

January 30, 2002

MEMORANDUM TO: Eric J. Leeds, Chief  
Special Projects Branch  
Division of Fuel Cycle Safety  
and Safeguards

THRU: Joseph G. Giitter, Chief  
Enrichment Section  
Special Projects Branch, FCSS

FROM: Timothy C. Johnson  
Senior Mechanical Systems Engineer  
Enrichment Section  
Special Projects Branch, FCSS

SUBJECT: JANUARY 15, 2002, IN-OFFICE REVIEW SUMMARY: MIXED OXIDE  
FUEL FABRICATION FACILITY SEISMIC ISSUES

On January 15, 2002, U.S. Nuclear Regulatory Commission (NRC) staff and staff from the Center for Nuclear Waste Regulatory Analyses conducted an in-office review at Stone & Webster offices in Englewood, Colorado, to review seismic calculations. I am attaching the meeting summary for your use.

Docket No: 70-3098

Attachment: Mixed Oxide Fuel Fabrication Facility Seismic Meeting Summary

cc: Mr. Peter Hastings, DCS  
Mr. James Johnson, DOE  
Mr. Henry Potter, SC Dept. of H&EC  
Mr. John T. Conway, DNFSB  
Mr. Don Moniak, BREDL  
Ms. Glenn Carroll, GANE  
Ms. Ruth Thomas, Environmentalists, Inc.

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**\*SEE PREVIOUS CONCURRENCE**

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| <b>DATE</b> | 1 / 28 /02    |  | 1 / 29 /02 |  | 1 / 28 /02 |  | 1 /30 /02 |  |

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Mixed Oxide Fuel Fabrication Facility Seismic Issues Meeting

Date: January 15, 2002

Place: Stone & Webster Offices; Englewood, Colorado

Attendees:

|                  |   |
|------------------|---|
| Tim Johnson      | U.S. Nuclear Regulatory Commission (NRC)                                      |
| Khalid Shaukat   | U.S. NRC  |
| Simon Hsiung     | Center for Nuclear Waste Regulatory Analyses (CNWRA)                          |
| John Stamatakos  | CNWRA   |
| Bob Tripathi     | Science Applications International Corporation -<br>U.S. Department of Energy |
| Ken Ashe         | Duke Cogema Stone & Webster   |
| John McConaghy   | Duke Cogema Stone & Webster   |
| Jim Meisenheimer | Stone & Webster   |
| Paul Trudeau     | Stone & Webster   |

Purpose:

The purpose of this meeting was to review seismic calculations associated with the Mixed Oxide (MOX) Fuel Fabrication Facility seismic issues raised in the U.S. Nuclear Regulatory Commission's (NRC's) Request of Additional Information dated June 21, 2001, and in a follow-up meeting held in Aiken, South Carolina, on September 19-20, 2001.

Discussion:

As part of the review of the construction authorization application for the proposed MOX Fuel Fabrication Facility at the Savannah River site in South Carolina, the staff from NRC and the Center for Nuclear Waste Regulatory Analyses (CNWRA) visited the offices of Stone & Webster in Englewood, Colorado. At the in-office review, NRC and CNWRA staff reviewed calculations as a follow-up to outstanding questions identified in the September 19-20, 2001, technical exchange on seismic and geotechnical issues, particularly soil liquefaction issues. This information is needed to prepare a Safety Evaluation Report on these subjects.

As follow-up to the September technical exchange meeting, the NRC staff raised several questions concerning the seismic hazard and geotechnical calculations for the proposed MOX fuel fabrication facility. These outstanding issues were documented in the November 12, 2001, letter from Duke Cogema Stone & Webster (DCS) to NRC. These issues centered on the application of soil data and the design basis ground motion. DCS proposed a Regulatory Guide 1.60 ground motion spectrum anchored at 0.20 g peak ground acceleration (PGA), for both vertical and horizontal ground motions. NRC and CNWRA staff also questioned the calculated site-specific ground motion used for the evaluation of subsurface conditions during an earthquake.

Calculations related to the following areas were reviewed:

- i. Development of engineering soil data;
- ii. Determination of consolidation settlement using recompression indices;
- iii. Analysis of consolidation settlement using numerical finite difference methods;
- iv. Foundation bearing capacity failure;
- v. Liquefaction potential assessment and dynamically induced settlement due to excessive pore pressure during an earthquake;
- vi. One-dimensional free-field site response analyses; and
- vii. Determination of shear modulus reduction curves and damping ratios.

A question was asked regarding whether potential failure of soil beneath the foundation was considered in the settlement assessment using the finite difference code FLAC. Consideration of the potential failure of soil layers beneath the foundation could result in foundation settlements. DCS personnel indicated that the potential failure was considered in the analysis as was confirmed through the CNWRA review of the supporting calculation. DCS staff also indicated that the best estimate shear wave velocities were taken for each layer of soil in the profile for calculating liquefaction potential and lower/upper bounds were used for soil structure interaction analyses to cover the uncertainties.

The DCS's "MOX Fuel Fabrication Facility Site Geotechnical Report" indicated that a procedure proposed by the National Center for Earthquake Engineering Research was used for liquefaction potential assessment. This statement is also included in the supporting calculation package. This procedure proposes a simple equation for the calculation of cyclic stress ratio, one of the key parameters for liquefaction potential evaluation. This equation has a large uncertainty associated with it. DCS personnel were asked how the uncertainty is considered. They indicated that the cyclic stress ratio equation provided in the procedure was not used. Instead, a formula relating the dynamic shear modulus and dynamic shear strain was used for determining the cyclic stress ratio. They provided a calculation showing that the cyclic stress ratio calculated using the formula appears to be located at the higher end of the uncertainty band. This calculation is acceptable to NRC and CNWRA staff.

Whether the design basis settlement profile should be provided in the Construction Authorization Request was discussed. DCS personnel suggested that the estimated settlement profile is dependent on the foundation design of the MOX Fuel Fabrication Facility. It is, therefore, reasonable not to provide the design basis settlement profile at this time. Instead, the settlement will be considered in the design phase. The NRC staff accepted this approach.

DCS personnel pointed out that a design basis earthquake was selected between Priority Category PC3 (2000 year bedrock) and PC4 (10,000 year bedrock) levels amplified to the surface to get 0.2g PGA for MOX facility site. The level chosen was 1.25 x PC3. DCS personnel indicated that they are in the process of validating this level.

In summary, the issues identified in the November 12, 2001, letter from DCS were satisfactorily answered by DCS technical personnel. The material provided for staff review was helpful to prepare the Safety Evaluation Report on the topics in question. During the review, the staff identified a calculation package not previously released by DCS in the construction application. This new calculation package provides additional confidence that the MOX facility will be able to safely function under unlikely events including seismic loads that are beyond the proposed design basis earthquake. DCS personnel indicated that they would follow up on the staff's

request to release the information to the docket, either as the original calculation package or as a summary document.

Action Items:

NRC and DCS staff to decide how to release information from calculation justifying unlikely events.