

Chapter 3



VCS UFSAR Table of Contents

Chapter 1 — Introduction and General Description of the Plant

Chapter 2 — Site Characteristics

Chapter 3 — Design of Structures, Components, Equipment and Systems

Chapter 4 — Reactor

Chapter 5 — Reactor Coolant System and Connected Systems

Chapter 6 — Engineered Safety Features

Chapter 7 — Instrumentation and Controls

Chapter 8 — Electric Power

Chapter 9 — Auxiliary Systems

Chapter 10 — Steam and Power Conversion

Chapter 11 — Radioactive Waste Management

Chapter 12 — Radiation Protection

Chapter 13 — Conduct of Operation

Chapter 14 — Initial Test Program

Chapter 15 — Accident Analyses






Chapter 16 — Technical Specifications

Chapter 17 — Quality Assurance

Chapter 18 — Human Factors Engineering

Chapter 19 — Probabilistic Risk Assessment

VCS UFSAR Formatting Legend

Color	Description
	Original Westinghouse AP1000 DCD Revision 19 content
	Departures from AP1000 DCD Revision 19 content
	Standard FSAR content
	Site-specific FSAR content
	Linked cross-references (chapters, appendices, sections, subsections, tables, figures, and references)

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
CHAPTER 3	DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT AND SYSTEMS	3.1-1
3.1	Conformance with Nuclear Regulatory Commission General Design Criteria	3.1-1
3.1.1	Overall Requirements	3.1-1
3.1.2	Protection by Multiple Fission Product Barriers	3.1-4
3.1.3	Protection and Reactivity Control Systems	3.1-10
3.1.4	Fluid Systems	3.1-14
3.1.5	Reactor Containment	3.1-23
3.1.6	Fuel and Reactivity Control	3.1-26
3.1.7	Combined License Information	3.1-29
3.1.8	References	3.1-29
3.2	Classification of Structures, Components, and Systems	3.2-1
3.2.1	Seismic Classification	3.2-1
3.2.1.1	Definitions	3.2-1
3.2.1.2	Classifications	3.2-3
3.2.1.3	Classification of Building Structures	3.2-3
3.2.2	AP1000 Classification System	3.2-3
3.2.2.1	Classification Definitions	3.2-3
3.2.2.2	Application of Classification	3.2-4
3.2.2.3	Equipment Class A	3.2-5
3.2.2.4	Equipment Class B	3.2-5
3.2.2.5	Equipment Class C	3.2-5
3.2.2.6	Equipment Class D	3.2-7
3.2.2.7	Other Equipment Classes	3.2-9
3.2.2.8	Instrumentation and Control Line Interface Criteria	3.2-11
3.2.2.9	Electrical Classifications	3.2-11
3.2.3	Inspection Requirements	3.2-11
3.2.4	Application of AP1000 Safety-Related Equipment and Seismic Classification System	3.2-12
3.2.5	Combined License Information	3.2-16
3.2.6	References	3.2-16
3.3	Wind and Tornado Loadings	3.3-1
3.3.1	Wind Loadings	3.3-1
3.3.1.1	Design Wind Velocity	3.3-1
3.3.1.2	Determination of Applied Forces	3.3-1
3.3.2	Tornado Loadings	3.3-1
3.3.2.1	Applicable Design Parameters	3.3-2
3.3.2.2	Determination of Forces on Structures	3.3-2
3.3.2.3	Effect of Failure of Structures or Components Not Designed for Tornado Loads	3.3-3
3.3.2.4	Tornado Loads on the Passive Containment Cooling System Air Baffle	3.3-3
3.3.3	Combined License Information	3.3-4
3.3.4	References	3.3-4
3.4	Water Level (Flood) Design	3.4-1
3.4.1	Flood Protection	3.4-1

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3.4.1.1 Flood Protection Measures for Seismic Category I Structures, Systems, and Components	3.4-1
	3.4.1.2 Evaluation of Flooding Events	3.4-4
	3.4.1.3 Permanent Dewatering System	3.4-20
3.4.2	Analytical and Test Procedures	3.4-20
3.4.3	Combined License Information	3.4-20
3.4.4	References	3.4-20
3.5	Missile Protection	3.5-1
3.5.1	Missile Selection and Description	3.5-3
3.5.1.1	Internally Generated Missiles (Outside Containment)	3.5-3
3.5.1.2	Internally Generated Missiles (Inside Containment)	3.5-7
3.5.1.3	Turbine Missiles	3.5-9
3.5.1.4	Missiles Generated by Natural Phenomena	3.5-10
3.5.1.5	Missiles Generated by Events Near the Site	3.5-11
3.5.1.6	Aircraft Hazards	3.5-11
3.5.2	Protection from Externally Generated Missiles	3.5-11
3.5.3	Barrier Design Procedures	3.5-12
3.5.3.1	Ductility Factors for Steel Structures	3.5-14
3.5.4	Combined License Information	3.5-14
3.5.5	References	3.5-15
3.6	Protection Against the Dynamic Effects Associated with the Postulated Rupture of Piping	3.6-1
3.6.1	Postulated Piping Failures in Fluid Systems Inside and Outside Containment	3.6-2
3.6.1.1	Design Basis	3.6-3
3.6.1.2	Description	3.6-5
3.6.1.3	Safety Evaluation	3.6-7
3.6.2	Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping	3.6-10
3.6.2.1	Criteria Used to Define High- and Moderate-Energy Break and Crack Locations and Configurations	3.6-10
3.6.2.2	Analytical Methods to Define Jet Thrust Forcing Functions and Response Models	3.6-17
3.6.2.3	Dynamic Analysis Methods to Verify Integrity and Operability	3.6-18
3.6.2.4	Protective Assembly Design Criteria	3.6-22
3.6.2.5	Evaluation of Dynamic Effects of Pipe Ruptures	3.6-22
3.6.2.6	Evaluation of Flooding Effects from Pipe Failures	3.6-25
3.6.2.7	Evaluation of Spray Effects from High- and Moderate-Energy Through-Wall Cracks	3.6-25
3.6.3	Leak-before-Break Evaluation Procedures	3.6-25
3.6.3.1	Application of Mechanistic Pipe Break Criteria	3.6-26
3.6.3.2	Design Criteria for Leak-before-Break	3.6-27
3.6.3.3	Analysis Methods and Criteria	3.6-29
3.6.3.4	Documentation of Leak-before-Break Evaluations	3.6-30
3.6.4	Combined License Information	3.6-31
3.6.4.1	Pipe Break Hazard Analysis	3.6-31

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3.6.4.2 Leak-before-Break Evaluation of As-Designed Piping	3.6-31
	3.6.4.3 Leak-before-Break Evaluation of As-Built Piping	3.6-31
	3.6.4.4 Primary System Inspection Program for Leak-before-Break Piping	3.6-31
	3.6.5 References	3.6-31
3.7	Seismic Design	3.7-1
	3.7.1 Seismic Input	3.7-1
	3.7.1.1 Design Response Spectra	3.7-1
	3.7.1.2 Design Time History	3.7-3
	3.7.1.3 Critical Damping Values	3.7-4
	3.7.1.4 Supporting Media for Seismic Category I Structures	3.7-5
	3.7.2 Seismic System Analysis	3.7-7
	3.7.2.1 Seismic Analysis Methods	3.7-8
	3.7.2.2 Natural Frequencies and Response Loads	3.7-9
	3.7.2.3 Procedure Used for Modeling	3.7-9
	3.7.2.4 Soil-Structure Interaction	3.7-13
	3.7.2.5 Development of Floor Response Spectra	3.7-13
	3.7.2.6 Three Components of Earthquake Motion	3.7-14
	3.7.2.7 Combination of Modal Responses	3.7-15
	3.7.2.8 Interaction of Seismic Category II and Nonseismic Structures with Seismic Category I Structures, Systems, or Components	3.7-15
	3.7.2.9 Effects of Parameter Variations on Floor Response Spectra	3.7-18
	3.7.2.10 Use of Constant Vertical Static Factors	3.7-18
	3.7.2.11 Method Used to Account for Torsional Effects	3.7-18
	3.7.2.12 Methods for Seismic Analysis of Dams	3.7-19
	3.7.2.13 Determination of Seismic Category I Structure Overturning Moments	3.7-19
	3.7.2.14 Analysis Procedure for Damping	3.7-19
	3.7.3 Seismic Subsystem Analysis	3.7-19
	3.7.3.1 Seismic Analysis Methods	3.7-20
	3.7.3.2 Determination of Number of Earthquake Cycles	3.7-20
	3.7.3.3 Procedure Used for Modeling	3.7-20
	3.7.3.4 Basis for Selection of Frequencies	3.7-21
	3.7.3.5 Equivalent Static Load Method of Analysis	3.7-21
	3.7.3.6 Three Components of Earthquake Motion	3.7-22
	3.7.3.7 Combination of Modal Responses	3.7-23
	[3.7.3.8 <i>Analytical Procedure for Piping</i>	3.7-27
	3.7.3.9 Combination of Support Responses	3.7-31
	3.7.3.10 Vertical Static Factors	3.7-34
	3.7.3.11 Torsional Effects of Eccentric Masses	3.7-34
	3.7.3.12 Seismic Category I Buried Piping Systems and Tunnels	3.7-34
	3.7.3.13 Interaction of Other Systems with Seismic Category I Systems	3.7-34

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3.7.3.14 Seismic Analyses for Reactor Internals	3.7-40
	3.7.3.15 Analysis Procedure for Damping	3.7-40
	3.7.3.16 Analysis of Seismic Category I Tanks	3.7-40
	3.7.3.17 Time History Analysis of Piping Systems	3.7-40
3.7.4	Seismic Instrumentation	3.7-41
	3.7.4.1 Comparison with Regulatory Guide 1.12	3.7-41
	3.7.4.2 Location and Description of Instrumentation	3.7-42
	3.7.4.3 Control Room Operator Notification	3.7-43
	3.7.4.4 Comparison of Measured and Predicted Responses ...	3.7-43
	3.7.4.5 Tests and Inspections	3.7-44
3.7.5	Combined License Information	3.7-44
	3.7.5.1 Seismic Analysis of Dams	3.7-44
	3.7.5.2 Post-Earthquake Procedures	3.7-44
	3.7.5.3 Seismic Interaction Review	3.7-44
	3.7.5.4 Reconciliation of Seismic Analyses of Nuclear Island Structures	3.7-44
	3.7.5.5 Free Field Acceleration Sensor	3.7-44
3.7.6	References	3.7-44
3.8	Design of Category I Structures	3.8-1
	3.8.1 Concrete Containment	3.8-1
	3.8.2 Steel Containment	3.8-1
	3.8.2.1 Description of the Containment	3.8-1
	3.8.2.2 Applicable Codes, Standards, and Specifications	3.8-5
	3.8.2.3 Loads and Load Combinations	3.8-5
	3.8.2.4 Design and Analysis Procedures	3.8-6
	3.8.2.5 Structural Criteria	3.8-14
	3.8.2.6 Materials, Quality Control, and Special Construction Techniques	3.8-15
	3.8.2.7 Testing and In-Service Inspection Requirements	3.8-16
3.8.3	Concrete and Steel Internal Structures of Steel Containment	3.8-16
	3.8.3.1 Description of the Containment Internal Structures	3.8-16
	3.8.3.2 Applicable Codes, Standards, and Specifications	3.8-20
	3.8.3.3 Loads and Load Combinations	3.8-20
	3.8.3.4 Analysis Procedures	3.8-22
	3.8.3.5 Design Procedures and Acceptance Criteria	3.8-28
	3.8.3.6 Materials, Quality Control, and Special Construction Techniques	3.8-35
	3.8.3.7 In-Service Testing and Inspection Requirements	3.8-36
	3.8.3.8 Construction Inspection	3.8-36
3.8.4	Other Category I Structures	3.8-37
	3.8.4.1 Description of the Structures	3.8-37
	3.8.4.2 Applicable Codes, Standards, and Specifications	3.8-42
	3.8.4.3 Loads and Load Combinations	3.8-42
	3.8.4.4 Design and Analysis Procedures	3.8-45
	3.8.4.5 Structural Criteria	3.8-49
	3.8.4.6 Materials, Quality Control, and Special Construction Techniques	3.8-53

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3.8.4.7 Testing and In-Service Inspection Requirements	3.8-55
	3.8.4.8 Construction Inspection	3.8-55
3.8.5	Foundations	3.8-56
	3.8.5.1 Description of the Foundations	3.8-56
	3.8.5.2 Applicable Codes, Standards, and Specifications	3.8-57
	3.8.5.3 Loads and Load Combinations	3.8-57
	3.8.5.4 Design and Analysis Procedures	3.8-57
	3.8.5.5 Structural Criteria	3.8-62
	3.8.5.6 Materials, Quality Control, and Special Construction Techniques	3.8-66
	3.8.5.7 In-Service Testing and Inspection Requirements	3.8-66
	3.8.5.8 Construction Inspection	3.8-66
3.8.6	Combined License Information	3.8-66
	3.8.6.1 Containment Vessel Design Adjacent to Large Penetrations	3.8-66
	3.8.6.2 Passive Containment Cooling System Water Storage Tank Examination	3.8-66
	3.8.6.3 As-Built Summary Report	3.8-66
	3.8.6.4 In-Service Inspection of Containment Vessel	3.8-66
	3.8.6.5 Structures Inspection Program	3.8-66
	3.8.6.6 Construction Procedures Program	3.8-67
3.8.7	References	3.8-67
3.9	Mechanical Systems and Components	3.9-1
3.9.1	Special Topics for Mechanical Components	3.9-1
	3.9.1.1 Design Transients	3.9-1
	3.9.1.2 Computer Programs Used in Analyses	3.9-23
	3.9.1.3 Experimental Stress Analysis	3.9-23
	3.9.1.4 Considerations for the Evaluation of the Faulted Conditions	3.9-23
	3.9.1.5 Module Interaction, Coupling, and Other Issues	3.9-24
3.9.2	Dynamic Testing and Analysis	3.9-24
	3.9.2.1 Piping Vibration, Thermal Expansion, and Dynamic Effects	3.9-24
	3.9.2.2 Seismic Qualification Testing of Safety-Related Mechanical Equipment	3.9-26
	3.9.2.3 Dynamic Response Analysis of Reactor Internals under Operational Flow Transients and Steady-State Conditions	3.9-28
	3.9.2.4 Pre-operational Flow-Induced Vibration Testing of Reactor Internals	3.9-31
	3.9.2.5 Dynamic System Analysis of the Reactor Internals Under Faulted Conditions	3.9-33
	3.9.2.6 Correlation of Reactor Internals Vibration Tests with the Analytical Results	3.9-37
3.9.3	ASME Code Classes 1, 2, and 3 Components, Component Supports, and Core Support Structures	3.9-37

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3.9.3.1 Loading Combinations, Design Transients, and Stress Limits	3.9-38
	3.9.3.2 Pump and Valve Operability Assurance	3.9-51
	3.9.3.3 Design and Installation Criteria of Class 1, 2, and 3 Pressure Relieving Devices	3.9-53
	3.9.3.4 Component and Piping Supports	3.9-55
	3.9.3.5 Instrumentation Line Supports	3.9-62
3.9.4	Control Rod Drive System (CRDS)	3.9-62
	3.9.4.1 Descriptive Information of CRDS	3.9-62
	3.9.4.2 Applicable CRDS Design Specifications	3.9-67
	3.9.4.3 Design Loads, Stress Limits, and Allowable Deformations	3.9-70
	3.9.4.4 Control Rod Drive Mechanism Performance Assurance Program	3.9-70
3.9.5	Reactor Pressure Vessel Internals	3.9-71
	3.9.5.1 Design Arrangements	3.9-71
	3.9.5.2 Design Loading Conditions	3.9-73
	3.9.5.3 Design Bases	3.9-74
3.9.6	Inservice Testing of Pumps and Valves	3.9-76
	3.9.6.1 Inservice Testing of Pumps	3.9-77
	3.9.6.2 Inservice Testing of Valves	3.9-77
	3.9.6.3 Relief Requests	3.9-87
3.9.7	Integrated Head Package	3.9-88
	3.9.7.1 Design Bases	3.9-88
	3.9.7.2 Design Description	3.9-89
	3.9.7.3 Design Evaluation	3.9-91
	3.9.7.4 Inspection and Testing Requirements	3.9-91
3.9.8	Combined License Information	3.9-91
	3.9.8.1 Reactor Internals Vibration Assessment and Predicted Response	3.9-91
	3.9.8.2 Design Specifications and Reports	3.9-91
	3.9.8.3 Snubber Operability Testing	3.9-92
	3.9.8.4 Valve Inservice Testing	3.9-92
	3.9.8.5 Surge Line Thermal Monitoring	3.9-92
	3.9.8.6 Piping Benchmark Program	3.9-92
	3.9.8.7 As-Designed Piping Analysis	3.9-92
3.9.9	References	3.9-92
3.10	Seismic and Dynamic Qualification of Seismic Category I Mechanical and Electrical Equipment	3.10-1
	3.10.1 Seismic and Dynamic Qualification Criteria	3.10-2
	3.10.1.1 Qualification Standards	3.10-2
	3.10.1.2 Performance Requirements for Seismic Qualification	3.10-2
	3.10.1.3 Performance Criteria	3.10-2
3.10.2	Methods and Procedures for Qualifying Electrical Equipment, Instrumentation, and Mechanical Components	3.10-3

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3.10.2.1 Seismic Qualification of Instrumentation and Electrical Equipment	3.10-4
	3.10.2.2 Seismic and Operability Qualification of Active Mechanical Equipment	3.10-4
	3.10.2.3 Valve Operator Qualification	3.10-6
	3.10.2.4 Seismic Qualification of Other Seismic Category I Mechanical Equipment	3.10-6
3.10.3	Method and Procedures for Qualifying Supports of Electrical Equipment, Instrumentation, and Mechanical Components	3.10-6
3.10.4	Documentation	3.10-6
3.10.5	Standard Review Plan Evaluation	3.10-7
3.10.6	Combined License Information Item on Experienced-Based Qualification	3.10-7
3.10.7	References	3.10-7
3.11	Environmental Qualification of Mechanical and Electrical Equipment	3.11-1
	3.11.1 Equipment Identification and Environmental Conditions	3.11-1
	3.11.1.1 Equipment Identification	3.11-1
	3.11.1.2 Definition of Environmental Conditions	3.11-1
	3.11.1.3 Equipment Operability Times	3.11-2
	3.11.1.4 Standard Review Plan Evaluation	3.11-3
3.11.2	Qualification Tests and Analysis	3.11-3
	3.11.2.1 Environmental Qualification of Electrical Equipment	3.11-3
	3.11.2.2 Environmental Qualification of Mechanical Equipment	3.11-3
3.11.3	Loss of Ventilation	3.11-4
3.11.4	Estimated Radiation and Chemical Environment	3.11-4
3.11.5	Combined License Information Item for Equipment Qualification File	3.11-5
3.11.6	References	3.11-6
APPENDIX 3A	HVAC DUCTS AND DUCT SUPPORTS	3A-1
3A.1	Codes and Standards	3A-1
3A.2	Loads and Load Combinations	3A-1
	3A.2.1 Loads	3A-1
	3A.2.1.1 Dead Load (D)	3A-1
	3A.2.1.2 Construction Live Load (L)	3A-1
	3A.2.1.3 Pressure (P)	3A-1
	3A.2.1.4 Safe Shutdown Earthquake (Es)	3A-2
	3A.2.1.5 Wind Loads (W)	3A-2
	3A.2.1.6 Tornado Loads (Wt)	3A-2
	3A.2.1.7 External Pressure Differential Loads (PA)	3A-2
	3A.2.1.8 Thermal (TO/TA)	3A-2
3A.2.2	Load Combinations	3A-2
3A.3	Analysis and Design	3A-2
	3A.3.1 Response Due to Seismic Loads	3A-3
	3A.3.2 Deflection Criteria	3A-3
	3A.3.3 Relative Movement	3A-3
	3A.3.4 Allowable Stresses	3A-3

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3A.3.5 Connections	3A-3
APPENDIX 3B	LEAK-BEFORE-BREAK EVALUATION OF THE AP1000 PIPING	3B-1
3B.1	Leak-before-Break Criteria for AP1000 Piping	3B-1
3B.2	Potential Failure Mechanisms for AP1000 Piping	3B-2
	3B.2.1 Erosion-Corrosion Induced Wall Thinning	3B-2
	3B.2.2 Stress Corrosion Cracking	3B-3
	3B.2.3 Water Hammer	3B-4
	3B.2.4 Fatigue	3B-5
	3B.2.5 Thermal Aging	3B-6
	3B.2.6 Thermal Stratification	3B-6
	3B.2.7 Other Mechanisms	3B-7
3B.3	Leak-before-Break Bounding Analysis	3B-8
	3B.3.1 Procedure for Stainless Steel Piping	3B-8
	3B.3.1.1 Pipe Geometry, Material and Operating Conditions ...	3B-8
	3B.3.1.2 Pipe Physical Properties	3B-9
	3B.3.1.3 Low Normal Stress Case (Case 1)	3B-9
	3B.3.1.4 High Normal Stress Case (Case 2)	3B-9
	3B.3.1.5 Develop the Bounding Analysis Curve	3B-10
	3B.3.2 Procedure for Non-stainless Steel Piping	3B-10
	3B.3.2.1 Pipe Geometry, Material and Operating Conditions ..	3B-10
	3B.3.2.2 Calculations Steps	3B-10
	3B.3.2.3 Low Normal Stress Case (Case 1)	3B-11
	3B.3.2.4 High Normal Stress Case (Case 2)	3B-11
	3B.3.2.5 Develop the Bounding Analysis Curve	3B-11
	3B.3.3 Evaluation of Piping System Using Bounding Analysis Curves	3B-12
	3B.3.3.1 Calculation of Stresses	3B-12
	3B.3.3.2 Normal Loads	3B-13
	3B.3.3.3 Maximum Loads	3B-13
	3B.3.3.4 Bounding Analysis Curve Comparison – LBB Criteria	3B-14
	3B.3.4 Bounding Analysis Results	3B-14
3B.4	Differences in Leak-before-Break Analysis for Stainless Steel and Ferritic Steel Pipe	3B-14
3B.5	Differences in Inspection Criteria for Class 1, 2, and 3 Systems	3B-14
3B.6	Differences in Fabrication Requirements of ASME Class 1, Class 2, and Class 3 Piping	3B-14
3B.7	Sensitivity Study for the Constraint Effect on LBB	3B-15
3B.8	References	3B-15
APPENDIX 3C	REACTOR COOLANT LOOP ANALYSIS METHODS	3C-1
3C.1	Reactor Coolant Loop Model Description	3C-1
	3C.1.1 Steam Generator Model	3C-1
	3C.1.1.1 Steam Generator Mass and Geometrical Model	3C-1
	3C.1.1.2 Steam Generator Supports	3C-1
	3C.1.2 Reactor Coolant Pump Model	3C-1
	3C.1.2.1 Static Model	3C-1
	3C.1.2.2 Seismic Model	3C-1
	3C.1.2.3 Reactor Coolant Pump Supports	3C-2

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
3C.1.3	Reactor Pressure Vessel Model	3C-2
	3C.1.3.1 Mass and Geometrical Model	3C-2
	3C.1.3.2 Reactor Pressure Vessel Supports	3C-2
3C.1.4	Containment Interior Building Structure Model	3C-2
3C.1.5	Reactor Coolant Loop Piping Model	3C-2
3C.2	Design Requirements	3C-2
3C.3	Static Analyses	3C-3
	3C.3.1 Deadweight Analysis	3C-3
	3C.3.2 Internal Pressure Analysis	3C-3
	3C.3.3 Thermal Expansion Analysis	3C-3
3C.4	Seismic Analyses	3C-3
3C.5	Reactor Coolant Loop Piping Stresses	3C-4
3C.6	Description of Computer Programs	3C-4
APPENDIX 3D	METHODOLOGY FOR QUALIFYING AP1000 SAFETY-RELATED ELECTRICAL AND MECHANICAL EQUIPMENT	3D-1
3D.1	Purpose	3D-2
3D.2	Scope	3D-2
3D.3	Introduction	3D-2
3D.4	Qualification Criteria	3D-2
	3D.4.1 Qualification Guides	3D-3
	3D.4.1.1 IEEE Standards	3D-3
	3D.4.1.2 NRC Regulatory Guides	3D-4
	3D.4.2 Definitions	3D-6
	3D.4.3 Mild Versus Harsh Environments	3D-6
	3D.4.4 Test Sequence	3D-7
	3D.4.5 Aging	3D-8
	3D.4.5.1 Design Life	3D-8
	3D.4.5.2 Shelf Life	3D-8
	3D.4.5.3 Qualified Life	3D-8
	3D.4.5.4 Qualified Life Reevaluation	3D-9
	3D.4.6 Operability Time	3D-10
	3D.4.7 Performance Criterion	3D-10
	3D.4.8 Margin	3D-11
	3D.4.8.1 Normal and Abnormal Extremes	3D-11
	3D.4.8.2 Aging	3D-11
	3D.4.8.3 Radiation	3D-12
	3D.4.8.4 Seismic Conditions	3D-12
	3D.4.8.5 High-Energy Line Break Conditions	3D-13
	3D.4.9 Treatment of Failures	3D-13
	3D.4.10 Traceability	3D-13
	3D.4.10.1 Auditable Link Document	3D-13
	3D.4.10.2 Similarity	3D-14
3D.5	Design Specifications	3D-14
	3D.5.1 Normal Operating Conditions	3D-15
	3D.5.1.1 Pressure, Temperature, Humidity	3D-15
	3D.5.1.2 Radiation Dose	3D-15
	3D.5.2 Abnormal Operating Conditions	3D-15

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	3D.5.2.1 Abnormal Environments Inside Containment	3D-16
	3D.5.2.2 Abnormal Environments Outside Containment	3D-16
3D.5.3	Seismic Events	3D-16
3D.5.4	Containment Test Environment	3D-16
3D.5.5	Design Basis Event Conditions	3D-17
	3D.5.5.1 High-Energy Line Break Accidents Inside Containment	3D-17
	3D.5.5.2 High-Energy Line Break Accidents Outside Containment	3D-20
3D.6	Qualification Methods	3D-20
3D.6.1	Type Test	3D-20
3D.6.2	Analysis	3D-21
	3D.6.2.1 Similarity	3D-21
	3D.6.2.2 Substitution	3D-21
	3D.6.2.3 Analysis of Safety-Related Mechanical Equipment ...	3D-22
3D.6.3	Operating Experience	3D-24
3D.6.4	On-Going Qualification	3D-24
3D.6.5	Combinations of Methods	3D-24
	3D.6.5.1 Use of Existing Qualification Reports	3D-25
3D.7	Documentation	3D-25
3D.7.1	Equipment Qualification Data Package	3D-26
3D.7.2	Specifications	3D-26
	3D.7.2.1 Equipment Identification	3D-26
	3D.7.2.2 Installation Requirements	3D-26
	3D.7.2.3 Electrical Requirements	3D-27
	3D.7.2.4 Auxiliary Devices	3D-27
	3D.7.2.5 Preventive Maintenance	3D-27
	3D.7.2.6 Performance Requirements	3D-27
	3D.7.2.7 Environmental Conditions	3D-27
3D.7.3	Qualification Program	3D-28
3D.7.4	Qualification by Test	3D-28
	3D.7.4.1 Specimen Description	3D-28
	3D.7.4.2 Number Tested	3D-28
	3D.7.4.3 Mounting	3D-28
	3D.7.4.4 Connections	3D-28
	3D.7.4.5 Test Sequence	3D-29
	3D.7.4.6 Simulated Service Conditions	3D-29
	3D.7.4.7 Measured Variables	3D-29
	3D.7.4.8 Type Test Summary	3D-29
3D.7.5	Qualification by Analysis	3D-30
3D.7.6	Qualification by Experience	3D-30
3D.7.7	Qualification Program Conclusions	3D-30
3D.7.8	Combined License Information	3D-30
3D.8	References	3D-30
Appendix 3D-Attachment A	— Sample Equipment Qualification Data Package (EQDP).....	3D-56
Appendix 3D-Attachment B	— Aging Evaluation Program	3D-74
B.1	Introduction	3D-74

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
B.2	Objectives	3D-74
B.3	Basic Approach	3D-74
B.4	Subprogram A	3D-74
	B.4.1 Scope	3D-75
	B.4.2 Aging Mechanisms	3D-75
	B.4.3 Time	3D-75
	B.4.4 Operational Stresses	3D-75
	B.4.5 External Stresses	3D-76
	B.4.6 Synergism	3D-77
	B.4.7 Design Basis Event Testing	3D-77
	B.4.8 Aging Sequence	3D-77
	B.4.9 Performance Criterion	3D-77
	B.4.10 Failure Treatment	3D-77
B.5	Subprogram B	3D-78
	B.5.1 Scope	3D-78
	B.5.2 Performance Criteria	3D-78
	B.5.3 Failure Treatment	3D-79
Appendix 3D-Attachment C — Effects of Gamma Radiation Doses Below 104 Rads on the Mechanical Properties of Materials		3D-82
C.1	Introduction	3D-82
C.2	Scope	3D-82
C.3	Discussion	3D-83
C.4	Conclusions	3D-83
C.5	References	3D-84
Appendix 3D-Attachment D — Accelerated Thermal Aging Parameters		3D-88
D.1	Introduction	3D-88
D.2	Arrhenius Model	3D-88
D.3	Activation Energy	3D-89
D.4	Thermal Aging (Normal/Abnormal Operating Conditions)	3D-90
	D.4.1 Normal Operation Temperature (T ₀)	3D-90
	D.4.1.1 External Ambient Temperature (T _a)	3D-90
	D.4.1.2 Temperature Rise in Enclosure (T _r)	3D-90
	D.4.1.3 Self-Heating Effects (T _j)	3D-91
	D.4.2 Accelerated Aging Temperature (T _i)	3D-91
	D.4.3 Examples of Arrhenius Calculations	3D-91
D.5	Post-Accident Thermal Aging	3D-92
	D.5.1 Post-Accident Operating Temperatures	3D-92
	D.5.2 Accelerated Thermal Aging Parameters for Post-Accident Conditions	3D-92
D.6	References	3D-92
Appendix 3D-Attachment E — Seismic Qualification Techniques		3D-98
E.1	Purpose	3D-98
E.2	Definitions	3D-98
	E.2.1 1/2 Safe Shutdown Earthquake	3D-98
	E.2.2 Seismic Category I Equipment	3D-98
	E.2.3 Seismic Category II Equipment	3D-98
	E.2.4 Non-seismic Equipment	3D-98

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
	E.2.5 Active Equipment	3D-98
	E.2.6 Passive Equipment	3D-98
E.3	Qualification Methods.....	3D-98
	E.3.1 Use of Qualification by Testing	3D-99
	E.3.2 Use of Qualification by Analysis.....	3D-99
E.4	Requirements.....	3D-99
	E.4.1 Damping.....	3D-99
	E.4.1.1 Testing.....	3D-99
	E.4.1.2 Analysis.....	3D-100
	E.4.2 Interface Requirements.....	3D-100
	E.4.3 Mounting Simulation	3D-100
	E.4.4 1/2 Safe Shutdown Earthquake	3D-100
	E.4.5 Safe Shutdown Earthquake	3D-100
	E.4.6 Other Dynamic Loads	3D-100
E.5	Qualification by Test.....	3D-101
	E.5.1 Qualification of Hard-Mounted Equipment.....	3D-101
	E.5.2 Qualification of Line-Mounted Equipment.....	3D-102
	E.5.2.1 Seismic Qualification Test Sequence.....	3D-102
	E.5.2.2 Line Vibration Aging.....	3D-103
	E.5.2.3 Single Frequency Testing.....	3D-103
	E.5.2.4 Seismic Aging.....	3D-103
	E.5.2.5 Static Deflection Testing of Active Valves.....	3D-103
	E.5.3 Operational Conditions	3D-104
	E.5.4 Resonant Search Testing	3D-104
E.6	Qualification by Analysis	3D-104
	E.6.1 Modeling	3D-104
	E.6.2 Qualification by Static Analysis	3D-105
	E.6.3 Qualification by Dynamic Analysis	3D-105
	E.6.3.1 Response Spectrum Analysis	3D-105
	E.6.3.2 Static Coefficient Method	3D-106
	E.6.3.3 Time History Analysis.....	3D-106
E.7	Qualification by Test Experience.....	3D-106
E.8	Performance Criteria.....	3D-106
	E.8.1 Equipment Qualification by Test	3D-106
	E.8.2 Equipment Qualification by Analysis.....	3D-106
	E.8.2.1 Structural Integrity	3D-106
	E.8.2.2 Operability	3D-107
APPENDIX 3E	HIGH-ENERGY PIPING IN THE NUCLEAR ISLAND	3E-1
APPENDIX 3F	CABLE TRAYS AND CABLE TRAY SUPPORTS	3F-1
3F.1	Codes and Standards	3F-1
3F.2	Loads and Load Combinations	3F-1
3F.2.1	Loads	3F-1
3F.2.1.1	Dead Load (D)	3F-1
3F.2.1.2	Construction Live Load (L)	3F-1
3F.2.1.3	Safe Shutdown Earthquake (Es)	3F-1
3F.2.1.4	Thermal Load	3F-1
3F.2.2	Load Combinations	3F-2

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
3F.3	Analysis and Design	3F-2
3F.3.1	Damping	3F-2
3F.3.2	Seismic Analysis	3F-2
3F.3.3	Allowable Stresses	3F-3
3F.3.4	Connections	3F-3
APPENDIX 3G	NUCLEAR ISLAND SEISMIC ANALYSES	3G-1
3G.1	Introduction	3G-1
3G.2	Nuclear Island Finite Element Models	3G-1
3G.2.1	Individual Building and Equipment Models	3G-2
3G.2.1.1	Coupled Auxiliary and Shield Building	3G-2
3G.2.1.2	Containment Internal Structures	3G-2
3G.2.1.3	Containment Vessel	3G-2
3G.2.1.4	Polar Crane	3G-3
3G.2.1.5	Major Equipment and Structures Using Stick Models ..	3G-4
3G.2.2	Nuclear Island Dynamic Models	3G-4
3G.2.2.1	NI10 Model	3G-4
3G.2.2.2	NI20 Model	3G-5
3G.2.2.3	Nuclear Island Stick Model	3G-5
3G.2.2.4	NI05 Model	3G-5
3G.2.2.5	Seismic Stability Model	3G-5
3G.2.3	Static Models	3G-6
3G.2.3.1	Quadrant Model of Shield Building Roof	3G-6
3G.2.3.2	Containment Vessel 3D Finite Element Model	3G-6
3G.2.3.3	Containment Vessel Axisymmetric Model	3G-6
3G.3	2D SASSI Analyses	3G-6
3G.4	Nuclear Island Dynamic Analyses	3G-8
3G.4.1	ANSYS Fixed Base Analysis	3G-8
3G.4.2	3D SASSI Analyses	3G-8
3G.4.3	Seismic Analysis	3G-9
3G.4.3.1	Response Spectrum Analysis	3G-9
3G.4.3.2	Absolute Accelerations	3G-9
3G.4.3.3	Seismic Response Spectra	3G-9
3G.4.3.4	Bearing Pressure Demand	3G-10
3G.5	References	3G-10
APPENDIX 3H	AUXILIARY AND SHIELD BUILDING CRITICAL SECTIONS	3H-1
3H.1	Introduction	3H-1
3H.2	Description of Auxiliary and Shield Buildings	3H-1
3H.2.1	Description of Auxiliary Building	3H-1
3H.2.2	Description of Shield Building	3H-2
3H.3	Design Criteria	3H-4
3H.3.1	Governing Codes and Standards	3H-4
3H.3.2	Seismic Input	3H-4
3H.3.3	Loads	3H-5
3H.3.4	Load Combinations and Acceptance Criteria	3H-8
3H.4	Seismic Analyses	3H-8
3H.4.1	Live Load for Seismic Design	3H-8
3H.5	Structural Design of Critical Sections	3H-8

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

TABLE OF CONTENTS (CONTINUED)

<u>Section</u>	<u>Title</u>	<u>Page</u>
3H.5.1	Shear Walls	3H-10
3H.5.1.1	Exterior Wall at Column Line 1	3H-11
3H.5.1.2	Wall at Column Line 7.3	3H-11
3H.5.1.3	Wall at Column Line L	3H-11
3H.5.1.4	Wall at Column Line 11	3H-12
3H.5.2	Composite Structures (Floors and Roof)	3H-12
3H.5.2.1	Roof at Elevation 180'-0", Area 6 (Critical Section is between Col. Lines N & K-2 and 3 & 4)	3H-13
3H.5.2.2	Floor at Elevation 135'-3", Area 1 (Between Column Lines M and P)	3H-14
3H.5.3	Reinforced Concrete Slabs	3H-14
3H.5.3.1	Operations Work Area (Tagging Room) Ceiling	3H-14
3H.5.4	Concrete Finned Floors	3H-15
3H.5.5	Structural Modules	3H-16
3H.5.5.1	West Wall of Spent Fuel Pool	3H-16
3H.5.6	Shield Building Roof and Connections	3H-17
3H.5.6.1	Air Inlets and Tension Ring	3H-17
3H.5.6.2	Compression Ring and Interior Wall of Passive Containment Cooling Water Storage Tank	3H-18
3H.5.6.3	Knuckle Region and Exterior Wall of Passive Containment Cooling System Tank	3H-18
3H.5.7	Shield Building Cylinder (SC)	3H-18
3H.5.7.1	Shield Building Cylindrical Wall	3H-18
3H.5.7.2	Reinforced Concrete (RC)/Steel Concrete Composite (SC) Horizontal and Vertical Connections	3H-19
3H.5.8	References	3H-20
APPENDIX 3I	EVALUATION FOR HIGH FREQUENCY SEISMIC INPUT	3I-1
3I.1	Introduction	3I-1
3I.2	High Frequency Seismic Input	3I-1
3I.3	NI Models Used To Develop High Frequency Response	3I-1
3I.4	Evaluation Methodology	3I-2
3I.5	General Selection Screening Criteria	3I-2
3I.6	Evaluation	3I-3
3I.6.1	Building Structures	3I-3
3I.6.2	Primary Coolant Loop	3I-4
3I.6.3	Piping Systems	3I-5
3I.6.4	Electrical and Electro-Mechanical Equipment	3I-5
3I.7	References	3I-8

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF TABLES

<u>Table Number</u>	<u>Title</u>	<u>Page</u>
3.2-1	Comparison of Safety Classification Requirements	3.2-18
3.2-2	Seismic Classification of Building Structures	3.2-19
3.2-3	(Sheet 1 of 75) AP1000 Classification of Mechanical and Fluid Systems, Components, and Equipment	3.2-20
3.6-1	High-Energy and Moderate-Energy Fluid Systems Considered for Protection of Essential Systems	3.6-33
3.6-2	(Sheet 1 of 7) Subcompartments and Postulated Pipe Ruptures	3.6-34
3.6-3	(Sheet 1 of 7) NI Rooms With Pipe Whip Restraints and Corresponding Hazard Sources and Essential Targets	3.6-41
3.7.1-1	Safe Shutdown Earthquake Damping Values	3.7-48
3.7.1-2	Embedment Depth and Related Dimensions of Category I Structures	3.7-49
3.7.1-3	AP1000 Design Response Spectra Amplification Factors for Control Points	3.7-50
3.7.1-4	Strain Compatible Soil Properties	3.7-51
3.7.3-1	Seismic Category I Equipment Outside Containment by Room Number	3.7-57
3.7.3-2	Equipment Classified as Sensitive Targets for Seismically Analyzed Piping, HVAC Ducting, Cable Trays	3.7-60
3.8.2-1	Load Combinations and Service Limits for Containment Vessel	3.8-71
3.8.2-2	Containment Vessel Pressure Capabilities	3.8-72
3.8.2-3	Analysis and Test Results of Fabricated Heads	3.8-73
3.8.2-4	Summary of Containment Vessel Models and Analysis Methods	3.8-74
3.8.2-5	Maximum Absolute Nodal Acceleration (ZPA) Steel Containment Vessel	3.8-75
3.8.3-1	Shear and Flexural Stiffnesses of Structural Module Walls	3.8-76
3.8.3-2	Summary of Containment Internal Structures Models and Analysis Methods ..	3.8-77
3.8.3-3	Definition of Critical Locations and Thicknesses for Containment Internal Structures	3.8-78
3.8.3-4	(Sheet 1 of 3) Design Summary of West Wall of Refueling Canal Design Loads, Load Combinations, and Comparison to Acceptance Criteria Mid-Span at Mid-Height	3.8-79
3.8.3-5	(Sheet 1 of 3) Design Summary of South Wall of Steam Generator Compartment Design Loads, Load Combinations, and Comparison to Acceptance Criteria Mid-Span at Mid-Height.....	3.8-82
3.8.3-6	(Sheet 1 of 3) Design Summary of North-East Wall of IRWST Design Loads, Load Combinations, and Comparison to Acceptance Criteria Mid-Span at Mid-Height.....	3.8-85
3.8.3-7	Design Summary of Steel Wall of IRWST	3.8-88
3.8.4-1	Load Combinations and Load Factors for Seismic Category I Steel Structures	3.8-89
3.8.4-2	Load Combinations and Load Factors for Seismic Category I Concrete Structures	3.8-90
3.8.4-3	Acceptance Tests for Concrete Aggregates	3.8-91
3.8.4-4	Criteria for Water Used in Production of Concrete	3.8-92
3.8.4-6	Materials Used in Structural and Miscellaneous Steel	3.8-94
3.8.5-1	Minimum Required Factor of Safety for Overturning and Sliding of Structures .	3.8-96
3.8.5-2	Factors of Safety for Flotation, Overturning and Sliding of Nuclear Island Structures	3.8-97
3.8.5-3	Definition of Critical Locations, Thicknesses and Reinforcement for Nuclear Island Basemat(1) (in ² /ft)	3.8-98

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF TABLES (CONTINUED)

<u>Table Number</u>	<u>Title</u>	<u>Page</u>
3.9-1	(Sheet 1 of 2) Reactor Coolant System Design Transients	3.9-96
3.9-2	Pump Starting/Stopping Conditions	3.9-98
3.9-3	Loadings for ASME Class 1, 2, 3, CS and Supports	3.9-99
3.9-4	First Plant AP1000 Reactor Internals Vibration Measurement Program Transducer Locations	3.9-101
3.9-5	Minimum Design Loading Combinations for ASME Class 1, 2, 3 and CS Systems and Components	3.9-102
3.9-6	Additional Load Combinations and Stress Limits for ASME Class 1 Piping	3.9-103
3.9-7	Additional Load Combinations and Stress Limits for ASME Class 2, 3 Piping	3.9-104
3.9-8	Minimum Design Loading Combinations for Supports for ASME Class 1, 2, 3 Piping and Components	3.9-105
3.9-9	Stress Criteria for ASME Code Section III Class 1 Components(a) and Supports and Class CS Core Supports	3.9-106
3.9-10	Stress Criteria for ASME Code Section III Class 2 and 3 Components and Supports	3.9-107
3.9-11	Piping Functional Capability – ASME Class 1, 2, and 3	3.9-109
3.9-12	(Sheet 1 of 7) List of ASME Class 1, 2, and 3 Active Valves	3.9-110
3.9-13	Control Rod Drive Mechanism Production Tests	3.9-117
3.9-14	Maximum Deflections Allowed for Reactor Internal Support Structures	3.9-118
3.9-15	Computer Programs for Seismic Category 1 Components	3.9-119
3.9-16	Valve Inservice Test Requirements	3.9-120
3.9-17	System Level Operability Test Requirements	3.9-148
3.9-18	AP1000 Pressure Isolation Valves	3.9-149
3.9-19	(Sheet 1 of 2) Critical Piping Design Methods and Criteria (Piping Design Criteria)	3.9-150
3.9-20	Piping Packages Chosen to Demonstrate Piping Design for Piping DAC Closure	3.9-152
3.9-201	Safety Related Snubbers	3.9-154
3.11-1	(Sheet 1 of 51) Environmentally Qualified Electrical and Mechanical Equipment	3.11-7
3B-1	(Sheet 1 of 2) AP1000 Leak-Before-Break Bounding Analysis Systems and Parameters	3B-16
3D.4-1	Typical Mild Environment Parameter Limits	3D-32
3D.4-2	Equipment Post-Accident Operability Times	3D-33
3D.4-3	AP1000 EQ Program Margin Requirements	3D-34
3D.5-1	(Sheet 1 of 3) Normal Operating Environments	3D-35
3D.5-2	60-Year Normal Operating Doses	3D-38
3D.5-3	Abnormal Operating Environments Inside Containment	3D-39
3D.5-4	(Sheet 1 of 2) Abnormal Operating Environments Outside Containment	3D-40
3D.5-5	Accident Environments	3D-42
3D.6-1	Mechanical Equipment Components Requiring Environmental Qualification ...	3D-43
3D.B-1	Typical Class 1E Equipment Scope and Subprogram Allocation	3D-80
3D.B-2	Aging Mechanism Sequence	3D-81
3D.C-1	Radiation-Induced Degradation of Material Mechanical Properties	3D-85
3D.D-1	Activation Energies From Westinghouse Reports	3D-93
3G.1-1	(Sheet 1 of 4) Summary of Models and Analysis Methods	3G-11
3G.1-2	Summary of Dynamic Analyses and Combination Techniques	3G-15

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF TABLES (CONTINUED)

<u>Table Number</u>	<u>Title</u>	<u>Page</u>
3G.2-1	(Sheet 1 of 2) Steel Containment Vessel Lumped-Mass Stick Model (Without Polar Crane) Modal Properties	3G-16
3G.2-2	Comparison of Frequencies for Containment Vessel Seismic Model	3G-18
3G.3-1	AP1000 ZPA for 2D SASSI Cases	3G-19
3G.4-1	Key Nodes at Location	3G-20
3G.4-2	Maximum Bearing Pressure from 2D Time History Analyses	3G-21
3H.5-1	Nuclear Island: Design Temperatures for Thermal Gradient	3H-21
3H.5-2	Exterior Wall at Column Line 1 Forces and Moments in Critical Locations	3H-22
3H.5-3	Exterior Wall on Column Line 1 Details of Wall Reinforcement (in ² /ft)	3H-23
3H.5-4	Interior Wall at Column Line 7.3 Forces and Moments in Critical Locations	3H-24
3H.5-5	Interior Wall on Column Line 7.3 Details of Wall Reinforcement	3H-25
3H.5-6	Interior Wall at Column Line L Forces and Moments in Critical Locations	3H-26
3H.5-7	Interior Wall on Column Line L Details of Wall Reinforcement	3H-27
3H.5-8	(Sheet 1 of 7) Design Summary of Spent Fuel Pool Wall Design Loads, Load Combinations, and Comparisons to Acceptance Criteria – Element No. 20477	3H-28
3H.5-9	(Sheet 1 of 3) Shield Building Roof Reinforcement Summary	3H-35
3H.5-10	Design Summary Of Roof At Elevation 180'-0", Area 6	3H-40
3H.5-11	Design Summary Of Floor At Elevation 135'-3" Area 1 (Between Column Lines M And P)	3H-41
3H.5-12	Design Summary Of Floor At Elevation 135'-3" (Operations Work Area (Previously Known As 'tagging Room') Ceiling))	3H-42
3H.5-13	Design Summary Of Floor At Elevation 135'-3" Area 1 (Main Control Room Ceiling)	3H-43
3H.5-14	(Sheet 1 of 3) Design Summary of Enhanced Shield Building Cylindrical Wall Load Combinations, and Comparison to Acceptance Criteria Elevation 180 Feet Near Fuel Handling Building Roof	3H-44
3H.5-15	Shield Building Roof Reinforcement Ratio of Code Required Versus Provided	3H-47
3I.6-1	Potential High Frequency Sensitive Equipment List	3I-10
3I.6-2	List of Potential High Frequency Sensitive AP1000 Safety-Related Electrical and Electro-Mechanical Equipment	3I-11
3I.6-3	List of AP1000 Safety-Related Electrical and Mechanical Equipment Not High Frequency Sensitive	3I-39

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3.3-1	Velocity Pressure Variation with Radius from Center of Tornado	3.3-6
3.4-1	Typical Details of Nuclear Island Waterproofing Below Grade	3.4-21
3.4-2	Typical Details of Nuclear Island Waterproofing Below Grade with Step Back	3.4-22
3.4-4	Typical Details of Membrane Corner Detail at Basemat and Exterior Wall	3.4-24
3.6-1	Typical U-Bar Restraint	3.6-48
3.6-2	Typical Energy Absorbing Material Restraint	3.6-49
3.6-3	Terminal Ends Definitions	3.6-50
3.7.1-1	Horizontal Design Response Spectra Safe Shutdown Earthquake	3.7-61
3.7.1-2	Vertical Design Response Spectra Safe Shutdown Earthquake	3.7-62
3.7.1-3	Design Horizontal Time History, "H1" Acceleration, Velocity & Displacement Plots	3.7-63
3.7.1-4	Design Horizontal Time History, "H2" Acceleration, Velocity & Displacement Plots	3.7-64
3.7.1-5	Design Vertical Time History Acceleration, Velocity & Displacement Plots	3.7-65
3.7.1-6	Acceleration Response Spectra of Design Horizontal Time History, "H1"	3.7-66
3.7.1-7	Acceleration Response Spectra of Design Horizontal Time History, "H2"	3.7-67
3.7.1-8	Acceleration Response Spectra of Design Vertical Time History	3.7-68
3.7.1-9	Minimum Power Spectral Density Curve (Normalized to 0.3g)	3.7-69
3.7.1-10	Power Spectral Density of Design Horizontal Time History, "H1"	3.7-70
3.7.1-11	Power Spectral Density of Design Horizontal Time History, "H2"	3.7-71
3.7.1-12	Power Spectral Density of Design Vertical Time History	3.7-72
3.7.1-14	[<i>Nuclear Island Structures Dimensions</i>]*	3.7-74
3.7.1-15	Strain Dependent Properties of Rock Material (Ref. 37)	3.7-75
3.7.1-16	Strain Dependent Properties of Soil Material (Ref. 38)	3.7-76
3.7.1-17	Generic Soil Profiles	3.7-77
3.7.2-12	(Sheet 1 of 12) [<i>Nuclear Island Key Structural Dimensions Plan at El. 66'-6"</i>]*	3.7-79
3.7.2-12	(Sheet 2 of 12) [<i>Nuclear Island Key Structural Dimensions Plan at El. 82'-6"</i>]*	3.7-80
3.7.2-12	(Sheet 3 of 12) [<i>Nuclear Island Key Structural Dimensions Plan at El. 100'-0" & 107'-2"</i>]*	3.7-81
3.7.2-12	(Sheet 4 of 12) [<i>Nuclear Island Key Structural Dimensions Plan at El. 117'-6"</i>]*	3.7-82
3.7.2-12	(Sheet 5 of 12) [<i>Nuclear Island Key Structural Dimensions Plan at El. 135'-3"</i>]*	3.7-83
3.7.2-12	(Sheet 6 of 12) [<i>Nuclear Island Key Structural Dimensions Plan at El. 153'-0" & 160'-6"</i>]*	3.7-84
3.7.2-12	(Sheet 7 of 12) [<i>Nuclear Island Key Structural Dimensions Plan at El. 160'-6", 180'-0", & 329'-0"</i>]*	3.7-85
3.7.2-12	(Sheet 8 of 12) [<i>Nuclear Island Key Structural Dimensions Section A - A</i>]*	3.7-86
3.7.2-12	(Sheet 9 of 12) [<i>Nuclear Island Key Structural Dimensions Section B - B</i>]*	3.7-87
3.7.2-12	(Sheet 10 of 12) [<i>Nuclear Island Key Structural Dimensions Sections C - C and H - H</i>]*	3.7-88
3.7.2-12	(Sheet 11 of 12) [<i>Nuclear Island Key Structural Dimensions Section G - G</i>]*	3.7-89
3.7.2-12	(Sheet 12 of 12) [<i>Nuclear Island Key Structural Dimensions Section J - J</i>]*	3.7-90
3.7.2-14	Typical Design Floor Response Spectrum	3.7-92

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES (CONTINUED)

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3.7.2-19	(Sheet 1 of 10) Annex Building Key Structural Dimensions Plan at Elevation 100'-0"	3.7-94
3.7.2-19	(Sheet 2 of 10) Annex Building Key Structural Dimensions Plan at Elevation 107'-2" and 117'-6"	3.7-95
3.7.2-19	(Sheet 3 of 10) Annex Building Key Structural Dimensions Plan at Elevation 135'-3"	3.7-96
3.7.2-19	(Sheet 4 of 10) Annex Building Key Structural Dimensions Plan at Elevation 158'-0" and 146'-3"	3.7-97
3.7.2-19	(Sheet 5 of 10) Annex Building Key Structural Dimensions Roof Plan at Elevation 154'-0" and 181'-11 3/4"	3.7-98
3.7.2-19	(Sheet 6 of 10) Annex Building Key Structural Dimensions Section A - A	3.7-99
3.7.2-19	(Sheet 7 of 10) Annex Building Key Structural Dimensions Section B - B	3.7-100
3.7.2-19	(Sheet 8 of 10) Annex Building Key Structural Dimensions Section C - C	3.7-101
3.7.2-19	(Sheet 9 of 10) Annex Building Key Structural Dimensions Sections D - D, E - E, & F - F	3.7-102
3.7.2-19	(Sheet 10 of 10) Annex Building Key Structural Dimensions Sections G - G, H - H, & J - J	3.7-103
3.7.2-20	East-West 2D SASSI Model with Adjacent Buildings	3.7-104
3.7.2-21	2D North-South SASSI Model with Adjacent Buildings	3.7-105
3.7.2-22	3D SASSI Model with Adjacent Buildings	3.7-106
3.7.3-1	Impact Evaluation Zone	3.7-107
3.7.3-2	Impact Evaluation Zone and Seismic Supported Piping	3.7-108
3.8.2-1	(Sheet 1 of 3) Containment Vessel General Outline	3.8-99
3.8.2-1	(Sheet 2 of 3) Containment Vessel General Outline	3.8-100
3.8.2-1	(Sheet 3 of 3) Containment Vessel General Outline	3.8-101
3.8.2-2	Equipment Hatches	3.8-102
3.8.2-3	Personnel Airlock	3.8-103
3.8.2-4	(Sheet 1 of 7) Containment Penetrations Main Steam	3.8-104
3.8.2-4	(Sheet 2 of 7) Containment Penetrations Startup Feedwater	3.8-105
3.8.2-4	(Sheet 3 of 7) Containment Penetrations Normal RHR Piping	3.8-106
3.8.2-4	(Sheet 4 of 7) Containment Penetrations	3.8-107
3.8.2-4	(Sheet 5 of 7) Containment Penetrations Fuel Transfer Penetration	3.8-108
3.8.2-4	(Sheet 6 of 7) Containment Penetrations Typical Electrical Penetration	3.8-109
3.8.2-4	(Sheet 7 of 7) Containment Penetrations Steam Line and Feedwater Line Insert Plates	3.8-110
3.8.2-5	(Sheet 1 of 5) Containment Vessel Response to Internal Pressure of 59 psig Displaced Shape Plot	3.8-111
3.8.2-5	(Sheet 2 of 5) Containment Vessel Response to Internal Pressure of 59 psig Membrane Stresses (ksi)	3.8-112
3.8.2-5	(Sheet 3 of 5) Containment Vessel Response to Internal Pressure of 59 psig Surface Meridional Stress (ksi)	3.8-113
3.8.2-5	(Sheet 4 of 5) Containment Vessel Response to Internal Pressure of 59 psig Outside Surface Stresses (ksi)	3.8-114
3.8.2-5	(Sheet 5 of 5) Containment Vessel Response to Internal Pressure of 59 psig Outer Stress Intensity (ksi)	3.8-115
3.8.2-6	(Sheet 1 of 2) Containment Vessel Axisymmetric Model	3.8-116
3.8.2-6	(Sheet 2 of 2) Containment Vessel Axisymmetric Model	3.8-117

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES (CONTINUED)

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3.8.2-7	Finite Element Model for Local Buckling Analyses	3.8-118
3.8.2-8	(Sheet 1 of 2) Location of Containment Seal	3.8-119
3.8.2-8	(Sheet 2 of 2) Seal Sections and Details	3.8-120
3.8.3-1	(Sheet 1 of 7) [<i>Structural Modules in Containment Internal Structures</i>]*	3.8-121
3.8.3-1	(Sheet 2 of 7) [<i>Structural Modules in Containment Internal Structures</i>]*	3.8-122
3.8.3-1	(Sheet 3 of 7) [<i>Structural Modules in Containment Internal Structures</i>]*	3.8-123
3.8.3-1	(Sheet 4 of 7) [<i>Structural Modules in Containment Internal Structures</i>]*	3.8-124
3.8.3-1	(Sheet 5 of 7) [<i>Structural Modules in Containment Internal Structures</i>]*	3.8-125
3.8.3-1	(Sheet 6 of 7) [<i>Structural Modules in Containment Internal Structures</i>]*	3.8-126
3.8.3-1	(Sheet 7 of 7) [<i>Structural Modules in Containment Internal Structures</i>]*	3.8-127
3.8.3-2	[<i>Typical Structural Wall Module</i>]*	3.8-128
3.8.3-3	Typical Structural Floor Module	3.8-129
3.8.3-4	Reactor Vessel Supports	3.8-130
3.8.3-5	(Sheet 1 of 5) Steam Generator Supports	3.8-131
3.8.3-5	(Sheet 2 of 5) Steam Generator Supports	3.8-132
3.8.3-5	(Sheet 3 of 5) Steam Generator Supports	3.8-133
3.8.3-5	(Sheet 4 of 5) Steam Generator Supports	3.8-134
3.8.3-5	(Sheet 5 of 5) Steam Generator Supports	3.8-135
3.8.3-6	(Sheet 1 of 4) Pressurizer Support Columns	3.8-136
3.8.3-6	(Sheet 2 of 4) Pressurizer Lower Lateral Supports	3.8-137
3.8.3-6	(Sheet 3 of 4) Pressurizer Lower Supports	3.8-138
3.8.3-6	(Sheet 4 of 4) Pressurizer Upper Supports	3.8-139
3.8.3-7	IRWST Temperature Transient	3.8-140
3.8.3-8	(Sheet 1 of 3) [<i>Structural Modules – Typical Design Details</i>]*	3.8-141
3.8.3-8	(Sheet 2 of 3) [<i>Structural Modules – Typical Design Details</i>]*	3.8-142
3.8.3-8	(Sheet 3 of 3) [<i>Structural Modules – Typical Design Details</i>]*	3.8-143
3.8.3-9	Test Tank Finite Element Model	3.8-144
3.8.3-10	(Sheet 1 of 2) IRWST Fluid Structure Finite Element Model CIS Structural Model	3.8-145
3.8.3-10	(Sheet 2 of 2) IRWST Fluid Structure Finite Element Model IRWST Structural Model	3.8-146
3.8.3-11	IRWST Fluid Structure Finite Element Model Fluid Model	3.8-147
3.8.3-12	IRWST Fluid Structure Finite Element Model Sparger Region Detail	3.8-148
3.8.3-13	Effective Sections for Floor Modules	3.8-149
3.8.3-14	(Sheet 1 of 5) [<i>CA-01 Module</i>]*	3.8-150
3.8.3-14	(Sheet 2 of 5) [<i>CA-02 Module</i>]*	3.8-151
3.8.3-14	(Sheet 3 of 5) [<i>CA-03 Module</i>]*	3.8-152
3.8.3-14	(Sheet 4 of 5) [<i>CA-04 Structural Module</i>]*	3.8-153
3.8.3-14	(Sheet 5 of 5) [<i>CA-05 Module</i>]*	3.8-154
3.8.3-15	(Sheet 1 of 2) [<i>Typical Submodule</i>]*	3.8-155
3.8.3-15	(Sheet 2 of 2) [<i>Typical Submodule</i>]*	3.8-156
3.8.3-16	Typical Liner Modules	3.8-157
3.8.3-17	(Sheet 1 of 2) [<i>Structural Modules – Design Details Standard Floor Connection</i>]*	3.8-158
3.8.3-17	(Sheet 2 of 2) [<i>Structural Modules – Design Details Heavily Loaded Floor Connection</i>]*	3.8-159
3.8.3-18	[<i>Location of Structural Wall Modules</i>]*	3.8-160

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES (CONTINUED)

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3.8.4-1	(Sheet 1 of 4) Containment Air Baffle General Arrangement	3.8-161
3.8.4-1	(Sheet 2 of 4) Containment Air Baffle Panel Types	3.8-162
3.8.4-1	(Sheet 3 of 4) Containment Air Baffle Typical Panel on Cylinder	3.8-163
3.8.4-1	(Sheet 4 of 4) Containment Air Baffle Sliding Plate	3.8-164
3.8.4-2	[Passive Containment Cooling Tank]*	3.8-165
3.8.4-4	(Sheet 1 of 5) [Structural Modules in Auxiliary Building]*	3.8-167
3.8.4-4	(Sheet 2 of 5) [Structural Modules in Auxiliary Building]*	3.8-168
3.8.4-4	(Sheet 3 of 5) [Structural Modules in Auxiliary Building]*	3.8-169
3.8.4-4	(Sheet 4 of 5) [Structural Modules in Auxiliary Building]*	3.8-170
3.8.4-4	(Sheet 5 of 5) [Structural Modules in Auxiliary Building]*	3.8-171
3.8.4-5	Shield Building Structure Key Areas	3.8-172
3.8.5-1	Foundation Plan	3.8-173
3.8.5-2	Isometric View of Finite Element Model	3.8-174
3.8.5-3	(Sheet 1 of 7) Radial Reinforcement, Top Side of DISH	3.8-175
3.8.5-3	(Sheet 2 of 7) Circumferential Reinforcement, Top Side of DISH	3.8-176
3.8.5-3	(Sheet 3 of 7) Longitudinal Reinforcement Map, Top Side in NS Direction	3.8-177
3.8.5-3	(Sheet 4 of 7) Longitudinal Reinforcement Map, Top Side in EW Direction	3.8-178
3.8.5-3	(Sheet 5 of 7) Longitudinal Reinforcement, Bottom Side of DISH and 6' Basemat (NS)	3.8-179
3.8.5-3	(Sheet 6 of 7) Longitudinal Reinforcement, Bottom Side of DISH and 6' Basemat (EW)	3.8-180
3.8.5-3	(Sheet 7 of 7) Shear Reinforcement Map	3.8-181
3.9-4	Control Rod Drive Mechanism	3.9-157
3.9-5	Lower Reactor Internals	3.9-158
3.9-6	Upper Core Support Structure	3.9-159
3.9-7	Integrated Head Package	3.9-160
3.9-8	Reactor Internals Interface Arrangement	3.9-161
3.9-9	Flow Skirt Schematic	3.9-162
3B-1	Typical Bounding Analysis Curve (BAC)	3B-18
3B-2	Bounding Analysis Curve for Primary Loop Hot Leg	3B-19
3B-3	Bounding Analysis Curve for Primary Loop Cold Leg	3B-20
3B-4	Bounding Analysis Curve for 38" Main Steam Line	3B-21
3B-5	Bounding Analysis Curve for 20" Normal RHR	3B-22
3B-6	(Sheet 1 of 2) Bounding Analysis Curve for 18" Surge Line	3B-23
3B-6	(Sheet 2 of 2) Bounding Analysis Curve for 18" Surge Line	3B-24
3B-7	Bounding Analysis Curve for 18" PRHR Supply/ADS 4	3B-25
3B-8	Bounding Analysis Curve for 14" PRHR Supply to Cold Trap, PRHR Supply/ADS4	3B-26
3B-9	Bounding Analysis Curve for 14" PRHR Supply after Cold Trap, Return – to Isolation Valve	3B-27
3B-10	Bounding Analysis Curve for 14" ADS Stage 2, 3	3B-28
3B-11	Bounding Analysis Curve for 14" PRHR Return – after Isolation Valve, 14" PRHR Return	3B-29
3B-13	Bounding Analysis Curve for 8" Accumulator to Isolation Valve	3B-31
3B-14	Bounding Analysis Curve for 8" CMT Cold Leg Balance Line and Vent, DVI Cold Trap to RV	3B-32
3B-15	Bounding Analysis Curve for 8" CMT, DVI IWRST (Various Sections)	3B-33

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES (CONTINUED)

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3B-17	Bounding Analysis Curve for Accumulator after Isolation Valve	3B-35
3B-18	Bounding Analysis Curve for RNS Discharge	3B-36
3B-19	Bounding Analysis Curve for ADS Header to RCS Safety Valve	3B-37
3B-20	Bounding Analysis Curve for 12" Normal RHR	3B-38
3B-21	Bounding Analysis Curve for 10" Normal RHR	3B-39
3B-22	Bounding Analysis Curve for 8" ADS Stage 2, 3	3B-40
3D.5-1	(Sheet 1 of 3) Typical Abnormal Environmental Test Profile: Main Control Room	3D-44
3D.5-1	(Sheet 2 of 3) Typical Abnormal Environmental Test Profile: I&C and DC Equipment Rooms	3D-45
3D.5-1	(Sheet 3 of 3) Typical Abnormal Environmental Test Profile: Voltage and Frequency Variations	3D-46
3D.5-2	Gamma Dose and Dose Rate Inside Containment After a LOCA	3D-47
3D.5-3	Beta Dose and Dose Rate Inside Containment After a LOCA	3D-48
3D.5-4	Gamma Dose and Dose Rate Inside Containment After a Steam Line Break	3D-49
3D.5-5	Beta Dose and Dose Rate Inside Containment After a Steam Line Break	3D-50
3D.5-8	(Sheet 1 of 2) Typical Combined LOCA/SLB/FLB Inside Containment Temperature	3D-52
3D.5-8	(Sheet 2 of 2) Typical Combined LOCA/SLB/FLB Inside Containment Pressure	3D-53
3D.5-9	(Sheet 1 of 2) MSIV Compartment Response to MSLB (Short Term)	3D-54
3D.5-9	(Sheet 2 of 2) MSIV Compartment Response to MSLB (Long Term)	3D-55
3D.C-1	Histogram of Threshold Gamma Dose for Mechanical Damage to Elastomers, Plastics, and Encapsulation Compounds	3D-87
3D.D-1	Frequency Distribution of Activation Energies of Various Components/Materials (EPRI Data)	3D-95
3D.D-2	Frequency Distribution of Activation Energies of Various Components/Materials (Westinghouse Data)	3D-96
3E-1	(Sheet 1 of 2) High Energy Piping – Steam Generator System	3E-2
3E-1	(Sheet 2 of 2) High Energy Piping – Steam Generator System	3E-3
3E-2	High Energy Piping – Normal Residual Heat Removal System	3E-4
3E-3	(Sheet 1 of 2) High Energy Piping – Reactor Coolant System	3E-5
3E-3	(Sheet 2 of 2) High Energy Piping – Reactor Coolant System	3E-6
3E-4	(Sheet 1 of 2) High Energy Piping – Passive Core Cooling System	3E-7
3E-4	(Sheet 2 of 2) High Energy Piping – Passive Core Cooling System	3E-8
3E-5	(Sheet 1 of 2) High Energy Piping – Chemical and Volume Control System	3E-9
3E-5	(Sheet 2 of 2) High Energy Piping – Chemical and Volume Control System	3E-10
3G.1-1	Nuclear Island Seismic Analysis Models	3G-22
3G.2-1	3D Finite Element Model of Coupled Shield and Auxiliary Building	3G-23
3G.2-2	3D Finite Element Model of Containment Internal Structures	3G-24
3G.2-3	3D Finite Element Model of Containment Outer Basemat (Dish)	3G-25
3G.2-4	Steel Containment Vessel and Polar Crane Models	3G-26
3G.2-5A	Polar Crane Model Simplified Model	3G-27
3G.2-5B	Polar Crane Model Detailed Model	3G-28
3G.2-6	Reactor Coolant Loop Lumped-Mass Stick Model	3G-29
3G.2-7	Pressurizer Model	3G-30

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES (CONTINUED)

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3G.2-8	Core Makeup Tank Models	3G-31
3G.2-9	AP1000 Nuclear Island Solid-Shell Model (NI10)	3G-32
3G.2-10	Containment Internal Structure with the SCV, PC, Reactor Coolant Loop, and Pressurizer	3G-33
3G.2-11	Soil Structure Interaction Model – NI20 Looking East	3G-34
3G.2-12	Coarse Model of Containment Internal Structures	3G-35
3G.2-13	Fine Mesh (NI05) Model of Auxiliary and Shield Building	3G-36
3G.2-14	NI05 Model of Containment Internal Structures	3G-37
3G.2-15	3D NI05 Refined Mesh Model of Outer Containment Basemat (Dish)	3G-38
3G.2-16	Quadrant Model of Shield Building Roof	3G-39
3G.2-17	Detailed 3D Finite Element Model of Containment Vessel Including Large Penetrations	3G-40
3G.2-18	Axisymmetric Model of Containment Vessel	3G-41
3G.2-19	Schematic of Non-linear 2D East-West Nuclear Island Stick Model Used for Stability Evaluation that Addresses Sliding and Overturning	3G-42
3G.3-1	Generic Soil Profiles	3G-43
3G.3-2	2D SASSI FRS – Node 41 X (ASB El. 99')	3G-44
3G.3-3	2D SASSI FRS – Node 41 Y (ASB El. 99')	3G-45
3G.3-4	2D SASSI FRS – Node 120 X (ASB El. 179.6')	3G-46
3G.3-5	2D SASSI FRS – Node 120 Y (ASB El. 179.6')	3G-47
3G.3-6	2D SASSI FRS – Node 310 X (ASB El. 333.2')	3G-48
3G.3-7	2D SASSI FRS – Node 310 Y (ASB El. 333.2')	3G-49
3G.3-8	2D SASSI FRS – Node 411 X (SCV El. 200.0')	3G-50
3G.3-9	2D SASSI FRS – Node 411 Y (SCV El. 200.0')	3G-51
3G.3-10	2D SASSI FRS – Node 535 X (CIS El. 134.3')	3G-52
3G.3-11	2D SASSI FRS – Node 535 Y (CIS El. 134.3')	3G-53
3G.4-1	Auxiliary Shield Building “Rigid” Nodes at El. 135'	3G-54
3G.4-2	Auxiliary Shield Building “Flexible” Nodes at El. 135'	3G-55
3G.4-3	Excavated Soil	3G-56
3G.4-4	Additional Elements for Soil Pressure Calculations	3G-57
3G.4-5X	[X Direction FRS for Node 130401 (NI10) or 1761 (NI20) CIS at Reactor Vessel Support Elevation of 100]*	3G-58
3G.4-5Y	[Y Direction FRS for Node 130401 (NI10) or 1761 (NI20) CIS at Reactor Vessel Support Elevation of 100]*	3G-59
3G.4-5Z	[Z Direction FRS for Node 130401 (NI10) or 1761 (NI20) CIS at Reactor Vessel Support Elevation of 100]*	3G-60
3G.4-6X	[X Direction FRS for Node 105772 (NI10) or 2199 (NI20) CIS at Operating Deck Elevation 134.25]*	3G-61
3G.4-6Y	[Y Direction FRS for Node 105772 (NI10) or 2199 (NI20) CIS at Operating Deck Elevation 134.25]*	3G-62
3G.4-6Z	[Z Direction FRS for Node 105772 (NI10) or 2199 (NI20) CIS at Operating Deck Elevation 134.25]*	3G-63
3G.4-7X	[X Direction FRS for Node 4724 (NI10) or 2078 (NI20) ASB Control Room Side Elevation 116.50]*	3G-64
3G.4-7Y	[Y Direction FRS for Node 4724 (NI10) or 2078 (NI20) ASB Control Room Side Elevation 116.50]*	3G-65

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES (CONTINUED)

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3G.4-7Z	[Z Direction FRS for Node 4724 (NI10) or 2078 (NI20) ASB Control Room Side Elevation 116.50]*	3G-66
3G.4-8X	[X Direction FRS for Node 5754 (NI10) or 2675 (NI20) ASB Fuel Building Roof Elevation 179.19]*	3G-67
3G.4-8Y	[Y Direction FRS for Node 5754 (NI10) or 2675 (NI20) ASB Fuel Building Roof Elevation 179.19]*	3G-68
3G.4-8Z	[Z Direction FRS for Node 5754 (NI10) or 2675 (NI20) ASB Fuel Building Roof Elevation 179.19]*	3G-69
3G.4-9X	[X Direction FRS for Node 8573 (NI10) or 3329 (NI20) ASB Shield Building Roof Elevation 327.41]*	3G-70
3G.4-9Y	[Y Direction FRS for Node 8573 (NI10) or 3329 (NI20) ASB Shield Building Roof Elevation 327.41]*	3G-71
3G.4-9Z	[Z Direction FRS for Node 8573 (NI10) or 3329 (NI20) ASB Shield Building Roof Elevation 327.41]*	3G-72
3G.4-10X	[X Direction FRS for Node 130412 (NI10) or 2788 (NI20) SCV Near Polar Crane Elevation 224.00]*	3G-73
3G.4-10Y	[Y Direction FRS for Node 130412 (NI10) or 2788 (NI20) SCV Near Polar Crane Elevation 224.00]*	3G-74
3G.4-10Z	[Z Direction FRS for Node 130412 (NI10) or 2788 (NI20) SCV Near Polar Crane Elevation 224.00]*	3G-75
3H.2-1	[General Layout of Auxiliary Building]*	3H-48
3H.5-1	(Sheet 1 of 3) [Nuclear Island Critical Sections Plan at El. 135'-3"]*	3H-49
3H.5-1	(Sheet 2 of 3) [Nuclear Island Critical Sections Plan at El. 180'-0"]*	3H-50
3H.5-1	(Sheet 3 of 3) [Nuclear Island Critical Sections Section A-A]*	3H-51
3H.5-2	(Sheet 1 of 3) [Wall on Column Line 1]*	3H-52
3H.5-2	(Sheet 2 of 3) [Wall on Column Line 7.3]*	3H-53
3H.5-2	(Sheet 3 of 3) [Wall on Column Line L]*	3H-54
3H.5-3	[Typical Reinforcement in Wall on Column Line 1]*	3H-55
3H.5-4	[Typical Reinforcement in Wall 7.3]*	3H-56
3H.5-5	(Sheet 1 of 3) [Concrete Reinforcement in Wall 11]*	3H-57
3H.5-5	(Sheet 2 of 3) [Concrete Reinforcement Layers in Wall 11 (Looking East)]*	3H-58
3H.5-5	(Sheet 3 of 3) [Wall 11 at Main Steamline Anchor Section A-A]*	3H-59
3H.5-6	[Auxiliary Building Typical Composite Floor]*	3H-60
3H.5-7	[Typical Reinforcement and Connection to Shield Building]*	3H-61
3H.5-8	[Auxiliary Building Operations Work Area (Tagging Room) Ceiling]*	3H-62
3H.5-9	(Sheet 1 of 3) [Auxiliary Building Finned Floor]*	3H-63
3H.5-9	(Sheet 2 of 3) [Auxiliary Building Finned Floor]*	3H-64
3H.5-9	(Sheet 3 of 3) [Auxiliary Building Finned Floor]*	3H-65
3H.5-10	[Spent Fuel Pool Wall Divider Wall Element Locations]*	3H-66
3H.5-11	(Sheet 1 of 6) [Design of Shield Building: Roof and Air Inlets]*	3H-67
3H.5-11	(Sheet 2 of 6) [Design of Shield Building: Concrete Detail at Tension Ring]*	3H-68
3H.5-11	(Sheet 3 of 6) [Design of Shield Building: Roof/Air Inlet Interface]*	3H-69
3H.5-11	(Sheet 4 of 6) [Design of Shield Building at Air Inlets]*	3H-70
3H.5-11	(Sheet 5 of 6) [Design of Shield Building: Tank/Roof Interface Reinforcement]*	3H-71
3H.5-11	(Sheet 6 of 6) Design of Shield Building: Tank/Compression Ring Roof Interface Reinforcement	3H-72

**V.C. Summer Nuclear Station, Units 2 and 3
Updated Final Safety Analysis Report**

LIST OF FIGURES (CONTINUED)

<u>Figure Number</u>	<u>Title</u>	<u>Page</u>
3H.5-12	[<i>Typical Reinforcement in Wall L</i>]*	3H-73
3H.5-13	Enhanced Shield Building Wall Panel Layout	3H-74
3H.5-14	Elevation View of Tension Ring and Air Inlets	3H-75
3H.5-15	Shield Building Tension Ring	3H-76
3H.5-16	(Sheet 1 of 2) [<i>Design of Shield Building: Surface Plates on Cylindrical Section – Developed View 90-270 Degrees</i>]*	3H-77
3H.5-16	(Sheet 2 of 2) [<i>Design of Shield Building: Surface Plates on Cylindrical Section – Developed View 270-90 Degrees</i>]*	3H-78
3I.1-1	Comparison of Horizontal AP1000 CSDRS and HRHF Envelope Response Spectra	3I-71
3I.1-2	Comparison of Vertical AP1000 CSDRS and HRHF Envelope Response Spectra	3I-72