

## CHAPTER 5—REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS TABLE OF CONTENTS

5.0	REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS.....	5.1-1
5.1	Summary Description .....	5.1-1
5.1.1	Design Bases .....	5.1-1
5.1.2	System Description.....	5.1-2
5.1.3	System Components .....	5.1-3
5.1.4	System Evaluation.....	5.1-5
5.2	Integrity of the Reactor Coolant Pressure Boundary.....	5.2-1
5.2.1	Compliance with Codes and Code Cases .....	5.2-1
5.2.1.1	Compliance with 10 CFR 50.55a.....	5.2-1
5.2.1.2	Compliance with Applicable Code Cases.....	5.2-1
5.2.2	Overpressure Protection.....	5.2-2
5.2.2.1	Design Bases .....	5.2-2
5.2.2.2	Design Evaluation .....	5.2-3
5.2.2.3	Piping and Instrumentation Diagrams .....	5.2-5
5.2.2.4	Equipment and Component Description.....	5.2-5
5.2.2.5	Mounting of Pressure Relief Devices .....	5.2-5
5.2.2.6	Applicable Codes and Classification .....	5.2-5
5.2.2.7	Material Specification .....	5.2-6
5.2.2.8	Process Instrumentation.....	5.2-6
5.2.2.9	System Reliability .....	5.2-6
5.2.2.10	Testing and Inspection .....	5.2-7
5.2.3	Reactor Coolant Pressure Boundary Materials .....	5.2-7
5.2.3.1	Material Specifications .....	5.2-8
5.2.3.2	Compatibility with Reactor Coolant .....	5.2-9
5.2.3.3	Fabrication and Processing of Ferritic Materials .....	5.2-10
5.2.3.4	Fabrication and Processing of Austenitic Stainless Steels.....	5.2-12
5.2.3.5	Prevention of Primary Water Stress-Corrosion Cracking for Nickel-Base Alloys .....	5.2-16

5.2.3.6	Threaded Fasteners .....	5.2-17
5.2.4	Inservice Inspection and Testing of the RCPB .....	5.2-17
5.2.4.1	Inservice Inspection and Testing Program .....	5.2-18
5.2.4.2	Preservice Inspection and Testing Program .....	5.2-24
5.2.5	RCPB Leakage Detection.....	5.2-24
5.2.5.1	Detecting, Monitoring and Collecting Unidentified Leakage.....	5.2-25
5.2.5.2	Detecting, Monitoring and Collecting Identified Leakage.....	5.2-28
5.2.5.3	Detecting and Monitoring Intersystem Leakage .....	5.2-28
5.2.5.4	Inspection and Testing Requirements.....	5.2-30
5.2.5.5	Instrumentation Requirements .....	5.2-30
5.2.6	References .....	5.2-31
5.3	Reactor Vessel .....	5.3-1
5.3.1	Reactor Vessel Materials.....	5.3-1
5.3.1.1	Material Specifications .....	5.3-1
5.3.1.2	Special Processes Used for Manufacturing and Fabrication.....	5.3-2
5.3.1.3	Special Methods for Nondestructive Examination.....	5.3-2
5.3.1.4	Special Controls for Ferritic and Austenitic Stainless Steels.....	5.3-3
5.3.1.5	Fracture Toughness .....	5.3-3
5.3.1.6	Material Surveillance .....	5.3-3
5.3.1.7	Reactor Vessel Fasteners .....	5.3-6
5.3.2	Pressure-Temperature Limits, Pressurized Thermal Shock, and Charpy Upper-Shelf Energy Data and Analyses .....	5.3-7
5.3.2.1	Pressure-Temperature Limit Curves .....	5.3-7
5.3.2.2	Operating Procedures .....	5.3-8
5.3.2.3	Pressurized Thermal Shock .....	5.3-8
5.3.2.4	Upper-Shelf Energy.....	5.3-8
5.3.3	Reactor Vessel Integrity .....	5.3-8
5.3.3.1	Design .....	5.3-8
5.3.3.2	Materials of Construction.....	5.3-11
5.3.3.3	Fabrication Methods.....	5.3-11

5.3.3.4	Inspection Requirements.....	5.3-11
5.3.3.5	Shipment and Installation.....	5.3-11
5.3.3.6	Operating Conditions.....	5.3-11
5.3.3.7	Inservice Surveillance .....	5.3-11
5.3.3.8	Threaded Fasteners .....	5.3-13
5.3.4	References .....	5.3-13
5.4	Component and Subsystem Design.....	5.4-1
5.4.1	Reactor Coolant Pumps .....	5.4-1
5.4.1.1	Design Bases .....	5.4-1
5.4.1.2	Design Description .....	5.4-1
5.4.1.3	Instrumentation Requirements .....	5.4-3
5.4.1.4	Design Evaluation .....	5.4-4
5.4.1.5	Inspection and Testing Requirements.....	5.4-4
5.4.1.6	Pump Flywheel Integrity .....	5.4-5
5.4.2	Steam Generators (PWR) .....	5.4-7
5.4.2.1	Design Bases .....	5.4-7
5.4.2.2	Design Description .....	5.4-7
5.4.2.3	Design Evaluation .....	5.4-10
5.4.2.4	Steam Generator Materials .....	5.4-12
5.4.2.5	Steam Generator Program .....	5.4-14
5.4.3	Reactor Coolant Piping.....	5.4-22
5.4.3.1	Design Bases .....	5.4-22
5.4.3.2	Design Description .....	5.4-23
5.4.3.3	Design Evaluation .....	5.4-24
5.4.3.4	Inspection and Testing Requirements.....	5.4-24
5.4.3.5	Instrumentation Requirements .....	5.4-25
5.4.4	Not Used in U.S. EPR Design .....	5.4-25
5.4.5	Not Used in U.S. EPR Design .....	5.4-25
5.4.6	Not Used in U.S. EPR Design .....	5.4-25
5.4.7	Residual Heat Removal System.....	5.4-25
5.4.7.1	Design Basis .....	5.4-25
5.4.7.2	System Description .....	5.4-27
5.4.7.3	Performance Evaluation .....	5.4-30

5.4.7.4	Inspection and Testing Requirements.....	5.4-35
5.4.7.5	Instrumentation Requirements .....	5.4-35
5.4.8	Not Used in U.S. EPR Design .....	5.4-35
5.4.9	Not Used in U.S. EPR Design .....	5.4-35
5.4.10	Pressurizer .....	5.4-35
5.4.10.1	Design Basis .....	5.4-36
5.4.10.2	Design Description .....	5.4-37
5.4.10.3	Design Evaluation .....	5.4-39
5.4.10.4	Inspection and Testing Requirements.....	5.4-39
5.4.11	Pressurizer Relief Tank .....	5.4-40
5.4.11.1	Design Bases .....	5.4-40
5.4.11.2	System Description .....	5.4-41
5.4.11.3	Performance Evaluation .....	5.4-41
5.4.11.4	Inspection and Testing Requirements.....	5.4-42
5.4.11.5	Instrumentation Requirements .....	5.4-42
5.4.12	Reactor Coolant System High Point Vents.....	5.4-43
5.4.12.1	Design Bases .....	5.4-43
5.4.12.2	Design Description .....	5.4-44
5.4.12.3	Safety Evaluation .....	5.4-44
5.4.12.4	Inspection and Testing Requirements.....	5.4-45
5.4.12.5	Instrumentation Requirements .....	5.4-45
5.4.13	Safety and Relief Valves .....	5.4-45
5.4.13.1	Design Bases .....	5.4-45
5.4.13.2	Design Description .....	5.4-46
5.4.13.3	Design Evaluation .....	5.4-47
5.4.13.4	Inspection and Testing Requirements.....	5.4-47
5.4.13.5	Instrumentation Requirements .....	5.4-47
5.4.14	Component Supports.....	5.4-48
5.4.14.1	Design Bases .....	5.4-48
5.4.14.2	Design Description .....	5.4-48
5.4.14.3	Design Evaluation .....	5.4-50
5.4.14.4	Inspection and Testing Requirements.....	5.4-51
5.4.15	References .....	5.4-51

Next File