

PROJECT PLAN - TWG #5

HIGHLY INTEGRATED CONTROL ROOM - HUMAN FACTORS

1. BACKGROUND:

Nuclear power plant personnel play a vital role in the productive, efficient, and safe generation of electric power, whether for conventional light water reactors (LWRs), advanced light water reactors (ALWRs), or fuel-cycle facilities. Operators monitor and control plant systems and components to ensure their proper functioning. Test and maintenance personnel help ensure that plant equipment is functioning properly and restore components when malfunctions occur. In order for them to accomplish their tasks safely they need access to accurate and timely information to maintain situation awareness, make informed decisions, and take appropriate actions. The role of the human factors engineering (HFE) regulatory review process is to ensure that the needed information is available.

ALWRs, LWRs with modernized control stations, and fuel-cycle facilities are expected to present new operational and maintenance environments due to the expanded use of digital systems. This could lead to concepts of operation and maintenance that are significantly different from conventional control rooms. New control rooms are expected to be fully computer-based, that is, fully digitized with computer displays and soft controls. Procedures are likely to be computerized and control actions may be taken directly from the procedure display or automated, with the operator only in the position to monitor and bypass the automation. Different training and qualifications may be required for the plant staff because of the need to focus on monitoring and bypassing automatic systems, rather than taking active control as they do now. Higher-levels of knowledge and training may be needed to respond to situations when automatic systems fail. These activities will pose new and challenging situations for operators and maintainers. Regulatory staff will need new tools, developed from the best available technical bases, to support licensing and oversight tasks. The ultimate goal is to minimize human error contribution to the risk associated with the design, construction, operation, testing, operations and maintenance of these new facilities.

Current regulations and guidance that address human performance issues were developed primarily for the review of conventional LWRs. New or revised regulations and guidance may need to be developed to address the new generation of control rooms. A sound technical basis needs to be developed as part of the guidance development process. The HFE aspects of new control stations should be developed, designed, and evaluated on the basis of a structured systems analysis using accepted HFE principles at the same time as other systems are being designed. The needs of personnel must be considered as a part of the system design from the initial concept development stage so that the role allocated to personnel is appropriate, as specified in regulatory review guidance such as, NUREG-0711; consensus standards from IEEE and ANS; and industry design guidance from NEI or EPRI.

2. SCOPE:

The scope of this effort is limited to human factors issues at ALWRs, conventional LWRs, and, where applicable, fuel-cycle facilities. The scope includes human-system interfaces, human to human interface and personnel issues, during design, construction, testing, operations, and maintenance of these facilities. Because of the cross-cutting nature of human factors, the Highly Integrated Control Rooms - Human Factors Task Working Group (TWG) will interface with all other Digital I&C TWGs. The following Human Factors problems, identified during the initial meetings of the Working Group, will be addressed:

3. PROBLEM STATEMENT:

Existing Human Factors Engineering (HFE) regulatory positions, review guidance, and acceptance criteria for the areas discussed below are obsolete, insufficiently detailed, subject to interpretation, or, in some cases, non-existent. Therefore, their application to new reactors, modernizing programs, and fuel facilities should be reviewed to determine applicability, modified as needed, or newly developed to facilitate the licensing of such facilities. The following should be addressed to resolve this issue:

- a. Minimum Inventory There is no clear guidance or acceptance criteria for the definition of minimum inventory for alarms, controls, and displays, nor an accepted process for its development.
- b. Procedures: Existing guidance and review criteria are not sufficiently detailed for review of procedures, including computerized procedures, or to determine their effect on safety.
- c. Manual Operator Actions: If credit for manual actions to replace failed digital systems is allowed by diversity and defense-in-depth guidance, a consistent and appropriate method is desired to demonstrate that operators can take timely and appropriate actions.
- d. Soft Controls: Additional guidance may be needed for the review of soft controls given advancing technology (to reflect current state-of-the-art and anticipated state-of-the-art in future designs).
- e. Emergency Response Capability: Current guidance and acceptance criteria for the review of the HFE aspects of the safety parameter display system may not be adequate for some adaptations to new digital systems.
- f. Role, Number, and Qualifications of Personnel: Review guidance and acceptance criteria for the role of personnel, including staffing levels, training and qualifications (e.g., 10CFR50.54, 10CFR50.120, 10CFR55, ANS-3.1, Reg. Guides 1.8 and 1.114), may need to be updated.

- g. Degraded Digital I&C: Current guidance and acceptance criteria for the review of the HFE aspects of I&C systems may not adequately address conditions where the I&C systems are degraded, as opposed to failed, such that the operator may not have sufficient situational awareness to be able to take appropriate action.
- h. Remote Shutdown Capability: Current guidance and acceptance criteria for the review of the HFE aspects of remote shutdown capability may need to be modified for totally digital systems where there may be unique features of the new system or if the capability of the system is enhanced.

4. DELIVERABLES:

- a. Interim guidance describing or clarifying the current regulatory guidance and acceptance criteria on each of the identified problem areas will be developed.
- b. A listing of regulatory guidance documents, industry standards, and regulations (if needed) that should be revised.
- c. Final guidance, acceptance criteria, and regulations (if needed) addressing each of the problem areas will be developed.
- d. Update the Standard Review Plan guidance to provide acceptable regulatory and licensing criteria for new reactors, modernized LWRs, and fuel facilities.

5. MILESTONES, ASSIGNMENTS AND DELIVERABLES:

NEAR-TERM					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fsct/Actual	Lead	Support
1 Minimum Inventory					
1a) Receive industry proposal on minimum inventory			F	NEI	N/A
1b) CRGR interaction (as needed)			F	NRC	N/A
1c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
1d) Receive public comments			F	NRC	N/A
1e) CRGR interaction (as needed)			F	NRC	N/A
1f) ACRS interaction (as needed)			F	NRC	NEI
1g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
2 Procedures					
2a) Receive industry white paper on computer-based procedures (Reference guidance - NUREG-0700, NUREG-0899, Reg. Guide 1.33, NUREG/CR -6634 & -6690, EPRI documents, ANS 3.2, IEC 964)			F	NEI	N/A
2b) CRGR interaction (as needed)			F	NRC	N/A
2c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
2d) Receive public comments			F	NRC	N/A
2e) CRGR interaction (as needed)			F	NRC	N/A
2f) ACRS interaction (as needed)			F	NRC	NEI

NEAR-TERM					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fsct/Actual	Lead	Support
2g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
3 Crediting Operator Actions					
3a) Receive industry white paper on use of manual actions to determine the most effective means to credit operator actions (Reference guidance ANS-58.8, NUREG-1852, NUREG-1764)			F	NEI	N/A
3b) CRGR interaction (as needed)			F	NRC	N/A
3c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
3d) Receive public comments			F	NRC	N/A
3e) CRGR interaction (as needed)			F	NRC	N/A
3f) ACRS interaction (as needed)			F	NRC	NEI
3g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
4 Soft Controls					
4a) Agree on definition of the term "soft controls" and how it is best used in the regulatory context			F	NRC	NEI
4b) CRGR interaction (as needed)			F	NRC	N/A
4c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
4d) Receive public comments			F	NRC	N/A
4e) CRGR interaction (as needed)			F	NRC	N/A
4f) ACRS interaction (as needed)			F	NRC	NEI

NEAR-TERM					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fsct/Actual	Lead	Support
4g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
5 Emergency Response Capability					
5a) Review safety parameter display system and related guidance to determine if gaps or inadequacies exist as related to digital systems to determine if 10CFR50.34(f) needs to be revised so that exemptions would not be needed to address SPDS and related functions			F	NRC	NEI
5b) CRGR interaction (as needed)			F	NRC	N/A
5c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
5d) Receive public comments			F	NRC	N/A
5e) CRGR interaction (as needed)			F	NRC	N/A
5f) ACRS interaction (as needed)			F	NRC	NEI
5g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
6 Role, Number, and Qualifications of Personnel					
6a) Review guidance and acceptance criteria for the role of personnel, including staffing levels, training and qualifications (e.g., 10CFR50.54, 10CFR50.120, 10CFR55, ANS-3.1, Reg. Guides 1.8 and 1.114) Establish scope of effort			F	NRC	NEI
6b) CRGR interaction (as needed)			F	NRC	N/A

NEAR-TERM					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fsct/Actual	Lead	Support
6c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
6d) Receive public comments			F	NRC	N/A
6e) CRGR interaction (as needed)			F	NRC	N/A
6f) ACRS interaction (as needed)			F	NRC	NEI
6g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
7 Degraded Digital I&C					
7a) Define the scope of the issues associated with degraded I&C systems and review existing guidance and industry documents to determine any potential gaps in guidance			F	NRC	NEI
7b) CRGR interaction (as needed)			F	NRC	N/A
7c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
7d) Receive public comments			F	NRC	N/A
7e) CRGR interaction (as needed)			F	NRC	N/A
7f) ACRS interaction (as needed)			F	NRC	NEI
7g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
8 Safe Shutdown Capability					

NEAR-TERM					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fsct/Actual	Lead	Support
8a) Review current regulations and guidance related to safe shutdown capability and determine if there are gaps and if there is a technical basis for changes to HFE			F	NRC	NEI
8b) CRGR interaction (as needed)			F	NRC	N/A
8c) Issue draft interim guidance if appropriate	✓		F	NRC	N/A
8d) Receive public comments			F	NRC	N/A
8e) CRGR interaction (as needed)			F	NRC	N/A
8f) ACRS interaction (as needed)			F	NRC	NEI
8g) Issue final interim guidance if appropriate	✓		F	NRC	N/A
LONG-TERM					
Revise consensus standards (e.g., EPRI, ANS, IEEE, IEC) if appropriate			F	NEI	N/A
Issue permanent regulatory guidance for milestones 1-8, if appropriate	✓		F	NRC	N/A