

18.0 HUMAN FACTORS ENGINEERING

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18.0 HUMAN FACTORS ENGINEERING

18.1 Introduction

This chapter of the U.S. Nuclear Regulatory Commission's (NRC's) safety evaluation report (SER) provides the NRC staff evaluation of the proposed North Anna 3 Human Factors design. This includes 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).

18.2 Summary of Application

Chapter 18 of the North Anna 3 Combined License (COL) Final Safety Analysis Report (FSAR), Revision 9, incorporates by reference, with no departures and one supplement, Chapter 18 of Revision 10 of the Design Control Document (DCD) for the Economic Simplified Boiling-Water Reactor (ESBWR), referenced in Appendix E to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." In addition, in FSAR Chapter 18, the applicant provides the following:

COL Item

- STD COL 18.13-1-A Milestone for Human Performance Monitoring Implementation.

The COL applicant is responsible for providing a milestone for the implementation of the Human Performance Monitoring (HPM) Program. The applicant indicates that a HPM Program will be implemented prior to the beginning of the first licensed operator training class.

18.3 Regulatory Basis

The regulatory basis for the information incorporated by reference is in NUREG-1966, "Final Safety Evaluation Report Related to the Certification of the Economic Simplified Boiling-Water Reactor Standard Design." In addition, the relevant requirements of the Commission regulations for human factors engineering (HFE), and the associated acceptance criteria, are in Chapter 18 of NUREG-0800, "Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)."

18.4 Technical Evaluation

As documented in NUREG-1966, "Final Safety Evaluation Report Related to the Certification of the ESBWR Standard Design," the staff reviewed and approved Chapter 18 of the certified ESBWR DCD. The staff reviewed Chapter 18 of the North Anna 3 COL FSAR and checked the referenced ESBWR DCD to ensure that the combination of the information in the COL FSAR and the information in the ESBWR DCD represents the complete scope of information relating to this review topic.¹ The staff's review confirmed that the information in the application and the information incorporated by reference addresses the required information related to HFE.

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

The staff reviewed the information in the North Anna 3 COL FSAR as follows:

COL Item

- STD COL 18.13-1-A Milestone for Human Performance Monitoring Implementation.

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

In ESBWR DCD, Revision 10, Section 18.13.3, "Elements of Human Performance Monitoring Process" states that the HPM strategy is implemented through the use of a representative training simulator during periodic training exercises.

Senior reactor operator and reactor operator licensing requires the use of a full scope training simulator to develop and demonstrate operating competencies. 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. Accordingly, the staff finds that the applicant has adequately addressed this COL item.

18.5 Post Combined License Activities

- STD COL 18.13-1-A Milestone for Human Performance Monitoring Implementation.

The HPM Program will be implemented prior to the beginning of the first licensed operator training class.

18.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff finds that the application includes all the information relevant to the North Anna 3 HFE design, and the staff confirmed that no outstanding information related to this section remains to be addressed in the COL FSAR. The staff's finding related to information incorporated by reference is in NUREG-1966.

In addition, the staff compared the additional COL information in the application to the relevant NRC regulations, the guidance in SRP Chapter 18, and other NRC regulatory guides. The staff concluded that the applicant has adequately addressed COL Item STD COL18.13-1-A.

References

1. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."
2. 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."
3. 10 CFR Part 52, Appendix E, "Design Certification Rule for the ESBWR Design."
4. NRC Staff NUREG-0800, "Standard Review Plan [SRP] for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)," March 2007 (ADAMS Accession No. ML070660036).
5. NRC Staff NUREG-1966, "Final Safety Evaluation Report Related to the Certification of the Economic Simplified Boiling-Water Reactor Standard Design," April 2014, and Supplement 1, September 2014 (ADAMS Accession Nos. ML14099A519, ML14099A522, ML14099A532, ML14100A187, ML14100A190, ML14100A194, ML14265A084).