Entergy

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PNP 2011-064

October 11, 2011

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Response to Request for Additional Information – License Amendment Request for Spent Fuel Pool Region I Criticality

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

References:
1. License Amendment Request for Spent Fuel Pool Region I Criticality, dated January 31, 2011 (ADAMS Accession No. ML110380093)
2. NRC e-mail, of August 25, 2011, Palisades Nuclear Plant - LAR – ME5419 - SFP Region I Criticality - RAIs - Revised - Non-Proprietary

Dear Sir or Madam:

Entergy Nuclear Operations, Inc. (ENO) submitted a license amendment request (Reference 1) to modify the Renewed Facility Operating License, Appendix A, Technical Specifications (TS), as they apply to the spent fuel pool (SFP) storage requirements in TS section 3.7.16 and criticality requirements for Region I SFP and north tilt pit fuel storage racks, in TS section 4.3. ENO received an electronic request for additional information (RAI) from the Nuclear Regulatory Commission (NRC) and held a conference call with the NRC, on August 24, 2011, to clarify the RAI. A final RAI was sent by electronic mail, on August 25, 2011 (Reference 2)

Attached is the ENO response to the RAI.

A copy of this RAI response has been provided to the designated representative of the State of Michigan.

This letter contains no new or revised commitments.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 11, 2011.

Sincerely,

for AJV

ajv/jlk

Attachment: 1. RAI Response on Spent Fuel Pool Region I Criticality

cc: Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC
State of Michigan

ATTACHMENT 1
RAI Response on Spent Fuel Pool Region I Criticality

Request for additional information received by electronic mail August 25, 2011.

The following requests pertain to the License Amendment Request (LAR) Attachment 5, AREVA NP Inc. Technical Report Document No. ANP-2858P-003

Nuclear Regulatory Commission (NRC) Request

1. *On page 19, the licensee mentions that the material for the cladding, instrument tube, and guide bars has changed. Clarify the material that the analysis assumes for all parts.*

Entergy Nuclear Operations, Inc (ENO) Response

1. Yes, in the analysis, the cladding, instrument tube, and guide bars were all modeled as pure zirconium.

NRC Request

2. *On page 28, the licensee mentioned several abnormal conditions. Please provide and justify any changes from the seismic analysis on record that may take place as a result of this license amendment.*

ENO Response

2. The original 1978 analysis for the Region I spent fuel pool (SFP) storage racks, along with the subsequent 1986 analysis of the Region I racks for the Region II re-rack project, were both reviewed. The Region I racks were analyzed as being fully loaded with fuel, which would result in the worst-case stresses from a seismic perspective. Racks with fewer fuel assemblies loaded into them (i.e. 3 of 4, or 2 of 4 fuel cell arrangements) would impart less loading and stresses into the rack, and are thus bounded by the existing analysis. Since the proposed LAR change allows for a potentially unsymmetrical pattern of fuel within the cells in a rack, there is the possibility that the cell loading within a rack can be unbalanced to some small degree. However, this loading pattern would still be bounded by the original analysis of a fully loaded rack.

   Review of the SFP storage racks with consideration to displacement of the B_4C (Carborundum®) determined that the buoyant weight of a storage can (fuel cell location within the rack) is still substantial, even without a fuel bundle present in that location. Additionally, the overall uplift force on the rack design is negligible considering the weight of the fuel assemblies.

   Considering the loss of all Carborundum®, and the proposed loading arrangement of the SFP storage racks in Region I, the resultant effects of the proposed changes in the LAR are negligible, and are still bounded by the original seismic analysis. Therefore, it is concluded that there is no revision needed with respect to the seismic analysis of the racks for this LAR.

NRC Request

3. *On page 37, the licensee states that on[ly] rack C was evaluated for storage of non-fuel bearing components. Please justify only using rack C in this case.*

ENO Response

3. In section 4.6, page 37, rack C was the only rack evaluated as it will be the only rack containing the non-fuel bearing components in designated empty locations. With the exception of control blades, rack E will not contain non-fuel bearing components in designated empty locations. Therefore, only rack C was considered. This is not a change from the present Technical Specifications.

As described in Appendix C, section C.1.9, page 130, control blades were specifically analyzed for storage in rack E. Control blades will not physically fit in the smaller rack C cells, so the analysis for control blades was only performed for rack E.

NRC Request

4. *On page 118, the swelling model was examined using fuel of several different configurations. Identify and justify the most limiting configurations?*

ENO Response

4. This part of the analysis examined the effects of wall bowing, examining the movement of both the inner and outer walls of the rack cells. The walls have little room to move. The models chosen were those that moved the walls the maximum possible under the constraints of the rack and fuel geometry. The mass of the walls was conserved in all models.

Wall bowing was analyzed for both 3-of-4 and 4-of-4 (i.e., full) loading patterns for both racks. Enrichments ranged from 1.35 to 4.54 wt% U-235. Burnup values ranged from fresh to 48 GWD/MTU. For each allowable loading pattern (2-of-4, 3-of-4, and 4-of-4 for rack C; 3-of-4 and 4-of-4 for rack E), the fuel configuration with the highest Keff was used for the examination of the swelling model. For rack C with 4-of-4 loading, the most reactive fuel configuration is 4.54 wt% at 48 GWD/MTU (see Table 4-7 or 4-8); likewise, for 3-of-4 loading, the most reactive fuel configuration is 4.54 wt% at 30 GWD/MTU (see Tables 4-4 or 4-5). For rack C with 2-of-4 loading, the fresh fuel with 4.54 wt% has a lower Keff than the 1.35 wt% fresh fuel in a 4-of-4 loading configuration (see Table 4-1 or

4-2 versus Table 4-7 or 4-8); therefore, the more limiting 4-of-4 configuration of fresh fuel was evaluated. The limiting rack E fuel configurations were also selected on the basis of the highest Keff values. For 3-of-4 loading, the most reactive fuel configuration is 4.54 wt% at 19 GWD/MTU (see Table 4-10 or 4-11) and for 4-of-4 loading, the most reactive fuel configuration is 4.54 wt% at 38 GWD/MTU (see Table 4-13 or 4-14). For rack E, the fresh fuel configurations were also evaluated for swelling effects even though they are significantly less reactive than the burned fuel configurations.

The results showed that no one form of wall bowing, or lack of bowing, is more reactive than another. This was evident in both racks C and E (see Tables C-2 and C-3). This would be expected since all cases use the same mass of wall material, and with no moderation in the gap region there is no impact to the flux in the fuel region due to the physical placement of the wall material. No evidence was seen of reflection changes, with the movement of the inner wall against the fuel. Since wall bowing was not found to create a reactivity impact at the extremes of possible movement, it can be considered that the analysis bounded other intermediate conditions. The nominal dimensions of the cells were used in the analysis since wall bowing was not found to be an issue.

Section C.1.3 explains that swelling effects were re-examined in combination with the effects of residual carbon (from degraded Carborundum®), again using the most reactive fuel configurations for 3-of-4 and 4-of-4 loading (the 2-of-4 loading is significantly less reactive and also showed a smaller reactivity increase than 3-of-4 loading for the residual carbon effect only, see Table C-4). Table C-5 lists the reactivity increases for residual carbon effects combined with extreme swelling and shows the maximum increase of 0.0028 Δk. Thus, the combined effects of residual carbon and extreme swelling were bounded by a reactivity penalty of 0.003 Δk for 2-of-4 and 3-of-4 loading only (Regions 1A and 1B); for 4-of-4 loading (Region 1C), the maximum combined effect was less than 0.001 Δk so the penalty was not considered necessary. The 0.003 Δk penalty for Regions 1A and 1B is included in the Δk_{sys} values shown in Table 3-5.

For rack E the swelling effects were also combined with residual carbon effects for the more reactive burned fuel configurations with both 3-of-4 and 4-of-4 loading (Regions 1D and 1E). These results are listed in Table C-7 and the maximum reactivity increase due to the combined effects of residual carbon and extreme swelling was determined to be 0.0022 Δk. This was bounded by a reactivity penalty of 0.003 Δk for both 3-of-4 and 4-of-4 loading configurations in Rack E. The 0.003 Δk penalty for Regions 1D and 1E is included in the Δk_{sys} values shown in Table 3-5.