ELECTRIC POWER RESEARCH INSTITUTE

Highly-Integrated Control Rooms – Human Factors TWG Continued Tasks to Achieve Plan Goals

Highly-Integrated Control Rooms – Human Factors Meeting

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Washington, DC

Human Factors TWG Problem Statement

- Existing Human Factors Engineering review guidance, regulatory positions, and acceptance criteria could be modified or developed, as needed, **to facilitate consistent and efficient licensing** of new digital Human-System Interface technology at operating and new reactors and certain fuel facilities

Human Factors Issues Identified

- Minimum inventory of human system interfaces (HSIs) (e.g., alarms, controls, indicators, and procedures)
- Computerized procedures including related topics of automation and soft controls
- Graded approach to human factors engineering
- Safety parameter display system
- Human factors aspects of feasibility and reliability of available manual operator action time – support Diversity and Defense-in-Depth TWG
- Human factors aspects of use of multi-channel VDUs – support Communications TWG
- Human factors document matrix - support Licensing Process TWG

Human Factors Issued ISGs

- Highly-Integrated Control Room—Human Factors ISGs issued end of September
  - Minimum inventory
  - Computer-based procedures
- ISGs are a good step forward but do not go far enough to provide stable, consistent, and efficient licensing
- NRC and Industry needs to continue working together to:
  - Address the above two issues completely
  - Address other identified issues
- These and other topics addressed by this TWG involve human factors and I&C and relate to both Chapter 7 and 18

Minimum Inventory of Human System Interfaces Industry Guidance Report

- Clear up confusion regarding the use of the term minimum inventory
- Define minimum inventory of HSI as those needed beyond selectable HSIs provided on non safety-related, computer-based workstations normally used by operators to monitor and control the plant including:
  - The minimum set of HSIs that need to be implemented using safety-related equipment for accident mitigation and to achieve safe shutdown
  - The minimum set of HSIs that should be spatially dedicated and continuously visible
  - The HSIs needed (beyond the safety-related HSIs noted above) to support the plant's concept of operations for situations in which the HSIs normally used are failed or degraded

Minimum Inventory of Human System Interfaces Report Versus ISG

- Industry guidance report provides detailed criteria for establishing the minimum inventory and associated design requirements for different types of HSI resources
  - ISG primarily addresses the process for identifying minimum inventory and is very high level
- Industry report addresses I&C-oriented issues as well as HF issues related to minimum inventory
  - Important example: what HSIs must be safety-related
  - Both I&C and HF issues must be considered in design and regulatory review of minimum inventory HSIs
  - ISG addresses only HF related issues

Minimum Inventory of Human System Interfaces Report Versus ISG

- ISG states that minimum inventory HSIs should be “readily accessible” but gives no additional guidance on this
  - Industry guidance report provides more specific guidance
  - Identifies categories of HSIs that should be spatially dedicated and continuously visible (highest level of accessibility), or can be “one-step accessible”, or can be selectable
  - Determined on a case-by-case basis in previous reviews
- Industry guidance report identifies which safety-related HSIs are candidates for application of a graded approach to qualification
  - Graded approaches have been accepted in previous reviews on a case-by-case basis

Minimum Inventory of Human System Interfaces Report Versus ISG

- Industry guidance report addresses modification of existing plants as well as new plants
  - Plants undergoing substantial modification of I&C and control room will face similar issues to what new plant designers face regarding minimum inventory
  - ISG addresses only new plant designs
- Industry guidance report identifies the minimum set of procedures needed as part of minimum inventory
  - Identifies backup procedures needed when the procedures normally used are computerized on a non-safety platform
  - Procedures are not addressed in the ISG

Minimum Inventory of Human System Interfaces Report Status and Future Actions

- Draft submitted to NRC for comments end of May
- Discussions on minimum inventory during ISG development
- Revised version of the Minimum Inventory report sent to Human Factors Task Force for review mid October
- After comments resolved give new draft to NRC for comments and discussion (December)
- Goal is that NRC endorse this guidance as a replacement for the ISG for reviews of minimum inventory for both new plant designs and operating plant modifications

Computerized Procedures Industry Guidance Report

- Design and implementation guidance for computerized procedures and associated automation and soft controls with focus on MCR
- Includes normal operating procedures, abnormal operating procedures, alarm response procedures, surveillance test procedures, and/or emergency operating procedures
- Types of procedures
  - Paper-based procedures – not covered in report
  - Computerized procedures:
    - Electronic procedures
    - Computer-based procedures
    - Procedure-based automation

Computerized Procedures Report Versus ISG

- Industry guidance report addresses digital systems aspects of computerized procedures systems as well as HF aspects
  - Both must be addressed in design and licensing
  - ISG addresses only HF issues
- Industry report gives guidance on measures to protect against errors in computerized procedures systems
  - For example: data validation, operator verifications and cross-checks, QA and V&V
- Industry guidance report provides detailed guidance and criteria on procedure-based automation
  - ISG addresses automation only at a high level

Computerized Procedures Report Versus ISG

- Industry report provides more detailed guidance on configuration management for computerized procedures
  - Addresses how the computerized procedures system structures the procedure content and application software to support effective configuration management, a critical issue
- Industry guidance report tailors the guidance where appropriate based on different categories of computerized procedures
  - Categories correspond to the level of functionality provided, including automation
  - Allows the guidance to be more definitive and reduces uncertainty in applicability of the guidance

Computerized Procedures Report Status and Future Actions

- Issue talking points discussed with NRC end of May
- Discussions on computerized procedures with NRC during ISG development
- Draft of Computerized Procedures report sent to Task Force for review early October
- After comments resolved give draft to NRC for comments and discussion (December)
- Goal is NRC endorse this guidance as a replacement for the ISG for reviews of computerized procedures for both new plant designs and operating plant modifications

Graded Approach to Human Factors Engineering Report

- There currently is no clear guidance or acceptance criteria on a process to implement a graded approach to HFE
- Graded approach to HFE
  - Basis for grading
  - Grading categories
  - Application to eight of the NUREG-0711 program elements
- Accepted graded approach should be used when performing HFE activities as part of design effort to:
  - Ensure that all required HFE activities are performed at an appropriate level of rigor
  - Minimize unnecessary work
  - Focus regulatory and applicant resources where they are needed to meet safety and reliability goals

Graded Approach to Human Factors Engineering Report Status and Future Actions

- Graded approach issues' talking points discussed with NRC end of May
- Draft of Graded Approach report to be sent to Task Force for review mid December
- After comments resolved give draft to NRC for comments and discussion (late February - March)
- Goal is NRC endorse this guidance reviews of use of graded approach to HFE for both new plant designs and operating plant modifications

Safety Parameter Display System

- Agreement that SPDS does not have to be on a stand-alone console
- NRC action item

Acceptability of Manual Operator Actions as a Defensive Measure Report

- Clarification on the use of operator action as a defensive measure and corresponding acceptable operator action times
- Key human factors issues to be addressed
  - Define an acceptable methodology to be used in best estimate analyses for defining time expected for operator actions
  - Define an acceptable methodology to validate manual operator action times draft of Manual Operator Actions report sent to NRC for comments and discussion early August
- Draft Issued for NRC review early August

Human Factors Aspects of Use of Multi-Channel Control and Display Stations

- Key human factors issues
  - Multi-channel VDUs and safety related back-up system
    - Consistency and/or compatibility between HSIs
    - System response time
  - Degraded HSI operations (some covered by Minimum Inventory)
  - Operational/functional restrictions
    - If necessary based on Communications TWG
- Work on this not started

Human Factors Document Matrix

- Human factors document matrix (what documents required and when for modifications in operating plants) development to support Licensing Process TWG

Questions?

Backup Slides

Minimum Inventory of Human System Interfaces Report

- Describe a process that can be used to identify the minimum inventory HSIs and their design requirements, addressing both new plants and modification of operating plants
- Address in detail various design requirements for minimum inventory HSIs
- Discuss options for implementing the minimum inventory HSIs and provide associated guidance

Computerized Procedures Report

- Provide general design implementation guidelines for computerized procedures, addressing topics such as HFE design, quality assurance, verification and validation, configuration management, and transitioning to backup procedures
- Provide additional guidelines for the design of procedure-based automation, interaction between the operator and the automation, and automation hold points
- Provide guidelines for the design of soft controls that may be integrated with computerized procedures

Methodology for Using a Graded Approach to Human Factors Engineering Report

- Provide guidance for a methodology to apply a graded approach to the performance of HFE activities for large scale modifications to control rooms and other HSIs in operating plants and for the design of control rooms and HSIs for new plants
- Describe an approach to determine risk significance of the modification or new plant design
- Provide description of Level 2 and 3 activities for eight elements of HFE