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 5.2-6

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 5.2-17

5.2.3.6 Threaded Fasteners 5.2-17
5.2.4 Inservice Inspection and Testing of the RCPB 5.2-18
5.2.4.1 Inservice Inspection and Testing Program 5.2-19
5.2.4.2 Preservice Inspection and Testing Program 5.2-25
5.2.5 RCPB Leakage Detection 5.2-26
5.2.5.1 Detecting, Monitoring and Collecting Unidentified Leakage 5.2-27
5.2.5.2 Detecting, Monitoring and Collecting Identified Leakage 5.2-29
5.2.5.3 Detecting and Monitoring Intersystem Leakage 5.2-30
5.2.5.4 Inspection and Testing Requirements 5.2-31
5.2.5.5 Instrumentation Requirements 5.2-31
5.2.6 References 5.2-33
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 5.3-3
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 5.3-4
5.3.1.7 Reactor Vessel Fasteners 5.3-7
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 5.3-9
5.3.3 Reactor Vessel Integrity 5.3-9
5.3.3.1 Design 5.3-9
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 5.3-12
5.3.3.7 Inservice Surveillance 5.3-12
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 5.4-4
5.4.1.4 Design Evaluation 5.4-4
5.4.1.5 Inspection and Testing Requirements 5.4-5
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 5.4-8
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 5.4-15
5.4.3 Reactor Coolant Piping 5.4-23
5.4.3.1 Design Bases 5.4-23
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 5.4-25
5.4.3.5 Instrumentation Requirements 5.4-25
5.4.4 Not Used in U.S. EPR Design 5.4-26
5.4.5 Not Used in U.S. EPR Design 5.4-26
5.4.6 Not Used in U.S. EPR Design 5.4-26
5.4.7 Residual Heat Removal System 5.4-26
5.4.7.1 Design Basis 5.4-26
5.4.7.2 System Description 5.4-27
5.4.7.3 Performance Evaluation 5.4-31

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 5.4-36
5.4.9 Not Used in U.S. EPR Design 5.4-36
5.4.10 Pressurizer 5.4-36
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 5.4-40
5.4.11 Pressurizer Relief Tank 5.4-40
5.4.11.1 Design Bases 5.4-41
5.4.11.2 System Description 5.4-41
5.4.11.3 Performance Evaluation 5.4-42
5.4.11.4 Inspection and Testing Requirements 5.4-43
5.4.11.5 Instrumentation Requirements 5.4-43
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 5.4-45
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 5.4-46
5.4.13.1 Design Bases 5.4-46
5.4.13.2 Design Description 5.4-46
5.4.13.3 Design Evaluation 5.4-48
5.4.13.4 Inspection and Testing Requirements 5.4-48
5.4.13.5 Instrumentation Requirements 5.4-48
5.4.14 Component Supports 5.4-48
5.4.14.1 Design Bases 5.4-48
5.4.14.2 Design Description 5.4-49
5.4.14.3 Design Evaluation 5.4-51
5.4.14.4 Inspection and Testing Requirements 5.4-51
5.4.15 References 5.4-51

Next File