

**Chapter 7
Table of Contents**

List of Tables v

List of Figures vii

7.0 Instrumentation and Control Systems 7.1-1

7.1 Introduction 7.1-1

 7.1.1 Identification of Safety-Related Systems 7.1-1

 7.1.1.1 General 7.1-1

 7.1.1.2 Safety System Logic and Control (SSLC) 7.1-1

 7.1.1.3 Reactor Trip System 7.1-14

 7.1.1.4 Engineered Safety Features (ESF) Systems 7.1-14

 7.1.1.5 Safe Shutdown Systems 7.1-16

 7.1.1.6 Information Systems Important to Safety 7.1-17

 7.1.1.7 Interlock System Important to Safety 7.1-17

 7.1.1.8 Control Systems 7.1-17

 7.1.1.9 Diverse Instrumentation and Control Systems 7.1-18

 7.1.1.10 Data Communication Systems 7.1-18

 7.1.2 Identification of Safety Criteria 7.1-18

 7.1.2.1 General 7.1-18

 7.1.2.2 Reactor Protection System (RPS)—Instrumentation and Controls 7.1-26

 7.1.2.3 Engineered Safety Features (ESF) 7.1-28

 7.1.2.4 Safe Shutdown Systems—Instrumentation and Controls 7.1-34

 7.1.2.5 Information Systems Important to Safety 7.1-36

 7.1.2.6 Interlock Systems Important to Safety 7.1-38

 7.1.2.7 Control Systems 7.1-39

 7.1.2.8 Diverse Instrumentation and Control Systems 7.1-43

 7.1.2.9 Data Communication Systems 7.1-44

 7.1.2.10 Conformance to Regulatory Requirements 7.1-45

 7.1.2.11 Conformance to Regulatory Guides 7.1-45

 7.1.2.12 Conformance to Industry Standards 7.1-50

 7.1.2.13 Conformance to Branch Technical Positions 7.1-51

 7.1.2.14 Conformance to TMI Action Plan Requirements 7.1-52

 7.1.2.15 Additional Design Consideration Analyses 7.1-52

7.2 Reactor Trip System—Instrumentation and Controls 7.2-1

 7.2.1 Description 7.2-1

 7.2.1.1 System Description 7.2-1

 7.2.1.2 Design Bases 7.2-21

 7.2.2 Conformance Analysis 7.2-24

 7.2.2.1 Conformance to Design Bases Requirements 7.2-24

 7.2.2.2 Conformance to Regulatory Codes, Guides, and Standards 7.2-30

 7.2.2.3 Additional Design Considerations Analyses 7.2-45

7.3 Engineered Safety Feature Systems, Instrumentation and Control 7.3-1

 7.3.1 Description 7.3-1

 7.3.1.1 Systems Descriptions 7.3-1

Table of Contents (Continued)

	7.3.1.2	Design Basis Information	7.3-60
	7.3.1.3	System Drawings	7.3-63
7.3.2	Analysis		7.3-63
	7.3.2.1	Emergency Core Cooling Systems—Instrumentation and Controls	7.3-63
	7.3.2.2	Leak Detection and Isolation System—Instrumentation and Controls	7.3-69
	7.3.2.3	RHR/Wetwell and Drywell Spray Cooling Mode	7.3-72
	7.3.2.4	RHR/Suppression Pool Cooling Mode—Instrumentation and Controls	7.3-75
	7.3.2.5	Standby Gas Treatment System—Instrumentation and Controls	7.3-78
	7.3.2.6	Emergency Diesel Generator Support Systems—Instrumentation and Control	7.3-80
	7.3.2.7	Reactor Building Cooling Water System and Reactor Building Service Water System Instrumentation and Controls	7.3-82
	7.3.2.8	Essential HVAC Systems—Instrumentation and Control	7.3-84
	7.3.2.9	Emergency Chilled Water System	7.3-86
	7.3.2.10	Nitrogen Supply System (N ₂)— Instrumentation and Controls	7.3-88
	7.3.2.11	Flammability Control System (FCS)—Instrumentation and Controls	7.3-90
	7.3.2.12	Additional Design Considerations Analyses	7.3-92
	7.3.2.13	Periodic Testing of ESF Instrumentation	7.3-92
7.3.3	References		7.3-92
7.4	Safe Shutdown Systems		7.4-1
	7.4.1	Description	7.4-1
	7.4.1.1	Reactor Shutdown Cooling (SDC) Mode—Instrumentation and Controls	7.4-1
	7.4.1.2	Remote Shutdown System (RSD)	7.4-4
	7.4.1.3	Standby Liquid Control System (SLC)— Instrumentation and Controls	7.4-11
7.4.2	Analysis		7.4-16
	7.4.2.1	Reactor Shutdown Cooling (SDC) Mode — Instrumentation and Controls	7.4-16
	7.4.2.2	Remote Shutdown System—Instrumentation and Controls	7.4-19
	7.4.2.3	Standby Liquid Control System — Instrumentation and Controls	7.4-22
7.5	Information Systems Important to Safety		7.5-1
	7.5.1	Systems Descriptions	7.5-1
	7.5.1.1	Post Accident Monitoring System (PAM)	7.5-1
	7.5.1.2	Process Radiation Monitoring System (PRM) — Instrumentation and Controls	7.5-4
	7.5.1.3	Containment Monitoring System — Instrumentation and Controls	7.5-5
7.5.2	Systems Analysis		7.5-7
	7.5.2.1	Post Accident Monitoring System (PAM)	7.5-7

Table of Contents (Continued)

7.5.2.2	Process Radiation Monitoring System — Instrumentation and Controls	7.5-16
7.5.2.3	Containment Monitoring System (CMS) — Instrumentation and Controls	7.5-18
7.5.3	References	7.5-21
7.6	Interlock Systems Important to Safety	7.6-1
7.6.1	Description Analysis	7.6-1
7.6.1.1	High Pressure/Low Pressure Systems Interlock Protection Functions	7.6-1
7.6.1.2	Wetwell-to-Drywell Vacuum Breaker Interlocks	7.6-3
7.6.2	Description/Analysis	7.6-3
7.6.2.1	High Pressure/Low Pressure Systems Interlock Function	7.6-3
7.6.2.2	Atmospheric Control Systems Vacuum Breaker Interlocks	7.6-6
7.7	Control Systems	7.7-1
7.7.1	Description	7.7-1
7.7.1.1	Main Steam System (MS) — Reactor Vessel Instrumentation	7.7-1
7.7.1.2	Rod Control and Information System (RCIS)—Instrumentation and Controls	7.7-7
7.7.1.3	Recirculation Flow Control System — Instrumentation and Controls	7.7-27
7.7.1.4	Feedwater Control System (FWC)—Instrumentation and Controls	7.7-37
7.7.1.5	Process Computer System (PCS)—Instrumentation and Controls	7.7-42
7.7.1.6	Neutron Monitoring System (NMS)—Instrumentation and Controls	7.7-50
7.7.1.7	Automatic Power Regulator System (APR)	7.7-62
7.7.1.8	Steam Bypass and Pressure Control System	7.7-65
7.7.1.9	Fuel Pool Cooling and Cleanup System (FPCU)—Instrumentation and Controls	7.7-69
7.7.1.10	Auxiliary Fuel Pool Cooling and Cleanup (AFPC) System—Instrumentation and Controls	7.7-71
7.7.2	Analysis	7.7-72
7.7.2.1	Main Steam (MS) System — Reactor Vessel Instrumentation	7.7-72
7.7.2.2	Rod Control and Information System (RCIS)—Instrumentation and Controls	7.7-73
7.7.2.3	Recirculation Flow Control System (RFC)— Instrumentation and Controls	7.7-74
7.7.2.4	Feedwater Control System (FWC)—Instrumentation and Controls	7.7-75
7.7.2.5	Process Computer System (PCS)—Instrumentation and Controls	7.7-76
7.7.2.6	Neutron Monitoring System (NMS)—Instrumentation and Controls	7.7-76
7.7.2.7	Automatic Power Regulator System (APR)—Instrumentation and Control	7.7-81

Table of Contents (Continued)

7.7.2.8 Steam Bypass and Pressure Control System (SBPC)— Instrumentation and Controls.....7.7-82

7.7.2.9 Fuel Pool Cooling and Cleanup System (FPCU)—Instrumentation and Control7.7-82

7.7.2.10 Auxiliary Fuel Pool Cooling and Cleanup System (AFPC)— Instrumentation and Control.....7.7-83

7.8 Diverse Instrumentation and Control Systems7.8-1

7.8.1 Description7.8-1

7.8.1.1 ATWS Mitigation7.8-1

7.8.1.2 Diverse Manual Controls and Displays7.8-4

7.8.1.3 Common Mode Failure Defenses within Safety System Design7.8-6

7.8.2 Conformance Analysis7.8-9

7.8.2.1 Conformance to NRC Document SECY-93-087.....7.8-9

7.8.2.2 Specific Regulatory Requirements Conformance7.8-9

7.9 Data Communication Systems7.9-1

7.9.1 Description7.9-1

7.9.1.1 Multiplexing System.....7.9-1

7.9.2 Analysis7.9-12

7.9.2.1 Data Communications Systems - Multiplexing System.....7.9-12