ATTACHMENT 65001.23

INSPECTION OF HUMAN FACTORS ENGINEERING INTEGRATED SYSTEM VALIDATION ITAAC

PROGRAM APPLICABILITY: 2503

65001.23-01 INSPECTION OBJECTIVES

01.01 To confirm by inspection that the combined license (COL) holder (licensee) has implemented a Human Factors Engineering (HFE) integrated system validation (ISV) for the main control room (MCR) and remote shutdown workstation (RSW) designs in accordance with the NRC approved ISV implementation plan. The inspection will be used to support an NRC finding as to whether the ISV implementation and results meet the acceptance criteria as stated in the HFE ISV Inspections, Tests, Analyses and Acceptance Criteria (ITAAC).

65001.23-02 INSPECTION REQUIREMENTS AND GUIDANCE

02.01 Background. Inspection of ITAAC associated with a COL is intended to support the Commission finding stipulated in 10 CFR Part 52.103(g), specifically that the COL acceptance criteria (ITAAC acceptance criteria) have been met, and that the facility has been designed and built to conform to the licensing basis. The Commission policy for Design Acceptance Criteria (DAC), as defined in SECY-92-053, allows licensees the option to provide HFE design process milestones as ITAAC. In these instances the HFE DAC-related ITAAC are inspected as the development process for the HFE design progresses and the licensee completes the ITAAC throughout the facility post-COL (construction) phase.

An HFE program, such as that described in NUREG-0711 (Reference 3), provides the structure for ensuring that the HFE aspects of a plant are developed, designed, and evaluated on the basis of a structured, disciplined analysis using accepted HFE principles. Verification and validation (V&V) evaluations are that part of an HFE program which comprehensively determine whether the design conforms to HFE design principles and if it enables plant personnel to successfully perform their tasks to achieve plant safety and other operational goals. ISV is an important element of the V&V process.

ISV is that part of the V&V process which evaluates an integrated system design (i.e., hardware, software, and personnel elements) using performance-based tests to determine whether the integrated system design acceptably supports safe operation of the plant. It is intended to evaluate the acceptability of those aspects of the design that cannot be determined through analytical means such as human-system interface (HSI) task-support verification and HFE design verification. The ISV process is comprised of several important activities, including but not limited to, establishing an appropriate test facility, specifying test objectives, developing test scenarios, specifying performance measures, developing and implementing a test design (including pilot testing), and analyzing and interpreting the data. More specifically, a successful ISV should:

- Validate the role of plant personnel, i.e., that the allocation of functions to human and automatic aspects of the integrated system are appropriate and takes advantage of human strengths and avoid allocating functions that would be negatively affected by human limitations.
- Validate that the shift staffing, assignment of tasks to crew members and crew coordination (both within the control room as well as between the control room and local control stations and support centers) is acceptable. This should include validation of the nominal shift levels, minimal shift levels, and shift turnover.
- Validate that for each human function, the design provides adequate alerting, information, control, and feedback capability for human functions to be performed under normal plant evolutions, transients, design basis accidents, and selected risk significant events that are beyond design basis.
- Validate that specific personnel tasks can be accomplished within the time and performance criteria, with a high degree of operating crew situation awareness, and within acceptable workload levels that provide a balance between vigilance and operator burden. Validate that the operator interfaces minimize operator error and provide for error detection and recovery capability when errors occur.
- Validate that the functional requirements are met for the major HSI features, e.g., group-view display, alarm system, safety parameter display system (SPDS) function, general display system, procedures, controls, communication systems, emergency operating procedure (EOP)-related local control stations.
- Validate that the crew can make effective transitions between the HSI features in the accomplishments of their tasks and that interface management tasks such as display configuration and navigation are not a distraction or undue burden.
- Validate that the integrated system performance is tolerant of failures of individual HSI features.
- Identify aspects of the integrated system (including staffing, communications, and training) that may negatively impact integrated system performance.

02.02 Inspection Requirements and Guidance.

a. General Inspection Requirements.
The licensee's commitments regarding implementation of the HFE ISV process are contained in the HFE ISV implementation plan provided as part of the COL application. The objective of this inspection is to verify that the licensee has implemented an HFE ISV process in accordance with the commitments contained in the approved implementation plan.

The general methodology for this inspection activity is to directly observe samples of activities in multiple phases of the HFE ISV process in order to obtain reasonable assurance that the licensee is implementing the process in accordance with the commitments in the implementation plan and that, as a result, the HFE ISV will provide a valid basis for determining the acceptability of the integrated design for safe operation.

The actual planning and scheduling of the HFE ISV inspections is dependent on the licensee's design development schedule and associated milestones. Inspections should

not be conducted until after the licensee has completed acceptance testing of the facility to be used for conduct of the HFE ISV. All construction inspection activities should be coordinated through Region II (RII).

Specific Guidance. Gather pertinent information and discuss inspection planning and scheduling issues with the RII and/or Office of New Reactors (NRO) HFE technical experts. For example:

- importance/prioritization of activities
- concurrent inspections to be conducted using other IPs
- status of previous NRC findings
- licensee responses to applicable Generic Bulletins, Regulatory Issue Summaries and Information Notices
- commitments made in the COL pertaining to human factors engineering verification and validation activities
- technical attributes that should be the focus of the inspection

Contact the licensee for information needed to prepare the inspection plan, for example:

- status of HFE ISV activities, planned activities and schedule (used to focus inspection and determine inspection sample)
- identification of individuals assigned key positions and functions described by the licensee's HFE ISV program implementation plan
- availability of licensee personnel during the period tentatively scheduled for the inspection
- changes to the HFE V&V program since any previous NRC inspection (e.g., policy, personnel, program description, implementing documents)

Conduct the inspection in accordance with this IP and its associated appendices.

b. Requirements for Performance of Inspection. The inspection will be performed in accordance with the inspection plan. Adjustments to the inspection plan will be communicated to Region II/CCI to minimize impact to the licensee and to assist in revising inspection planning efforts accordingly.

Specific Guidance. Conduct the inspection in accordance with this IP and the appendix applicable to the certified design to be inspected.

c. Requirements for Inspection Reporting. An inspection report and any findings will be prepared and approved in accordance with Inspection Manual Chapter 0613.

Specific Guidance. No specific guidance.

65001.23-03 RESOURCE ESTIMATE

The total estimated hours to complete this inspection for one COL licensee is 328 staff hours.

65001.23-04 REFERENCES

1. 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants”
2. Regulatory Guide 1.206, C.II.1.2.9, “Human Factors Engineering” and C.III.5, “Design Acceptance Criteria”
3. NUREG-0711, Rev 2, “Human Factors Engineering Program Review Model,” February, 2004.
4. NUREG-0800 (SRP), Section 14.3.9, “Human Factors Engineering - Inspections, Tests, Analyses, and Acceptance Criteria”
5. NUREG-0800 (SRP), Section 18, “Human Factors Engineering.”
6. NUREG-1793, Supplement 2, Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design, 2011 (ML112091878)
7. NUREG/CR-6393: Integrated System Validation: Methodology and Review Criteria (O'Hara et al., 1997)
8. Inspection Manual Chapter 0613, “Documenting 10 CFR Part 52 Construction and Test Inspections” (ML082490463).
9. ANSI/ANS 3.5 – 1998: Nuclear Power Plant Simulators for Use in Operator Training and Examination (American National Standards Institute, 1998)
10. ANSI/ANS 3.5 – 2009: Nuclear Power Plant Simulators for Use in Operator Training and Examination (American National Standards Institute, 2009)
11. IEC 1771: Nuclear Power Plants Main Control Rooms--Verification and Validation of Design (International Electrotechnical Commission, 1995).

65001.23-05 PROCEDURE COMPLETION

Implementation of this IP is complete when the planned sample of attributes for the specified appendices has been completed.

END

Attachment:
Revision History Sheet for IP 65001.23

Revision History Sheet for IP 65001.23

INSPECTION OF HUMAN FACTORS ENGINEERING INTEGRATED SYSTEM VALIDATION ITAAC

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number
N/A	ML12191A252 08/30/12 CN 12-019	Initial Issuance - To confirm by inspection that the combined license (COL) holder (licensee) has implemented a Human Factors Engineering (HFE) integrated system validation (ISV) for the main control room (MCR) and remote shutdown workstation (RSW) designs in accordance with the NRC approved ISV implementation plan. The inspection will be used to support an NRC finding as to whether the ISV implementation and results meet the acceptance criteria as stated in the HFE ISV Inspections, Tests, Analyses and Acceptance Criteria (ITAAC).	N/A	ML120930581