DRAFT- HUMAN FACTORS ENGINEERING

RAI-HFE-1: Describe the process that will be used to conduct a "human factors engineering review of the human-system interfaces" for those IROFS requiring operator actions.

The license application states, on page 3.3-1:

"For those IROFS requiring operator actions, a human factors engineering review of the human-system interfaces shall be conducted using applicable guidance in NUREG-0700, "Human-System Interface design Review Guidelines," Revision 2, dated May 2002 (NRC, 200a), and NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, dated February 2004 (NRC, 2004a).

A detailed description is needed of how the guidance will be applied specifically to the design and implementation of the human system interfaces for the AES-EREF (e.g., detailed implementation plans as identified in NUREG-0711).

10 CFR 70.62(d) requires, in part, that "….***engineered and administrative controls and control systems that are identified as items relied on for safety pursuant to § 70.61(e) of this subpart are designed, implemented, and maintained, as necessary, to ensure they are available and reliable to perform their function when needed*****,*** to comply with the performance requirements of § 70.61 of this subpart" [emphasis added].

In addition, 10 CFR 70.64(a) (10) requires that, "The design must provide for inclusion of instrumentation and control systems to monitor and control the behavior of items relied on for safety." Given that the AES-EREF application contains many IROFS that rely on human action, the instrumentation and control systems associated with these IROFS must be designed to adequately support operator task performance.

Further, staff guidance contained in NUREG-1513, "Integrated Safety Analysis Guidance Document," identifies that for administrative controls (e.g., certain human actions), "…the man-machine interface for that individual should be carefully designed."

RAI-HFE-2: Explain the purpose(s) and function(s) of the overview screen, control desk, and fire alarm system contained in the Control Room. Describe the method(s) used to design the overview screen, control desk, and fire alarm system. Describe the composition of the overview screen (e.g., the layout of the viewing area, information to be displayed, physical characteristics of the screen, etc.). Describe the composition of the control desk (e.g., presentation media used [VDUs, soft-controls, computerized procedures, etc], information to be displayed, etc.). Describe the composition of the fire alarm system (e.g., presentation medium used, information to be displayed, etc.). The explanations and descriptions should focus on how these control room components support the role of the operator in controlling and maintaining the facility in a safe condition and under upset/accident conditions.

The license application states, on page 3.3-10,

The OSB [Operations Support Building] contains the following functional areas located on the second floor.

Control Room

The Control Room is the main monitoring point for the entire facility. The Control Room provides all of the facilities for the control of the plant, operational requirements, and personnel comfort. It is a permanently staffed area that contains the following equipment:

- Overview screen
- Control desk
- Fire alarm system
- Storage facilities
- Communication systems

RAI-HFE-3: Explain the purpose(s) and function(s) of the "Radiation Monitoring Control Room" contained in the Technical Support Building. Describe the composition of the "Radiation Monitoring Control Room" e.g., presentation media used, information to be displayed, functions to be controlled, etc.). The explanations and descriptions should focus on how the control room components support the role of personnel in controlling and maintaining the facility in a safe condition and under upset/accident conditions. In addition, explain the relationship of the "Radiation Monitoring Control Room" to the "Radiation Monitoring Room" described in the ISA Summary.

The license application (SAR), on page 1.1-4, indicates that:

One of the major functional areas of the Technical Support Building (TSB) is the "Radiation Monitoring Control Room."

In addition, page 3.3-5 of the ISA Summary provides a brief explanation of the "Radiation Monitoring Room."

RAI-HFE-4: Clarify the meaning and composition of ISA Summary, page 3.5.-37, Section 3.5.9, as "Control Systems."

The license application identifies, in the ISA Summary, page 3.5.-37, Section 3.5.9, as "Control Systems." Section 3.5.9 continues with a description of one system, the Plant Control System (PCS) and its associated components (e.g., Central Control System, Local Control Systems, Interfaces to process equipment and Auxiliary Systems, etc.).

The terminology used in the application appears confusing. Please clarify: is there more than one "Control System" or just the PCS which is composed of "sub-systems"?

RAI-HFE-5: Explain the purpose and function of the Central Control System switches and services contained in the Training Room and Operations Support Area.

The license application states, on page 3.3-11,

The Training Room and associated support area is used for Control Room training and provides some operation support functions. It has visual and personnel access to the Control Room and contains the following:

• Plant Control System training system
• Centrifuge Monitoring System training system
• Central Control System switches and services.

RAI-HFE-6: Explain the purpose and functions of the Alarm Annunciation System and describe the method(s) used to design it.

The license application states, on page 3.5-36,

….Facility alarm systems which provide security, safety, and environmental protection such as fire alarm, radiation monitoring, gas release, equipment failure, etc. all provide audio and visual annunciation in either the Control Room or CAS. Control Room and or security personnel will respond to the alarm condition directly and if applicable annunciate the condition over the PA system.

RAI-HFE-7: Explain the process used to design the human system interfaces (HSIs) that support the Plant Control System (PCS). Describe the HSIs that comprise the PCS, method(s) used to design the HSIs, and how the HSIs are determined to support the role of the operator in controlling the facility under normal and abnormal/emergency conditions. Supplement the response with diagrams, layout drawings, graphics, where feasible.

The license application states, on pages 3.5-36, 3.5-37,

The Plant Control System (PCS) performs the following functions:

• Provide asset protection
• Enable operators to supervise and control enrichment plant operations
Control and protect the enrichment process
• Provide local operators with facilities to enable preparation of the enrichment process
• Provide a supervisory interface for auxiliary systems
• Provide historical data for analysis.

The detailed instrumentation needed to achieve the functionality identified above is included in the process system descriptions (Section 3.4, Enrichment and other Process Descriptions). Facility control and monitoring systems are designed to handle abnormal levels of data and alarms that may occur during upset and emergency conditions. The Control Room is designed to accommodate equipment to monitor, alarm, and record environmental, effluent, and fire protection data.

The license application further describes, on pages 3.5-8 through 3.5-42, various human performance-related characteristics of the five parts of the PCS (Central Control System; Local Control Systems; Interfaces to Process Equipment and Auxiliary Systems; Training System; and Process Instrumentation and Wiring).

The application describes these systems at a high level. The application does not explain the methodology used to determine the systems' characteristics. For example, the purpose and function of the CCS is explained but, the application does not explain the rationale used for determining attributes of HSIs (e.g., "The organizational level of

the interface has a maximum of four display levels." What factors/analysis methods were used to make this determination?).

In the Local Control Systems (LCCs) discussion, the application provides a level of detail related to the instrumentation and control specifications supporting the LCCs (e.g., use of PLCs, proprietary software, etc.). However, the application provides a description of the operator interface (i.e., LOI) limited to function with no explanation of the methodology used to determine the characteristics of the LOI or how the operators are expected to interact with them.

RAI-HFE-8: Clarify terminology, "Local Control Systems" versus "The Local Control System (LCS)."

The license application states, on page 3.5-40,

"Local Control Systems," in the title. The first sentence of the description states, **"**The Local Control System (LCS) is the process-level control and protection system that includes process instrumentation and Local Control Centers (LCC) installed locally in the process area."

Is there one Local Control System or are there multiple systems?

RAI-HFE-9: Explain how operator actions taken from LCCs are coordinated with the CCS.

The license application states, on page 3.5-40,

"Each LCC has sufficient functionality to completely operate and protect its associated process system without any CCS intervention."

The application indicates that each local control station can "completely operate and protect its associated process system with out CCS intervention." What measures are in place to ensure that coordination between the local control operators and control center operators (e.g., isolation devices/lock-outs present, administrative procedures, etc.).