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Sent: Thursday, July 19, 2012 5:05 PM
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Subject: ME8074_RAI.docx
Attachments: ME8074_RAI.docx

Here is the combined request for additional information from several branches of NRR for the submittal on Palisades re-rack LAR. Please let us know when you would like to have teleconference with members of the NRC staff. Thanks

REQUEST FOR ADDITIONAL INFORMATION
REGARDING LICENSE AMENDMENT REQUEST
FOR REPLACEMENT OF SPENT FUEL POOL REGION 1 STORAGE RACKS
PALISADES NUCLEAR PLANT
DOCKET NO. 50-255

Jim,

By letter dated February 28, 2012 (ML12061A288, ML12061A289, and ML12061A290), Entergy Nuclear Operations, the licensee for the Palisades Nuclear Plant provided a fuel storage criticality analysis in order to revise Appendix A, Technical Specifications (TSs) 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.

On the basis of the provided information, the NRC staff has concluded that additional information is required from the licensee to determine that the licensee has acceptably demonstrated that the spent fuel pool will remain subcritical under all conditions. The request for additional information (RAI) is divided into separate groups.

If you need clarifications, please arrange a teleconference with the staff to discuss this information.

Please provide this information within 45 calendar days of the receipt of the RAI.

Reactor Systems (SRXB)

1. Appendix D, "Guidance on Spent Fuel Pool Racks" of Standard Review Plan (SRP) Section 3.8.4, "Other Seismic Category I Structures," Revision 3, stated that "Because of gaps between fuel assemblies and the walls of the guide tubes, additional loads will be generated by the impact of fuel assemblies during a postulated seismic excitation. Additional loads resulting from this impact effect may be determined by estimating the kinetic energy of the fuel assembly. The maximum velocity of the fuel assembly may be estimated to be the spectral velocity associated with the natural frequency of the submerged fuel assembly. Loads thus generated should be considered for local as well as overall effects on the walls of the rack and the supporting framework. It should be demonstrated that the consequent loads on the fuel assembly do not lead to damage of the fuel." Please provide fuel handling accident analysis and any associated information regarding the damage fuel during the postulated "fuel to fuel" drop event, and the associated decontamination factor, compared to the design-basis FHA analysis.

2. In Section 4.2.3.1, the licensee states that the design basis assembly is determined with a single cell MCNP5-1.51 Region I model. Please provide more detailed analysis and sensitivity studies on how the design basis assembly is appropriate for the specific condition of the Region I pool.

3. In Section 4.2.3.5, the licensee states that "any missing fuel rod [from a fuel rod assembly] replaced with a solid material is acceptable." The licensee then provided two cases, "Missing Four Fuel Rods from One Assembly in a 3x3 Array" and "Missing Four Fuel Rods from Every Assembly in SFP." What replacement materials were analyzed

that are considered acceptable? Also, please provide analysis that the two scenarios analyzed in Section 4.2.3.5 are the most limiting cases.

4. In Section 4.2.2.1, the licensee stated that actinides and HTC experiments where considered when performing the benchmarking calculations for MCNP5. Please provide the trending analysis that shows the applicability of this data.

5. The licensee did not specify that the B-10 areal density in the Metamic would be incorporated into the Technical Specifications (TSs). Please include this information in the TSs.

Mechanical and Civil Engineering Branch

1. Section 5.7.6.1, "Region 1 Racks," and Section 5.7.6.2, "Region 2 Racks," of the Palisades Final Safety Analysis Report (FSAR) both indicate that the racks are designed in accordance with Standard Review Plan (SRP or NUREG-0800) Section 3.8.4, "Other Seismic Category I Structures." In Section 6.2.2 of Attachment 6 to the LAR submittal, Revision 2 of SRP Section 3.8.4 is listed as the version used to demonstrate acceptability of the proposed racks for Palisades. However, the latest revision to SRP Section 3.8.4 is Revision 3. Please provide a justification for the use of the dated revision of SRP Section 3.8.4 and reconcile any technical variations between the two revisions as they relate to the design of the replacement spent fuel racks at Palisades.

2. Appendix D to SRP Section 3.8.4, Revision 3, "Guidance on Spent Fuel Pool Racks", states that because of gaps between fuel assemblies and the walls of the guide tubes, additional loads will be generated by the impact of fuel assemblies during a postulated seismic excitation. Subsequently, Appendix D states that it should be demonstrated that the consequent loads on the fuel assembly do not lead to damage of the fuel. Please confirm that the time-history analyses performed for the Palisades SFP rack design have demonstrated that the consequent loads on the fuel assemblies do not lead to damage of the fuel. This confirmation should include information related to the structural capacity of the most limiting spent fuel bundles at Palisades, including material properties, and a demonstrated ability of the bundles to withstand the impact loads generated in the time history analyses.

3. In Table 1 of Appendix D to SRP 3.8.4, Revision 3, for Level B Service Limits, under load combination $D + L + T_o + P_f$, P_f is defined as follows:

   P_f: *Force on the racks caused by postulated stuck fuel assembly. This load is considered to be an accident condition.*

   Please discuss why the load due to P_f was not included in Section 6.2.2.b of Attachment 6 to the LAR submittal, "Code Stress Limits under Different Service Conditions."

4. Section 3.8.4 of the SRP and the NRC position paper on spent fuel storage and handling applications indicate that differential thermal expansion loads under normal conditions (T_o) and differential thermal expansion loads under abnormal conditions (T_a) are to be used in combination with primary stresses in loading combinations when determining the structural adequacy of the SFP rack structures. However, Section 6.8.2 of Attachment 6 to the LAR submittal, "Analysis of Thermal Effects," states that thermal stresses do not

require evaluation under Subsection NF (of the American Society of Mechanical Engineers Boiler + Pressure Vessel Code). Please provide justification for evaluating the secondary and primary stresses separately in the structural analyses of the cell-to-cell welds for the proposed replacement rack structures. Additionally, please confirm that the guidance of SRP 3.8.4 and the NRC position paper, relative to combining thermal and primary loads, has been considered in the Palisades SFP re-rack analysis and design.

5. Section 6.7.4 of Attachment 6 to the LAR submittal presents a summary of the rack-to-rack and rack-to-wall impacts. The discussion in this portion of the submittal focuses on the rack-to-rack impacts at the base of the racks, however no discussion is provided regarding potential impacts at the top of the racks. Please discuss whether the time-history analyses performed using DYNARACK resulted in any apparent rack-to-rack impacts at the top of the rack structures. Additionally, if these impacts were predicted, confirm that the consequences of these impacts (e.g., buckling) have been sufficiently accounted for in the overall analysis of the racks.

6. Figure 6.4.1 of Attachment 6 to the LAR submittal depicts the model used for DYNARACK time history analyses. Please state whether the DYNARACK model has been previously benchmarked against other numerical analysis methods, namely methods which employ a more explicit method of analysis (e.g., commercial finite element analysis software). Additionally, state whether the Palisades-specific acceleration time histories were used to benchmark the DYNARACK time history analyses.

7. With respect to the numerical analyses performed for the fuel handling accidents, as described in Section 7 of Attachment 6 to the February 28, 2012, LAR submittal, please address the following as they relate to the use of the LS-DYNA computer code to perform these analyses:

   a) Table 7.4.2 of Attachment 6 of the LAR submittal for the Palisades re-rack documents the data points used for the strain rate amplification curve applicable to the base metal material for the LS-DYNA fuel handling accident simulations. Provide the bases for the strain rate amplification data and any references which document prior NRC approval regarding the use of this data.
   b) Table 7.3.2 of Attachment 6 documents the material properties used in the numerical analyses for the racks. Please provide these properties for the rack weld material as they are applied in the LS-DYNA simulation and state the bases for these properties.

8. Section 7.2 of Attachment 6 of the LAR submittal for the Palisades re-rack summarizes the fuel handling accidents considered in the structural design of the Palisades replacement SFP storage racks. The shallow drop accident considers the case whereby a fuel bundle and handling tool are postulated to drop on an outer rack call wall. For the shallow drop accident, please provide a technical justification which confirms that the outer cell wall produces the limiting drop location, as opposed to a drop of the bundle over an interior portion of the SFP rack.

Accident Dose Branch

1) On page 13 of Attachment 1 to your February 28, 2012, submittal, it states:

"The structural damage to the fuel building, pool liner, and fuel assembly resulting from a dropped fuel assembly striking the pool floor or another assembly located in the racks is primarily dependent on the mass of the falling object and drop height. Since these two parameters are not changed by the proposed modification, the postulated structural damage to these items remains unchanged. The radiological dose at the exclusion area boundary has been evaluated and found to remain well below levels established by regulatory guidance."

Please provide additional information for the basis that the radiological dose at the exclusion area boundary was found to remain well below the levels described in regulatory guidance. Include the following information in your response:

a) Provide which regulatory guidance that is being referenced.

b) Provide assumptions and parameters used in the above mentioned radiological dose analyses.

c) Provide the depth (i.e. how many feet) of water coverage is assumed in the above mentioned radiological dose analyses.

d) Provide the decontamination factor assumed in the above mentioned radiological dose analyses.

e) Provide the resulting radiological dose values that your conclusion is based upon including the low population zone and control room values.

2) Please provide a comparison of the above mentioned radiological dose analyses to the design-basis FHA dose analysis for Palisades Nuclear Plant.

Health Physics and Human Performance Branch

The Health Physics and Human Performance Branch performed a preliminary review of the human performance associated changes in the license amendment request. The licensee's responses to the following request for additional information (RAI) with regard to the human performance aspects of the license amendment will allow the staff to complete its review in a timely manner.

Human Performance

RAI-1: In section 4.0 of Attachment 1 (Technical Analysis) in the Human Performance section, the LAR states that the human performance tools used during fuel handling activities are "considered appropriate to minimize the probability of the occurrence of a fuel

misload event. Following the replacement of all Region I fuel storage racks, a misloading event within Region I could not occur." There is not enough information in the LAR to support the conclusion that a misload event could not occur once the fuel racks have been replaced. Please provide additional information which Palisades used to determine that a misloading event could not occur.

RAI-2: The LAR does not indicate whether the proposed Technical Specification changes will present any new or increased opportunities for operator error. Please provide information as to whether the new changes might present increased opportunities for operator error, and if there are administrative controls in place to prevent or mitigate such errors.

RAI-3: Section 4.0 of Attachment 1 contains very little information regarding Human Performance review activities. This RAI contains several questions:

1. Was an operating experience review done to consider lessons learned? And if so, please provide this information.
2. Have there been changes to spent fuel loading training? Please provide any information regarding changes to training or qualifications as a result of this LAR.
3. Please describe any changes to physical interfaces, such as monitoring instruments for radioactivity, boron concentration, and include any changes to the crane operation.
4. Will there be any changes required to the procedures for fuel movement, including engineering procedures for analyzing and planning moves? If so, please provide a list of those changes.

Health Physics

1) What is the total person-rem estimated for the job. Include in the estimate, the dose to install the racks and the dose from the radioactive waste processing of the existing contaminated racks. If you have contingency plans to use divers, include the dose to the divers in the total estimate.

2) Provide specific details of radiological controls for this job. Discuss how work, personnel, traffic and equipment movement are going to be monitored and controlled to minimize contamination and maintain exposure ALARA, protective clothing requirements, personnel monitoring requirements. What provisions will be implemented to detect, control and minimize worker exposure to discreet radioactive particles in the work environment that may be generated or displaced by fuel rack replacement activities?

3) Are divers being considered either to perform any activity or being considered as a contingency plan? If divers are being considered, provide specific detail of the radiological controls consistent with the requirements of Regulatory Guide 8.38, "Control of Access to High and Very High Radiation Areas of Nuclear Plants."

4) Provide the necessary information (e.g., shielding calculations, plant layout, etc.) that demonstrates that the radiological impact to areas of the plant adjacent to the spent fuel

pool from the proposed design change is minimal. Is the change expected to impact the plant radiation zoning design?

5) Discuss the methods that will be used to remove radioactive crud, sediment and other debris generated in the rack replacement and maintain water clarity in the pool. Is the additional quantity of solid radioactive waste generated from the requested changes expected to result in a significant change in the generation of solid radioactive waste at PNP?

Steam Generator Tube Integrity and Chemical Engineering Branch

1. Please provide the following:

   a) Physical dimensions (length, width, and thickness) of the coupons in the coupon surveillance program.

   b) A description of how the coupons mounted on the coupon tree are representative of the Metamic installed in the spent fuel pool cells. Will there be any sheathing covering the coupons similar to the sheathing holding the Metamic in the storage cells? If not, please provide justification on how the coupon thermal and chemical environment will be similar to that of the Metamic in the storage cells.

2. The license amendment request (LAR) stated that over the duration of the coupon testing program, the coupons will have accumulated more radiation dose than the expected lifetime dose for the normal storage cells. Please provide a description on how you will ensure that the coupons will have accumulated more dose than the Metamic in the storage cells once the first four offloads are complete.

3. The LAR stated coupons that were removed from the pool for testing that had not been destructively analyzed, may optionally be returned to the spent fuel pool and remounted.

   - How long will a coupon be allowed to remain out of the pool before being reinserted?
   - Will the coupon go through a vacuum drying phase before testing and reinsertion?
   - Provide a justification for how the coupon will still be representative of the Metamic in the storage cells once it is reinserted.