TABLE OF CONTENTS

CHAPTER 3

DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

Section	Title	Page
3.1	CONFORMANCE WITH NRC GENERAL DESIGN CRITERIA	3.1-1
3.1.1	Summary Description	3.1-1
3.1.2	Criterion Conformance	3.1-1
3.2	CLASSIFICATION OF STRUCTURES, COMPONENTS, AND SYSTEMS	3.2-1
3.2.A	Classification of Structures, Components, and Systems (Balance-of-Plant Scope)	3.2-1
3.2.A.1	Seismic Classifications	3.2-1
3.2.A.2	Quality Group Classification	3.2.2
3.2.B	Classification of Structures, Components, and Systems (Nuclear Steam Supply System Scope)	3.2-4
3.2.B.1	Seismic Classification	3.2-4
3.2.B.2	System Quality Group Classification	3.2-6
3.2.C	Use of USNRC Generic Letter 89-09 for ASME Component Replacements	3.2-6
3.2.C.1	Generic Letter 89-09 Replacement List	3.2-6
3.3	WIND AND TORNADO LOADINGS	3.3-1
3.3.1	Wind Loading	3.3-1
3.3.2	Tornado Loadings	3.3-4
3.4	WATER LEVEL (FLOOD) DESIGN	3.4-1
3.4.1	Flood Protection	3.4-1
3.4.2	Analysis Procedures	3.4-3
3.4.3	Internal Flood Protection	3.4-5
3.4.4	Internal Flood Analysis Procedures	3.4-7
3.5	MISSILE PROTECTION	3.5-1
3.5.1	Missile Selection and Description	3.5-1
3.5.2	Systems To Be Protected	3.5-11
3.5.3	Barrier Design Procedures	3.5-11
3.6	PROTECTION AGAINST DYNAMIC EFFECTS ASSOCIATED WITH THE POSTULATED RUPTURE OF PIPING	3.6-1
3.6.1	Postulated Piping Failures in Fluid System Inside and Outside Containment	3.6-1

TABLE OF CONTENTS (Continued)

CHAPTER 3

Section	Title	Page
3.6.2	Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping	3.6-7
APPENDIX 3.6.A	ISOLATION VALVE CUBICLE SUBCOMPARTMENT ANALYSIS	3.6.A-1
3.6.A.1	Design Features	3.6.A-1
3.6.A.2	Design Evaluation	3.6.A-1
3.6.A.3	FLUD, A Compartment Differential Pressure Analysis Code	3.6.A-3
3.6.A.4	Energy Transfer Mechanisms	3.6.A-6
3.6.A.5	Thermodynamic Properties of Steam, Water and Air	3.6.A-9
3.6.A.6	GOTHIC 4.0 HLP-001	3.6.A-11
3.6.A.7	Stem Travel	3.6.A-12
APPENDIX 3.6.B	HIGH ENERGY LINE BREAK EFFECTS	3.6.B-1
3.6.B.1	Isolation Valve Cubicle (IVC)	3.6.B-1
3.6.B.2	Mechanical Auxiliary Building	3.6.B-2
3.6.B.3	Reactor Containment Building	3.6.B-3
3.7	SEISMIC DESIGN	3.7-1
3.7.1	Seismic Input	3.7-1
3.7.2	Seismic System Analysis	3.7-4
3.7.3A	Seismic Subsystem Analysis, Balance of Plant (BOP, exclusive of NSSS)	3.7-20
3.7.3B	Subsystem Seismic Analysis, NSSS Scope	3.7-27
3.7.4	Seismic Instrumentation	3.7-41
APPENDIX 3.7.A	DYNAMIC LATERAL EARTH PRESSURES	3.7.A-1
3.7.A.1	Introduction	3.7.A-1
3.7.A.2	General Procedures	3.7.A-1
3.7.A.3	Dynamic Earth Pressures, Cross Section 1	3.7.A-2
3.7.A.4	Dynamic Earth Pressures, Cross Section 2	3.7.A-2
3.7.A.5	Dynamic Earth Pressures, Cross Section 3	3.7.A-3
3.7.A.6	Base Shear Forces	3.7.A-3

TABLE OF CONTENTS (Continued)

CHAPTER 3

Section	Title	Page
3.8	DESIGN OF CATEGORY I STRUCTURES	3.8-1
3.8.1	Concrete Containment	3.8-1
3.8.2	Steel Containment System (ASME Class MC Components)	3.8-44
3.8.3	Concrete and Structural Steel Internal Structures of Concrete Containment	3.8-53
3.8.4	Other Category I Structures	3.8-72
3.8.5	Foundations and Concrete Supports	3.8-91
APPENDIX 3.8.A	COMPUTER PROGRAMS USED IN STRUCTURAL ANALYSIS	3.8.A-1
3.8.A.1	Computer Programs	3.8.A-1
3.8.A.2	Static Analysis of Thin Shells of Revolution (ES418)	3.8.A-1
3.8.A.3	NASTRAN	3.8.A-2
3.8.A.4	Static Analysis of Shells - Data Management (ES420)	3.8.A-2
3.8.A.5	Interaction Analysis for Members Subjected to Bending with Axial Load and Thermal Gradient (ES423-WSD) and (ES424-USD)	3.8.A-3
3.8.A.6	ICES STRUDL - II - The Structural Design Language	3.8.A-3
3.8.A.7	Cross-Sectional Properties and Weight System Resultant (ES415)	3.8.A-4
3.8.A.8	Buckling of Shell of Revolution (BOSOR 4)	3.8.A-4
3.8.A.9	GEMIS - Geotechnical Engineering Monitoring Information System (ES211)	3.8.A-5
3.8.A.10	Plane Section Properties and Shear Force Distribution on an Assemblage of Rectangular Sections (ES432)	3.8.A-5
3.8.A.11	Determination of Stress and Displacements in an Elastic Half-Space (ES213)	3.8.A-5
3.8.A.12	SETTLE	3.8.A-6
3.8.A.13	NASTRAN Data Management-"Penetration Tendon Analyses" (ES428)	3.8.A-6
3.8.A.14	Fourier Series Analyses (ES0l7)	3.8.A-6
3.8.A.15	Generation of New Time History Load (ES434)	3.8.A-6
3.8.A.16	SRSS Loading Combination (ES439)	3.8.A-6
3.8.A.17	ICES COGO	3.8.A-7
3.8.A.18	Slope Stability Analysis System (SLOPE)	3.8.A-7

TABLE OF CONTENTS (Continued)

CHAPTER 3

Section	Title	Page
3.8.A.19	STPSYS - A System to Calculate Settlements (ES214)	3.8.A-7
3.8.A.20	Response Envelope (ES431)	3.8.A-8
3.8.A.21	ICES STRUDL DYNAL	3.8.A-8
3.8.A.22	STRUCTURAL WELDS (CP-291 AO)	3.8.A-8
3.8.A.23	STARDYNE	3.8.A-8
3.8.A.24	BASEPLT and BASEPLATE II	3.8.A-9
3.8.A.25	BSAP (CE800) - Bechtel Structural Analysis Program	3.8.A-9
3.8.A.26	BSAP-POST (CE201)	3.8.A-10
3.8.A.27	BSAP-DYNAM (CE207)	3.8.A-12
3.8.A.28	BSAP-PRE (CE212)	3.8.A-12
3.8.A.29	SPECTRA (CE802) - Response Spectra Analysis	3.8.A-12
3.8.A.30	ASHD (CE803) - Axisymmetric Solids and Shells	3.8.A-12
3.8.A.31	ASHPOST/ASHCOMB (CE823)	3.8.A-13
3.8.A.32	FINEL(CE801) - Finite Element Program for Cracking Analysis	3.8.A-13
3.8.A.33	TENDON(CE239) - Prestressed Forces on a Hemispherical Dome	3.8.A-13
3.8.A.34	TURMIS(CE450)	3.8.A-14
3.8.A.35	SHAKE3 (CE9l5) - Vertical Shear in Horizontal Layers	3.8.A-14
3.8.A.36	FLUSH (CE988) - Soil Structure Interaction Time History Analysis	3.8.A-14
3.8.A.37	CLASS 1 (CE982) - Continuum Linear Analysis for Soil-Structure Interaction	3.8.A-15
APPENDIX 3.8.B	VISUAL INSPECTION ACCEPTANCE CRITERIA FOR STRUCTURAL STEEL AND MISCELLANEOUS STEEL WELDING TO MEET DESIGN REQUIREMENTS	3.8.B-1
3.8.B.1	Scope	3.8.B-1
3.8.B.2	Classification of Weld Joints (Applicable to Section 3.8.B.3 only)	3.8.B-1
3.8.B.3	Acceptance Criteria Prior to August 15, 1985	3.8.B-2
3.8.B.4	Acceptance Criteria After August 15, 1985	3.8.B-7
3.9	MECHANICAL SYSTEMS AND COMPONENTS	3.9-1
3.9.1	Special Topics for Mechanical Components	3.9-1
3.9.2	Dynamic Testing and Analysis	3.9-34

TABLE OF CONTENTS (Continued)

CHAPTER 3

Section	Title	Page
3.9.3	ASME Code Class l, 2, and 3 Components, Component Supports, and Core Support Structures of Pressure Relief Devices	3.9-48
3.9.4	Control Rod Drive Systems	3.9-68
3.9.5	Reactor Pressure Vessel Internals	3.9-79
3.9.6	Inservice Testing of Pumps and Valves	3.9-87
3.10	SEISMIC QUALIFICATION OF CATEGORY I MECHANICAL AND ELECTRICAL EQUIPMENT	3.10-1
3.10.1	Seismic Qualification Criteria	3.10-1
3.10.2	Methods for Qualifying Electrical Equipment and Instrumentation	3.10-2
3.10.3	Methods and Procedures of Analysis or Testing of Supports of Mechanical and Electrical Equipment and Instrumentation	3.10-4
3.10.4	Operating License Review	3.10-5
3.10N	SEISMIC QUALIFICATION OF SEISMIC CATEGORY I INSTRUMENTATION AND ELECTRICAL EQUIPMENT (NSSS)	3.10N-1
3.10N.1	Seismic Qualification Criteria	3.10N-1
3.10N.2	Methods and Procedures for Qualifying Electrical Equipment and Instrumentation	3.10N-2
3.10N.3	Method and Procedures for Qualifying Supports of Electrical Equipment and Instrumentation	3.10N-4
3.10N.4	Operating License Review	3.10N-4
3.11	ENVIRONMENTAL DESIGN OF MECHANICAL AND ELECTRICAL EQUIPMENT	3.11-1
3.11.1	Equipment Identification and Environmental Conditions	3.11-1
3.11.2	Qualification Tests and Analyses	3.11-2
3.11.3	Qualification Test Results	3.11-3
3.11.4	Loss of Ventilation	3.11-4
3.11.5	Estimated Chemical and Radiation Environment	3.11-4

TABLE OF CONTENTS (Continued)

CHAPTER 3

Section	Title	Page
3.11N	ENVIRONMENTAL DESIGN OF ELECTRICAL EQUIPMENT (NSSS)	3.11N-1
3.11N.1	Equipment Identification and Environmental Conditions	3.11N-1
3.11N.2	Qualification Test and Analysis	3.11N-1
3.11N.3	Qualification Program Results	3.11N-2
3.11N.4	Loss of Ventilation	3.11N-2
3.11N.5	Estimated Chemical and Radiation Environment	3.11N-2
3.12	CONFORMANCE WITH NRC REGULATORY GUIDES	3.12-1
3.12.1	Regulatory Guide l.121	3.12-1
3.12.2	Regulatory Guide l.2	3.12-2

LIST OF TABLES

CHAPTER 3

Table	Title	Page
3.2.A-1	Balance of Plant-Quality Classification of Structures, Systems and Components	3.2-8
3.2.A-2	Correlation of Safety Classification with Industry Codes and Standards for Mechanical Components	3.2-43
3.2.B-1	Equipment Code and Classification List, Westinghouse Fluid System Components	3.2-44
3.2.B-2	Equipment Code and Classification List, Westinghouse Supplied Non-Fluid System Components	3.2-54
3.2.C-1	Generic Letter 89-09 Replacement List	3.2-63
3.3-1	Effective Velocity Pressures	3.3-9
3.3-2	Pressure Coefficients Selection Guide	3.3-10
3.4-1	Flood Loads for Category I Structures	3.4-13
3.5-1	Safety Class Systems and Components and Seismic Category I Structures To Be Protected	3.5-20
3.5-2	Barriers Designed for Missiles	3.5-33
3.5-3	Summary of Control Rod Drive Mechanism Missile Analysis	3.5-35
3.5-4	Characteristics of Other Missiles Postulated Within Reactor Containment	3.5-36
3.5-9	Characteristics of Tornado-Generated Missiles	3.5-37
3.5-10	Barriers for Tornado Missiles	3.5-38
3.5-11	General Aviation Accident Rate	3.5-40
3.5-12	Aircraft Accidents, Fatalities and Accident Rates - U.S. General Aviation Flying: 1972-1981	3.5-41
3.5-13	Ductility Factors	3.5-42
3.5-14	Resistance/Yield Displacement Values for Beams	3.5-44
3.5-15	Resistance/Yield Displacement Values for Rectangular Slabs	3.5-45

LIST OF TABLES (Continued)

CHAPTER 3

Table	Title	Page
3.5-16	Rotating Equipment Missile Sources Outside Containment	3.5-46
3.5-17	Rotating Equipment Missile Sources Inside Containment	3.5-51
3.6.1-1	Essential, High Energy, and Moderate - Energy Systems	3.6-29
3.6.1-2	Design Comparison to Positions of NRC Branch Technical Position ASB 3-1	3.6-31
3.6.1-3	Design Comparison to NRC Branch Technical Position MEB 3-1	3.6-34
3.6.2-1	High-Energy Pipe Break Initial Stress Summary Results	3.6-37
3.6.A-1	Main Steam Line Break Short-Term Mass and Energy Release Rates in IVC	3.6.A-15
3.6.A-2	IVC Subcompartment Nodal Description for Main Steam Line Break	3.6.A-16
3.6.A-3	Node 10, Variable Node Parameters	3.6.A-17
3.6.A-4	Node 11, Variable Node Parameters	3.6.A-18
3.6.A-5	Mass/Energy Release Results for a 4.05 ft^2 Split Steam Line Break at 0% Power	3.6.A-19
3.6.A-6	IVC Common Corrider Area Subcompartment Nodal Description	3.6.A-20
3.6.B-1	Equipment Below RCB Maximum Flood Elevation	3.6.B-5
3.7-1	Damping Values	3.7-47
3.7-2	Method of Seismic Analysis Used for Category I Structures	3.7-48
3.7-3	Reactor Containment Building Natural Frequencies	3.7-50
3.7-4	Mechanical-Electrical Auxiliaries Building Natural Frequencies	3.7-51
3.7-5	Diesel Generator Building Natural Frequencies	3.7-52
3.7-6	Fuel Handling Building Natural Frequencies	3.7-53
3.7-7	Damping Values Used for Seismic Analysis of NSSS Equipment	3.7-54
3.7-8	Cases Where the Confirmatory-Basis Spectra are Used for the Justification of Completed Seismic Analysis, Designs and/or Qualifications	3.7-55

LIST OF TABLES (Continued)

CHAPTER 3

Table	Title	Page
3.7-9	Maximum Relative Displacements Among Principal Power Block Structures	3.7-56
3.7.A-1	Final Analysis Cases, Soil/Structure Interaction Studies	3.7.A-6
3.7.A-2	Calculated Dynamic Pressures on Tendon Galleries	3.7.A-7
3.7.A-3	Calculated Base Shear Forces on Buildings	3.7.A-8
3.8.1-1	Load Combinations for Containment Structure	3.8-97
3.8.1-2	Summary of In-Process Test Results, Portland Cement	3.8-98
3.8.1-3A	Summary of In-Process Test Results, Sieve Analysis and Fineness Modulus, Fine Aggregate (Sand)	3.8-99
3.8.1-3B	Summary of In-Process Test Results, Fine Aggregate (Sand)	3.8-100
3.8.1-3C	Summary of In-Process Test Results, Sieve Analysis, Coarse Aggregates	3.8-101
3.8.1-3D	Summary of In-Process Test Results, Aggregate No. 67 (3/4 in. Gravel)	3.8-102
3.8.1-3E	Summary of In-Process Test Results, Aggregate No. 4 (1-1/2 in. Gravel)	3.8-103
3.8.1-4	Summary of In-Process Test Results, Mix Water	3.8-104
3.8.1-5	Summary of In-Process Test Results, Admixtures	3.8-105
3.8.1-6	Summary of In-Process Test Data, Concrete CP-244 Results	3.8-106
3.8.1-7A	Loading Combination for Design and Final Analysis of Containment Shell	3.8-107
3.8.1-7B	Stress Analysis Results	3.8-109
3.8.2-1	Load Combinations for Class MC Components	3.8-120
3.8.2-2	Personal Airlock Penetrations	3.8-121
3.8.3-1	Load Combinations for Concrete Internal Structures	3.8-122
3.8.3-2	Load Combinations for Steel Internal Structures	3.8-123
3.8.3-3	Load Combinations for Class l, 2, 3, and MC Component Supports	3.8-124
3.8.3-4	Containment Internal Structures Summary of Governing Combined Stress Ratios from the Beam/Column Interaction Equation for Principal Structural Steel Members	3.8-125
3.8.4-1	Load Combinations for Concrete Category I Structures	3.8-129
3.8.4-2	Load Combinations for Steel Category I	

LIST OF TABLES (Continued)

CHAPTER 3

Table	Title	Page
	Structures	3.8-131
3.8.A-1	Computer Programs and Areas of Applications	3.8.A-16
3.9-1.1	List of Active Components	3.9-91
3.9-1.2	Active Valves (BOP Systems)	3.9-93
3.9-1.2A	Active Valves (NSSS Systems)	3.9-104
3.9-2.1	Loading Combinations for ASME Class l NSSS Components and Supports	3.9-108
3.9-2.1A	Stress Criteria for ASME B&PV Code, Section III Class 1 Components (BOP Scope of Supply)	3.9-109
3.9-2.2	Design Loading Combinations for ASME Code Classes 2 and 3 Components and Supports (NSSS Suppliers)	3.9-110
3.9-2.3	Design Loading Combinations for ASME III Class 1 Components (BOP Scope of Supply)	3.9-111
3.9-2.3A	Design Loading Combinations for ASME III Code Class 2 and 3 Components (BOP Scope of Supply)	3.9-114
3.9-2.4	Design Loading Combinations for ASME III Code Class 1, 2, and 3 Component Supports (BOP Scope of Supply)	3.9-115
3.9-2.4A	Load Combinations and Acceptance Criteria for Pressurizer Safety and Relief Valve Piping and Supports (ASME Class 1 Portion)	3.9-116
3.9-2.5	Conformance with NRC Regulatory Guide 1.48 (Bechtel Scope of Supply)	3.9-118
3.9-3	Stress Criteria for ASME III Code Class 2 and 3 Vessels Designed to NC-3300 and ND-3300 (BOP Scope of Supply)	3.9-120
3.9-3A	Stress Criteria for ASME Code Class 2 and 3 Tanks by NSSS Supplier	3.9-121
3.9-4	Stress Criteria for ASME Code Section III Class 2 and Class 3 Nonactive Pumps (BOP Scope of Supply)	3.9-122
3.9-4A	Stress Criteria for ASME Code Section III Class 2 and 3 Active Pumps (BOP Scope of Supply)	3.9-123
3.9-4B	Stress Criteria for ASME Code Class 2 and 3 Active Pumps by the NSSS Supplier	3.9-124

LIST OF TABLES (Continued)

CHAPTER 3

Table	Title	Page
3.9-4C	Stress Criteria for ASME Code Class 2 and 3 Non-Active Pumps by the NSSS Supplier	3.9-125
3.9-5	Stress Criteria for ASME III Code Class 1 Valves (BOP Scope of Supply)	3.9-126
3.9-5A	Stress Criteria for ASME Code Section III Class l Valves (NSSS)	3.9-127
3.9-6	Stress Criteria for Safety-Related ASME Code Class 2 and 3 Valves by NSSS Supplier	3.9-129
3.9-6A	Stress Criteria for ASME III Code Class 2 and 3 Valves (BOP Scope of Supply)	3.9-130
3.9-7	Stress Criteria for ASME Section III Code Class 1 Piping (BOP Scope of Supply)	3.9-131
3.9-7A	Stress Criteria for ASME III Code Class 2 and 3 Piping (BOP Scope of Supply)	3.9-132
3.9-7B	Stress Criteria for ASME III Code Class 1 Component Supports (BOP Scope of Supply)	3.9-133
3.9-7C	Stress Criteria for ASME III Code Class 2 and 3 Component Supports (BOP Scope of Supply)	3.9-134
3.9-8	Summary of Reactor Coolant System Design Transients	3.9-135
3.9-9	Maximum Deflections Allowed for Reactor Internal Support Structures	3.9-138
3.9-10	Safety-Related Seismic Category I Equipment Qualification Procedure (NSSS Scope)	3.9-139
3.9-18	Reactor Vessel Support Loads and Stresses	3.9-146
3.9-19	CRDM Head Adapter Bending Moments	3.9-147
3.9-21	Comparison of Results Between ME 913 and ASME Sample Problem	3.9-148
3.9-22	Hand-Calculated Results Compared with ME 913 Outputs	3.9-149
3.9-23	Compliance with Regulatory Guide 1.148 (NSSS Scope)	3.9-150
3.9-24	Compliance with Regulatory Guide1.148 (Non-NSSS Scope)	3.9-152

LIST OF TABLES (Continued)

CHAPTER 3

Table	Title	Page
3.10N-1	Seismic Category I Instrumentation and Electrical Equipment in Westinghouse NSSS Scope of Supply	3.10N-7
3.11-1	Environmental Conditions	3.11-6
3.11-3	Safety-Related Equipment (Inside Containment) Operational and Qualification Requirements	3.11-25
3.11-4	Safety-Related Equipment (Outside Containment Harsh Environment) Operational and Qualification Requirements	3.11-26
3.11-5	Safety-Related Applications of Polyethylene Cable	3.11-27
3.12-1	Regulatory Guide Matrix	3.12-4

LIST OF FIGURES

CHAPTER 3

Figure Number	Title
3.3-1	Effective Velocity - Pressure Profile
3.3-2	Atmospheric Pressure - Field Profile
3.3-3	Tornado Pressure Distribution on a Structure
3.4-1	Typical Section through Plant
3.4-2	Maximum Flow Profiles Through the Plant
3.4-3	Typical Force Diagram
3.6.1-1	Sheet 1A - Postulated Break Points and Restraint Locations Main Steam, Loop 1 30"-MS-1001-GA2
	Sheet 1B - Postulated Break Points and Restraint Locations Main Steam, Loop 2 30"-MS-1002-GA2
	Sheet 1C - Postulated Break Points and Restraint Locations Main Steam, Loop 3 30"-MS-1003-GA2
	Sheet 1D - Postulated Break Points and Restraint Locations Main Steam, Loop 4 30"-MS-1004-GA2
	Sheet 2A - Postulated Break Points and Restraint Locations Feedwater, Loop 1 16", 18" FW-2012-GA2 – Unit 2
	Sheet 2B - Postulated Break Points and Restraint Locations Feedwater, Loop 2 16", 18" FW-2014-GA2 – Unit 2
	Sheet 2C - Postulated Break Points and Restraint Locations Feedwater, Loop 3 16", 18" FW-2016-GA2 – Unit 2

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Sheet 2D - Postulated Break Points and Restraint Locations Feedwater, Loop 4 16", 18" FW-2018-GA2 – Unit 2
	Sheet 2E - Postulated Break Points and Restraint Locations Feedwater, Loop 1 16", 18" FW-1012-GA2 – Unit 1
	Sheet 2F - Postulated Break Points and Restraint Locations Feedwater, Loop 2 16", 18" FW-1014-GA2 – Unit 1
	Sheet 2G - Postulated Break Points and Restraint Locations Feedwater, Loop 3 16", 18" FW-1016-GA2 – Unit 1
	Sheet 2H - Postulated Break Points and Restraint Locations Feedwater, Loop 4 16", 18" FW-1018-GA2 – Unit 1
	Sheet 3A - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 1 (Inside Containment)- Unit 2
	Sheet 3B - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 2 (Inside Containment) – Unit 2
	Sheet 3C - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 3 (Inside Containment) – Unit 2
	Sheet 3D - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 4 (Inside Containment) – Unit 2
	Sheet 3E - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 1 (Inside Containment) – Unit 1
	Sheet 3F - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 2 (Inside Containment) – Unit 1
	Sheet 3G- Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 3 (Inside Containment) – Unit 1
	Sheet 3H- Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 4 (Inside Containment) – Unit 1

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Sheet 4A - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 1 (Outside Containment)
	Sheet 4B - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 2 (Outside Containment)
	Sheet 4C - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 3 (Outside Containment)
	Sheet 4D - Postulated Break Points and Restraint Locations Auxiliary Feedwater Loop 4 (Outside Containment)
	Sheet 5A – Unit 1 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 1 (Inside Containment)
	Sheet 5B – Unit 1 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 2 (Inside Containment)
	Sheet 5C - Unit 1 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 3 (Inside Containment)
	Sheet 5D – Unit 1 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 4 (Inside Containment)
	Sheet 5E – Unit 2 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 1 (Inside Containment)
	Sheet 5F – Unit 2 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 2 (Inside Containment)
	Sheet 5G – Unit 2 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 3 (Inside Containment)
	Sheet 5H – Unit 2 - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 4 (Inside Containment)
	Sheet 6A - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 1 (Outside Containment)

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Sheet 6B - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 2 (Outside Containment)
	Sheet 6C - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 3 (Outside Containment)
	Sheet 6D - Postulated Break Points and Restraint Locations Steam Generator Blowdown Loop 4 (Outside Containment)
	Sheet 7B - Postulated Break Points and Restraint Locations Pressurizer Spray Line
	Sheet 7C - Postulated Break Points and Restraint Locations RC Loop 2 Drain to RCDT
	Sheet 7D - Postulated Break Points andRestraint Locations RC Loop 2 to RCDT
	Sheet 8A - Postulated Break Points and Restraint Locations Residual Heat Removal Pump A Suction: Inside Containment
	Sheet 8B - Postulated Break Points and Restraint Locations Residual Heat Removal Pump B Suction: Inside Containment
	Sheet 8C - Postulated Break Points and Restraint Locations Residual Heat Removal Pump C Suction: Inside Containment
	Sheet 8D - Postulated Break Points and Restraint Locations Safety Injection to Hot Leg Loop 1 (Inside Containment)
	Sheet 8E - Postulated Break Points and Restraint Locations Safety Injection to Hot Leg Loop 2 (Inside Containment)
	Sheet 8F - Postulated Break Points and Restraint Locations Safety Injection to Hot Leg Loop 3 (Inside Containment)
	Sheet 8J - Postulated Break Points and Restraint Locations Accumulators Drain to the RCDT

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Sheet 9A - Postulated Break Points and Restraint Locations CVCS Letdown from Crossover Leg to Regenerative Heat Exchanger
	Sheet 9B - Postulated Break Points and Restraint Locations CVCS Letdown (Outside Containment)
	Sheet 9C - Postulated Break Points and Restraint Locations Normal Charging (Inside Containment)
	Sheet 9D - Postulated Break Points and Restraint Locations Auxiliary Pressurizer Spray
	Sheet 9E - Postulated Break Points and Restraint Locations Alternate Charging to Loop 3
	Sheet 9F - Postulated Break Points and Restraint Locations Excess Letdown from Loop 4
	Sheet 9G - Postulated Break Points and Restraint Locations Excess Letdown to Heat Exchangers
	Sheet 9H - Postulated Break Points and Restraint Locations CVCS Letdown to Containment Penetrations
	Sheet 10A - Postulated Break Points and Restraint Locations CVCS (Letdown Outside Containment)
	Sheet 10B - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10C - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10D - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10E - Postulated Break Points and Restraint Locations (Letdown Outside Containment)

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Sheet 10F - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10G - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10H - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10I - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10J - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10K - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10L - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10M - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10N - Postulated Break Points and Restraint Locations (Letdown Outside Containment)
	Sheet 10P - Postulated Break Points and Restraint Locations CVCS Letdown (Inside Containment) (2 sheets)
	Sheet 10Q - Postulated Break Points and Restraint Locations CVCS Letdown (Inside Containment) (2 sheets)

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
3.6.2-1	Loss of Reactor Coolant Accident Boundary Limits
3.6.2-3	Typical U-Bar Restraint
3.6.2-4	Typical EAM Restraint
3.6.2-5	Letdown Heat Exchanger Compartment Pressure Profile
3.6.2-6	Letdown Heat Exchanger Compartment Temperature Profile
3.6.2-7	Pipe Break Exclusion Zone for Main Steam (Typical)
3.6.2-8	Pipe Break Exclusion Zone for Feedwater (Typical)
3.6-3	Single Pipe Penetration for High Energy Lines
3.6.A-1	Node and Junction Diagram of the IVC for GOTHIC
3.6.A-2	Basic Flud Calculation Flowchart
3.6.A-3	Pressures in IVC due to MSLB Node 1 Break Node 6: Case 1 (Sheet 1 of 9)
	Pressures in IVC due to MSLB Node 2 Break Node 6: Case 1 (Sheet 2 of 9)
	Pressures in IVC due to MSLB Node 3 Break Node 6: Case 1 (Sheet 3 of 9)
	Pressures in IVC due to MSLB Node 4 Break Node 6: Case 1 (Sheet 4 of 9)
	Pressures in IVC due to MSLB Node 5 Break Node 7: Case 2 (Sheet 5 of 9)
	Pressures in IVC due to MSLB Node 6 Break Node 6: Case 1 (Sheet 6 of 9)
	Pressures in IVC due to MSLB Node 7 Break Node 7: Case 2 (Sheet 7 of 9)

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Pressures in IVC due to MSLB Node 8 Break Node 7: Case 2 (Sheet 8 of 9)
	Pressures in IVC due to MSLB Node 9 Break Node 6: Case 1 (Sheet 9 of 9)
3.6.A-4	IVC EQ Temperature Node 1 MSLB (Sheet 1 of 3) Node 1 MSLB (Sheet 2 of 3) Node 2 MSLB (Sheet 3 of 3) Node 3 MSLB
3.6.A-5	Node and Junction Diagram of the Common Corridor Area of the IVC Structure
3.7-1	Horizontal SSE Design Response Spectra
3.7-2	Horizontal OBE Design Response Spectra
3.7-3	Vertical SSE Design Response Spectra
3.7-4	Vertical OBE Design Response Spectra
3.7-5	Artificial Time Histories, Horizontal & Vertical SSE
3.7-6	Horizontal Response Spectra, SSE, l% Damping
3.7-7	Horizontal Response Spectra, SSE, 2% Damping
3.7-8	Horizontal Response Spectra, SSE, 4% Damping
3.7-9	Horizontal Response Spectra, SSE, 7% Damping
3.7-10	Horizontal Response Spectra, SSE, l0% Damping
3.7-11	Vertical Response Spectra, SSE, l% Damping
3.7-12	Vertical Response Spectra, SSE, 2% Damping

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
3.7-13	Vertical Response Spectra, SSE, 4% Damping
3.7-14	Vertical Response Spectra, SSE, 7% Damping
3.7-15	Vertical Response Spectra, SSE, l0% Damping
3.7-15A	Comparison of Surface Motion Response Spectra with NRC Criteria, Horizontal OBE
3.7-15B	Comparison of Computed Motion Response Spectra with NRC Criteria, Vertical OBE
3.7-15C	Comparison of Foundation-level Motion Response Spectra with NRC Criteria, Horizontal OBE
3.7-16	Reactor Containment Building Mathematical Model
3.7-17	M-E Auxiliary Building Mathematical Model
3.7-17A	Fuel-Handling Building Mathematical Model
3.7-17B	Diesel-Generator Building Mathematical Model
3.7-17C	Essential Cooling Water Intake Structure Mathematical Model
3.7-18	Location of Cross Sections for Soil-Structure Interaction Analysis
3.7-18A	Finite Element Mesh Cross Section 1
3.7-18B	Finite Element Mesh Cross Section 2
3.7-18C	Finite Element Mesh Cross Section 3
3.7-19A	E-W Total Acceleration Diagram (OBE), Containment Structure
3.7-19B	N-S Total Acceleration Diagram (OBE), Containment Structure
3.7-20	Vertical Total Acceleration Diagram (OBE), Containment Structure

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
3.7-21	E-W Shear Force Diagram (OBE), Containment Structure
3.7-22	N-S Shear Force Diagram (OBE), Containment Structure
3.7-23	Bending Moment Diagram (About N-S Axis) (OBE), Containment Structure
3.7-24	Bending Moment Diagram (About E-W Axis) (OBE), Containment Structure
3.7-25	E-W Total Acceleration Diagram (OBE), M-E Auxiliary Building
3.7-26	N-S Total Acceleration Diagram (OBE), M-E Auxiliary Building
3.7-27	Vertical Total Acceleration Diagram (OBE), M-E Auxiliary Building
3.7-28	E-W Shear Force Diagram (SSE), M-E Auxiliary Building
3.7-29	N-S Shear Force Diagram (SSE), M-E Auxiliary Building
3.7-30	Bending Moment Diagram About E-W Axis (OBE), M-E Auxiliary Building
3.7-31	Bending Moment Diagram About N-S Axis (SSE), M-E Auxiliary Building
3.7-32	Floor Design Spectrum at El. 153.0 ft - East-West. OBE, RCB Containment Structure
3.7-33	Floor Design Spectrum at El. 153.0 ft - North-South. OBE, RCB Containment Structure
3.7-34	Floor Design Spectrum at El. 153.0 ft - Vertical. OBE, RCB Containment Structure
3.7-35	Floor Design Spectrum at El. 153.0 ft - East-West. SSE, RCB Containment Structure
3.7-36	Floor Design Spectrum at El. 153.0 ft - North-South. SSE, RCB Containment Structure

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
3.7-37	Floor Design Spectrum at El. 153.0 ft - Vertical. SSE, RCB Containment Structure
3.7-38	Floor Design Spectrum at El. 68.0 ft - East-West. OBE, RCB Internal Structure
3.7-39	Floor Design Spectrum at El. 68.0 ft - North-South. OBE, RCB Internal Structure
3.7-40	Floor Design Spectrum at El. 68.0 ft - Vertical. OBE, RCB Internal Structure
3.7-41	Floor Design Spectrum at El. 68.0 ft - East-West. SSE, RCB Internal Structure
3.7-42	Floor Design Spectrum at El. 68.0 ft - North-South. SSE, RCB Internal Structure
3.7-43	Floor Design Spectrum at El. 68.0 ft - Vertical. SSE, RCB Internal Structure
3.7-44	Floor Design Spectrum at All Elevations - Vertical. OBE, M-E Auxiliary Building
3.7-45	Floor Design Spectrum at All Elevations - Vertical. SSE, M-E Auxiliary Building
3.7-46	Floor Design Spectrum at El. 51.0 ft - East-West. OBE, M-E Auxiliary Building
3.7-47	Floor Design Spectrum at El. 51.0 ft - North-South. OBE, M-E Auxiliary Building
3.7-48	Floor Design Spectrum at El. 51.0 ft - East-West. SSE, M-E Auxiliary Building
3.7-49	Floor Design Spectrum at El. 51.0 ft - North-South. SSE, M-E Auxiliary Building

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
3.7-49A	Structural - Configuration Revised Spectrum, MEAB El. 51 ft - E/W, OBE
3.7-49B	Structural - Configuration Revised Spectrum, MEAB El. 51 ft - N/S, OBE
3.7-49C	Structural - Configuration Revised Spectrum, MEAB El. 51 ft - Vertical, OBE
3.7-49D	Structural - Configuration Revised Spectrum, MEAB El. 51 ft - E/W, SSE
3.7-49E	Structural - Configuration Revised Spectrum, MEAB El. 51 ft - N/S, SSE
3.7-49F	Structural - Configuration Revised Spectrum, MEAB El. 51 ft - Vertical, SSE
3.7-49G	Floor Design Spectrum, FHB All Elevations - Vertical, OBE
3.7-49H	Floor Design Spectrum, FHB All Elevations - Vertical, SSE
3.7-49I	Floor Design Spectrum, FHB El. 30 ft - E/W, OBE
3.7-49J	Floor Design Spectrum, FHB El. 30 ft - N/S, OBE
3.7-49K	Floor Design Spectrum, FHB El. 30 ft - E/W, SSE
3.7-49L	Floor Design Spectrum, FHB El. 30 ft - N/S, SSE
3.7-49M	Floor Design Spectrum, DGB El. 55 ft - E/W, OBE
3.7-49N	Floor Design Spectrum, DGB El. 55 ft - N/S, OBE
3.7-49O	Floor Design Spectrum, DGB El. 55 ft - Vertical, OBE
3.7-50	Comparison of Acceleration Response Spectra at El. 68 ft of the RCB Internal Structure, E-W, OBE
3.7-51	Comparison of Acceleration Response Spectra at El. 30 ft of Fuel Handling Building, N-S, OBE
3.7-52	Comparison of Acceleration Response Spectra at El. 100 ft of Diesel

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Generator Building, N-S, OBE
3.7-53	Comparison of Acceleration Response Spectra at El. 86 ft of Mechanical Auxiliary Building, E-W, OBE
3.7-54	Comparison of Acceleration Response Spectra at El. 108 ft of RCB Containment Structure, N-S, OBE
3.7-55	Damping as a Function of ZPA for Design of Cable Tray Hangers
3.7-56	Multi-Degree of Freedom System
3.7.A-1	Finite Element Mesh, Cross Section 1
3.7.A-2	Lateral Dynamic Pressure on East Wall of Auxiliary Building, Cross Section 1, Due to OBE
3.7.A-3	Lateral Dynamic Pressure on East Wall of Auxiliary Building, Cross Section 1, Due to SSE
3.7.A-4	Lateral Dynamic Pressure on East Wall of Reactor Building, Cross Section 1, Due to OBE
3.7.A-5	Lateral Dynamic Pressure on East Wall of Reactor Building, Cross Section 1, Due to SSE
3.7.A-6	Lateral Dynamic Pressure on West Wall of Reactor Building, Cross Section 1, Due to OBE
3.7.A-7	Lateral Dynamic Pressure on West Wall of Reactor Building, Cross Section 1, Due to SSE
3.7.A-8	Finite Element Mesh, Cross Section 2
3.7.A-9	Lateral Dynamic Pressure on Upper Wall of Fuel Handling Building, Cross Section 2, Due to OBE
3.7.A-10	Lateral Dynamic Pressure on Lower Wall of Fuel Handling Building, Cross Section 2, Due to OBE

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
3.7.A-11	Lateral Dynamic Pressure on North Wall of Reactor Building, Cross Section 2, Due to OBE
3.7.A-12	Finite Element Mesh, Cross Section 3
3.7.A-13	Dynamic Pressure Distribution on North Wall of Auxiliary Building, Cross Section 3, Due to OBE
3.7.A-14	Lateral Dynamic Pressure on South Wall of Auxiliary Building, Cross Section 3, Due to OBE
3.8.1-1	Reactor Containment Building, General Arrangement
3.8.1-2	Reactor Containment Building, Mat & Shell Reinforcement
3.8.1-3	Reactor Containment Building, Dome Reinforcement
3.8.1-4	Reactor Containment Building, Reinforcement at Equipment Hatch
3.8.1-5	Reactor Containment Building, Buttress Reinforcement
3.8.1-6	Reactor Containment Building, Liner Details
3.8.1-7	Reactor Containment Building, Tendon Arrangement
3.8.1-8	Fuel Transfer Tube Penetration
3.8.1-9	Multiple Pipe Penetrations
3.8.1-10	Moderate Energy Pipe Penetrations
3.8.1-11	High Energy Pipe Penetration
3.8.1-12	Electrical Penetration
3.8.1-13	Strain Gage Locations and Crack Inspection Areas
3.8.1-14	Reactor Containment Building Key Elevations Showing Location of

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
	Reference Sections
3.8.1-15	Reactor Containment Building Mathematical Model
3.8.1-16	Boundaries of Math Model of Equipment Hatch Opening Analysis
3.8.1-17	Reactor Containment Building Mathematical Model for Equipment Hatch Opening Analysis
3.8.2-1	Reactor Containment Building - Equipment Hatch, Typical Details
3.8.3-1	Reactor Containment Building, Reactor Pressure Vessel Support System
3.8.3-3	Reactor Containment Building, Typical Joint Detail for Internal Structure Element to Base Mat
3.8.3-4	Reactor Containment Building, Steam Generator Support System
3.8.3-5	Reactor Containment Building, Reactor Coolant Pump Support System
3.8.3-6	Reactor Containment Building, Pressurizer Support System
3.8.4-1	Category I Structures, Plan and Elevations
3.8.5-1	Category I Structures, Foundation Plans and Sections
3.8.B-1	Category A Welds, Permissible Undercut Values
3.8.B-2	Typical Cases of Oversize Fillet Welds Subjected to Category A Criterion
3.9-1	Lower Core Support Assembly (Core Barrel Assembly)
3.9-2	Upper Core Support Assembly
3.9-3	Plan View of Upper Support Plate Assembly
3.9-4	Full Length Control Rod Drive Mechanism
3.9-5	Full Length Control Rod Drive Mechanism Schematic

LIST OF FIGURES (Continued)

CHAPTER 3

Figure Number	Title
3.9-6	Reactor Coolant Loop Support, Dynamic Structural Model
3.9-7	Not Used
3.9-8	Through-Wall Thermal Gradients
3.9-9	Nominal Latch Clearance at Minimum and Maximum Temperature
3.9-10	Control Rod Drive Mechanism Latch Clearance Thermal Effects
3.9-11	RPV Shell Submodel
3.9-12	Core Barrel Submodel
3.9-12A	Internals Submodel
3.9-13	Steam Generator Lower Lateral Supports
3.9-14	Steam Generator Upper Lateral Supports
3.9-15	Steam Generator Upper Support Model
3.9-16	Reactor Coolant Pump Supports