

TABLE OF CONTENTS

7.0 CONTROL AND INSTRUMENTATION

7.1	Summary Description	7.1-1
7.1.1	Safety Systems	7.1-1
7.1.2	Power Generation Systems	7.1-2
7.1.3	Safety Functions	7.1-2
7.1.4	Plant Operational Control	7.1-4
7.1.5	Definitions	7.1-5
7.1.6	Environmental Qualification of Electrical Equipment	7.1-6
7.2	Reactor Protection System	7.2-1
7.2.1	Safety Objective	7.2-1
7.2.2	Safety Design Basis	7.2-1
7.2.3	Description	7.2-3
7.2.4	Safety Evaluation	7.2-16
7.2.5	Inspection and Testing	7.2-20
7.3	Primary Containment Isolation System	7.3-1
7.3.1	Safety Objective	7.3-1
7.3.2	Definitions	7.3-1
7.3.3	Safety Design Basis	7.3-2
7.3.4	Description	7.3-4
7.3.5	Safety Evaluation	7.3-22
7.3.6	Inspection and Testing	7.3-29
7.4	Emergency Core Cooling Control and Instrumentation	7.4-1
7.4.1	Safety Objective	7.4-1
7.4.2	Safety Design Basis	7.4-1
7.4.3	Descriptions	7.4-3
7.4.4	Safety Evaluation	7.4-27
7.4.5	Inspection and Testing	7.4-29
7.5	Neutron Monitoring System	7.5-1
7.5.1	Safety Objective	7.5-1
7.5.2	Power Generation Objective	7.5-1
7.5.3	Identification	7.5-1
7.5.4	Source Range Monitor Subsystem	7.5-1
7.5.5	Intermediate Range Monitor Subsystem	7.5-5
7.5.6	Local Power Range Monitoring Subsystem	7.5-9
7.5.7	Average Power Range Monitor Subsystem	7.5-13
7.5.8	Rod Block Monitor Subsystem	7.5-18
7.5.9	Traversing Incore Probe Subsystem	7.5-20

TABLE OF CONTENTS

7.0 CONTROL AND INSTRUMENTATION

7.6	Refueling Interlocks	7.6-1
	7.6.1 Safety Objective	7.6-1
	7.6.2 Safety Design Basis	7.6-1
	7.6.3 Description	7.6-1
	7.6.4 Safety Evaluation	7.6-5
	7.6.5 Inspection and Testing	7.6-5
7.7	Reactor Manual Control System	7.7-1
	7.7.1 Power Generation Objection	7.7-1
	7.7.2 Safety Design Basis	7.7-1
	7.7.3 Power Generation Design Basis	7.7-1
	7.7.4 Description	7.7-2
	7.7.5 Safety Evaluation	7.7-13
	7.7.6 Inspection and Testing	7.7-14
Appendix 7.7A	Deleted	
Appendix 7.7B	Deleted	
7.8	Reactor Vessel Instrumentation	7.8-1
	7.8.1 Safety Objective	7.8-1
	7.8.2 Safety Design Basis	7.8-1
	7.8.3 Power Generation Objective	7.8-1
	7.8.4 Power Generation Design Basis	7.8-2
	7.8.5 Description	7.8-2
	7.8.6 Safety Design Evaluation	7.8-8
	7.8.7 Inspection and Testing	7.8-8
7.9	Recirculation Flow Control System	7.9-1
	7.9.1 Power Generation Objective	7.9-1
	7.9.2 Power Generation Design Basis	7.9-1
	7.9.3 Safety Design Basis	7.9-1
	7.9.4 Description	7.9-1
	7.9.5 Safety Evaluation	7.9-10
	7.9.6 Inspection and Testing	7.9-10
7.10	Feedwater Control System	7.10-1
	7.10.1 Power Generation Objective	7.10-1
	7.10.2 Power Generation Design Basis	7.10-1
	7.10.3 Description (Figures 7.10-2 through 7.10-8)	7.10-1
	7.10.4 Inspection and Testing	7.10-9

TABLE OF CONTENTS

7.0 CONTROL AND INSTRUMENTATION

7.11	Pressure Regulator And Turbine-Generator Control.....	7.11-1
	7.11.1 Power Generation Objective	7.11-1
	7.11.2 Power Generation Design Basis	7.11-1
	7.11.3 Deleted	7.11-1
	7.11.4 System Description (Figures 7.11-1 and 7.11-2).....	7.11-1
	7.11.5 Deleted	7.11-4
	7.11.6 Normal Operation.....	7.11-4
7.12	Process Radiation Monitoring.....	7.12.1
	7.12.1 Main Steam Line Radiation Monitoring System	7.12-1
	7.12.2 Air Ejector Offgas Radiation Monitoring System	7.12-3
	7.12.3 Main Stack Radiation Monitoring System	7.12-5
	7.12.4 Process Liquid Radiation Monitors.....	7.12-7
	7.12.5 Reactor Building Ventilation Radiation Monitoring System	7.12-9
	7.12.6 Plant Ventilation Exhaust Radiation Monitoring System	7.12-11
	7.12.7 Unit Sharing of Monitoring Systems.....	7.12-12
7.13	Area Radiation Monitoring System	7.13-1
	7.13.1 Power Generation Objective	7.13-1
	7.13.2 Power Generation Design Basis	7.13-1
	7.13.3 Description.....	7.13-1
	7.13.4 Inspection and Testing.....	7.13-2
	7.13.5 Additional Area Radiation Monitoring Systems	7.13-2
7.14	Drywell Leak Detection Radiation Monitoring System	7.14-1
	7.14.1 Safety Objective.....	7.14-1
	7.14.2 Power Generation Objectives	7.14-1
	7.14.3 Power Generation Design Basis	7.14-1
	7.14.4 Description.....	7.14-1
	7.14.5 Safety Evaluation.....	7.14-2
7.15	Health Physics Laboratory Radiation Monitoring Equipment	7.15-1
	7.15.1 Power Generation Objective	7.15-1
	7.15.2 Radiation Monitoring Equipment.....	7.15-1
	7.15.3 Personnel Monitoring	7.15-1
7.16	Process Computer System	7.16-1
	7.16.1 Safety Objective.....	7.16-1
	7.16.2 Power Generation Objective	7.16-1
	7.16.3 Safety Design Basis.....	7.16-1
	7.16.4 Power Generation Design Basis	7.16-1

TABLE OF CONTENTS

7.0 CONTROL AND INSTRUMENTATION

7.16.5	Description	7.16-2
7.16.6	Safety Evaluation	7.16-8
7.16.7	Inspection and Testing	7.16-9
7.17	Deleted	7.17-1
7.18	Backup Control System	7.18-1
7.18.1	Design Objectives	7.18-1
7.18.2	Design Bases	7.18-1
7.18.3	Description	7.18-2
7.18.4	System Operation	7.18-4
7.18.5	Design Evaluation	7.18-4
7.18.6	Inspection and Test	7.18-5
7.19	Anticipated Transient Without Scram	7.19-1
7.19.1	Design Objectives	7.19-1
7.19.2	Design Bases	7.19-2
7.19.3	Descriptions	7.19-3
7.19.4	Design Evaluation	7.19-4
7.19.5	Containment Cooling	7.19-5
7.20	Instrument Setpoint Methodology	7.20-1
7.20.1	Objectives	7.20-1
7.20.2	Design Bases	7.20-1
7.20.3	Descriptions	7.20-1
7.20.4	Instrument Setpoints - Design Output	7.20-4

BFN-26

LIST OF TABLES
CONTROL AND INSTRUMENTATION

<u>Table</u>	<u>Title</u>
7.2-1	Reactor Protection System Instrumentation Specifications for Units 1 and 2
7.2-1a	Reactor Protection System Instrumentation Specifications for Unit 3
7.2-2	Deleted
7.3-1	Deleted
7.3-2	Primary Containment Isolation System Instrument Specifications
7.4-1	Deleted
7.4-2	Automatic Depressurization System Instrumentation
7.4-3	Core Spray System Instrumentation
7.4-4	Low Pressure Coolant Injection Instrumentation
7.5-1	SRM Trips
7.5-2	IRM Trips
7.5-3	LPRM Trips
7.5-4a	APRM Trips (Unit 1)
7.5-4b	APRM Trips (Units 2 and 3)
7.5-4c	Deleted
7.6-1	Refueling Interlock Effectiveness Sheet 1 Sheet 2
7.7-1	Reactor Manual Control System Instrumentation Sheet 1 Sheet 2
7.8-1	Reactor Vessel Instrumentation Sheet 1 Sheet 2
7.8-2	Primary Containment Monitoring Instrumentation Sheet 1 Sheet 2
7.12-1	Process Radiation Monitoring Systems Characteristics
7.12-2	Deleted
7.13-1	Deleted
7.13-2	Locations of Area Radiation Monitors Sheet 1 Sheet 2 Sheet 3 Sheet 4 Sheet 5 Sheet 6

Sheet 7

7.16-1 Deleted

7.16-2 Deleted

7.17-1 Deleted

7.17-2 Deleted

7.20-1 Design Output Documents

 Sheet 1 - Unit 1

 Sheet 2 - Unit 2

 Sheet 3 - Unit 3

|

CONTROL AND INSTRUMENTATION
LIST OF ILLUSTRATIONS

<u>Figure</u>	<u>Title</u>
7.1-1	Use of Protection System, Control, and Instrumentation Portions
7.2-1	Reactor Protection System, Single Line
7.2-2	Reactor Protection System, Auxiliary Instrument Room Panel
7.2-3	Reactor Protection System, Single Line
7.2-3a	(Deleted)
7.2-3b	(Deleted)
7.2-3c	(Deleted)
7.2-3d	(Deleted)
7.2-3e	(Deleted)
7.2-3f	(Deleted)
7.2-3g	(Deleted)
7.2-3h	(Deleted)
7.2-3i	(Deleted)
7.2-3j	(Deleted)
7.2-3k	(Deleted)
7.2-3l	(Deleted)
7.2-4	Schematic Diagram of Logics in Trip System A (Trip System B Similar)
7.2-5	Schematic Diagram of Actuators and Actuator Logics
7.2-6	Reactor Protection System, Scram Functions
7.2-7a	Reactor Protection System Instrument Engineering Diagram
7.2-7b	Reactor Protection System Instrument Engineering Diagram (Unit 3)
7.2-7c	Reactor Protection System - Single Line
7.2-7d	Reactor Protection System Instrument Engineering Diagram
7.2-8	Reactor Protection System, Auxiliary Instrument Panel
7.2-9	Reactor Protection System Auxiliary Instrument Room Panel
7.2-10	Typical Arrangement of Channels and Logics
7.2-11	Typical Configuration for Turbine Stop Valve Closure Scram
7.2-12	Typical Configuration for Main Steam Line Isolation Scram
7.2-13	(Deleted)
7.3-1, sht 1	Nuclear Boiler Flow Diagram
7.3-1, sht 2	Nuclear Boiler Flow Diagram
7.3-1, sht 3	Nuclear Boiler Flow Diagram
7.3-2a	(Deleted)
7.3-2b	(Deleted)
7.3-2c	(Deleted)
7.3-2d	(Deleted)
7.3-2e	(Deleted)
7.3-2f	(Deleted)
7.3-2g	(Deleted)
7.3-2h	(Deleted)
7.3-2i	(Deleted)
7.3-2j	(Deleted)
7.3-2k	(Deleted)

CONTROL AND INSTRUMENTATION
LIST OF ILLUSTRATIONS (Cont'd)

<u>Figure</u>	<u>Title</u>
7.3-2l	(Deleted)
7.4-1a	(Deleted)
7.4-1b sht 1	High Pressure Coolant Injection System, Flow Diagram
7.4-1b sht 2	High Pressure Coolant Injection System, Flow Diagram
7.4-1b sht 3	High Pressure Coolant Injection System, Flow Diagram
7.4-2a	(Deleted)
7.4-2b	(Deleted)
7.4-2c	(Deleted)
7.4-2d	(Deleted)
7.4-2e	(Deleted)
7.4-2f	(Deleted)
7.4-2g	(Deleted)
7.4-2h	(Deleted)
7.4-3	(Deleted)
7.4-4	(Deleted)
7.4-5a	ECCS Preferred Pump Logic - Mechanical Control Diagram
7.4-5b	(Deleted)
7.4-5c	(Deleted)
7.4-5d	Pre-ACD and Common ACD Signal - Mechanical Control Diagram
7.4-5e	(Deleted)
7.4-5f	(Deleted)
7.4-5g	(Deleted)
7.4-5h	(Deleted)
7.4-5i	ECCS Preferred Pump Logic - Mechanical Control Diagram
7.4-5l	Pre-ACD and Common ACD Signal - Mechanical Control Diagram
7.4-5m	ECCS Preferred Pump Logic - Mechanical Control Diagram
7.4-6a sht 1	Residual Heat Removal System, Flow Diagram
7.4-6a sht 2	Residual Heat Removal System - Flow Diagram
7.4-6a sht 3	Residual Heat Removal System, Flow Diagram
7.4-6b sht 1	Residual Heat Removal System, Mechanical Flow Diagram
7.4-6b sht 2	Residual Heat Removal System - Mechanical Control Diagram
7.4-6b sht 3	Residual Heat Removal System - Mechanical Control Diagram
7.4-6b sht 4	Residual Heat Removal System - Mechanical Control Diagram
7.4-6b sht 5	Residual Heat Removal System - Mechanical Control Diagram
7.4-7a	(Deleted)
7.4-7b	ECCS Preferred Pump Logic - Mechanical Control Diagram
7.4-7c	(Deleted)
7.4-7d	(Deleted)
7.4-7e	(Deleted)
7.4-7f	(Deleted)
7.4-7g	(Deleted)
7.4-7h	(Deleted)

CONTROL AND INSTRUMENTATION
LIST OF ILLUSTRATIONS (Cont'd)

<u>Figure</u>	<u>Title</u>
7.4-7i	Pre-ACD and Com ACD Signal - Mechanical Control Diagram
7.4-7j	(Deleted)
7.4-7k	(Deleted)
7.4-7l	(Deleted)
7.4-7m	(Deleted)
7.4-7n	(Deleted)
7.4-7p	ECCS Preferred Pump - Residual Heat Removal System - Mechanical Control Diagram
7.4-8	(Deleted)
7.4-8a	(Deleted)
7.4-8b	(Deleted)
7.4-8c	(Deleted)
7.4-8d	(Deleted)
7.4-9	(Deleted)
7.5-1	(Deleted)
7.5-1a	Startup Range Neutron Monitoring System, Instrument Engineering Diagram
7.5-1b	Startup Range Neutron Monitoring System, Instrument Engineering Diagram
7.5-1c	Startup Range Neutron Monitoring System, Instrument Engineering Diagram
7.5-2	SRM/IRM Neutron Monitoring Unit
7.5-3a	Detector Drive System
7.5-3b	(Deleted)
7.5-3c	(Deleted)
7.5-4	Functional Block diagram of SRM Channel
7.5-5	(Deleted)
7.5-6	Source Range Monitoring System Core Locations
7.5-7	Functional Block Diagram of IRM Channel
7.5-8	IRM Locations
7.5-9	Control Rod Withdrawal Error
7.5-10	Normalized Flux Distribution for Rod Withdrawal Error
7.5-11	(Deleted)
7.5-11a	Power Range Neutron Monitoring System, Instrument Engineering Diagram (Unit 2)
7.5-11b	Power Range Neutron Monitoring System, Instrument Engineering Diagram (Unit 3)
7.5-11c	Power Range Neutron Monitoring System, Instrument Engineering Diagram (Unit 1)
7.5-12	LPRM Locations
7.5-13	Power Range Neutron Monitoring Unit
7.5-14a	LPRM to APRM Assignment Scheme (System A) (Unit 1)
7.5-14b	LPRM to APRM Assignment Scheme (System B) (Unit 1)
7.5-14c	Units 1, 2, and 3 LPRM to APRM Assignment Scheme
7.5-15	(Deleted)
7.5-16	(Deleted)
7.5-17	(Deleted)
7.5-17a	Assignment of LPRM Assemblies to RBM's
7.5-17b	Typical LPRM Assignments in RBMS (Units 1, 2, and 3)

CONTROL AND INSTRUMENTATION
LIST OF ILLUSTRATIONS (Cont'd)

<u>Figure</u>	<u>Title</u>
7.5-18	RBM Channel A + C Response to Control Rod Motion
7.5-19	RBM Channel B + D Response to Control Rod Motion
7.5-20	Assignment to LPRM Strings to TIP Machines
7.5-21	Traversing In-Core Probe Subsystem Block Diagram
7.5-22	Traversing In-Core Probe Assembly
7.5-23a	Neutron Monitoring System Physical Arrangement
7.5-23b	Neutron Monitoring System Physical Arrangement
7.5-23c	Neutron Monitoring System Physical Arrangement (Units 2 and 3)
7.5-23d	Neutron Monitoring System Physical Arrangement (Unit 1)
7.5-24	(Deleted)
7.5-24a	(Deleted)
7.5-24b	(Deleted)
7.5-24c	(Deleted)
7.5-24d	(Deleted)
7.5-24e	(Deleted)
7.5-24f	(Deleted)
7.5-25	Ranges of Neutron Monitoring System
7.5-26	Typical IRM Circuit Arrangement for Reactor Protection System Input
7.5-27	(Deleted)
7.5-28	(Deleted)
7.6-1	Refueling Interlocks, Functional Block Diagram
7.7-1	Reactor Manual Control System Instrumentation
7.8-1	Reactor Vessel Instrumentation
7.8-2	Primary Containment Monitoring Instrumentation
7.12-1	Process Radiation Monitoring Systems Characteristics
7.12-2	(Deleted)
7.13-1	(Deleted)
7.13-2	Locations of Area Radiation Monitors
7.16-1	(Deleted)
7.16-2	(Deleted)
7.17-1	(Deleted)
7.17-2	(Deleted)
7.20-1	Design Output Documents Sheet 1 – Unit 1 Sheet 2 – Unit 2 Sheet 3 – Unit 3

CONTROL AND INSTRUMENTATION
LIST OF ILLUSTRATIONS (Cont'd)

<u>Figure</u>	<u>Title</u>
7.8-3	Reactor Vessel Temperature Monitoring System Physical Arrangement
7.9-1	(Deleted)
7.9-2	(Deleted)
7.9-3	(Deleted)
7.9-4a	(Deleted)
7.9-4b	(Deleted)
7.9-4c	(Deleted)
7.9-4d	(Deleted)
7.9-4e	(Deleted)
7.9-4f	(Deleted)
7.10-1	(Deleted)
7.10-2	Feedwater Control System, Mechanical Control Diagram
7.10-3	Feedwater Control System, Mechanical Control Diagram
7.10-4	Feedwater Control System, Mechanical Control Diagram
7.10-5	Feedwater Control System - Mechanical Control Diagram
7.10-6	Feedwater Control System - Mechanical Control Diagram
7.10-7	Feedwater Control System - Mechanical Control Diagram
7.10-8	Feedwater Control System - Mechanical Control Diagram
7.11-1	(Deleted)
7.11-2	Turbine Control and Reactor Pressure Control System Functional Block Diagram
7.12-1	(Deleted)
7.12-2a sht 1	Radiation Monitoring System - Mechanical Control Diagram
7.12-2a sht 2	Radiation Monitoring System - Mechanical Control Diagram
7.12-2a sht 3	Radiation Monitoring System - Mechanical Control Diagram
7.12-2a sht 4	Radiation Monitoring System - Mechanical Control Diagram
7.12-2a sht 5	Radiation Monitoring System - Mechanical Control Diagram
7.12-2a sht 6	Radiation Monitoring System - Mechanical Control Diagram
7.12-2a sht 7	Radiation Monitoring System - Mechanical Control Diagram
7.12-2b sht 1	(Deleted)
7.12-2b sht 2	Radiation Monitoring System - Mechanical Control Diagram
7.12-2b sht 3	(Deleted)
7.12-2b sht 4	Radiation Monitoring System - Mechanical Control Diagram
7.12-2b sht 5	Radiation Monitoring System - Mechanical Control Diagram
7.12-2b sht 6	Radiation Monitoring System - Mechanical Control Diagram
7.13-1	(Deleted)
7.16-1	(Deleted)
7.17-1	(Deleted)
7.17-2	(Deleted)
7.17-3	(Deleted)
7.17-4	(Deleted)
7.17-5	(Deleted)
7.17-6a	(Deleted)

7.17-6b (Deleted)

CONTROL AND INSTRUMENTATION
LIST OF ILLUSTRATIONS (Cont'd)

<u>Figure</u>	<u>Title</u>
7.17-6c	(Deleted)
7.17-7	(Deleted)
7.17-8a	(Deleted)
7.17-8b	(Deleted)
7.17-8c	(Deleted)
7.17-8d	(Deleted)
7.17-9a	(Deleted)
7-17-9b	(Deleted)
7.17-9c	(Deleted)
7.17-9d	(Deleted)