March 27, 2009

Mr. Dealis W. Gwyn, Licensing Manager
Shaw AREVA MOX Services
P.O. Box 7097
Aiken, SC 29804-7097

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING THE REVIEW OF THE HUMAN FACTORS ENGINEERING INFORMATION IN THE LICENSE APPLICATION AND INTEGRATED SAFETY ANALYSIS SUMMARY FOR THE MIXED OXIDE FUEL FABRICATION FACILITY

Dear Mr. Gwyn:

We have reviewed the human factors engineering (HFE) information in your license application submittal, dated November 17, 2006, and the integrated safety analysis summary dated September 27, 2006, as revised on December 17, 2007. The submittal requests a license to possess and use special nuclear, source, and by-product material in the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF). The MFFF, which is to be located on the U.S. Department of Energy's (DOE's) Savannah River Site in Aiken, South Carolina, will process and fabricate MOX fuel for use in commercial nuclear power plants as part of the DOE's plutonium disposition program.

We have enclosed a list of additional information that is needed by the staff in order to complete the review of the HFE aspects of the MFFF. Please provide us with a response describing how our questions were addressed and any other changes to licensing documents that were necessary to incorporate the response. The response should be provided within 90 days of the date of this letter.

In accordance to the Title 10 *Code of Federal Regulations* 2.390 of the U.S. Nuclear Regulatory Commission's (NRC's) "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Please contact me at (301) 492-3130 if you have any questions.

Sincerely,

/RA/

Kevin Morrissey, Project Manager
Mixed Oxide and Uranium
Deconversion Branch
Special Projects and Technical
Support Directorate
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket: 70-3098

Enclosure: As stated

cc w/enclosure:

S. Glenn, NNSA/SRS
J. Olencz, DOE
S. Jenkins, SC Dept. of HEC
D. Curran, Esq., NWS
A.J. Eggenberger, DNFSB
L. Zeller, BREDL
G. Carroll, NWS
D. Silverman, Esq.

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Mixed Oxide Fuel Fabrication Facility
Requests for Additional Information
Human Factors Engineering

Human Factors Engineering (HFE) Planning

Section 12.4.3.B.i of NUREG-1718 states that the applicant's approach for planning HFE design review should include identification of appropriate goals and scope to ensure that HFE practices and guidelines are implemented during design, construction, and operation of the facility. The applicant's HFE planning activities are described in Section 12.2.1 of the license application (LA), the Human Factors Engineering Program Plan (HEPP), and the Human Factors Engineering Implementation Plan (HEIP).

HFE – 1 Scope of HFE Activities

HEPP Section 1.1 provides for application of HFE in design, construction, test and evaluation, startup, and operation of the Mixed Oxide Fuel Fabrication Facility (MFFF). Section 1.3 states that the HFE program is focused on human-system integration (HSI) vis-à-vis engineering and administrative items relied on for safety (IROFS) and that it is only applicable to integrated safety analysis (ISA)-identified IROFS functions. Section 1.4 and Section 1.5 also state that the HEPP is only applicable to ISA-identified IROFS functions. However, another constraint in Section 1.5 states that HFE is also applied to eliminate or reduce the possibilities of challenges to the performance capability of operators or maintainers. Title 10 of the *Code of Federal Regulations* (10 CFR) 70.64, Section (b)(2) states that facility and system design and facility layout must be based on defense-in-depth practices. The design must incorporate, to the extent practicable features that enhance safety by reducing challenges to IROFS. Defense-in-depth practices and their relation to safety are further described in footnote 1 of the regulation. Chapter 12 of NUREG-1718 notes that HFE is to be applied to personnel activities identified as safety-significant consistent with the ISA. This is noted to include activities identified as IROFS and personnel activities that support safety. Defense-in-depth items are identified in the ISA as supporting safety and are required by 10 CFR 70.64, which notes that they enhance safety. Please clarify that the scope for the HEPP and HEIP includes the controls, displays, and alarms associated with both administrative and the engineering IROFS, the defense-in-depth items, and their related control rooms.

HFE – 2 Analysis Personnel Actions

Section 4 of the HEIP indicates that a subset of events is analyzed within the ISA that may involve personnel actions that have the potential to result in negative actions. Please clarify what is meant by negative actions. It also states that HFE evaluations performed for the ISA include evaluating errors of commission in addition to omission. How is the evaluation of errors of commission accomplished?

HFE – 3 HEIP Level of Specificity

Much of the HEIP is written with the following characteristics:

- The guidance is very general. For example, it states that when necessary, the human factors engineering (HFE) team should perform studies to examine special features of the system design to support engineering. How does the team know when it is necessary and what studies will be performed?

- The guidance does not commit to a specific methodology.
- The guidance is derived from NUREG-0711 with little modification. For example, almost the entire validation and verification (V&V) section is close to a restatement of the NUREG-0711 review criteria. NUREG-0711 provides criteria for reviewing an applicant's HFE methodology and HFE products. While there are some exceptions, it does not serve as stand-alone executable guidance by design personnel.

Is more detailed, specific guidance available to the HFE design team for performing HFE activities?

Issue Tracking

Section 12.4.3.B.iii of NUREG-1718 states that an applicant's approach for planning HFE design review should include an HFE team that attains the HFE goals and scope through established processes and procedures and that tracks HFE issues. The applicant's HFE issue tracking is described in the LA, Section 12.2.4 and in the HEPP and HEIP.

HFE – 4 Tracking System Methodology

The HEIP discusses tracking of HFE issues. Please clarify the use of the MOX Project Action Tracking System and the Action Tracking System for HFE issue tracking. Please provide additional information on the methodology, documentation, and responsibilities of system users.

Operating Experience

Section 12.4.3.C of NUREG-1718 states that an applicant should identify safety-related HFE events or potential events that have occurred in existing facilities that are similar to the proposed facility. The applicant should:

- Review the HFE-related events or potential events for relevance,
- Analyze the HSI technology employed for the relevant HFE events or potential events, and
- Conduct (or reviewed existing) operator interviews and surveys on the HSI technology for relevant HFE events or potential events.

Use of operating experience is described in the LA, Section 12.5 and in the HEPP and HEIP.

HFE – 5 Tracking of MELOX Lessons Learned

The report "MOX Processing Area Lessons Learned from Experience at MELOX, Overall Summary," dated September 29, 2006, provides a list of recommended modifications to the MFFF based on discussions with the MELOX operator. Please provide a discussion of how the implementation status of these recommendations is being tracked and a reference to where that status can be reviewed by the NRC.

HFE – 6 Operating Experience Review (OER) for HSI Technology

The OER process addresses predecessor plant experience; however, it appears to be missing reviews of the reactor operating experience for planned HSIs in MFFF. Will the MFFF use the

same HSIs and the reference plants? If yes, discuss the applicability and advisability of using old technology. If not, what aspects will be different and what are the plans for conducting OER of HSI technologies planned for use at the MFFF?

Function Allocation

Section 12.4.3.D.i of NUREG-1718 states that the functional allocation analysis should be based on the OER. Personnel activities are functionally allocated to take advantage of human strengths and to avoid demands that are not compatible with human capabilities. The applicant's function allocation analysis is described in the LA, Section 12.3 and in the HEPP and HEIP.

HFE – 7 Function Allocation Methodology

The HEIP indicates that function allocation will be based on HFE principles using a structured well-documented methodology that seeks to provide personnel with logical, coherent, meaningful tasks. What methodology will be used to accomplish this? Given that the MFFF operations are highly automated, how will the plant design and allocation of functions support operators to maintain operator vigilance and provide acceptable workload levels, i.e., to minimize periods of operator underload and overload?

HFE – 8 Basis of Automation

The functional allocation element in the HFE plans and the document "Basis of Design for I&C" state that the base design goal is to automate MFFF operations as much as possible. They also state that this reduces the chances and consequences of error or incident. Please provide the basis for this reduction in the: chances of error, chances of incident, consequences of error and consequences of incidents.

Task Analysis

Section 12.4.3.D.ii of NUREG-1718 states that task analysis includes:

- the task analysis scope
- identification and analysis of critical tasks
- detailed description of personnel demands (e.g., input, processing, and output)
- iterative nature of the analysis
- incorporation of job design issues

The task analysis should address each operating mode for each personnel activity (e.g., startup, normal operations, emergency operations, and shutdown) and its results should support the functional allocation. The applicant's task analysis is described in the LA, Section 12.4 and in the HEPP and HEIP.

HFE – 9 Task Analysis Scope

The task analysis scope includes administrative IROFS and personnel activities that support safety. Does this include the range of human actions discussed in the request for additional information (RAI) number HFE - 1? The plans also indicate that task analysis addresses each operating mode, e.g., startup, normal operations, emergency operations, and shutdown. Is the

scope of human actions subject to tasks analysis in these analyses limited to administrative IROFS and personnel activities that support safety?

HSI Design

Section 12.4.3.E of NUREG-1718 states the following:

- The HSI design should incorporate the functional allocation analysis and task analysis into the detailed design of safety-significant HSI components (e.g., alarms, displays, controls, and operator aids) through the systematic application of HFE (HSI design inputs).
- The HSI design should include the overall work environment, the work space layout (e.g., control room and remote shutdown facility layouts), the control panel and console design, the control and display device layout, and information and control interface design details (HSI design scope).
- The HSI design process should ensure the application of HFE to the HSI required to perform personnel activities (HSI design process).
- The HSI design process should exclude the development of extraneous controls and displays (extraneous HSIs).
- The HSI design documentation should include a complete HSI inventory and the basis for the HSI characterization (HSI design documentation).

The applicant's HSI design is described in the LA, Section 12.6 and in the HEPP and HEIP.

HFE – 10 HSI Design Scope

If the HSI design process is only applied to HSIs not carried over from the reference facility and those that have been substantially changed, please indicate how consistency between the new and old HSIs is assured?

HFE – 11 HSI Design Style Guide

HSI design is addressed in LA Section 12.6 and in HEIP Section 8.5. These sections indicate that prior to detailed design work, the MFFF HFE team will compose and provide an appropriate "guidelines document" or "style guide" limited to suitability for the evaluation of IROFS equipment that have human interfacing. Does this mean the style guide will only be used for evaluation? Why is the scope limited to IROFS equipment? If limited as such, might that create inconsistencies in design between IROFS and non-IROFS HSIs? What is the general content of the style guide and how will it be maintained? Will it contain procedures for its use?

HFE – 12 Review of the Style Guide

Will the style guide(s) be consistent with NUREG 0700? If not, please justify an acceptable alternative.

HFE – 13 Designs for Error Tolerance

What approaches will be used in the design of operator interfaces to minimize operator error and provide for error detection and recovery?

HFE – 14 Alarms for Automation Failure

If an automatic safety action fails and there is no automatic backup, is an alarm generated to signal operator action? For example, what happens if the automatic response that triggers a safety actuation warning fails? Is operator backup required and how is the operator notified of the need for action? Are these actions proceduralized?

HFE – 15 Alarm/warning Selection Criteria

HEIP Section 7.4.2 (p.95) states that one of the alarm/warning selection criteria is "[t]he operator's normal surveillance activities cannot be relied on to alert them to the condition." Relying on surveillance may delay the detection of important conditions and may result in those conditions being overlooked altogether. Please clarify why important conditions should not have an alarm or warning to ensure that the operators are aware of them.

HFE – 16 Operator Action Criteria for Alarms

HEIP Section 7 states that alarm or warning conditions not within the operating responsibilities may be candidates for elimination or combination. What types of conditions degrade plant or HSI performance even if remedial actions are outside the operators responsibly? Are such conditions sent elsewhere, e.g., are lower level alarms sent to maintenance personnel?

HFE – 17 Alarm Reduction, Conditioning, and Processing

HEIP Section 7 discusses alarm conditioning to help prevent nuisance alarms. Mention is made of time delay and input logic. Can additional detail be provided as to how alarms will be conditioned and how the conditioning will prevent the elimination of true alarms? How is prioritization of alarms based on urgency of action determined?

HFE – 18 Higher-Level Alarms

Are there higher-level alarms/warnings, e.g., event alarms or system level that indicate the meaning of patterns of lower-level alarms/warnings? Such alarms help operators to quickly understand the "big picture" in situations were there are many lower-level alarms/warnings.

HFE – 19 User-Defined Alarms

The HEIP Section 7 indicates this capability will be available. How is this functionality implemented? Does this mean user-defined alarms? Can users reset setpoints or logic on non-user-defined alarms?

HFE – 20 Alarm Management

HEIP Section 7, (p.106) suggests that all alarms don't need acknowledgement. Why is that?

HFE – 21 Use of Safety Injection Units in Displays

Section 8 indicates that HMI devices are calibrated in SI units in the English language. Is this appropriate for U.S. operators and maintainers?

HFE – 22 Color Coding on Maintenance and Mechanical Dismantling Displays

The “General Specification for Equipment Labeling...” in Section 43.0 specifies color codes (e.g., orange, purple, etc.) for electric cables, circuits, raceways, and electrical equipment. Will these colors also be used on screen displays for the same electric equipment or for other equipment powered from these electric supplies? If so, where will the guidelines for such usage be documented?

Staffing

Section 12.4.3.F of NUREG-1718 states that staffing should be based on a review of the number and qualifications of personnel for each personnel activity during all plant operating conditions. The applicant should conduct this review in a systematic manner that incorporates the functional allocation and task analysis results. Categories of personnel should be based on the types of personnel activities. Staffing considerations should include issues identified in the OER, functional allocation, HSI design, procedure development, and V&V. The applicant’s description of staffing is contained in the LA, Section 12.7 and in the HEPP and HEIP.

HFE – 23 MFFF Staffing

Section 6 of the HEIP discusses staffing and Figure 6.1 shows the expected MFFF organization for full production operation. The figure includes staff numbers which total 787. Missing from this section is the number and type of personnel on a full normal shift and the number of shifts planned. Please provide this information. Additionally, the HEIP does not provide discussions of shift staff teamwork and communication. Pease provide this information.

Procedures

Section 12.4.3.G of NUREG-1718 states that an applicant's procedure development for personnel activities should incorporate HFE principles and criteria, along with all other design requirements to develop procedures that are technically accurate, comprehensive, explicit, easy to use, and validated consistent with the acceptance criteria in Section 15.5.4. Because procedures are considered an essential component of the HSI design, they should be derived from the same design process and analyses as the other components of the HSI (i.e., displays, controls and operator aids) and subject to the same evaluation processes. Procedures should include, as needed to support the personnel activity: generic technical guidance, plant and system operations, abnormal and emergency operations, tests (i.e., preoperational, startup, and surveillance) and alarm response. The applicant’s procedures are described in the LA, Section 12.8 and in the HEPP and HEIP.

HFE – 24 Alarm Procedures

HEIP Section 7 suggests that both hardcopy and computer-based procedures may be used. If so, how is it determined which will be implemented in computer form?

HFE – 25 Procedure V&V

Section 8 of the HEPP states that all applicable procedures will be verified and validated to ensure they can be carried out as required. Section 9.8 of HEIP states that the MFFF HFE team

will review the writers' style guides and the IROFS procedures. They will also verify and validate the IROFS procedures. The scope of V&V for procedures in Section 9.8 of HEIP is not clear and appears to be too limited. Please clarify.

Training

Section 12.4.3.H of NUREG-1718 states that an applicant's training program development should address all personnel activities. The training program development should indicate how the knowledge and skill requirements of personnel will be evaluated, how the training program development is coordinated with the other activities of the HFE design process, and how the training program will be implemented in an effective manner consistent with human factors principles and practices. The training program development should address the areas of review and acceptance criteria described in Section 15.4.4 and should result in a training program that provides personnel with the qualifications commensurate with the personnel activities. The applicant's training is described in the LA, Sections 12.9 and 15 and in the HEPP and HEIP.

HFE – 26 Scope of Personnel Training

The HEPP doesn't specifically address who gets trained. The HEIP, Section 10.4, "General Approach Outline," states that the overall scope of training includes "The categories of personnel (e.g. managers, supervisors, operators, etc.)." Please clarify what is meant by "etc." and identify all staff that will be trained by category.

Integrated System Validation

Section 12.4.3.I.iii of NUREG-1718 states that an applicant should commit to a performance-based evaluation of the integrated design to ensure that the HFE/HSI supports safe operation of the plant. Integrated system validation should be performed after HFE problems identified in HFE design activities are resolved or corrected because these may negatively affect performance and, therefore, validation results. Validation should be performed by evaluating personnel activities using appropriate measurement tools. All personnel activities should be tested and found to be adequately supported in the design, including personnel activities outside the control room. The applicant's integrated system validation is described in the LA, Section 12.10 and in the HEPP and HEIP

HFE – 27 Verification vs. Validation

HEPP indicates that "integrated system validation is intended to evaluate the acceptability of those aspects of the design that cannot be determined through such analytical means as the two verifications." However, integrated system validation has a different objective (to evaluate performance using the integrated system) than the two verifications, thus performing verification does not eliminate the need for validation. Please clarify.

HFE – 28 Validation Scope Modifications

As new HSIs are integrated into the plant, they may interact with existing HSIs whose design is essentially the same as the reference plants. Selection of what to validate should be based on operational sampling methods and not specifically whether an individual HSI has been modified or not. Also, system or plant changes might change the acceptability of the HSIs that are not

being modified, i.e., HSIs that were appropriate for use in the reference plants are no longer appropriate in the MFFF. Please clarify the scope of the validation activities.

HFE – 29 Validation Testbed

The HFIP states that no simulator will be available for impulse safety valves. It states that "Validation will begin as final design winds down. If procedures and training are in place for augmented administrative controls (or enhanced administrative controls) and station air compressor, and the HMIs are in place there is no reason not to begin validating those parts of the HSI design that are complete. During cold startup, a dynamic control room environment will be available and can be used to validate the few remaining HSIs." This raises a few questions:

- How can integrated performance be validated prior to the availability of a dynamic control room environment?
- How will performance during scenarios of primary interest, such as event and failure scenarios, be assessed?
- Many of the performance measures described would seem to require a simulator; how will they be measured using the actual plant?

HFE – 30 Operational Condition Sampling

HFIP Section 11.7.1 indicates that operational condition sampling for validation may be used. What criteria will be used to determine whether it will be used or not?

HFE – 31 Design Implementation Methodology

Section 11 of the HEPP and Section 12 of the HEIP provide a high level commitment to the two criteria from NUREG-1718 and the three criteria from NUREG-0711 on Design Implementation. Section 12.4 of the HEIP provides some more detailed discussion of how these criteria are to be implemented. However, it does not provide any detail for one criterion, namely the comparison of the final as-built HSIs to the final detailed design description. For example, are 100% of screens, icons, controls, labels, location aids, and labels to be verified or is a sampling program to be used? Please provide added description to address this criterion.