



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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**TERRAPOWER, LLC – U.S. NUCLEAR REGULATORY COMMISSION STAFF FEEDBACK
REGARDING WHITE PAPER: “NATRIUM HUMAN FACTORS ENGINEERING CONCEPT OF
OPERATIONS,” REVISION 0 (EPID NO. L-2023-LRO-0042)**

SPONSOR INFORMATION

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DOCUMENT INFORMATION

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**Submittal Agencywide Documents Access and Management System (ADAMS) Accession
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Purpose the White Paper: TerraPower stated the purpose of this white paper (WP) is to describe the ways users interact with the Human-System Interfaces (HSIs) and with one another to monitor, control, and maintain the Natrium plant.

Action Requested: TerraPower requested U.S. Nuclear Regulatory Commission (NRC) staff feedback and observations on the information discussed in the WP.

FEEDBACK AND OBSERVATIONS

The feedback and observations on this WP are preliminary and subject to change. The feedback and observations are not regulatory findings on any specific licensing matter and are not official agency positions. NUREG-0711, “Human Factors Engineering Program Review Model,” Revision 3 (ML12324A013), is used by the staff to ensure that the applicant incorporated standard practices, guidelines, and considerations into a Human Factor Engineering (HFE) program. The HFE program has twelve elements but in reviewing this WP the staff specifically focused on portions of the elements HFE Program Management and Human-System Interface Design due to the content of the WP.

General Observation:

The WP included the following statement in its introduction:

The HFE Concept of Operation (COO), sometimes referred to as a concept of use document, describes the ways users interact with the [HSIs] and with one another to monitor, control, and maintain the plant so that it functions in a safe, secure,

Enclosure

regulatory compliant, and efficient manner. The HFE COO acts as a baseline set of assumptions regarding the operational plant. This includes job design aspects such as the definition of user roles, assumed minimum staffing, user population characteristics, aspects of work coordination relevant to the design, and crew communications.

Based on this description, the NRC staff's observations and feedback on the WP were developed assuming that the WP is a hybrid between a concept of use and a concept of operations (ConOps) document.

Specific Observations:

The WP provides an appropriate level of information describing the plant goals (or missions), a high-level overview of operating personnel roles and responsibilities, considerations for HSI design and how personnel will work with HSI resources, and a high-level overview of the coordination of personnel activities. The WP also describes the conceptual monitoring and control area layout and provided a general description of the workstation design for each role included in the nominal staffing for Nuclear Island Control Room (NCR). This information specifies those personnel who will work at individual workstations. In the description of the conceptual layout for the NCR, the WP provides the type of information that will be displayed to the crew. This information is consistent with the guidance for a concept of use document as described in NUREG-0711, Revision 3, Section 8.4.2, "Concept of Use and HSI Design Overview," paragraph (1).

The WP also provides a general overview of the HSI design principles and considerations. The WP presents the principles for allocation of functions (AOFs), or automation level, and the Task Analysis (TA) considerations based on Operating Experience (OE) reviews. The use of OE results to develop the AOF and TA provides a technical basis for the approach to the HSI design. This information is consistent with the guidance regarding information that applicants should provide relative to an HSI overview as described in NUREG-0711, Revision 3, Section 8.4.2, paragraph (2).

Regarding the WP also serving as a ConOps, the list below outlines certain aspects of a ConOps which were not addressed in the WP. This list is not intended to be a comprehensive assessment of all applicable regulatory requirements and guidance.

- Management of Normal Operations
- Management of Off-normal Conditions and Emergencies
- Management of Maintenance and Modifications
- Staffing, Qualifications, and Training¹

The NRC staff would expect that a ConOps, submitted as part of an HFE program, includes the elements outlined in the ConOps definition as presented in the glossary of NUREG-0711, Revision 3.

Regarding the WP also serving as a concept of use document, dependent upon the specific design, further engagement may be warranted or additional information provided during the

¹ Training for these roles is delivered based on the training program plan. Additional detail regarding these processes is provided in the HFE Program Plan, which was not reviewed, and this feedback is not applicable to that document.

application process regarding (1) the description of the allocation of tasks between the NCR or to local control stations, and (2) whether any tradeoff studies simultaneously considering multiple alternatives and engineering tests and evaluations were employed when developing the technical bases for the HSI.

As noted above, the WP also provided additional information on TA considerations and AOF based on OE. The NRC staff did not review this information in detail. However, the NRC staff notes this information presents a high-level overview of the guiding principles and consideration for HSI development and may serve as a useful foundation for the development of results summary reports or implementation plans for functional requirements analysis and function allocation and TA.

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