use to project the long-term impact of climate change after 10,000 years as called for by EPA.

Industry takes no position on the first two issues above, because it opposes regulating beyond 10,000 years. As stated in NEI's comments to EPA, the dose limits and performance assessment criteria they specify are protective and technically defensible on a conceptual basis, but they are inconsistent with sound public policy. Therefore, as long as EPA's decision to promulgate a one-million-year standard stands, it is also appropriate for NRC to adopt EPA's limits and criteria. Our specific comments, both detailing our support for, and seeking clarification of, NRC's implementation of these limits and criteria are contained in section I of the enclosure to this letter.

On the third and fourth issues, NEI endorses NRC's decision to adopt the application of the latest dose calculation methodologies for worker protection. These methods are based on the internationally accepted recommendations of the International Commission on Radiation Protection (ICRP) as published in ICRP 60 and 72. Use of ICRP 60/72 internal dosimetry should be applied in all matters of radiation protection for workers and public. We further encourage NRC to consistently apply these methodologies throughout its regulations.

On the fifth issue, we endorse the approach of specifying the rate of water seepage through Yucca Mountain (expressed as deep percolation rate) as an appropriate and practical approach to adopting EPA's recommendation of holding constant the post-10,000-year climate state. However, we oppose the specific range for deep water percolation that NRC proposes, which is approximately six times greater than the current rate.

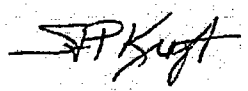
Although the industry agrees with EPA and NRC that a stylized approach to addressing climatological features, events, and processes beyond 10,000 years is necessary to avoid speculation about potential future climate states, there are two main reasons why it opposes the specific numerical range for deep percolation that NRC proposes.

1. Requiring climate to be assumed constant at present-day conditions over the beyond-10,000-year period would be a more appropriate implementation of a stylized approach. This would be consistent with the existing specification of present-day human behavior, conservative from a groundwater usage standpoint, and supported by the most current climatological studies.
2. The specific range of deep percolation values NRC proposes is not appropriate for the long-term average climate state EPA specifies based on existing data.

Both above reasons are explained in detail in the section II of the enclosure to this letter.

We would be pleased to address any questions the NRC may have on the industry's comments on this rulemaking.

Sincerely,



Steven P. Kraft

Enclosure

c: The Honorable Nils J. Diaz, Chairman, U.S. Nuclear Regulatory Commission
The Honorable Jeffrey S. Merrifield, U.S. Nuclear Regulatory Commission
The Honorable Edward McGaffigan Jr., U.S. Nuclear Regulatory Commission
The Honorable Gregory B. Jaczko, U.S. Nuclear Regulatory Commission
The Honorable Peter B. Lyons, U.S. Nuclear Regulatory Commission
Mr. Luis A. Reyes, U.S. Nuclear Regulatory Commission
Mr. Martin J. Virgillio, U.S. Nuclear Regulatory Commission
Mr. Jack R. Strosnider, U.S. Nuclear Regulatory Commission
Dr. Margaret V. Federline, U.S. Nuclear Regulatory Commission

The Honorable Stephen L. Johnson, Administrator, U.S. Environmental Protection Agency
The Honorable Marcus Peacock, Deputy Administrator, U.S. Environmental Protection Agency
The Honorable Bill Wehrum, Assistant Administrator, U.S. Environmental Protection Agency
Ms. Elizabeth Cotsworth, U.S. Environmental Protection Agency

Mr. Paul M. Golan, U.S. Department of Energy
Mr. W. John Arthur, U.S. Department of Energy

ENCLOSURE

Nuclear Energy Institute's Detailed Comments on Nuclear Regulatory Commission's (NRC) Proposed Revised 10 CFR Part 63

I. Specific Comments on NRC's Implementation of the Environmental Protection Agency's (EPA) Proposed Limit and Criteria in 10 CFR 63.342

1. In 10 CFR 63.342 (a) and (b), NRC proposes to adopt EPA's recommendation that performance assessment approaches taken for analysis during the first 10,000 years should form the basis for projecting repository performance assessment after 10,000 years. We agree with this most important stipulation. However, it is equally important that NRC clarify that this approach means that the features, events, and processes (FEPs) that are screened-in for the first 10,000 years after repository closure are the *only* FEPs that need to be considered in the entire post-closure period. This additional clarification should be articulated in both the NRC regulation, and in subsequent changes to NRC's Yucca Mountain Review Plan such that, for example, if DOE provides an adequate basis to screen-out post-closure criticality or microbially-influenced corrosion (MIC) effects during the first 10,000 years after repository closure, the Yucca Mountain Review Plan should specify that no additional consideration of criticality or MIC in the post-10,000-year period is necessary.

   NRC correctly notes that "NRC's existing regulations at 10 CFR Part 63 already include additional requirements, governing the preparation of the performance assessment, that ensure that features, events, and processes considered for inclusion in the performance assessment over the 10,000-year compliance period represent a wide range of both favorable and detrimental effects on performance."[1] Accordingly, NRC should more clearly assert that performance assessment methods meeting these existing requirements are also adequate for the post-10,000-year period.

2. In 10 CFR 63.342(c)(1)(i), NRC proposes to limit the analysis of long-term effects of seismicity to effects on the drift and waste package. We agree that other seismic effects need not be considered. This limitation is reasonable since other seismic effects will likely have little to no peak dose consequence to the Reasonably Maximally Exposed Individual (RMEI). NRC should also clarify that seismic effects, due to magma movement, do not need to be

considered in the analysis. The Electric Power Research Institute (EPRI) analysis demonstrates that seismic activity induced due to magma movement is very minor compared to seismic activity due to tectonism[2] and its effects are enveloped.[3]

3. In 10 CFR 63.342(c)(1)(ii), NRC proposes to limit consideration of igneous activity to the effects on the waste package that may result in release of radioactive material to the biosphere, atmosphere, or groundwater. We agree with this limitation since other potential impacts due to igneous activity, such as changes to local or regional groundwater hydrology, are likely to be insignificant.

II. Basis for Industry Opposition to the Deep Percolation Rate Specified in 10 CFR 63.342(c)(2)

To represent future climate state, NRC has proposed the use of a log-uniform probability distribution for deep percolation rates from 13 to 64 mm/yr or approximately 32 mm/yr. While we support the stylized use of deep percolation rate to represent future climate state, industry opposes the use of this specific range of rates for the following two reasons:

1. Requiring that climate be assumed constant at present-day conditions over the beyond-10,000-year period would be a more appropriate implementation of a stylized approach. Human behavior and climate are inexorably linked. Varying one and not the other creates analytical inconsistencies leading to artificial results not representative of any conceivable future population. For example, why would the future RMEI continue to irrigate his crops almost entirely with groundwater (as does today's present day rural– residential desert dweller) when those crops might already be receiving significant amounts of rain due to climate change?

   Holding climate constant at the present-day state in the Yucca Mountain Total Systems Performance Assessment is supported by the knowledge that today's present climate is a conservative approximation of future climates in that it is relatively dry, forcing high dependence on groundwater.

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[2] EPRI Technical Report 1011165, *Potential Igneous Processes Relevant to the Yucca Mountain Repository – Intrusive-release Scenario*, August 2005.

[3] EPRI Technical Report 1011812, *Effects of Seismicity and Rockfall on Long-Term Performance of the Yucca Mountain, Nevada – 2005 Progress Report*, September 2005

Groundwater is by far the most significant contributor to potential future radiation exposures. The assumed present-day RMEI is virtually 100% dependent on groundwater. The small likelihood that an individual in any future climate state would be more dependent on groundwater would make a regulatory specification of present-day climate highly conservative.

EPRI has also studied this aspect of the standard and recommended that climate state (as defined through deep percolation or, alternately, net infiltration rates) be fixed to the present day interglacial state. This recommendation was based on the following considerations:[4]

- "Recent evidence suggests that net infiltration over time periods spanning multiple climate states has been more constant than previously understood;
- "Biosphere dose conversion factors (converting, for example, groundwater concentrations into dose to the RMEI) for the present-day interglacial climate are reasonably bounding due to the relatively high use of groundwater and higher atmospheric dust loadings;
- "The goal of maintaining an internally consistent compliance assessment requires that future human behavior be consistent with changes in the surface environment in different climate states. It would be impossible to avoid having to make large arbitrary assumptions about such future human behavior as it doesn't exist in the Yucca Mountain region today; and
- "The only climate state for which the most detailed information is available upon which to develop and defend net infiltration and biosphere models is the present-day climate."

[4] EPRI Interim Technical Report 1011754, *Yucca Mountain Licensing Standard Options for Very Long Time Frames*, April 2005, p 4-9.

Furthermore, recent EPRI global climate modeling work[5] suggests that anthropogenic greenhouse gases may delay the onset of the next glaciation cycle by 130,000 to more than 500,000 years. Furthermore, this work, based on the most recent global climate modeling with known greenhouse gas generation rates factored in, indicates that the full glaciation conditions attained in the future may be of less duration and weaker, or no different, and the predominant interglacial conditions are likely to be warmer and drier than present-day climate[6]. This information weighs against specifying higher infiltration/percolation rates as representative of long-term average climate.

The specific range of deep percolation values NRC proposes is not appropriate for the long term average climate state EPA specifies. We note that NRC has specified a deep percolation rate of 32 mm/yr in an effort to be consistent with EPA's recommendation to use a doubling of present day rainfall as the benchmark for future climate states. Industry has also commented to EPA expressing opposition to this recommendation. However, even if it were reasonable to assume a wetter climate in the future, NRC's values are too high. NRC's estimate that 5 to 20% of all precipitation will be converted to percolation is an outlier compared to other published estimates of 5 to 10%. Additional information on these estimates is contained in Table 1. Based on this information EPRI, concludes that specifying a deep percolation rate consistent with a range of 3 to 11% of precipitation converted to percolation would be a more appropriate implementation of EPA's recommendation.

[5] *EPRI Comments Related to Yucca Mountain TSPA and Future Climates*, Presentation of Matthew Kozak to the NRC Advisory Committee on Nuclear Waste, November 14, 2005

[6] EPRI Letter, Kessler to McCullum, *Comments related to future climates and net infiltration on NRC Proposed Amendments to 10 CFR Part 63*, December 6, 2005

Table 1. Net Infiltration Estimates for Yucca Mountain, Nevada[7]

Net Infiltration (mm/year)	Precipitation (mm/year)	Net Infiltration, % of Precipitation	Author	Comment
0	<203		Maxey and Eakin, 1950	Death Valley recharge estimate
	189		Spaulding, 1985	Analysis of pack rat midden dataset
1.2			Flint and Flint, 1994	Saturated hydraulic conductivity of matrix
0 – 5.4			Fabryka-Martin, 1996	Cl^{36} mass balance
6.7			Flint et al., 1996	Neutron logs from 90 borings (may not represent repository)
4.5	170	2.7%	Flint et al., 1996	Model results
5.0			Bodvarsson (Ed.), 1996	UZ5 temperature profile matching
7.2	154.6	4.7%	EPRI Phase 4, 1998	Infiltration model based on Yucca Mountain datasets
	125		Thompson et al., 1999	Re-analysis of Spaulding's pack rat midden dataset. This paper is cited by NRC, 2005
3.6 – 4.7	188	2.2%	USGS 2000	Model calibration for 123.7 Km^2 area
7 – 14	170	4.2%	CRWMS M&O 2000b	Saturated zone chloride data
5	170	2.9%	CRWMS M&O 2000a	Unsaturated zone chloride data
18.7 – 20.3			USGS 2001	Neutron log water content change (may not represent repository conditions)
5, 6.5, 8.5	170	5 - 8.8%	Flint et al., 2002	Cs bomb pulse, C-14, borehole temperature analyses
5			Zhu et al., 2003	Chloride mass balance, chlorine-36 This value is proposed by NRC, 2005
7	160	4.4%	Mohanty et al., 2004	CNWRA simplified 1-d conceptual model sensitivity testing
4.7	196.9	2.8%	Bechtel/SAIC, 2004	Nov 2004 INFIL model – repository area
			Glacial and Wetter Climate Estimates	
21 – 27	305 – 380	7%	Maxey and Eakin, 1950	Death Valley recharge estimate
	246-265		Spaulding, 1985	Analysis of pack rat midden dataset; includes summer and winter seasons
11.4 – 32.5	336.3	3% - 10%	Lichty and McKinley, 1995	High elevation watershed estimates
19.6	194.5	10%	EPRI Phase 4, 1998	Infiltration model. Glacial transition climate with drier summers than CRWMS M&O 1998
32.5	300	11%	CRWMS M&O 1998	Flint et al. 1996 model for full glacial climate
	266-321		Thompson et al., 1999	Re-analysis of Spaulding's pack rat midden dataset
14	342.8	4%	USGS 2000	DOE/Flint model calibration
15	300	5%	Zhu et al., 2003	Chloride mass balance for perched Pleistocene groundwater
37	330	11%	Mohanty et al., 2004	CNWRA simplified 1-d conceptual model sensitivity testing
19.8	323.1	6%	Bechtel/SAIC, 2004	Nov 2004 INFIL model – repository area, glacial transition climate
13 – 64	266 – 321	5% - 20%	NRC, 2005	Precipitation from Thompson et al., 1999, infiltration percentage from Mohanty et al., 2004
32 average	294	11%		

* * * * *

[7] EPRI Letter, Kessler to McCullum, *Comments related to future climates and net infiltration on NRC Proposed Amendments to 10 CFR Part 63*, December 6, 2005

From: "KRAFT, Steven" <spk@nei.org>
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Subject: NEI Comments on Proposed Amendments to 10 CFR Part 63

December 6, 2005

Secretary

U.S. Nuclear Regulatory Commission

Washington DC 20555-0001

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Enclosure

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