

CHAPTER 7—INSTRUMENTATION AND CONTROLS

TABLE OF CONTENTS

7.0	INSTRUMENTATION AND CONTROLS	7.1-1
7.1	Introduction.....	7.1-1
7.1.1	U.S. EPR I&C Systems	7.1-5
7.1.1.1	Overview	7.1-5
7.1.1.2	Use of TELEPERM XS in the U.S. EPR.....	7.1-7
7.1.1.3	DCS HMI Systems	7.1-13
7.1.1.4	DCS Automation Systems.....	7.1-26
7.1.1.5	Black Box I&C Systems.....	7.1-56
7.1.1.6	DCS Design Principles	7.1-67
7.1.2	Response Time	7.1-83
7.1.3	Identification of Safety Criteria.....	7.1-84
7.1.3.1	Compliance with 10 CFR 50.....	7.1-85
7.1.3.2	Compliance with 10 CFR 50, Appendix A GDC	7.1-87
7.1.3.3	Conformance to Staff Requirements Memoranda... ..	7.1-91
7.1.3.4	Conformance to Regulatory Guides	7.1-92
7.1.3.5	Conformance to Branch Technical Positions	7.1-96
7.1.3.6	Compliance with IEEE Std 603-1998	7.1-99
7.1.4	References	7.1-115
7.2	Reactor Trip System.....	7.2-1
7.2.1	Description.....	7.2-1
7.2.1.1	System Description	7.2-1
7.2.1.2	Reactor Trip Functional Description	7.2-3
7.2.1.3	Permissive Signal Functional Description	7.2-17
7.2.2	Analysis	7.2-22
7.2.2.1	Design Basis Information	7.2-22
7.2.2.2	Failure Modes and Effects Analysis	7.2-24
7.2.2.3	Compliance with and Conformance to Applicable Criteria.....	7.2-24

7.2.3	References	7.2-27
7.3	Engineered Safety Features Systems.....	7.3-1
7.3.1	Description.....	7.3-1
7.3.1.1	System Description	7.3-1
7.3.1.2	Engineered Safety Features Actuation Functional Descriptions.....	7.3-3
7.3.1.3	Engineered Safety Features Control Functional Descriptions.....	7.3-28
7.3.1.4	Essential Auxiliary Support Controls Functional Descriptions.....	7.3-32
7.3.2	Analysis	7.3-37
7.3.2.1	Design Basis Information	7.3-37
7.3.2.2	Failure Modes and Effects Analysis	7.3-39
7.3.2.3	Compliance with and Conformance to Applicable Criteria.....	7.3-39
7.3.3	References	7.3-43
7.4	Systems Required For Safe Shutdown	7.4-1
7.4.1	Description.....	7.4-1
7.4.1.1	I&C Systems Associated with Safe Shutdown	7.4-1
7.4.1.2	Safe Shutdown Using Safety-Related Systems and Equipment	7.4-3
7.4.1.3	Post-fire Safe Shutdown Systems.....	7.4-5
7.4.1.4	Station Blackout Safe Shutdown	7.4-8
7.4.2	Analysis	7.4-8
7.4.2.1	Compliance with General Design Criteria	7.4-8
7.4.2.2	Compliance with 10 CFR 50.55 a(h) and IEEE Std 603.....	7.4-9
7.4.2.3	Remote Shutdown Capability	7.4-11
7.4.2.4	Loss of Plant Instrument Air Systems	7.4-11
7.4.2.5	Loss of Cooling Water to Vital Equipment.....	7.4-11
7.4.2.6	Turbine Trip and Plant Load Rejection.....	7.4-11
7.4.3	References	7.4-11
7.5	Information Systems Important to Safety	7.5-1
7.5.1	Description.....	7.5-1
7.5.1.1	Annunciator Systems	7.5-1

7.5.1.2	Post-Accident Monitoring Instrumentation.....	7.5-1
7.5.1.3	Emergency Response Information	7.5-2
7.5.1.4	Bypass and Inoperable Status Indication	7.5-2
7.5.2	Analysis	7.5-2
7.5.2.1	Acceptance Criteria	7.5-3
7.5.2.2	Discussion	7.5-5
7.5.3	References	7.5-9
7.6	Interlock Systems Important to Safety.....	7.6-1
7.6.1	Description.....	7.6-1
7.6.1.1	System Description	7.6-1
7.6.1.2	Functional Descriptions	7.6-2
7.6.2	Analysis	7.6-12
7.6.2.1	Compliance with Applicable Criteria	7.6-12
7.6.3	References	7.6-14
7.7	Control Systems Not Required for Safety	7.7-1
7.7.1	Description.....	7.7-1
7.7.1.1	I&C Systems Related to Core Control.....	7.7-2
7.7.1.2	I&C Systems Related to Plant Control	7.7-3
7.7.2	Design Basis Information.....	7.7-3
7.7.2.1	Operational Core Control Functions.....	7.7-3
7.7.2.2	Operational Plant Control Functions	7.7-7
7.7.2.3	Process Limitation I&C Functions	7.7-11
7.7.2.4	Non-Safety Control Systems Described in Other Sections.....	7.7-25
7.7.2.5	Safety Classification	7.7-25
7.7.2.6	Effects of Control System Operation Upon Accidents.....	7.7-25
7.7.2.7	Effects of Control System Failures	7.7-25
7.7.2.8	Environmental Control System.....	7.7-27
7.7.2.9	Independence.....	7.7-27
7.7.2.10	Interactions between Safety-Related and Non- Safety-Related I&C Systems.....	7.7-27
7.7.2.11	Defense in Depth and Diversity.....	7.7-27
7.7.2.12	Potential for Inadvertent Actuation	7.7-27



7.7.2.13	Control of Access	7.7-28
7.7.3	Analysis	7.7-28
7.7.4	References	7.7-28
7.8	Diverse I&C Systems	7.8-1
7.8.1	Description.....	7.8-1
7.8.1.1	Systems Description.....	7.8-1
7.8.1.2	Functional Descriptions.....	7.8-4
7.8.2	Analysis	7.8-7
7.8.2.1	Regulatory Requirements.....	7.8-7
7.8.3	References	7.8-8
7.9	Data Communication Systems.....	7.9-1