

April 29, 2005

MEMORANDUM TO: James Lyons, Deputy Director  
Division of Licensing and Project Management  
Nuclear Reactor Regulation (NRR)

FROM: Marc Dapas, Director /RA/  
Division of Nuclear Materials Safety (DNMS)  
Region III

SUBJECT: REQUEST FOR TECHNICAL ASSISTANCE - LICENSING BASIS  
FOR, AND SEISMIC DESIGN OF, THE PALISADES  
INDEPENDENT SPENT FUEL STORAGE INSTALLATION  
(ISFSI)

Region III requests NRR assistance, in coordination with the Nuclear Materials Safety and Safeguards (NMSS) Spent Fuel Project Office (SFPO), to resolve questions involving the licensing basis for the Palisades Nuclear Power Plant and the appropriateness of the licensee's application of the licensing basis to the seismic design of the Palisades ISFSI.

Background

On August 4, 2005, the NRC completed an inspection of design and operational activities associated with the newly constructed Palisades ISFSI pad. The results of this inspection were documented in NRC Inspection Report No. 07200007/2004-002 (DNMS). As a result, the inspectors identified two issues, characterized as unresolved items (URI), associated with the licensee's translation of the safe shutdown earthquake (SSE) from the reactor site to the ISFSI pad (URI 072007/2004-002-1) and its assessment of the sub-surface bearing stability beneath the ISFSI pad (URI 0720007/2004-002-2).

Inspection Findings

During an inspection of the 2004 ISFSI installation, the inspectors reviewed the licensee's seismic calculations associated with the ISFSI pad and the spent fuel canisters. The inspectors determined that the licensee performed the ISFSI pad SSE calculations assuming a seismic horizontal acceleration of 0.2g in the free-field and at the ISFSI pad ground surface elevation of 623 feet. The licensee stated its understanding that the seismic horizontal acceleration value of 0.2g was approved by the NRC at the time of initial reactor plant licensing. The licensee further stated its understanding that the 0.2g horizontal acceleration value was applicable for SSE seismic calculations associated with any location and at any elevation on the plant site. The inspectors noted that the licensee performed a soil-structure interaction, seismic assessment for the ISFSI pad using the SSE seismic horizontal acceleration of 0.2g. The soil-structure interaction assessment results indicated that the spent fuel canisters would experience a 0.25g horizontal acceleration during an SSE. The spent fuel cannister seismic horizontal acceleration design limit is 0.25g.

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While reviewing the licensee's calculations, the inspectors noted significant differences between the elevation and subsurface soil composition of the reactor plant and the 2004 ISFSI pad. Specifically, the reactor containment building was constructed, following the removal of the soil/sands overburden, at a ground surface elevation of 590 feet on compacted glacial till. The 2004 ISFSI pad was constructed, without the removal of the soils/sands overburden, at a ground surface elevation of 625 feet on sands that the licensee mechanically compacted. The licensee estimated that the compacted glacial till soil layer, at the location of the 2004 ISFSI pad, was at an elevation of 560 to 570 feet.

Based upon the subsurface soil composition and elevation differences between the reactor plant site and the 2004 ISFSI site, the inspectors concluded that the licensee's application of the 0.2g horizontal acceleration value at the ISFSI site was non-conservative. Specifically, the inspectors noted that the calculated SSE seismic horizontal acceleration would likely be larger at the ISFSI compared to the reactor plant site due to the increased site elevation and the approximately 50 to 60 feet of mechanically compacted sands present on top of the compacted glacial till material at the ISFSI site. In addition, the inspectors concluded that the soil-structure interaction calculation results were non-conservative, which if revised to incorporate a larger horizontal acceleration value based on the increased ISFSI pad elevation and the soil profile differences, would likely result in a seismic horizontal acceleration value in excess of the spent fuel canister design limit.

#### Additional Information

- Correspondence between the NRC and the licensee, dated December 1966, telephone call between R. Maccary (AEC) and H. Wahl (Bethel for licensee), indicates that the NRC considered the SSE to be defined as having a horizontal acceleration, at the bedrock, of 0.15g with an amplification factor of 1.25, producing a 0.2g ground acceleration. [Demonstrates the NRC's understanding of the need for, and an accounting of, an amplification of the horizontal acceleration at the bedrock during a seismic event and the resultant ground surface acceleration.]
- The NRC's Safety Evaluation for the Palisades Nuclear Power Plant, dated February 7, 1967, indicates that the NRC was aware of the presence of significant sand dunes on the plant site and that those sand dunes would be removed prior to construction. "[The site] is overlain by a 100 foot sand dune which is being removed prior to construction. Bedrock is about 150 feet below the surface." [Demonstrates that the NRC was aware of the licensee's intent to remove the overburden of sand dunes prior to construction of critical plant structures. Therefore, it is unlikely that the NRC accepted the concept of sand dunes being present between the bedrock and foundation of critical plant structures. Removal of the overburden would also be a reasonable basis for using the "ground surface" term to describe calculations referencing the 590 foot elevation, since no other "ground surface" elevation would have any safety or regulatory significance.]
- The NRC's documentation of the design and construction of the reactor plant makes use of the terms "ground surface" and "grade elevation" interchangeably. [This may have been appropriate at the time since the overburden sands were removed down to the compacted glacial till level, elevation 590 feet, prior to plant construction.]

- The NRC's evaluation of the seismic design was performed by J. A. Blume and Associates, dated November 28, 1969 and was included as Appendix E to the March 6, 1970 NRC Safety Evaluation Report. The evaluation in the first few paragraphs acknowledges that the plant was built in an area of sand dunes; however, the evaluation also notes that the sand dunes were removed to the compacted glacial till level prior to construction. [Since the sand dunes were removed prior to construction, it would appear that the only logical reference point for the ground acceleration would be that elevation at which the critical plant structures were to be built, i.e. 590 feet.] The evaluation also indicates that the maximum potential earthquake was specified with a maximum horizontal ground acceleration of 0.2g. [The wording included here would appear to indicate that the author was neither approving or commenting on the maximum horizontal acceleration value, merely noting that the value had been prescribed.]
- The June 1966 Palisades Preliminary Safety Analysis Report states:
  - "...material above elevation 590 is the area covered by sand dunes should be excavated [sic] to provide adequate foundation for all heavy structures. Such excavation will generally expose the glacial lake deposits which yield higher blow count figures. Foundations of important structures will not be placed on dune sand without special compaction." [It should be noted that the licensee did not propose this option and the NRC did not approve the use of this option during initial licensing of the reactor plant.]
  - "Primary plant structures utilize the compact glacial deposits, the upper surface of which ranges from about elevation 575 to 590 [feet]..."
- Revision 0 of the Final Safety Analysis Report indicated that a 0.2g surface acceleration was used for the SSE. Licensee calculations of the seismic adequacy of those structures housing safety-related components were all performed at the grade elevation of 590 feet. This was also the ground surface elevation since the overburden of sand dunes was removed prior to construction.

#### Requested Action

Provide a response for each of the following questions:

1. During initial licensing of the Palisades Nuclear Power Plant, did the NRC anchor the horizontal acceleration for seismic evaluations at:
  - a. the "ground surface" of the reactor building, elevation 590' and on top of the compacted glacial till, or;
  - b. the "ground surface" of the general plant site, any elevation and with any combination of soil structures intervening between the "ground surface" and the underlying bedrock?

2. During initial licensing of the Palisades Nuclear Power Plant, did the NRC consider that the seismic horizontal acceleration would be amplified from its value at the bedrock to the value used at the "ground surface" due to the type and thickness of the intervening soil between the bedrock and the "ground surface?"
3. Does the NRC expect, based upon the regulations in 10 CFR 72.212 (b)(2)(i)(B) and 10 CFR 72.212 (b)(3), a licensee to incorporate new information and technology into its assessment of the continued appropriateness and re-application of the previous reactor plant seismic siting and design criteria for the design and construction of an ISFSI pad?
4. Irrespective of the previous answers, should the NRC require the licensee to demonstrate that the spent fuel canister seismic design is appropriate, using ISFSI pad-specific seismic data, given that the calculated ISFSI horizontal acceleration is at the canister design limit without consideration of the increases expected due to the site-specific soil profile and elevation?

Coordination

This request was discussed by Kenneth O'Brien (RIII/RAO/EICS), Richard Laufer (NRR/DLPM/PD-1-1), Darrell Roberts (NRR/DLPM/PD 1-2), and others during a teleconference call held on April 29, 2005. At the conclusion of the teleconference, NRR agreed to accept this issue as a Task Interface Agreement and to respond to this request within approximately 30 days after receipt. The Task Interface Agreement Number is 2005-06.

Attachment: References

cc w/att: W. Brach, NMSS  
C. Holden, NRR  
D. Jaffe, NRR  
L. Raghavaan, NRR  
D. Roberts, NRR  
F. Congel, OE  
J. Caldwell, RA  
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M. Satorious, DRP  
S. Reynolds, DRP  
E. Duncan, DRP  
R. Lerch, DRP  
G. Shear, DNMS  
J. Cameron, DNMS

## References

- NRC Inspection Manual, Inspection Procedure 60856, "Review of 10 CFR 72.212(b) Evaluations," dated April 2, 2003
- Palisades Current FSAR Chapter 2, (Revision 21) Sections 2.3-Geology, and 2.4-Seismicity
- Palisades Current FSAR Chapter 5, (Revision 24) Section 5.7.1-Seismic Input
- Palisades Plant, Preliminary Facility Description and Safety Analysis Report (PSAR), Sections II D-Geology, and II E-Seismicity, June 2, 1966
- Record of Telephone Conversation from R. Maccary of the AEC to H. Wahl of Bechtel, dated December 9, 1966.
- Consumer Power Company, Application for Reactor Construction Permit and Operating License – Docket No. 50-255, Amendment No. 7, dated 1/10/67
- Palisades Final Safety Analysis Report (FSAR), Rev. 0, (Issued in conjunction with Amendment 9, November 1, 1968, and subsequent Amendments 10 through 20), Sections 2.3-Geology, and 2.4-Seismicity
- Safety Analysis by the Test and Power Reactor Safety Branch Division of Reactor Licensing In the Matter of Consumers Power Company Palisades Plant Docket No. 50-255, Dated February 7, 1967, Sections B-Geology and Hydrology, and C-Seismology
- Appendix E of Reference 7, dated January 5, 1967: "Report on the Seismicity of the Holland, Michigan Area," Seismology Division of the U.S. Coast and Geodetic Survey
- Appendix H of Reference 7, dated December 19, 1966, "Adequacy of the Structural Criteria for the Palisades Plant," by Newmark and Hall
- AEC SER on Palisades FSAR, Rev. 0, dated March 6, 1970, Section 2.4-Geology and Seismology
- Appendix E of Supplement No. 1 to Ref. 10, dated May 27, 1970: "Review of the Seismic Design of the Palisades Plant," John A. Blume & Associates, November 28, 1969
- Palisades Plant – NRC Final Safety Assessment of Independent Spent Fuel Storage Installation (ISFSI) Support Pad, September 20, 1994
- EA-EAR-2000-0309-13, Rev. 1, "Soil-Structure Interaction (SSI) Analysis," of ISFSI PAD