

18.0 HUMAN FACTORS ENGINEERING

18.1 Introduction

Human Factors Engineering (HFE) describes the human system interface (HSI) design development, the HSI design goals and bases, the standard HSI design features and the detailed HSI design and implementation process, with embedded design acceptance criteria, for the Economic Simplified Boiling-Water Reactor (ESBWR). The incorporation of HFE principles into all phases of the design of these interfaces is also discussed.

18.2 Summary of Application

Chapter 18 of the North Anna 3 Combined License (COL) Final Safety Analysis Report (FSAR) Revision 1 incorporates by reference, with no departures and one supplement, Chapter 18, "Human Factors Engineering" of Revision 5 of the ESBWR Design Control Document (DCD).

In addition, in FSAR Section 18.13, "Human Performance Monitoring," the applicant provided the following supplement information:

COL Item

- STD COL 18.13-1-H Milestone for Human Performance Monitoring (HPM) Implementation.

The COL Holder is responsible to provide a milestone for the implementation of the HPM program. The applicant indicated that an HPM program will be implemented prior to the beginning of the first licensed operator training class.

18.3 Regulatory Basis

The regulatory basis of the information incorporated by reference and the supplemental information presented in this application is addressed in Chapter 18 of the Final Safety Evaluation Report (FSER) related to the ESBWR DCD.

18.4 Technical Evaluation

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed Chapter 18 of the North Anna 3 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic.¹ The NRC staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information related to HFE.

Chapter 18 of the ESBWR DCD is being reviewed by the staff on Docket No. 52-010. The NRC staff's technical evaluation of the information incorporated by reference related to general HFE program and scope will be documented in the staff safety evaluation report (SER) on the design certification application for the ESBWR design.

¹ See Section 1.2.2, "Finality of Referenced NRC Approvals," for a discussion on the staff's review related to verification of the scope of information to be included within a COL application that references a design certification.

The staff reviewed the information contained in the COL FSAR:

COL Item

- COL STD 18.13-1-H Milestone for HPM Implementation.

The applicant stated that an HPM program will be implemented prior to the beginning of the first licensed operator training class.

The ESBWR DCD Revision 5, Section 18.13.3 states the strategy for this COL Holder Item is implemented through the use of a representative training simulator during periodic training exercises.

By implementing the monitoring program at the beginning of the first licensing class, the COL applicant has selected the earliest opportunity subsequent to the completion of the HFE design verification and validation to begin collecting performance information. Senior reactor operator/reactor operator licensing requires the use of a full scope simulator to develop and demonstrate operating competencies. This implements the DCD methodology and ensures simulated design conditions are used to evaluate human performance. Timely initiation of the HPM program using a plant reference simulator provides reasonable assurance that any degradation in performance will be detected and corrected before plant safety is compromised.

18.5 Post Combined License Activities

There are no post COL activities related to this chapter.

18.6 Conclusions

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to HFE and there is no outstanding information expected to be addressed in the COL FSAR related to this subsection.

The staff is reviewing the information in ESBWR DCD Chapter 18 on Docket No. 52-010. The results of the NRC staff's technical evaluation of the information related to the HFE incorporated by reference in the North Anna 3 COL FSAR will be documented in the staff SER on the design certification application for the ESBWR. The SER on the ESBWR is not yet complete, and this is being tracked as Open Item 1-1. The staff will update Chapter 18 of this SER to reflect the final disposition of the DC application.

The NRC staff concludes that the information pertaining to the COL Holder Item has been addressed satisfactorily. The applicant provided an acceptable schedule for implementation of the HPM program, starting with the first license class. The NRC finds that there is a reasonable assurance that any performance degradation will be detected and corrected before plant safety is compromised.