

CHAPTER 18—HUMAN FACTORS ENGINEERING TABLE OF CONTENTS

18.0	HUMAN FACTORS ENGINEERING.....	18.1-1
18.1	Human Factors Engineering Program Management.....	18.1-1
18.1.1	Human Factors Engineering Program Goals, Assumptions and Constraints, and Scope	18.1-1
18.1.1.1	Goals	18.1-1
18.1.1.2	Assumptions and Constraints.....	18.1-1
18.1.1.3	Applicable U.S. EPR Facilities	18.1-1
18.1.1.4	Applicable Human System Interfaces	18.1-2
18.1.1.5	Applicable Plant Personnel	18.1-2
18.1.1.6	Effects of Modifications on Personnel Performance.....	18.1-3
18.1.2	Human Factors Engineering and Control Room Design Team Organization	18.1-3
18.1.3	Human Factors Engineering Processes and Procedures.....	18.1-3
18.1.3.1	Design Process Management Tools	18.1-3
18.1.3.2	Integration of HFE with Other Plant Design Activities	18.1-4
18.1.3.3	HFE Program Milestones	18.1-5
18.1.3.4	HFE Documentation	18.1-5
18.1.3.5	Subcontractor HFE Efforts	18.1-5
18.1.4	Human Factors Engineering Issues Tracking.....	18.1-5
18.1.5	Technical Program	18.1-6
18.1.5.1	HFE Program Process Drawing	18.1-6
18.1.5.2	Relationship Between HFE and Other Engineering Disciplines	18.1-7
18.1.5.3	HFE Program Element Documentation	18.1-7
18.1.6	References	18.1-7
18.2	Operating Experience Review.....	18.2-1
18.2.1	Objectives and Scope.....	18.2-1
18.2.2	Methodology	18.2-1

18.2.3	Evaluation of Results	18.2-2
18.2.4	References	18.2-2
18.3	Functional Requirements Analysis and Functional Allocation	18.3-1
18.3.1	Objectives and Scope.....	18.3-1
18.3.2	Functional Requirement Analysis Methodology and Results Summary	18.3-1
18.3.3	Functional Allocation Methodology and Results Summary	18.3-3
18.3.4	Changes to Functional Analysis or Allocation	18.3-4
18.3.5	References	18.3-4
18.4	Task Analysis	18.4-1
18.4.1	Task Analysis Objectives and Scope	18.4-1
18.4.2	Task Analysis Methodology	18.4-1
18.4.3	Results Summary	18.4-2
18.4.4	References	18.4-3
18.5	Staffing and Qualifications.....	18.5-1
18.5.1	Objectives and Scope of Analysis	18.5-1
18.5.2	Staffing and Qualifications Analysis Methodology.....	18.5-2
18.5.3	Results.....	18.5-2
18.5.4	References	18.5-2
18.6	Human Reliability Analysis	18.6-1
18.6.1	Objectives and Scope of HRA / HFE Integration.....	18.6-1
18.6.2	Methodology	18.6-1
18.6.3	Results.....	18.6-2
18.6.4	References	18.6-3
18.7	Human System Interface Design.....	18.7-1
18.7.1	Human System Interface Design Inputs	18.7-1
18.7.1.1	Analysis of Personnel Task Requirements.....	18.7-1
18.7.1.2	System Requirements	18.7-4
18.7.1.3	Regulatory Requirements.....	18.7-7
18.7.1.4	Other Requirements	18.7-10
18.7.2	Concept of Operations.....	18.7-10
18.7.2.1	Crew Composition	18.7-10
18.7.2.2	Roles and Responsibilities of Crew Members.....	18.7-10
18.7.2.3	Personnel Supervision of Plant Automation	18.7-11
18.7.2.4	Use of Main Control Room	18.7-11

18.7.2.5	Crew Member Coordination Methods.....	18.7-11
18.7.3	Functional Requirements Specification	18.7-13
18.7.4	HSI Concept Design	18.7-13
18.7.4.1	Safety Parameter Display System.....	18.7-13
18.7.4.2	Operation and Control Centers System	18.7-14
18.7.4.3	Inventory of Alarms, Displays, and Controls	18.7-14
18.7.4.4	Minimum Inventory of Main Control Room Alarms, Displays, and Controls	18.7-14
18.7.4.5	Remote Shutdown Station Alarms, Displays, and Controls	18.7-15
18.7.4.6	Computer-Based Procedures.....	18.7-16
18.7.5	Guidance for Local Control Station Design	18.7-16
18.7.5.1	Plant Layout Design and Equipment Accessibility.....	18.7-16
18.7.5.2	Coding, Language, and Information Presentation	18.7-16
18.7.5.3	Lighting of the Control Rooms and Workspaces.....	18.7-17
18.7.5.4	Acoustic Environment.....	18.7-17
18.7.5.5	Personnel Protection Equipment.....	18.7-17
18.7.5.6	Ambient Conditions	18.7-17
18.7.6	HSI Detailed Design and Integration	18.7-18
18.7.6.1	HSI Style Guide.....	18.7-18
18.7.6.2	HSI Considerations and Demands on Operators	18.7-20
18.7.6.3	HSI Modifications	18.7-21
18.7.7	HSI Verification and Validation (Tests and Evaluations)	18.7-21
18.7.8	HSI Design Results and Documentation	18.7-22
18.7.9	References	18.7-22
18.8	Procedure Development.....	18.8-1
18.9	Training Program Development	18.9-1
18.10	Verification and Validation.....	18.10-1
18.10.1	Objectives.....	18.10-1
18.10.2	Scope	18.10-1
18.10.3	Methodology.....	18.10-2

18.10.3.1	Operational Conditions Sampling.....	18.10-3
18.10.3.2	HSI Inventory and Characterization	18.10-6
18.10.3.3	HSI Task Support Verification	18.10-7
18.10.3.4	Design Verification	18.10-8
18.10.3.5	Integrated System Validation	18.10-9
18.10.3.6	Human Engineering Discrepancy Resolution.....	18.10-16
18.10.3.7	Results	18.10-17
18.10.4	References.....	18.10-18
18.11	Design Implementation.....	18.11-1
18.11.1	Objectives and Scope	18.11-1
18.11.2	Methodology.....	18.11-1
18.11.2.1	Aspects of the Design Not Verified During the V&V Process	18.11-2
18.11.2.2	Verification of the As-Built HSIs	18.11-2
18.11.3	Verification that HFE Issues Tracking Database Items Have Been Addressed.....	18.11-2
18.11.4	Results Summary	18.11-3
18.11.5	References	18.11-3
18.12	Human Performance Monitoring	18.12-1
18.12.1	Objectives and Scope	18.12-1
18.12.2	Methodology.....	18.12-2
18.12.2.1	Corrective Action Program and Issue Tracking.....	18.12-2
18.12.2.2	Design Change Process.....	18.12-3
18.12.2.3	Performance Indicators	18.12-3
18.12.2.4	Probabilistic Risk Assessment	18.12-4
18.12.2.5	Existing Plant Maintenance and Inspection Programs.....	18.12-4
18.12.3	Results Summary	18.12-5
18.12.4	References.....	18.12-5