CHAPTER 18
HUMAN FACTORS ENGINEERING

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CHAPTER 18
HUMAN FACTORS ENGINEERING

18.1 OVERVIEW

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.2 HUMAN FACTORS ENGINEERING PROGRAM MANAGEMENT

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

18.2.1.3 Applicable Facilities

Add the following information at the end of DCD Subsection 18.2.1.3:

VCS COL 18.2-2 The EOF and TSC communications strategies, as well as the EOF and TSC Human Factors attributes, are described in the Emergency Plan.

18.2.6 COMBINED LICENSE INFORMATION

18.2.6.2 Emergency Operations Facility

VCS COL 18.2-2 This COL item is addressed in Section 18.2.1.3.

18.3 OPERATING EXPERIENCE REVIEW

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.4 FUNCTIONAL REQUIREMENTS ANALYSIS AND ALLOCATION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.5 AP1000 TASK ANALYSIS IMPLEMENTATION PLAN

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.6 STAFFING

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

STD COL 18.6-1 Replace the DCD paragraph in Section 18.6 with the following information.

Table 13.1-201 contains the estimated staffing levels for those categories of personnel that are addressed by the Human Factors Engineering program per NUREG-0711, "Human Factors Engineering Program Review Model" (Reference 201), as follows:

- Licensed operators
- Shift Supervisors
- Non-licensed operators
- Shift technical advisors
- Instrumentation and control technicians
- Mechanical maintenance technicians
- Electrical maintenance technicians
- Radiation protection technicians
- Chemistry technicians
- Engineering support

The minimum level of staffing for control room personnel who directly monitor and control the plant is stated in Table 13.1-202 and meets the requirements of 10 CFR 50.54(m). Information about the staffing levels of security personnel is contained in the separately submitted physical security plan.

Qualification requirements of plant personnel listed above are discussed in Subsections 13.1.1.4, Qualifications of Technical Support Personnel, and 13.1.3, Qualification Requirements of Nuclear Plant Personnel, and, for security personnel, in the physical security plan.

The baseline level of staffing for the categories of personnel discussed above is derived from experience in current operating nuclear power plants. The number of personnel in operating plants has evolved over many years to a level that is safe and efficient and provides adequate personnel to operate the plant under all

conditions, including abnormal and emergency, meets regulatory requirements, and supports individual training and personal needs.

Iterative adjustments are implemented to the level of staffing, as necessary, based on findings and input from periodic reviews and staffing analysis. Input to this analysis includes information derived from the other elements of the human factors engineering program, particularly operating experience review, functional requirements analysis and function allocation, task analysis, human reliability analysis, human-system interface design, procedure development, and training program development.

In addition to the regulatory requirements referenced, input to the analyses and the level of staffing is provided by WCAP-14694, "Designer's Input to Determination of the AP600 Main Control Room Staffing Level" (DCD Section 18.6, Reference 1), AP1000 Combined License Technical Report APP-GW-GLR-010, "AP1000 Main Control Room Staff Roles and Responsibilities" (Reference 202), and EPRI Technical Report 1011717, "Program on Technology Innovation: Staff Optimization Scoping Study for New Nuclear Power Plants" (Reference 203).

18.6.1 COMBINED LICENSE INFORMATION ITEM

STD COL 18.6-1 This COL Item is addressed in Section 18.6.

18.6.2 REFERENCES

201. United States Nuclear Regulatory Commission, "Human Factors Engineering Program Review Model," NUREG-0711, Revision 2, February 2004.

202. Westinghouse, "AP1000 Main Control Room Staff Roles and Responsibilities," APP-GW-GLR-010, Rev. 2, June 2007.

203. EPRI, "Program on Technology Innovation: Staff Optimization Scoping Study for New Nuclear Power Plants," Technical Report 1011717, Final Report, August 2005.

18.7 INTEGRATION OF HUMAN RELIABILITY ANALYSIS WITH HUMAN FACTORS ENGINEERING

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.8 HUMAN SYSTEM INTERFACE DESIGN

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

18.8.3.5 Technical Support Center Mission and Major Tasks

Replace the last sentence of the first paragraph with the following:

VCS DEP 18.8-1 The Technical Support Center (TSC) location is described in the Emergency Plan.

18.8.3.6 Operations Support Center Mission and Major Tasks

Replace the last sentence of the first paragraph with the following:

VCS DEP 18.8-1 The Operations Support Center (OSC) location is described in the Emergency Plan.

18.9 PROCEDURE DEVELOPMENT

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.10 TRAINING PROGRAM DEVELOPMENT

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

Add the following paragraphs at the end of DCD subsection 18.10:

STD COL 18.10-1 Information regarding training program development is located in Section 13.2, Training. The training organization and roles and responsibilities of training personnel are discussed in Section 13.1, Organizational Structure of Applicant.

18.10.1 COMBINED LICENSE INFORMATION

STD COL 18.10-1 This COL Item is addressed in Section 18.10, 13.1 and 13.2.

18.11 HUMAN FACTORS ENGINEERING VERIFICATION AND VALIDATION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.12 INVENTORY

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.13 DESIGN IMPLEMENTATION

This section of the referenced DCD is incorporated by reference with no departures or supplements.

18.14 HUMAN PERFORMANCE MONITORING

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

Replace the DCD paragraph with the following text.

STD COL 18.14-1 Human performance monitoring applies after the plant is placed in operation. The human performance monitoring process implements the guidance and methods as described in DCD Section 18.14 Reference 1.

The human performance monitoring process provides reasonable assurance that:

- The design can be effectively used by personnel, including within the control room and between the control room and local control stations and support centers.
- Changes made to the human system interface(s), procedures, and training do not have adverse effects on personnel performance, (e.g., a change does not interfere with previously trained skills).
- Human actions can be accomplished within time and performance criteria.
- The acceptable level of performance established during the design integrated system validation is maintained.

The human performance monitoring process is structured such that:

- Human actions are monitored commensurate with their safety importance.
- Feedback of information and corrective actions are accomplished in a timely manner.
- Degradation in performance can be detected and corrected before plant safety is compromised (e.g., by use of the plant simulator during training exercises).

The human performance monitoring process for risk-informed changes is integrated into the corrective action program, training program and other programs as appropriate. Identified human performance conditions/issues are evaluated for human factors engineering applicability.

Human factors engineering conditions are assigned specific human factors cause determination codes, trended for indications of degraded performance or potential human performance failures and have specific corrective actions identified.

The cause investigation:

- Identifies the cause of the failure or degraded performance to the extent that corrective action can be taken consistent with the corrective action program requirements.

- Addresses failure significance which includes the circumstances surrounding the failure or degraded performance, the characteristics of the failure, and whether the failure is isolated or has generic or common cause implications.

- Identifies and establishes corrective actions necessary to preclude the recurrence of unacceptable failures or degraded performance in the case of a significant condition adverse to quality.

When appropriate, design changes are integrated into training exercises to monitor for degradation in performance and allow for early detection and corrective actions before plant safety is challenged (e.g., by use of the plant simulator during training exercises).

Plant or personnel performance under actual design conditions may not be readily measurable. When actual conditions cannot be simulated, monitored, or measured, the available information that most closely approximates performance data in actual conditions should be used.

Monitoring strategies for human performance trending after the implementation of design changes is capable of demonstrating that performance is consistent with that assumed in the various analyses conducted to justify the change.

Risk-informed changes are screened commensurate with their safety importance to determine if the change requires monitoring of actions. For changes which require monitoring, the appropriate monitoring requirements are determined and implemented in the training program or other program as appropriate.