



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN
OFFICE OF NUCLEAR REACTOR REGULATION

18.0 HUMAN FACTORS ENGINEERING - INTRODUCTION

The Human Factors Engineering Branch (HFEB) has primary responsibility for review of the human factors engineering design of the main control room and of control centers outside of the main control room. Because of the close relationship of the human factors engineering aspects of plant staffing, shift composition, procedures and operating instructions to control station design, the HFEB will coordinate its reviews closely with those Branches having primary responsibility for Chapter 13 of the Standard Review Plan.

Following the accident at Three Mile Island Unit 2, the NRC staff developed an Action Plan, NUREG-0660, to provide a comprehensive and integrated plan to improve the safety of power reactors. Specific items from NUREG-0660 have been approved by the Commission for implementation at reactors and these were incorporated in NUREG-0737, dated October 31, 1980. Subsequently on December 17, 1982, the NRC staff issued Supplement 1 to NUREG-0737 which provided additional clarification on emergency response capabilities including the Detailed Control Room Design Review (DCRDR) and Safety Parameter Display System (SPDS).

Both the DCRDR and the SPDS address problems caused by the lack of emphasis on human factors engineering during the control room design process. The DCRDR is performed by licensees and applicants who have already designed their control room, to identify and correct human factors engineering design deficiencies. The SPDS is also part of the control room upgrade and provides operating personnel with a concentrated display of a minimum set of parameters which define the safety status of the plant. Applicants who have not developed a control room design or are in the very early stages of a control room design should be utilizing accepted human factors engineering principles during this process. Therefore, it is not specifically required that they perform a DCRDR as defined in Supplement 1 to NUREG-0737, and the function of a separate SPDS may be integrated into the overall control room design.

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Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

The human factors engineering (HFE) chapter of the SRP has been formatted to provide reviewer guidance for (a) licensees and applicants with existing or already designed control rooms and (b) applicants just starting the control room design process.

A section of the SRP is currently being developed which will include the SPDS. In addition, other SRP sections and/or appendices to Chapter 18 are under development which will establish positions on technical problems and questions of interpretation that have arisen during reviews of control station design. Table 18.0-1 identifies topics which are potential candidates for inclusion as SRP sections or appendices.

Table 18.0-1 Potential SRP Sections and/or Appendices to Chapter 18

1. Environment
 - Maintenance
 - Acoustics
 - Illumination
2. Multiunit Control Rooms
 - Degree of Similarity
 - Mirror Imaging
3. Control Room Workspace
 - Communications
 - Emergency Equipment
 - Storage
 - Habitability/Access
4. Annunciators
 - Types of Auditory Signals/Coding
 - Periodic Testing
 - First Out Panels
 - Color Coding
 - Prioritization
 - Functional Grouping
 - Tile Flash Rates
 - Controls and Locations
 - Normally "On" Tiles
 - Multi-Input Tiles
 - Alarm Operation and Diagnostic Procedures
 - "Out of Service" Alarm Tiles
 - "Blank" Tiles
 - "Dark" Board Concept
 - Alarm Tile, Matrix Identification
 - Bulb Replacement
 - Alarm Tile, Contrast
 - Labeling/Engraving
 - Auditory Alarm Frequency and Intensity (Preferred)
5. Panel Layout
 - Consistency & Standardization
 - Mirror-Imaging
 - Clusters of Displays or Controls
6. Visual Displays
 - Color Coding (Lights, Indicators, CRT, C/D Relationship, Subsystem Delineation)
 - Display Character Size vs Viewing Distance (Visual Angle)
 - Flash Coding (Lights, CRT)
 - Lamp Test
7. Controls
 - Primary Control Location (Definition of Primary Controls)
 - Coding of Controls
 - Accidental Activation
 - Controls - Outside the Control Room