Shaw | AREVA
MOX SERVICES, LLC

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DCS-NRC-000208

Subject: Docket Number 070-03098
Shaw AREVA MOX Services
Mixed Oxide Fuel Fabrication Facility
Submittal of Responses to Request for Additional Information regarding the Review of the Civil/Structural Design for the Mixed Oxide Fuel Fabrication Facility License Application Request

Reference: (A) Letter, D. Tiktinsky (NRC) to D. W. Gwyn (MOX Services), *Request For Additional Information regarding the Review of the* Civil/Structural Design for the Mixed Oxide Fuel Fabrication Facility *License Application Request*, August 8, 2007
(B) Letter, K. David Stinson (DCS) to Document Control Desk (NRC), *Submittal of License Application*, DCS-NRC-000190, 27 September, 2006
(C) Letter, K. David Stinson (MOX Services) to Document Control Desk (NRC), Submittal of License Application, DCS-NRC-000198, 16 November 2006

Shaw AREVA MOX Services, LLC (MOX Services) hereby submits to the U.S. Nuclear Regulatory Commission (NRC) responses to the Reference (A) Request for Additional Information (RAI) regarding the review of the Mixed Oxide Fuel Fabrication Facility (MFFF) License Application (LA).

Enclosure (1) provides the responses to the Reference (A) RAIs. The responses to the RAIs do not result in a revision to the LA (Reference (B) as updated by Reference (C)), or other licensing documents (e.g., Integrated Safety Analysis Summary), therefore, no LA or other licensing document change pages are included in this transmittal.

If you have any questions, please feel free to contact me or Dealis W. Gwyn, Licensing and Regulatory Compliance Manager, at (803) 819-2780.

Sincerely,

W L Elliott

Walter Elliott
Vice President, Engineering

WLE/OPM

P. O. Box 7097. Aiken. SC 29804-7097/Savannah River Site. Road 2. Bldg. 730-2B. Aiken. SC 29808

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Enclosures (Entitled "Mixed Oxide Fuel Fabrication Facility - Responses to Request for Additional Information regarding the Review of the Civil/Structural Design"):

(1) Docket Number: 070-03098, MOX Services Response to Request for Additional Information (RAI) Regarding the Civil/Structural Design for the MFFF License Application (LA) Dated September 27, 2006

cc: (w/ encl.)
David H. Tiktinsky, USNRC/HQ

cc: (w/o encl.):
Mostafa (Mosi) Dayani, NNSA/SRS
Carol Elliott, NNSA/SRS
Joseph G. Giitter, USNRC/HQ
William Gloersen, USNRC/RII
Dealis W. Gwyn, MOX Services
Margaret A. Kotzalas, USNRC/HQ
Robert C. Pierson, USNRC/HQ
Clay H. Ramsey, NNSA/SRS
Deborah Seymour, USNRC/RII
Donald J. Silverman, Esq., MOX Services
Garrett A. Smith, NNSA/HQ
David Stinson, MOX Services
William Travers, NRC/RII
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Enclosure 1

Docket Number: 070-03098
MOX Services Response to
NRC Request for Additional Information (RAI)
Regarding the Civil/Structural Design for the
MFFF License Application (LA) Dated September 27, 2006

RAI GI-1

Please describe the potential effects of the soil layer thicknesses used in the soil/structure interaction analysis for the Mixed Oxide Fuel Fabrication Building that do not meet the maximum thickness commonly accepted in engineering practice (Lysmer and Kuhlemeyer, 1969) and recommended in the SASSI User's and Theoretical Manuals (Lysmer, et al., 1999a,b) on the seismic response of the building system.

This information is needed to determine compliance with 10 CFR 70.61 for evaluating the likelihood of seismically induced accident sequences and their potential consequences and the 70.64(a)(2) baseline design criterion.

REFERENCES:

Lysmer, J. and R.L. Kuhlemeyer. "Finite Dynamic Model for Infinite Media." *Journal of Engineering Mechanics Division*. American Society of Civil Engineering. Vol. 95, No. EM4. pp. 859–877. 1969.

Lysmer, J., F. Ostandan, and C.C. Chin. "SASSI 2000— A System for Analysis of Soil-Structure Interaction, User's Manual." Revision 1. Berkeley, California: University of California. 1999a.

"SASSI 2000—A System for Analysis of Soil-Structure Interaction, Theoretical Manual." Revision 1. Berkeley, California: University of California. 1999b

Response

There are no effects on the Mixed Oxide Fuel Fabrication Building design due to the soil layer thicknesses that are used in the MOX Services soil/structure analysis. This was confirmed by a parametric analysis that was performed by MOX Services (and was the subject of an NRC in-office review on 28 July 2007) that yielded favorable results. A summary of the parametric analysis is presented below.

In the SSI (Soil Structure Interaction) analysis calculation for the Mixed Oxide Fuel Fabrication Building, some of the soil layers have a low passing frequency for vertically propagating shear waves. An SSI parametric study has been completed that expanded the SASSI code to accommodate 99 soil layers instead of the original 36 soil layers.

To establish the confidence in the expanded SASSI code, the existing SSI analysis for the 37-layer Best Estimate (BE) soil case is first run with the modified SASSI code. The response spectra at both the roof and the grade level from the new 37-layer run with the modified SASSI code for the BE soil case are compared to the existing 37-layer solutions. The 72-layer BE soil case is run with the expanded SASSI code. The response spectra at both the roof and grade level from the new 72-layer run with the expanded SASSI code for the BE soil case are compared to the new 37-layer solution. The comparison results are favorable.

In the reference calculation, the thicknesses of most soil layers are refined to give a total of 72 layers so that the minimum passing frequency is 24 HZ. The maximum thickness of the refined soil layers in this parametric SSI study is less than or equal to one-fifth of the shear-wave velocity of the soil layer under consideration divided by the intended cutoff frequency 24 Hz. This is in compliance with 10 CFR 70.61.

The new 72-layer and 37-layer solutions for the BE soil case from the expanded SASSI code have been compared in the reference calculation for the response spectra at both the roof and grade for the X, Y and Z directions, respectively. The two solutions are nearly identical to each other. It validates the above-stated stipulation that the sufficiency of the existing SSI analysis results would not be compromised although some soil layers have a passing frequency as low as around 8 Hz for vertically propagating shear waves.

The SSI parametric study was the subject of an NRC in-office review on 28 July 2007, and no issues were identified.

RAI GI-2

During the Nuclear Regulatory Commission staff's onsite review performed June 19-June 21, 2007, Shaw AREVA MOX Services stated that a cutoff frequency of 25 Hertz (Hz) was used in the soil-structure interaction analysis for the Mixed Oxide Fuel Fabrication Building for determining the seismic response of the building system. Please demonstrate that the analysis includes all frequencies that make significant contributions to the seismic response of the building system and the rationale for using 25 Hz as the cutoff.

This information is needed to determine compliance with 10 CFR 70.61 for evaluating the likelihood of seismically induced accident sequences and their potential consequences and the 70.64(a)(2) baseline design criterion.

Response

The soil-structure interaction (SSI) analysis includes all frequencies that make significant contributions to the seismic response fox Mixed Oxide Fabrication Building system as evidenced in the parametric analysis discussed in the response to RAI GI-1. The confirmatory calculation in the parametric study lists the frequencies and participation mass ratios in both X and Y directions of the first 20 modes of the SSI model using the approximate Best Estimate case soil springs (6 DOF) for the BMF structure. The dynamic Modal analysis results are extracted for up to 275 modes. However, the total mass participation within 20^{th} mode is 99%. The frequency at 20^{th} mode in both X-Direction and Y-Direction is 12 Hz. For all other modes beyond 20^{th} mode, the mass participations are insignificant.

Therefore the cut off frequency at 25Hz for SSI analysis results in the inclusion of all frequencies that make significant contributions to the seismic response and is fully justified. The 25 Hz cutoff frequency for the Soil-Structure Interaction analysis is further justified by investigating the spectra curves in the calculation. All the accelerations are very flat beyond 20Hz frequency almost close to ZPA. Both the investigations demonstrate that the SSI original analysis used the appropriate cutoff frequency of 25Hz.

The SSI parametric study was the subject of an NRC in-office review on 28 July 2007, and no issues were identified.