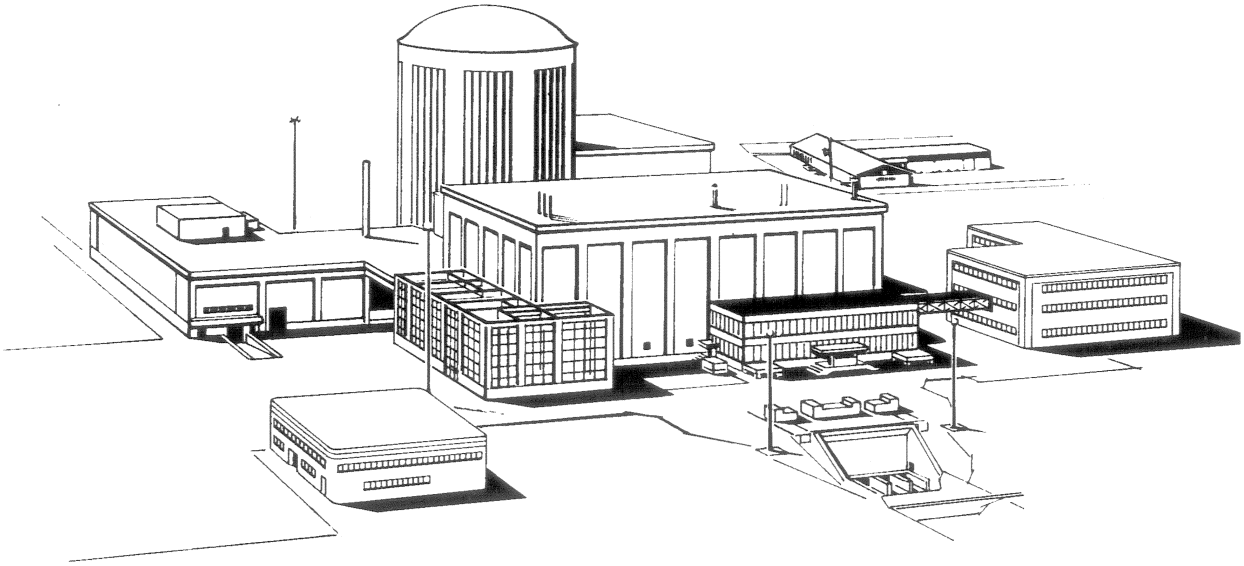

KEWAUNEE POWER STATION

UPDATED SAFETY ANALYSIS REPORT

REVISION SUMMARY

Revision 20 (04/07)

Section	Changes Made under the provisions of 10 CFR 50.59 except where indicated in brackets.
All (no change bars)	• Updated applicable descriptions throughout to reflect the transfer of the facility from NMC to Dominion (e.g., “KNPP” changed to “KPS”) • Changed from “Section” to “Chapter” terminology • Removed notations associated with previously deleted material and applied sequential numbering to paragraphs, tables, figures, and references • Substituted consistent expressions in text (e.g., “%” changed to “percent”) • Applied consistent typeface and page layouts • Improved consistency of measurement notation (e.g., time, mass, velocity), including abbreviations
1.1, 2.2, 2.4, 2.5, 2.6.4, 2.7, 3.3.3, 4.2.2.6, 4.4.1.6, Figure 4.2-11, 6.2.2.2.14, 7.5.3.3, 7.5.3.3.4, 7.5.3.3.5, 7.7.5, 9.3.3.8, 9.6.1, 9.6.5.6, Figure 10.2-11, 10A.1.2, 10A.3.3.6, 11.1.2.1.1, 11.1.2.4, 11.1.3.2, 11.2.3.22, 11.2.3.24, 11.2.3.26, Table 11.2-7, 12.3.2, 12.3.3, 12.4.7, 14.1.4.2, 14.1.5, 14.1.8, 14.1.8.3.1, 14.1.11.1, 14.3.4.1.2, 14.3.4.2, 14.3.5.1, 14.3.7.8, 14C.2.1, 3.2.3.2.1.1, Table 3.2.1, 5.9.2.18.3, 7.2.1.9.1, 10.2 Refs., Table 10A.3-2, Table 10A.4-2, Figure 10A.4-10, 11.3.2, Table 13.1-1, 14.2.1.3, 14.3.3.1, 14.3.4 Refs., Table 14.3-1, 14A Refs., 14C.1.4, Table D.8-1, Attachment 1, E.2.1, H.2, H.4.2	Corrected typographical errors.
1.2.8, 8.2.3.4, Table 8.2-2,	Clarified the description of the station batteries and loss of all ac power.
2.5.1, 12.4.1, 12.6	Improved the description of regional land use, administrative directives, surveillance procedures, and safety review & administrative control.

Revision 20 (04/07)

Section	Changes Made under the provisions of 10 CFR 50.59 except where indicated in brackets.
2.6.2	Clarified lake storm surge probable maximum water level and controlled seepage into the screenhouse.
2.6.2	Clarified elevation of screenhouse access tunnel ramp.
3.2.3.4.1, Table 4.2-4, 14.2.6	Replaced the reactor vessel closure head including the control rod drive mechanisms.
3.2 Refs, 3.3 Refs	Incorporated the revised reactor test program.
4.1 Refs, Table B.7-1	Reflected current version of reactor vessel head design report.
Table 4.1-9, 4.4.1.1, 5.2.1.29, 5.3.2, Table 10.1-2, Table 11.1-2, App. B.3, Table B.7-2, Table B.7-3, Table B.7-6	Allowed use of ASME III code allowables instead of USAS B31.1.
4.2.2.2	Inserted text regarding foreign obligations.
4.2.2.7	Corrected the description of use of component cooling water supplied to the reactor coolant pumps.
Figure 4.2-1	Modified reactor makeup water line.
4.3.4.2	Provided additional description of the reactor vessel low temperature overpressure protection system.
4.4.16	Updated description of Inservice Inspection Program for fourth 10-year interval.
6.2.2.1.2, 6.6 Refs, Table 6.2-6, Figure 6.2-4, 14.3.2.3.1, Table 14.3.3-3	Revised the description of the containment recirculation sump strainer.
6.2.3.8, Table 6.2-12	Updated the description of the residual heat removal system with respect to LOCA containment analysis and containment sump recirculation mode.
6.5.1.2.13, 9.3.2.3, 10.2.2.8	Corrected typographical errors.

Revision 20 (04/07)

Section	Changes Made under the provisions of 10 CFR 50.59 except where indicated in brackets.
6.6.2	Clarified the description of auxiliary feedwater pump operation.
6.6.2, 6.6 Refs	Revised the description of auxiliary feedwater pump recirculation flow.
6.6.2, 6.6.3, 9.6.2.2, Figure 10.2-3	Installed new suction pressure trip switches and rerouted supply piping to the auxiliary feedwater pumps.
6.6.3	Clarified the loss of normal feedwater accident analysis assumptions for auxiliary feedwater pump operation.
7.2, 13.1.3, 13.5	Reflected compliance with the Quality Assurance Program Description.
7.6.2.2	Revised the description of the core exit thermocouples.
7.6.2.2, 7.6.2.3, and 7.6.2.3.1	Corrected the description of control room displays.
7.2.2.2.1	Added the safety injection signal input for start of component cooling pumps.
7.7.6.1.3, 7.7.6.1.5, 7.7.6.2	Completed the list of indications and controls located on the dedicated shutdown panel.
7.7.6.2	Revised the description of the main feedwater control valves.
8.2.3.2	Revised the diesel generator loading description.
8.2.3.3.1	Added the description of non-safety related loads assigned to the emergency buses.
8.2.4.4	Updated the condensate inventory.
8.2.4.5	Clarified the description of the Class 1E battery capacity.
8.2.4.7, Table 8.2-3	Clarified room and area temperature limits in the event of station blackout.
9.2.2.28, Table 9.2-2	Revised the quantity of boric acid required to achieve cold shutdown.
9.2.3.7, 11.2.3.1.8, 11.2.3.15	Revised the radiation monitor check source response.
9.3.1.3, 9.3.3.6, 9.3 Refs	Provided additional description of spent fuel pool cooling system operation.

Revision 20 (04/07)

Section	**Changes** Made under the provisions of 10 CFR 50.59 except where indicated in brackets.
9.3.2.7	Replaced the flanged opening on the component cooling surge tank with a capped connection.
9.3.2.8	Provided a limit stop on a component cooling water flow control valve to prevent pump runout.
9.3.4	Corrected the description of use of component cooling water to cool safety injection pumps.
Table 9.3-4	Corrected typographical error involving a footnote notation.
9.4.3.2, 12.2, 12.3.2, 12.4.1, 12.4.2, 12.4.3, 12.4.4, 12.4.5, 12.4.6, 12.5, 12.6, 13.4.1, App. C	Reflected compliance with the Dominion Nuclear Facility Quality Assurance Program Description.
9.5.1.1	Added statement of compliance with 10 CFR 50.68.
9.5.1.1	Provided editorial clarification of prevention of fuel storage criticality.
Figure 9.6-6	Modified the description of the control room air conditioning system.
10.2.2.8	Installed float switches to provide circulating water pump internal flooding trip.
10.2.2.10	Reduced the shaft speed that actuates the turbine overspeed trip.
Figure 10.2-9	Provided an alternate source of deionized water to the self-regenerating suppressor in the in-line ion chromatograph.
10.4	Changed test frequency of mechanical trip system from monthly to periodically.
10A.2.1.2	Revised method of evaluation for high energy line break analysis and break location selection.
Table 10A.2-3	Corrected damper nomenclature and numbering. Corrected the actuation train for the control room outside air bypass damper.
Section 10A.12	Reinserted the description of jet impingement load analysis that was inadvertently omitted.

Revision 20 (04/07)

Section	Changes Made under the provisions of 10 CFR 50.59 except where indicated in brackets.
Tables 10A.3-1, 10A.3-3, 10A.4-1, 10A.5-2, and 10A.6-2	Corrected references to motor control centers.
Figure 10A.4-1	Corrected the description of the B feedwater bypass line.
10A.14, Table 10A.14-1	Added evaluation of condensate piping downstream of the steam generator blowdown heat exchangers as a high energy line.
11.1.2.4	Revised the description of spent resin containers.
Table 11.2-7	Changed the sensitivity values for radiation monitoring channels R-16 and R-20.
12.1, 12.4.1, 12.4.3, 12.4.7, 12.6	Updated organizational and administrative descriptions to reflect the transfer of Kewaunee Power Station from NMC to Dominion.
14.0.1, 14.0.4.1, 14.1.9.2, 14.1.11.2.5, 14.1.13.2.6, 14.1 Refs	Incorporated the fuel transition and stretch power uprate. [10 CFR 50.90 License Amendment]
14.1.11.3, 14.1.13.3, Table 14.1.12-1	Corrected the safety analysis input parameter for pressurizer volume.
14.2.5.8, 14.2.5.11, 14.3.4.11, 14.3.4.1.1, 14.3.4.2, 14.3.4.2.4, 14.3.4.3	Clarified the description of the containment integrity safety analysis acceptance criteria.
14.3.1.4, 14.3.1.4, 14.3.1.5.1, 14.3.1.6, 14.3.1.9, 14.3.1 Refs	Incorporated the Reload Transition Safety Report SBLOCA analysis. [10 CFR 50.90 License Amendment]
14.3.5.1, Reference 14.3.5.1, Table 14.3-7	Clarified the description of ECCS leakage to the Auxiliary Building and updated the reference to the appropriate license amendment.
Figure 14.3-25	Improved legibility of the graph's axis labels.
Figure 14.3-42	Deleted figure previously superceded by power uprate containment integrity analysis.
Section B.2.1.6	Modified Doors 142 and 143 for tornado atmospheric pressure change relief.
Section B.2.1.6	Installed breakaway pins on Door 49.
Table B.2-1	Added note to clarify the classification of structures, systems, and components.

Revision 20 (04/07)

Section	**Changes** Made under the provisions of 10 CFR 50.59 except where indicated in brackets.
B.3	Clarified the use of code editions with documentation of reconciliation.
Table D.1-1	Corrected the activity values for Kr-85 and Kr-85m.

Contents

Section	Title	Page
CHAPTER 1	**INTRODUCTION AND SUMMARY**	**1-1**
1.1	**Site and Environment**	**1.1-1**
1.2	**Summary Plant Description**	**1.2-1**
1.2.1	Structures	1.2-1
1.2.2	Nuclear Steam Supply System	1.2-2
1.2.3	Reactor and Plant Control	1.2-2
1.2.4	Waste Disposal System	1.2-3
1.2.5	Fuel Handling System	1.2-3
1.2.6	Turbine and Auxiliaries	1.2-3
1.2.7	Electrical System	1.2-4
1.2.8	Engineered Safety Features	1.2-4
1.3	**General Design Criteria**	**1.3-1**
1.3.1	Overall Plant Requirements (GDC 1 - GDC 5)	1.3-2
1.3.2	Protection By Multiple Fission Product Barrier (GDC 6 - GDC 10)	1.3-4
1.3.3	Nuclear and Radiation Controls (GDC 11 - GDC 18)	1.3-6
1.3.4	Reliability and Testability of Protection System (GDC 19 - GDC 26)	1.3-9
1.3.5	Reactivity Control (GDC 27 - GDC 32)	1.3-12
1.3.6	Reactor Coolant Pressure Boundary (GDC 33 - GDC 36)	1.3-14
1.3.7	Engineered Safety Features (GDC 37 - GDC 65)	1.3-15
1.3.8	Fuel and Waste Storage Systems (GDC 66 - GDC 69)	1.3-23
1.3.9	Plant Effluents (GDC 70)	1.3-25
1.4	**Design Parameters and Plant Comparison**	**1.4-1**
1.4.1	Line Item Comparison	1.4-1
1.5	**Design Highlights**	**1.5-1**
1.5.1	Power Level	1.5-1
1.5.2	Reactor Coolant Loops	1.5-1
1.5.3	Peak Specific Power	1.5-1
1.5.4	Fuel Assembly Design	1.5-2
1.5.5	Engineered Safety Features	1.5-2
1.5.6	Emergency Power	1.5-2
1.5.7	Load Rejection Capability	1.5-2

Contents

Section	Title	Page
1.6	**Research and Development Requirements**	**1.6-1**
1.6.1	Containment Vessel Internal Spray Additive for Iodine Removal	1.6-1
1.6.2	Burnable Poison Rod Program	1.6-1
1.6.3	Core Stability Evaluation	1.6-2
1.6.4	Blowdown Forces Program	1.6-4
1.6.5	Reactor Vessel Thermal Shock Program	1.6-5
1.6.6	Failed Fuel Detection	1.6-5
1.6.7	Flecht (Full-length Emergency Cooling Heat Transfer Test)	1.6-5
1.6.8	Fuel Rod Burst Program	1.6-7
1.6.9	Fixed In-Core Detector Program	1.6-8
1.6.10	Seismograph	1.6-9
1.6.11	Reactor Internals Vibration Monitoring	1.6-11
1.6.12	Post-LOCA Hydrogen Control	1.6-11
1.7	**Identification of Contractors**	**1.7-1**
1.8	**Atomic Energy Commission (AEC) General Design Criteria**	**1.8-1**
1.9	**Facility Safety Conclusions**	**1.9-1**
CHAPTER 2	**SITE**	**2-1**
2.1	**Summary and Conclusions**	**2.1-1**
2.2	**Location**	**2.2-1**
2.3	**Topography**	**2.3-1**
2.4	**Population**	**2.4-1**
2.5	**Land Use**	**2.5-1**
2.5.1	Regional Land Use	2.5-1
2.5.2	Local Land Use	2.5-1
2.6	**Hydrology**	**2.6-1**
2.6.1	Summary	2.6-1
2.6.2	General Lake Hydrology	2.6-1
2.6.3	General Site Hydrology	2.6-7
2.6.4	Dilution and Diffusion in Lake Michigan	2.6-10
2.7	**Meteorology**	**2.7-1**
2.7.1	Meteorological Program	2.7-1

Contents

Section	Title	Page
2.7.2	Descriptive Meteorology	2.7-3
2.7.3	Atmospheric Dilution	2.7-8
2.7.4	Hypothetical Accident Meteorology	2.7-9
2.8	**Environmental Radioactivity Program**	**2.8-1**
2.9	**Geology**	**2.9-1**
2.10	**Seismology**	**2.10-1**
CHAPTER 3	**REACTOR**	**3-1**
3.1	**Design Bases**	**3.1-1**
3.1.1	Performance Objectives	3.1-1
3.1.2	Principal Design Criteria	3.1-2
3.1.3	Safety Limits	3.1-6
3.2	**Reactor Design**	**3.2-1**
3.2.1	Nuclear Design And Evaluation	3.2-1
3.2.2	Thermal and Hydraulic Design and Evaluation	3.2-8
3.2.3	Mechanical Design and Evaluation	3.2-15
3.3	**Tests and Inspections**	**3.3-1**
3.3.1	Reactivity Anomalies	3.3-1
3.3.2	Thermal and Hydraulic Tests And Inspections	3.3-1
3.3.3	Core Component Tests and Inspections	3.3-1
CHAPTER 4	**REACTOR COOLANT SYSTEM**	**4-1**
4.1	**Design Bases**	**4.1-1**
4.1.1	Performance Objectives	4.1-1
4.1.2	General Design Criteria	4.1-1
4.1.3	Principal Design Criteria	4.1-4
4.1.4	Design Characteristics	4.1-8
4.1.5	Cyclic Loads	4.1-9
4.1.6	Service Life	4.1-16
4.1.7	Codes and Classifications	4.1-17
4.2	**System Design and Operation**	**4.2-1**
4.2.1	General Description	4.2-1

Contents

Section	Title	Page
4.2.2	Components	4.2-1
4.2.3	Pressure-Relieving Devices	4.2-17
4.2.4	Protection Against Proliferation of Dynamic Effects	4.2-18
4.2.5	Materials of Construction	4.2-18
4.2.6	Maximum Heating and Cooling Rates	4.2-22
4.2.7	Water Chemistry	4.2-22
4.2.8	Reactor Coolant Flow Measurements	4.2-23
4.2.9	Reactor Coolant System Temperature	4.2-23
4.2.10	Loose Parts Monitoring System	4.2-25
4.3	**System Design Evaluation**	**4.3-1**
4.3.1	Safety Factors	4.3-1
4.3.2	Reliance on Interconnected Systems	4.3-4
4.3.3	System Integrity	4.3-4
4.3.4	Overpressure Protection	4.3-4
4.3.5	System Incident Potential	4.3-5
4.4	**Tests and Inspections**	**4.4-1**
4.4.1	Reactor Coolant System Inspection	4.4-1
CHAPTER 5	**CONTAINMENT SYSTEM**	**5-1**
5.1	**Containment System Concept**	**5.1-1**
5.1.1	Containment Systems	5.1-1
5.1.2	Design Bases	5.1-2
5.2	**Containment System Structure Design**	**5.2-1**
5.2.1	Reactor Containment Vessel Design	5.2-1
5.2.2	Shield Building Design	5.2-32
5.3	**Reactor Containment Vessel Isolation Systems**	**5.3-1**
5.3.1	Design Bases	5.3-1
5.3.2	System Design	5.3-1
5.3.3	System Evaluation	5.3-4
5.4	**Containment Vessel Air Handling System**	**5.4-1**
5.4.1	Design Conditions	5.4-1
5.4.2	System Design	5.4-2

Contents

Section	Title	Page
5.4.3	Vacuum Relief System	5.4-3
5.5	**Shield Building Ventilation System**	**5.5-1**
5.5.1	Design Conditions	5.5-1
5.5.2	System Description	5.5-3
5.5.3	Actuation and System Operation	5.5-4
5.5.4	Component Design	5.5-5
5.5.5	System Evaluation	5.5-6
5.5.6	Reliability and Testing	5.5-7
5.6	**Leakage Monitoring**	**5.6-1**
5.7	**Tests and Inspections**	**5.7-1**
5.7.1	Reactor Containment Vessel	5.7-1
5.7.2	Shield Building	5.7-3
5.7.3	Auxiliary Building Special Ventilation Zone	5.7-4
5.8	**System Evaluation**	**5.8-1**
5.9	**Internal Structures**	**5.9-1**
5.9.1	Description	5.9-1
5.9.2	Design Basis	5.9-1
5.9.3	Materials	5.9-20
5.9.4	Construction	5.9-23
CHAPTER 6	**ENGINEERED SAFETY FEATURES**	**6-1**
6.1	**Criteria**	**6.1-2**
6.1.1	Engineered Safety Features Criteria	6.1-2
6.1.2	Related Criteria	6.1-7
6.2	**Safety Injection System**	**6.2-1**
6.2.1	Design Basis	6.2-1
6.2.2	System Design and Operation	6.2-4
6.2.3	Design Evaluation	6.2-22
6.2.4	Tests and Inspections	6.2-29
6.2.5	Effects of Leakage from Residual Heat Removal System	6.2-31
6.3	**Containment Air Cooling System**	**6.3-1**
6.3.1	Design Basis	6.3-1

Contents

Section	Title	Page
6.3.2	System Design and Operation	6.3-3
6.3.3	Design Evaluation	6.3-8
6.3.4	Tests and Inspection	6.3-10
6.4	**Containment Vessel Internal Spray System**	**6.4-1**
6.4.1	Design Basis	6.4-1
6.4.2	System Design and Operation	6.4-4
6.4.3	Design Evaluation	6.4-8
6.4.4	Inspection and Tests	6.4-10
6.5	**Leakage Detection and Provisions for the Primary and Auxiliary Coolant Loops**	**6.5-1**
6.5.1	Leakage Detection Systems	6.5-1
6.5.2	Leakage Provisions	6.5-8
6.5.3	Leakage Experience from Similar Plant Design	6.5-9
6.6	**Auxiliary Feedwater System**	**6.6-1**
6.6.1	Design Basis	6.6-1
6.6.2	System Design and Operation	6.6-1
6.6.3	System Evaluation	6.6-3
6.6.4	System Testing and Inspection	6.6-4
6.6.5	Leakage Provisions	6.6-5
6.6.6	Incident Control	6.6-5
CHAPTER 7	**INSTRUMENTATION AND CONTROL**	**7-1**
7.1	**Scope**	**7.1-1**
7.2	**Protection Systems**	**7.2-1**
7.2.1	Design Basis	7.2-1
7.2.2	System Design	7.2-12
7.2.3	System Evaluation	7.2-28
7.3	**Regulating Systems**	**7.3-1**
7.3.1	Design Basis	7.3-1
7.3.2	System Design	7.3-2
7.3.3	System Design Evaluation	7.3-7

Contents

Section	Title	Page
7.4	**Nuclear Instrumentation**	**7.4-1**
7.4.1	Design Basis	7.4-1
7.4.2	System Design	7.4-1
7.4.3	Design Evaluation	7.4-3
7.5	**Engineered Safety Features Instrumentation**	**7.5-1**
7.5.1	Design Basis	7.5-1
7.5.2	System Design	7.5-2
7.5.3	System Evaluation	7.5-6
7.6	**In-core Instrumentation and Inadequate Core Cooling Monitoring System**	**7.6-1**
7.6.1	Design Basis	7.6-1
7.6.2	System Design	7.6-1
7.6.3	System Evaluation	7.6-4
7.7	**Operating Control Stations**	**7.7-1**
7.7.1	Control Room	7.7-1
7.7.2	Load Control From the Control Room	7.7-1
7.7.3	Vertical Panels and Consoles	7.7-2
7.7.4	Additional Control Stations	7.7-4
7.7.5	Fire Prevention Design	7.7-4
7.7.6	Emergency Shutdown Control	7.7-4
CHAPTER 8	**ELECTRICAL SYSTEMS**	**8-1**
8.1	**Design Basis**	**8.1-1**
8.1.1	Principal Design Criteria	8.1-1
8.2	**Electrical System**	**8.2-1**
8.2.1	Network Interconnections	8.2-1
8.2.2	Plant Distribution System	8.2-4
8.2.3	Emergency Power	8.2-14
8.2.4	Station Blackout	8.2-27

Contents

Section	Title	Page
CHAPTER 9	**AUXILIARY AND EMERGENCY SYSTEMS**	**9-1**
9.1	**General Design Criteria**	**9.1-2**
9.1.1	Related Criteria	9.1-2
9.2	**Chemical and Volume Control System**	**9.2-1**
9.2.1	Design Bases	9.2-1
9.2.2	System Design and Operation	9.2-4
9.2.3	System Design Evaluation	9.2-23
9.3	**Auxiliary Coolant System**	**9.3-1**
9.3.1	Design Basis	9.3-1
9.3.2	System Design and Operation	9.3-3
9.3.3	System Evaluation	9.3-9
9.3.4	Test and Inspection Capability	9.3-15
9.4	**Sampling System**	**9.4-1**
9.4.1	Design Basis	9.4-1
9.4.2	System Design and Operation	9.4-2
9.4.3	System Evaluation	9.4-5
9.5	**Fuel Handling System**	**9.5-1**
9.5.1	Design Basis	9.5-1
9.5.2	System Design and Operation	9.5-2
9.5.3	System Evaluation	9.5-9
9.5.4	Test and Inspection Capability	9.5-12
9.6	**Facility Services**	**9.6-1**
9.6.1	Fire Protection System	9.6-1
9.6.2	Service Water System	9.6-1
9.6.3	Auxiliary Building Ventilation Systems	9.6-5
9.6.4	Control Room Air Conditioning System	9.6-7
9.6.5	Auxiliary Building Special Ventilation System (Zone SV)	9.6-9
9.7	**Equipment and System Decontamination**	**9.7-1**
9.7.1	Design Basis	9.7-1
9.7.2	Methods of Decontamination	9.7-1
9.7.3	Decontamination Facilities	9.7-2

Contents

Section	Title	Page
9.8	**System Evaluation**	**9.8-1**
9.9	**Internal Structures**	**9.9-1**
9.9.1	Description	9.9-1
9.9.2	Design Basis	9.9-1
9.9.3	Materials	9.9-21
9.9.4	Construction	9.9-23
CHAPTER 10	**STEAM AND POWER CONVERSION SYSTEM**	**10-1**
10.1	**Design Basis**	**10.1-1**
10.1.1	Performance Objectives	10.1-1
10.1.2	Load Change Capability	10.1-1
10.1.3	Functional Limits	10.1-2
10.1.4	Secondary Functions	10.1-2
10.2	**System Design and Operation**	**10.2-1**
10.2.1	Schematic Flow Diagrams	10.2-1
10.2.2	Design Features	10.2-1
10.2.3	Chemistry and Radioactivity	10.2-16
10.2.4	Shielding	10.2-16
10.2.5	Codes and Classifications	10.2-17
10.3	**System Evaluation**	**10.3-1**
10.3.1	Safety Features	10.3-1
10.3.2	Secondary-Primary Interactions	10.3-2
10.3.3	Single Failure Analysis	10.3-3
10.4	**Tests And Inspections**	**10.4-1**
Appendix 10A	**Postulated Pipe Failure Analysis**	**10A-i**
10A.1	Description of High-Energy Systems	10.A-1
10A.2	Criteria for Protection Against Pipe Rupture	10.A-2
10A.3	Main Steam Line Routing and Rupture Evaluation	10.A-12
10A.4	Feedwater Line Routing and Rupture Evaluation	10.A-21
10A.5	CVCS Letdown Line Routing and Rupture Evaluation	10.A-24

Contents

Section	Title	Page
10A.6	Steam Generator Blowdown Line Routing and Rupture Evaluation	10.A-26
10A.7	Sampling System Line Routing and Rupture Evaluation	10.A-28
10A.8	Control Room Habitability	10.A-29
10A.9	Emergency Procedures	10.A-29
10A.10	Description of Pipe Whip Dynamic Analysis	10.A-29
10A.11	Description of Compartment Pressure Differential Analysis	10.A-29
10A.12	Description of Jet Impingement Load Analysis	10.A-30
10A.13	Containment Integrity	10.A-32
10A.14	Evaluation of Additional High Energy Systems	10.A-32
CHAPTER 11	**WASTE DISPOSAL AND RADIATION PROTECTION SYSTEM**	**11-1**
11.1	**Waste Disposal System**	**11.1-1**
11.1.1	Design Basis	11.1-1
11.1.2	System Design and Operation	11.1-2
11.1.3	Design Evaluation	11.1-12
11.1.4	Minimum Operating Conditions	11.1-13
11.2	**Radiation Protection**	**11.2-1**
11.2.1	Design Basis	11.2-1
11.2.2	Primary and Secondary Shielding	11.2-2
11.2.3	Radiation Monitoring System	11.2-7
11.2.4	Evaluation	11.2-28
11.2.5	Minimum Operating Conditions	11.2-29
11.2.6	Tests and Inspections	11.2-29
11.3	**Radioactive Materials Safety**	**11.3-1**
11.3.1	Materials Safety Program	11.3-1
11.3.2	Facilities and Equipment	11.3-2
11.3.3	Personnel and Procedures	11.3-2

Contents

Section	Title	Page
CHAPTER 12	**CONDUCT OF OPERATIONS**	**12-1**
12.1	**General**	**12.1-1**
12.2	**Organization and Responsibilities**	**12.2-1**
12.3	**Training**	**12.3-1**
12.3.1	Preoperational Training	12.3-1
12.3.2	Retraining	12.3-1
12.3.3	Emergency Plan and Other Significant Training	12.3-1
12.4	**Procedures**	**12.4-1**
12.4.1	Nuclear Administrative Directives	12.4-1
12.4.2	Operating Procedures	12.4-1
12.4.3	Surveillance Procedures	12.4-3
12.4.4	Maintenance Procedures	12.4-3
12.4.5	Instrument and Control Procedures	12.4-4
12.4.6	Radiation Protection and Chemistry Procedures	12.4-4
12.4.7	Quality Programs Procedures	12.4-5
12.5	**Records and Reports**	**12.5-1**
12.6	**Safety Review and Administrative Control**	**12.6-1**
12.6.1	Facility Safety Review Committee (FSRC)	12.6-1
12.6.2	Management Safety Review Committee (MSRC)	12.6-1
CHAPTER 13	**INITIAL TEST AND OPERATION**	**13-1**
13.1	**Tests Prior To Initial Reactor Fueling (Phase I)**	**13.1-1**
13.1.1	Construction Tests	13.1-1
13.1.2	Pre-Operational Tests	13.1-2
13.1.3	Hot Functional Tests	13.1-3
13.2	**Final Plant Preparation (Phase II)**	**13.2-1**
13.2.1	Core Loading	13.2-1
13.2.2	Post-Loading Tests	13.2-3
13.3	**Initial Testing of the Operating Reactor (Phase III)**	**13.3-1**
13.3.1	Initial Criticality	13.3-1
13.3.2	Zero Power Testing	13.3-1
13.3.3	Power Level Escalation	13.3-2

Contents

Section	Title	Page
13.3.4	Post-Startup Surveillance and Testing Requirements	13.3-3
13.3.5	Procedure Preparation and Checkout	13.3-4
13.4	**Startup Test Program Organization and Responsibilities**	**13.4-1**
13.4.1	Organization and Responsibility	13.4-1
13.4.2	Preoperational and Startup Testing	13.4-1
13.4.3	Procedural Mechanics	13.4-4
13.4.4	Technical Assistance - Test Program	13.4-6
13.5	**Corrective Action**	**13.5-1**
13.6	**Documentation**	**13.6-1**
13.7	**Scheduling**	**13.7-1**
13.7.1	Construction Tests	13.7-1
13.7.2	Preoperational Tests	13.7-1
13.7.3	Post Core Loading and Initial Tests	13.7-1
CHAPTER 14	**SAFETY ANALYSIS**	**14-1**
14.0.1	Safety Analysis Overview	14.0-1
14.0.2	Safety Analysis Assumptions	14.0-7
14.0.3	Operating Parameters	14.0-7
14.0.4	Reactor Protection System	14.0-8
14.0.5	Safety Analysis and Core Reload Methodology	14.0-13
14.1	**Core and Coolant Boundary Protection Analysis**	**14.1-1**
14.1.1	Uncontrolled RCCA Withdrawal from a Subcritical Condition	14.1-1
14.1.2	Uncontrolled RCCA Withdrawal at Power	14.1-5
14.1.3	RCCA Misalignment	14.1-9
14.1.4	Chemical and Volume Control System Malfunction	14.1-13
14.1.5	Startup of an Inactive Reactor Coolant Loop	14.1-17
14.1.6	Excessive Heat Removal Due to Feedwater System Malfunctions	14.1-17
14.1.7	Excessive Load Increase Incident	14.1-22
14.1.8	Loss of Reactor Coolant Flow	14.1-24
14.1.9	Loss of External Electrical Load	14.1-35
14.1.10	Loss of Normal Feedwater	14.1-38

Contents

Section	Title	Page
14.1.11	Loss of Normal Feedwater - Operation at 100.6 Percent of 1772 MWt Reactor Power	14.1-41
14.1.12	Anticipated Transients Without Scram	14.1-44
14.1.13	Loss of AC Power to the Plant Auxiliaries	14.1-45
14.2	**Standby Safety Features Analysis**	**14.2-1**
14.2.1	Fuel Handling Accidents	14.2-1
14.2.2	Accidental Release-Recycle of Waste Liquid	14.2-5
14.2.3	Accidental Release-waste Gas	14.2-7
14.2.4	Steam Generator Tube Rupture	14.2-10
14.2.5	Steam Line Break	14.2-15
14.2.6	Rupture of a Control Rod Drive Mechanism Housing (RCCA Ejection)	14.2-26
14.2.7	Turbine Missile Damage to Spent Fuel Pool	14.2-32
14.3	**Reactor Coolant System Pipe Ruptures (LOCA)**	**14.3-1**
14.3.1	General	14.3-1
14.3.2	Major Reactor Coolant System Pipe Ruptures (LOCA)	14.3-6
14.3.3	Core and Internals Integrity Analysis	14.3-19
14.3.4	Containment Integrity Evaluation	14.3-27
14.3.5	Off-Site Dose Consequences	14.3-42
14.3.6	Charcoal Filter Ignition Hazard Due to Iodine Absorption	14.3-47
14.3.7	Generation and Disposition of Hydrogen	14.3-48
14.3.8	Steam Generator Tube Plugging	14.3-61
14.3.9	Steam Generator Tube Fatigue Analysis	14.3-61
14.3.10	Steam Generator Tube Removal	14.3-61
Appendix 14A	**Heat Transfer Coefficients - LOCTA-R**	**14A-1**
Appendix 14B	**Westinghouse Heat Transfer Research and Development Programs**	**14B-1**
Appendix 14C	**Containment Pressure Response to LOCA**	**14C-1**
APPENDIX A	**GEOLOGY & SEISMOLOGY**	**A-i**
APPENDIX B	**SPECIAL DESIGN PROCEDURES**	**B-i**

Contents

Section	Title	Page
APPENDIX C	**QUALITY ASSURANCE PROGRAM**	**C-i**
APPENDIX D	**RADIOACTIVE SOURCE BASES**	**D-i**
APPENDIX E	**FOUNDATION DESIGN CRITERIA**	**E-i**
APPENDIX F	**EMERGENCY CORE COOLING**	**F-i**
APPENDIX G	**EMERGENCY PLAN**	**G-i**
APPENDIX H	**CONTAINMENT SYSTEM EVALUATION**	**H-i**

LIST OF EFFECTIVE PAGES

General Table of Contents

First Page	Last Page	Revision
TOC-i	TOC-xiv	Revision 20—04/07

List of Effective Pages

First Page	Last Page	Revision
LEP-1	LEP-6	Revision 20—04/07

Chapter 1

First Page	Last Page	Revision
1-i	1-iv	Revision 20—04/07
1.0-1	1.0-8	Revision 20—04/07
1.1-1	1.1-6	Revision 20—04/07
1.2-1	1.2-18	Revision 20—04/07
1.3-1	1.3-26	Revision 20—04/07
1.4-1	1.4-20	Revision 20—04/07
1.5-1	1.5-2	Revision 20—04/07
1.6-1	1.6-12	Revision 20—04/07
1.7-1	1.7-2	Revision 20—04/07
1.8-1	1.8-28	Revision 20—04/07
1.9-1	1.9-2	Revision 20—04/07
1.10-1	1.10-2	Revision 20—04/07

Chapter 2

First Page	Last Page	Revision
2-i	2-iv	Revision 20—04/07
2.1-1	2.1-2	Revision 20—04/07
2.2-1	2.2-4	Revision 20—04/07
2.3-1	2.3-4	Revision 20—04/07
2.4-1	2.4-4	Revision 20—04/07
2.5-1	2.5-2	Revision 20—04/07
2.6-1	2.6-20	Revision 20—04/07
2.7-1	2.7-26	Revision 20—04/07

Chapter 2 (continued)

First Page	Last Page	Revision
2.8-1	2.8-2	Revision 20—04/07
2.9-1	2.9-2	Revision 20—04/07
2.10-1	2.10-4	Revision 20—04/07
2.11-1	2.11-2	Revision 20—04/07

Chapter 3

First Page	Last Page	Revision
3-i	3-iv	Revision 20—04/07
3.1-1	3.1-10	Revision 20—04/07
3.2-1	3.2-68	Revision 20—04/07
3.3-1	3.3-2	Revision 20—04/07

Chapter 4

First Page	Last Page	Revision
4-i	4-vi	Revision 20—04/07
4.1-1	4.1-32	Revision 20—04/07
4.2-1	4.2-44	Revision 20—04/07
4.3-1	4.3-10	Revision 20—04/07
4.4-1	4.4-20	Revision 20—04/07

Chapter 5

First Page	Last Page	Revision
5-i	5-x	Revision 20—04/07
5.1-1	5.1-6	Revision 20—04/07
5.2-1	5.2-92	Revision 20—04/07
5.3-1	5.3-6	Revision 20—04/07
5.4-1	5.4-16	Revision 20—04/07
5.5-1	5.5-8	Revision 20—04/07
5.6-1	5.6-2	Revision 20—04/07
5.7-1	5.7-4	Revision 20—04/07
5.8-1	5.8-2	Revision 20—04/07
5.9-1	5.9-52	Revision 20—04/07

Chapter 6

First Page	Last Page	Revision
6-i	6-vi	Revision 20—04/07
6.1-1	6.1-8	Revision 20—04/07
6.2-1	6.2-60	Revision 20—04/07
6.3-1	6.3-16	Revision 20—04/07
6.4-1	6.4-20	Revision 20—04/07
6.5-1	6.5-10	Revision 20—04/07
6.6-1	6.6-8	Revision 20—04/07

Chapter 7

First Page	Last Page	Revision
7-i	7-vi	Revision 20—04/07
7.1-1	7.1-2	Revision 20—04/07
7.2-1	7.2-58	Revision 20—04/07
7.3-1	7.3-10	Revision 20—04/07
7.4-1	7.4-4	Revision 20—04/07
7.5-1	7.5-14	Revision 20—04/07
7.6-1	7.6-8	Revision 20—04/07
7.7-1	7.7-10	Revision 20—04/07

Chapter 8

First Page	Last Page	Revision
8-i	8-iv	Revision 20—04/07
8.1-1	8.1-4	Revision 20—04/07
8.2-1	8.2-48	Revision 20—04/07

Chapter 9

First Page	Last Page	Revision
9-i	9-x	Revision 20—04/07
9.1-1	9.1-2	Revision 20—04/07
9.2-1	9.2-40	Revision 20—04/07
9.3-1	9.3-30	Revision 20—04/07
9.4-1	9.4-12	Revision 20—04/07
9.5-1	9.5-20	Revision 20—04/07

Chapter 9 (continued)

First Page	Last Page	Revision
9.6-1	9.6-22	Revision 20—04/07
9.7-1	9.7-2	Revision 20—04/07
9.8-1	9.8-2	Revision 20—04/07
9.9-1	9.9-50	Revision 20—04/07

Chapter 10

First Page	Last Page	Revision
10-i	10-x	Revision 20—04/07
10.1-1	10.1-6	Revision 20—04/07
10.2-1	10.2-30	Revision 20—04/07
10.3-1	10.3-4	Revision 20—04/07
10.4-1	10.4-4	Revision 20—04/07
10A-i	10A-ii	Revision 20—04/07
10A-1	10A-240	Revision 20—04/07

Chapter 11

First Page	Last Page	Revision
11-i	11-vi	Revision 20—04/07
11.1-1	11.1-32	Revision 20—04/07
11.2-1	11.2-54	Revision 20—04/07
11.3-1	11.3-4	Revision 20—04/07

Chapter 12

First Page	Last Page	Revision
12-i	12-ii	Revision 20—04/07
12.1-1	12.1-2	Revision 20—04/07
12.2-1	12.2-2	Revision 20—04/07
12.3-1	12.3-2	Revision 20—04/07
12.4-1	12.4-6	Revision 20—04/07
12.5-1	12.5-2	Revision 20—04/07
12.6-1	12.6-2	Revision 20—04/07

Chapter 13

First Page	Last Page	Revision
13-i	13-iv	Revision 20—04/07
13.1-1	13.1-18	Revision 20—04/07
13.2-1	13.2-4	Revision 20—04/07
13.3-1	13.3-8	Revision 20—04/07
13.4-1	13.4-10	Revision 20—04/07
13.5-1	13.5-2	Revision 20—04/07
13.6-1	13.6-2	Revision 20—04/07
13.7-1	13.7-2	Revision 20—04/07

Chapter 14

First Page	Last Page	Revision
14-i	14-xx	Revision 20—04/07
14-1	14-20	Revision 20—04/07
14.1-1	14.1-188	Revision 20—04/07
14.2-1	14.2-66	Revision 20—04/07
4.3-1	14.3-168	Revision 20—04/07
14A-1	14A-6	Revision 20—04/07
14B-1	14B-4	Revision 20—04/07
14C-1	14C-44	Revision 20—04/07

Appendix A

First Page	Last Page	Revision
A-i	A-vi	Revision 20—04/07
A-1	A-92	Revision 20—04/07

Appendix B

First Page	Last Page	Revision
B-i	B-vi	Revision 20—04/07
B-1	B-64	Revision 20—04/07

Appendix C

First Page	Last Page	Revision
C-i	C-ii	Revision 20—04/07
C-1	C-2	Revision 20—04/07

Appendix D

First Page	Last Page	Revision
D-i	D-iv	Revision 20—04/07
D-1	D-28	Revision 20—04/07

Appendix E

First Page	Last Page	Revision
E-i	E-viii	Revision 20—04/07
E-1	E-114	Revision 20—04/07

Appendix F

First Page	Last Page	Revision
F-i	F-ii	Revision 20—04/07
F-1	F-2	Revision 20—04/07

Appendix G

First Page	Last Page	Revision
G-i	G-ii	Revision 20—04/07
G-1	G-2	Revision 20—04/07

Appendix H

First Page	Last Page	Revision
H-i	H-vi	Revision 20—04/07
H-1	H56	Revision 20—04/07