Department of Energy
Washington, DC 20585

QA: N/A
DOCKET NUMBER 63-001

August 13, 2009

ATTN: Document Control Desk
Christian Jacobs, Senior Project Manager
Project Management Branch Section B
Division of High-Level Waste Repository Safety
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
EBB-2B2
11545 Rockville Pike
Rockville, MD 20852-2738

YUCCA MOUNTAIN – SUPPLEMENTAL RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION – VOLUME 2, CHAPTER 2.1.1.7, SET 6 (DEPARTMENT OF ENERGY'S SAFETY ANALYSIS REPORT SECTIONS 1.2.3, 1.2.4, 1.2.5,1.2.6, 1.2.8,1.3.3, 1.4.1and 1.4.2)– Design of SSCs, Electrical

Reference : Ltr, Jacobs to Williams, dtd 5/5/09, "Yucca Mountain - Request for Additional Information - Volume 2, Chapter 2.1.1.7, Set 6 (Department of Energy's: Safety Analysis Report Sections 1.2.3, 1.2.4, 1.2.5, 1.2.6, 1.2.8, 1.3.3, 1.4.1, and 1.4.2)"

The purpose of this letter is to transmit the U.S. Department of Energy's (DOE) supplemental responses to RAI numbers 4 and 9 identified in the reference above. The original DOE responses to Set 6 RAIs were provided on June 3, 2009. Each supplemental RAI response is provided as a separate enclosure.

There are no commitments in the enclosed RAI responses. If you have any questions regarding this letter, please contact me at (202) 586-9620, or by email to jeff.williams@hw.doe.gov.

Jeffrey R. Williams, Supervisor
Licensing Interactions Branch
Regulatory Affairs Division
Office of Technical Management

OTM: SAB-0974

Enclosures (2):
Supplemental Responses to 2 Requests for Additional Information Numbers Volume 2, Chapter 2.1.1.7, Set 6, Numbers 4 and 9

Printed with soy ink on recycled paper

cc w/encls:
J. C. Chen, NRC, Rockville, MD
J. R. Cuadrado, NRC, Rockville, MD
J. R. Davis, NRC, Rockville, MD
R. K. Johnson, NRC, Rockville, MD
A. S. Mohseni, NRC, Rockville, MD
N. K. Stablein, NRC, Rockville, MD
D. B. Spitzberg, NRC, Arlington, TX
J. D. Parrott, NRC, Las Vegas, NV
L. M. Willoughby, NRC, Las Vegas, NV
Jack Sulima, NRC, Rockville, MD
Christian Jacobs, NRC, Rockville, MD
Lola Gomez, NRC, Rockville, MD
W. C. Patrick, CNWRA, San Antonio, TX
Budhi Sagar, CNWRA, San Antonio, TX
Bob Brient, CNWRA, San Antonio, TX
Rod McCullum, NEI, Washington, DC
B. J. Garrick, NWTRB, Arlington, VA
Bruce Breslow, State of Nevada, Carson City, NV
Alan Kalt, Churchill County, Fallon, NV
Irene Navis, Clark County, Las Vegas, NV
Ed Mueller, Esmeralda County, Goldfield, NV
Ron Damele, Eureka County, Eureka, NV
Alisa Lembke, Inyo County, Independence, CA
Chuck Chapin, Lander County, Battle Mountain, NV
Connie Simkins, Lincoln County, Pioche, NV
Linda Mathias, Mineral County, Hawthorne, NV
Darrell Lacy, Nye County, Pahrump, NV
Jeff VanNeil, Nye County, Pahrump, NV
Joe Kennedy, Timbisha Shoshone Tribe, Death Valley, CA
Mike Simon, White Pine County, Ely, NV
K. W. Bell, California Energy Commission, Sacramento, CA
Barbara Byron, California Energy Commission, Sacramento, CA
Susan Durbin, California Attorney General's Office, Sacramento, CA
Charles Fitzpatrick, Egan, Fitzpatrick, Malsch, PLLC
Barbara Byron, California Energy Commission, Sacramento, CA
Susan Durbin, California Attorney General's Office, Sacramento, CA
Charles Fitzpatrick, Egan, Fitzpatrick, Malsch, PLLC

EIE Document Components:
001_NRC_Trans_2.2.1.1.7_Set_6_Suppl.pdf
002_Encls_Suppl_4_9_2.2.1.1.7.pdf 151 kB

RAI Volume 2, Chapter 2.1.1.7, Sixth Set, Number 4: Supplemental Question

A follow-up clarification call for RAI Volume 2 – Chapter 2.1.1.7, Sets 5 and 6 was held on June 30, 2009. DOE's response to RAI 2.2.1.1.7-6-004 stated that based on the results of the preclosure safety analysis (PCSA) and detailed design, appropriate sections of nuclear related codes and standards will be applied to the ITS electrical system. The NRC requested DOE to provide a comprehensive table with the following information:

- Applicable principal codes and standards,
- List of important to safety (ITS) structures, systems, or components (SSC) related to the ITS electrical system,
- Justification or rationale for sections of the Institute of Electrical and Electronics Engineers (IEEE) principal codes and standards applicable to the repository.

1. SUPPLEMENTAL RESPONSE

The applicable principal codes and standards provided in the initial response to RAI 2.2.1.1.7-6-004 and used in the design of important to safety (ITS) electrical systems are:

- IEEE Std 308-2001, *IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations*
- IEEE Std 379-2000, *IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*
- IEEE Std 384-1992, *IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits*
- IEEE Std 603-1998, *IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations*.

These principal codes and standards were developed for the commercial nuclear power industry. They have been either adopted in whole or in part based on whether they are determined to be applicable or appropriately adapted for use in the repository design. Please refer to the supplemental response to RAI 2.2.1.1.7-5-001, which provides a comprehensive table that contains the list of ITS structures, systems, or components related to the ITS electrical system, the applicability of the principal IEEE codes and standards to these structures, systems, or components, and the rationale for sections of the principal IEEE codes and standards applicable to the repository.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

IEEE Std 308-2001. 2002. *IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations*. New York, New York: Institute of Electrical and Electronic Engineers. TIC: 252746.

IEEE Std 379-2000. 2001. *IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*. New York, New York: Institute of Electrical and Electronics Engineers. TIC: 255427.

IEEE Std 384-1992. 1998. *IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits*. New York, New York: Institute of Electrical and Electronics Engineers. TIC: 258693.

IEEE Std 603-1998. *IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations*. New York, New York: The Institute of Electrical and Electronics Engineers. TIC: 242993.

RAI Volume 2, Chapter 2.1.1.7, Sixth Set, Number 9: Supplemental Question:

A follow-up clarification call for RAI Volume 2 – Chapter 2.1.1.7, Sets 5 and 6 was held on June 30, 2009. DOE's response to RAI 2.2.1.1.7-6-009 stated that IEEE Std 379-200, *IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems* applied to the ITS electrical system as a means of achieving the system reliability required to meet the preclosure safety nuclear design bases. The NRC requested DOE to provide a comprehensive table with the following information:

- List of important to safety (ITS) structures, systems, or components (SSC) related to the ITS electrical system,
- Justification or rationale for sections of the Institute of Electrical and Electronics Engineers (IEEE) Std 379-2000, *IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*, applicable to the repository.

1. SUPPLEMENTAL RESPONSE

IEEE Std 379-2000 is applicable to the commercial nuclear power industry, and has been adopted with clarification for use in the Yucca Mountain repository design. Please refer to the supplemental response to RAI 2.2.1.1.7-5-001, which contains a comprehensive table with a list of electrical important to safety (ITS) structures, systems, and components (SSCs), and detailed discussion regarding the applicability of IEEE Std 379-2000. The following discussion provides the rationale for selective application of the standard in the repository design.

The Yucca Mountain repository design approach is risk informed, and selectively implements the guidance of IEEE Std 379-2000 as a means of achieving the system reliability required to meet the regulatory objectives for the preclosure safety analysis (PCSA), pursuant to 10 CFR 63. The scope and definitions of safety systems and related features as defined in IEEE Std 379-2000 are based on commercial nuclear power generating station safety systems. The repository design utilizes IEEE Std 379-2000 selectively (e.g., Section 6.1 step 4) where the PCSA demonstrates the need for functional or spatial diversity, independence, isolation, and/or redundancy to meet SSC reliability criteria.

Further, the PCSA process used to implement these principles is fundamentally different from that described in IEEE Std 379-2000, Section 6, *Design analysis for single failure* in ways which include the following:

- IEEE Std 379-2000 is based on deterministically defining consequential "Design Basis Events" and preventing or mitigating them. In contrast, the repository PCSA applies the requirements of 10 CFR 63.111 and 63.112 and the guidance of the four High-Level Waste Repository Safety Staff Interim Staff Guidance documents to identify potential initiating events and evaluate the probability (and where necessary, the potential consequences) of the resulting event sequences.

- Rather than requiring at least two safety groups (IEEE Std 379-2000, Section 6.1.4), the PCSA determines the necessary number of safety groups consistent with the event sequence categorization probability thresholds of 10 CFR 63.111 and the category definitions of 10 CFR 63.2.

- The PCSA iterates the analysis and the SSC design process and develops the listing of design features and design bases that will satisfy the 10 CFR 63.111 performance objectives. This process results in the nuclear safety design bases and ITS designation found in SAR Section 1.9. Direct application of the process steps in IEEE Std 379-2000, Sections 6.1.3 through 6.1.5 to each SSC (or event sequence analysis) is not performed. The nuclear safety design bases quantitatively establish the reliability of ITS SSCs.

Where sufficient SSC reliability can be attained to demonstrate compliance with probabilities meeting the objectives of the regulation without functional or spatial diversity, independence, isolation, and/or redundancy, the process steps of IEEE Std 379-2000 are either not applied or applied only in part, consistent with the analysis outcomes. Consequently, using the analytical PCSA processes required by 10 CFR Part 63, selected provisions of the standard are employed to support repository performance in attaining the reliabilities required to satisfy the nuclear safety design bases.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

IEEE Std 379-2000. 2001. *IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*. New York, New York: Institute of Electrical and Electronics Engineers. TIC: 255427.