CHAPTER 19: PROBABILISTIC RISK ASSESSMENT TABLE OF CONTENTS

19.1 INTRODUCTION 19.1-1 19.2 INTERNAL INITIATING EVENTS 19.2-1 19.3 MODELING OF SPECIAL INITIATORS 19.3-1 19.4 EVENT TREE MODELS 19.4-1 19.5 SUPPORT SYSTEMS 19.5-1 19.6 SUCCESS CRITERIA ANALYSIS 19.6-1 19.7 FAULT TREE GUDELINES 19.7-1 19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.8-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — MUTOMATIC 19.11-1 19.12 PASSIVE CORT ECOOLING SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK 19.12-1 19.13 PASSIVE CONTAINMENT COOLING 19.13-1 19.14 19.15 19.14-1 19.15 CONTAINMENT COOLING WATER SYSTEM 19.16-1 19.16 CONTAINMENT COOLING WATER SYSTEM 19.17-1 19.16 CONTAINMENT COOLING WATER SYSTEM 19.17-1 19.17 NORMAL RESIDUAL HEAT REMOVAL SYSTEM 19.16-1 19.16 CONTAINMENT HYDROGEN CON	CHAP	TER 19	PROBABILISTIC RISK ASSESSMENT	19.1-1		
19.2 INTERNAL INITIATING EVENTS 19.2-1 19.3 MODELING OF SPECIAL INITIATORS 19.3-1 19.4 EVENT TREE MODELS 19.4-1 19.5 SUPPORT SYSTEMS 19.5-1 19.6 SUCCESS CRITERIA ANALYSIS 19.6-1 19.7 FAULT TREE GUDELINES 19.7-1 19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.8-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — MUCONTAINMENT REFUELING WATER STORAGE TANK 19.12-1 19.13 PASSIVE CONTAINMENT COOLING 19.14-1 19.15 SOSIVE CONTAINMENT COOLING SYSTEM 19.15-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.16-1 19.17 NORMAL RESIDUAL HEAT REMOVAL SYSTEM 19.17-1 19.18 COMPONENT COOLING WATER SYSTEM 19.16-1 19.19 SERVICE WATER SYSTEM 19.21-1 19.18 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.16-1 19.19 CONTAINMENT GOLING WATER SYSTEM 19.20-1 19.20	19 1	INTRO	DUCTION	19 1-1		
19.3 MODELING OF SPECIAL INITIATORS 19.3-1 19.4 EVENT TREE MODELS 19.4-1 19.5 SUPPORT SYSTEMS 19.5-1 19.6 SUCCESS CRITERIA ANALYSIS 19.6-1 19.7 FAULT TREE GUIDELINES 19.7-1 19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.8-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.11-1 19.12 PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK 19.12-1 19.13 PASSIVE CORT COOLING SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK 19.14-1 19.14 MAIN AND STARTUP FEEDWATER SYSTEM 19.15-1 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.16-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.16-1 19.17 NORAL RESIDUAL HEAT REMOVAL SYSTEM 19.16-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.20-1 19.20 CONTAL CHILLED WATER SYSTEM 19.21-1 19.21 AC POWER SYSTEM <t< td=""><td>19.2</td><td>INTERN</td><td>JAL INITIATING EVENTS</td><td>19 2-1</td></t<>	19.2	INTERN	JAL INITIATING EVENTS	19 2-1		
19.4 EVENT TREE MODELS 19.4-1 19.5 SUPPORT SYSTEMS 19.5-1 19.6 SUCCESS CRITERIA ANALYSIS 19.6-1 19.7 FAULT TREE GUIDELINES 19.7-1 19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.9-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.11-1 19.12 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.12-1 19.14 MAIN AND STARTUP FEEDWATER SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK 19.13-1 19.14 MAIN AND STARTUP FEEDWATER SYSTEM	19.3	MODELING OF SPECIAL INITIATORS				
19.5 SUPPORT SYSTEMS 19.5-1 19.6 SUCCESS CRITERIA ANALYSIS 19.6-1 19.7 FAULT TREE GUIDELINES 19.7-1 19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.8-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR 19.11-1 19.12 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR 19.11-1 19.12 PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK 19.12-1 19.13 PASSIVE CORTAINMENT COOLING 19.13-1 19.14 MAIN AND STARTUP FEEDWATER SYSTEM 19.14-1 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.15-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.17-1 19.18 COMPONENT COOLING WATER SYSTEM 19.17-1 19.19 SERVICE WATER SYSTEM 19.20-1 19.20 LASS 1E DC & UPS SYSTEM 19.20-1 19.21 AC POWER SYSTEM 19.21-1 19.22 CLASS 1E DC & UPS SYSTEM 19.23-1 <td< td=""><td>19.4</td><td>EVENT</td><td>TREE MODELS</td><td></td></td<>	19.4	EVENT	TREE MODELS			
19.6 SUCCESS CRITERIA ANALYSIS 19.6-1 19.7 FAULT TREE GUIDELINES 19.7-1 19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.8-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — ACUMATIC 19.10-1 19.12 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.11-1 19.12 PASSIVE CORTAINMENT COOLING 19.13-1 19.14 MAIN AND STARTUP FEEDWATER SYSTEM 19.14-1 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.16-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.16-1 19.17 NORMAL RESIDUAL HEAT REMOVAL SYSTEM 19.16-1 19.18 COMPONENT COOLING WATER SYSTEM 19.20-1 19.21 AC POWER SYSTEM 19.20-1 19.22 CENTRAL CHILLED WATER SYSTEM 19.20-1 19.22 CLASS 1E DC & UPS SYSTEM 19.20-1 19.22 CLASS 1E DC & UPS SYSTEM 19.20-1 19.22 CLASS 1E DC & UPS SYSTEM 19.22-1 19.22 C	19.5	SUPPO	RT SYSTEMS			
19.7 FAULT TREE GUIDELINES 19.7-1 19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.8-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR 19.10-1 19.12 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR 19.11-1 19.12 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.12-1 19.13 PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT 19.12-1 19.14 PASSIVE CONTAINMENT COOLING 19.13-1 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.14-1 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.15-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.17-1 19.18 COMPONENT COOLING WATER SYSTEM 19.17-1 19.19 SERVICE WATER SYSTEM 19.17-1 19.20 CENTRAL CHILED WATER SYSTEM 19.20-1 19.21 CASS TE DC & UPS SYSTEM 19.21-1 19.22 CLASS 1E DC & UPS SYSTEM 19.22-1 19.23 NON-CLASS 1E DC & UPS SYSTEM 19.24-1	19.6	SUCCE	SS CRITERIA ANALYSIS			
19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL 19.8-1 19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS 19.9-1 19.10 PASSIVE CORE COOLING SYSTEM — AUTOMATIC DEPRESSURIZATION SYSTEM 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — AUTOMATIC DEPRESSURIZATION SYSTEM 19.11-1 19.12 PASSIVE CORE COOLING SYSTEM — AUTOMATIC DEPRESSURIZATION SYSTEM 19.12-1 19.13 PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK 19.12-1 19.14 PASSIVE CONTAINMENT COOLING 19.14-1 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.16-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.16-1 19.17 NORMAL RESIDUAL HEAT REMOVAL SYSTEM 19.16-1 19.18 CONTRAL CHILLED WATER SYSTEM 19.19-1 19.20 CENTRAL CHILLED WATER SYSTEM 19.20-1 19.21 CLASS 1E DC & UPS SYSTEM 19.21-1 19.22 CLASS 1E DC & UPS SYSTEM 19.22-1 19.23 NON-CLASS 1E DC & UPS SYSTEM 19.22-1 19.24 CONTAINMENT ISOLATION 19.24-1 19.25 COMPRESSED AND INSTRUMENT AIR SYSTEM 19.22-1 <tr< td=""><td>19.7</td><td>FAULT</td><td>TREE GUIDELINES</td><td></td></tr<>	19.7	FAULT	TREE GUIDELINES			
REMOVAL19.8-119.9PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS19.9-119.10PASSIVE CORE COOLING SYSTEM — ACUMULATOR19.10-119.11PASSIVE CORE COOLING SYSTEM — AUTOMATICDEPRESSURIZATION SYSTEM — IN-CONTAINMENT19.12PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT19.12-119.13PASSIVE CORT COOLING SYSTEM — IN-CONTAINMENT19.12-119.14PASSIVE CONTAINMENT COOLING19.13-119.14MAIN AND STARTUP FEEDWATER SYSTEM19.14-119.15CHEMICAL AND VOLUME CONTROL SYSTEM19.16-119.16CONTAINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.20-119.21AC POWER SYSTEM19.20-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23CONTAINMENT ISOLATION19.24-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27PLANT CONTROL SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.27-119.29PLANT CONTROL SYSTEM19.26-119.30OTHER EVENT TREE NODE PROBABILITIES19.31-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.34-119.34SEVERE ACCIDENT THENOMENA TREATMENT19.35-119.35CONTAINMENT EVENT TREE	19.8	PASSI	E CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT			
19.9 PASSIVE CORE COOLING SYSTEM — ACQUMULATOR 19.0-1 19.10 PASSIVE CORE COOLING SYSTEM — ACUMULATOR 19.10-1 19.11 PASSIVE CORE COOLING SYSTEM — AUTOMATIC 19.10-1 19.12 PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT 19.11-1 19.12 PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT 19.12-1 19.13 PASSIVE CORTAINMENT COOLING 19.13-1 19.14 MAIN AND STARTUP FEEDWATER SYSTEM 19.14-1 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.16-1 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.16-1 19.17 NORMAL RESIDUAL HEAT REMOVAL SYSTEM 19.17-1 19.18 COMPONENT COOLING WATER SYSTEM 19.20-1 19.20 CENTRAL CHILLED WATER SYSTEM 19.20-1 19.21 AC POWER SYSTEM 19.21-1 19.22 CLASS 1E DC & UPS SYSTEM 19.22-1 19.23 NON-CLASS 1E DC & UPS SYSTEM 19.22-1 19.24 CONTAINMENT ISOLATION 19.24-1 19.25 COMPRESSED AND INSTRUMENT AIR SYSTEM 19.26-1 19.26 PROTECTION AND SAFETY MONITORING SYSTEM 19.26-1 19		REMO\	/AL			
19.10 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR	19.9	PASSI	E CORE COOLING SYSTEM — CORE MAKEUP TANKS	19.9-1		
19.11 PASSIVE CORE COOLING SYSTEM — AUTOMATIC DEPRESSURIZATION SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK 19.13 PASSIVE CONTAINMENT COOLING 19.14 19.13 PASSIVE CONTAINMENT COOLING 19.14 19.15 CHEMICAL AND VOLUME CONTROL SYSTEM 19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM 19.17 NORMAL RESIDUAL HEAT REMOVAL SYSTEM 19.18 19.19 SERVICE WATER SYSTEM 19.19 SERVICE WATER SYSTEM 19.20 CENTRAL CHILLED WATER SYSTEM 19.21 AC POWER SYSTEM 19.22 19.23 NON-CLASS 1E DC & UPS SYSTEM 19.24 CONTAINMENT ISOLATION 19.25 COMPRESSED AND INSTRUMENT AIR SYSTEM 19.26 PROTECTION AND SAFETY MONITORING SYSTEM 19.25 POPRECTION AND SAFETY MONITORING SYSTEM 19.26 PROTECTION AND SAFETY MONITORING SYSTEM 19.27 19.28	19.10	PASSI	E CORE COOLING SYSTEM — ACCUMULATOR	19.10-1		
DEPRESSURIZATION SYSTEM19.11-119.12PASSIVE CORE COOLING SYSTEMIN-CONTAINMENTREFUELING WATER STORAGE TANK19.12-119.13PASSIVE CONTAINMENT COOLING19.13-119.14MAIN AND STARTUP FEEDWATER SYSTEM19.15-119.15CHEMICAL AND VOLUME CONTROL SYSTEM19.16-119.16CONTAINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.17-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.20-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.22-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.29PLANT CONTROL SYSTEM19.26-119.29PLANT CONTROL SYSTEM19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.36-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37NON-ELASEL REFLOODING19.38-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRI	19.11	PASSI	/E CORE COOLING SYSTEM — AUTOMATIC			
19.12PASSIVE CORE COOLING SYSTEMIN-CONTAINMENT REFUELING WATER STORAGE TANK19.12-119.13PASSIVE CONTAINMENT COOLING19.13-119.14HAIN AND STARTUP FEEDWATER SYSTEM19.14-119.15CHEMICAL AND VOLUME CONTROL SYSTEM19.15-119.16CONTAINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.18-119.19SERVICE WATER SYSTEM19.10-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.22-119.22CLASS 1E DC & UPS SYSTEM19.22-119.22CLASS 1E DC & UPS SYSTEM19.22-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.24-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.26-119.29COMMON CAUSE ANALYSIS19.20-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.36-119.37CONTAINMENT ISOLATION19.		DEPRE	SSURIZATION SYSTEM	19.11-1		
REFUELING WATER STORAGE TANK19.12-119.13PASSIVE CONTAINMENT COOLING19.13-119.14MAIN AND STARTUP FEEDWATER SYSTEM19.14-119.15CHEMICAL AND VOLUME CONTROL SYSTEM19.15-119.16CONTAINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.17-119.19SERVICE WATER SYSTEM19.18-119.19SERVICE WATER SYSTEM19.20-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.26-119.29COMMON CAUSE ANALYSIS19.20-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.36-119.35CONTAINMENT EVENT TREE ANALYSIS19.36-119.36CONTAINMENT EVENT TREE ANALYSIS19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT FOR MOLTEN CO	19.12	PASSI	E CORE COOLING SYSTEM — IN-CONTAINMENT			
19.13PASSIVE CONTAINMENT COOLING19.13-119.14MAIN AND STARTUP FEEDWATER SYSTEM19.14-119.15CHEMICAL AND VOLUME CONTROL SYSTEM19.15-119.16CONTAINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18CONTAINMENT RYDROGEN CONTROL SYSTEM19.17-119.19SERVICE WATER SYSTEM19.19-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.24-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.26-119.28PLANT CONTROL SYSTEM19.26-119.29COMMON CAUSE ANALYSIS19.20-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.34-119.34SEVERE ACCIDENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT EVENT TREE ANALYSIS19.35-119.38REACTOR VESSEL REFLOODING19.37-119.39IN-VESSEL REFLOIDING MOLTEN CORE DEBRIS19.30-119.31 <td></td> <td>REFUE</td> <td>LING WATER STORAGE TANK</td> <td>19.12-1</td>		REFUE	LING WATER STORAGE TANK	19.12-1		
19.14MAIN AND STARTUP FEEDWATER SYSTEM19.14-119.15CHEMICAL AND VOLUME CONTROL SYSTEM19.15-119.16CONTAINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.18-119.19SERVICE WATER SYSTEM19.19-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.20-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.33-119.35CONTAINMENT EVENT TREE ANALYSIS19.36-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT EVENT TREE ANALYSIS19.36-119.38REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.36REACTOR VESSEL REFLOODING19.37-119.38REACTOR VESSEL REFLOODING19.40-119.44MAAP4	19.13	PASSI	E CONTAINMENT COOLING	19.13-1		
19.15CHEMICAL AND VOLUME CONTROL SYSTEM19.16-119.16CONTAINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.18-119.19SERVICE WATER SYSTEM19.19-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.22-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.36-119.35CONTAINMENT EVENT TREE ANALYSIS19.36-119.36REACTOR COGLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT EVENT TREE ANALYSIS19.36-119.38REACTOR VESSEL REFLOODING19.38-119.34REACTOR COLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT EVENT TREE ANALYSIS19.30-119.38REACTOR VESSEL REFLOODING19.34-119.39 </td <td>19.14</td> <td>MAIN A</td> <td>ND STARTUP FEEDWATER SYSTEM</td> <td>19.14-1</td>	19.14	MAIN A	ND STARTUP FEEDWATER SYSTEM	19.14-1		
19.16CONTRINMENT HYDROGEN CONTROL SYSTEM19.16-119.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.18-119.19SERVICE WATER SYSTEM19.19-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.22-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.26-119.28PLANT CONTROL SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.26-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.30-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR VESSEL REFLOODING19.37-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.44MAAP4.0 CODE DESCRIPTION AND AP1000	19.15	CHEMI	CAL AND VOLUME CONTROL SYSTEM	19.15-1		
19.17NORMAL RESIDUAL HEAT REMOVAL SYSTEM19.17-119.18COMPONENT COOLING WATER SYSTEM19.18-119.19SERVICE WATER SYSTEM19.19-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.22-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.27-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.36-119.36REACTOR VESSEL REFLOODING19.37-119.38REACTOR VESSEL REFLOODING19.37-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.42-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.16	CONTA	INMENT HYDROGEN CONTROL SYSTEM	19.16-1		
19.18COMPONENT COOLING WATER SYSTEM19.18-119.19SERVICE WATER SYSTEM19.19-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22AC POWER SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.26-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.26-119.28PLANT CONTROL SYSTEM19.26-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37ONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.40-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITYDISTRIBUTION19.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.17	NORM	AL RESIDUAL HEAT REMOVAL SYSTEM	19.17-1		
19.19SERVICE WATER SYSTEM19.19-119.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.26-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.36-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL REFLOODING19.38-119.39IN-VESSEL REFLOODING19.39-119.40PASSIVE CONTAINMENT COOLING19.41-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITYDISTRIBUTION19.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.18	COMPO		19.18-1		
19.20CENTRAL CHILLED WATER SYSTEM19.20-119.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.26-119.29COMMON CAUSE ANALYSIS19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL REFLOODING19.38-119.39IN-VESSEL REFLOODING19.30-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.44RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.19	SERVIC	CE WATER SYSTEM	19.19-1		
19.21AC POWER SYSTEM19.21-119.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.27-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.39-119.40PASSIVE CONTAINMENT COOLING19.39-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.20	CENTR	AL CHILLED WATER SYSTEM	19.20-1		
19.22CLASS 1E DC & UPS SYSTEM19.22-119.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.39-119.40PASSIVE CONTAINMENT COOLING19.39-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.21	AC PO	VER SYSTEM	19.21-1		
19.23NON-CLASS 1E DC & UPS SYSTEM19.23-119.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL REFLOODING19.30-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.22	CLASS	1E DC & UPS SYSTEM	19.22-1		
19.24CONTAINMENT ISOLATION19.24-119.25COMPRESSED AND INSTRUMENT AIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.34-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.35-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.39IN-VESSEL REFLOODING19.37-119.39IN-VESSEL REFLOODING19.38-119.40PASSIVE CONTAINMENT COOLING19.30-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.23	NON-C	LASS 1E DC & UPS SYSTEM			
19.25COMPRESSED AND INSTRUMENTAIR SYSTEM19.25-119.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.24	CONTA		19.24-1		
19.26PROTECTION AND SAFETY MONITORING SYSTEM19.26-119.27DIVERSE ACTUATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.25	COMP		19.25-1		
19.27DIVERSE ACTOATION SYSTEM19.27-119.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.26		CTION AND SAFETY MONITORING SYSTEM	19.26-1		
19.28PLANT CONTROL SYSTEM19.28-119.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.27			19.27-1		
19.29COMMON CAUSE ANALYSIS19.29-119.30HUMAN RELIABILITY ANALYSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.28			19.28-1		
19.30HUMAN RELIABILITY ANALTSIS19.30-119.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.29		UN CAUSE ANALYSIS	19.29-1		
19.31OTHER EVENT TREE NODE PROBABILITIES19.31-119.32DATA ANALYSIS AND MASTER DATA BANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.30			19.30-1		
19.32DATA ANALITSIS AND MASTER DATA DANK19.32-119.33FAULT TREE AND CORE DAMAGE QUANTIFICATION19.33-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.31		NALVENT TREE NODE PRODADILITIES	10 22 1		
19.3319.34SEVERE ACCIDENT PHENOMENA TREATMENT19.35-119.34SEVERE ACCIDENT PHENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.52			10 33 1		
19.34SEVERE ACCIDENT THENOMENA TREATMENT19.34-119.35CONTAINMENT EVENT TREE ANALYSIS19.35-119.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	10.34			10 3/ 1		
19.36REACTOR COOLANT SYSTEM DEPRESSURIZATION19.36-119.37CONTAINMENT ISOLATION19.37-119.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	10.34			10 35-1		
19.30REACTOR VESCEART OF OF LM DELIVEDUM DELIVEDUM 19.30119.37CONTAINMENT ISOLATION19.38REACTOR VESSEL REFLOODING19.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.40PASSIVE CONTAINMENT COOLING19.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.42CONDITIONAL CONTAINMENT FAILURE PROBABILITYDISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING	19.00	REACT	OR COOLANT SYSTEM DEPRESSURIZATION	19.35-1		
19.38REACTOR VESSEL REFLOODING19.38-119.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.37	CONTA	INMENT ISOLATION	19 37-1		
19.39IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS19.39-119.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.38	REACT	OR VESSEL REFLOODING	19.38-1		
19.40PASSIVE CONTAINMENT COOLING19.40-119.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.39	IN-VES	SEL RETENTION OF MOLTEN CORE DEBRIS	19 39-1		
19.41HYDROGEN MIXING AND COMBUSTION ANALYSIS19.41-119.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19 40	PASSI	E CONTAINMENT COOLING	19 40-1		
19.42CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.41	HYDRC	GEN MIXING AND COMBUSTION ANALYSIS			
DISTRIBUTION19.42-119.43RELEASE FREQUENCY QUANTIFICATION19.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1	19.42	CONDI	TIONAL CONTAINMENT FAILURE PROBABILITY			
19.43RELEASE FREQUENCY QUANTIFICATION19.43-119.44MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING19.44-1		DISTRI	BUTION	19.42-1		
19.44 MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING	19.43	RELEA	SE FREQUENCY QUANTIFICATION	19.43-1		
	19.44	MAAP4	.0 CODE DESCRIPTION AND AP1000 MODELING	19.44-1		

CHAPTER 19 TABLE OF CONTENTS (CONT.)

19.45	FISSION	PRODUCT SOURCE TERMS	19.45-1
19.46	NOT USE	D	19.46-1
19.47	NOT USE	D	19.47-1
19.48	NOT USE	D	19.48-1
19.49	OFFSITE	DOSE EVALUATION	19.49-1
19.50	IMPORTA	NCE AND SENSITIVITY ANALYSIS	19.50-1
19.51	UNCERT/	AINTY ANALYSIS	19.51-1
19.52	NOT USE	D	19.52-1
19.53	NOT USE	D	19.53-1
19.54	LOW POV	VER AND SHUTDOWN PRA ASSESSMENT	19.54-1
19.55	SEISMIC	MARGIN ANALYSIS	19.55-1
19.56	PRA INTE	RNAL FLOODING ANALYSIS	19.56-1
19.57	INTERNA	L FIRE ANALYSIS	19.57-1
19.58	WINDS, F	LOODS, AND OTHER EXTERNAL EVENTS	19.58-1
	19.58.2.1	Severe Winds and Tornadoes	19.58-1
19.	58.4 REFE	RENCES	19.58-5
19.59	PRA RES	ULTS AND INSIGHTS	19.59-1
	19.59.10.	5 Combined License Information	19.59-1
	19.59.10.6	6 PRA Configuration Controls	19.59-3
APPEN	NDIX 19A	THERMAL HYDRAULIC ANALYSIS TO SUPPORT	
		SUCCESS CRITERIA	19A-1
APPEN	NDIX 19B	EX-VESSEL SEVERE ACCIDENT PHENOMENA	19B-1
APPENDIX 19C		ADDITIONAL ASSESSMENT OF AP1000 DESIGN	
		FEATURES	19C-1
APPENDIX 19D		EQUIPMENT SURVIVABILITY ASSESSMENT	19D-1
APPENDIX 19E		SHUTDOWN EVALUATION	19E-1
APPENDIX 19F		MALEVOLENT AIRCRAFT IMPACT	19F-1

CHAPTER 19 LIST OF TABLES

Number	Title

19.58-201 High Winds and Tornadoes Results for Units 6 & 7

CHAPTER 19 PROBABILISTIC RISK ASSESSMENT

19.1 INTRODUCTION

19.2 INTERNAL INITIATING EVENTS

19.3 MODELING OF SPECIAL INITIATORS

19.4 EVENT TREE MODELS

19.5 SUPPORT SYSTEMS

19.6 SUCCESS CRITERIA ANALYSIS

19.7 FAULT TREE GUIDELINES

19.8 PASSIVE CORE COOLING SYSTEM — PASSIVE RESIDUAL HEAT REMOVAL

19.9 PASSIVE CORE COOLING SYSTEM — CORE MAKEUP TANKS

19.10 PASSIVE CORE COOLING SYSTEM — ACCUMULATOR

19.11 PASSIVE CORE COOLING SYSTEM — AUTOMATIC DEPRESSURIZATION SYSTEM

19.12 PASSIVE CORE COOLING SYSTEM — IN-CONTAINMENT REFUELING WATER STORAGE TANK

19.13 PASSIVE CONTAINMENT COOLING

19.14 MAIN AND STARTUP FEEDWATER SYSTEM

19.15 CHEMICAL AND VOLUME CONTROL SYSTEM

19.16 CONTAINMENT HYDROGEN CONTROL SYSTEM

19.17 NORMAL RESIDUAL HEAT REMOVAL SYSTEM

19.18 COMPONENT COOLING WATER SYSTEM

19.19 SERVICE WATER SYSTEM

19.20 CENTRAL CHILLED WATER SYSTEM

19.21 AC POWER SYSTEM

19.22 CLASS 1E DC & UPS SYSTEM

19.23 NON-CLASS 1E DC & UPS SYSTEM

19.24 CONTAINMENT ISOLATION

19.25 COMPRESSED AND INSTRUMENT AIR SYSTEM

19.26 PROTECTION AND SAFETY MONITORING SYSTEM

19.27 DIVERSE ACTUATION SYSTEM

19.28 PLANT CONTROL SYSTEM

19.29 COMMON CAUSE ANALYSIS

19.30 HUMAN RELIABILITY ANALYSIS

19.31 OTHER EVENT TREE NODE PROBABILITIES

19.32 DATA ANALYSIS AND MASTER DATA BANK

19.33 FAULT TREE AND CORE DAMAGE QUANTIFICATION
19.34 SEVERE ACCIDENT PHENOMENA TREATMENT

19.35 CONTAINMENT EVENT TREE ANALYSIS

19.36 REACTOR COOLANT SYSTEM DEPRESSURIZATION

19.37 CONTAINMENT ISOLATION

19.38 REACTOR VESSEL REFLOODING

19.39 IN-VESSEL RETENTION OF MOLTEN CORE DEBRIS

19.40 PASSIVE CONTAINMENT COOLING

19.41 HYDROGEN MIXING AND COMBUSTION ANALYSIS

19.42 CONDITIONAL CONTAINMENT FAILURE PROBABILITY DISTRIBUTION

19.43 RELEASE FREQUENCY QUANTIFICATION

19.44 MAAP4.0 CODE DESCRIPTION AND AP1000 MODELING

19.45 FISSION PRODUCT SOURCE TERMS

19.46 NOT USED

19.47 NOT USED

19.48 NOT USED

19.49 OFFSITE DOSE EVALUATION

19.50 IMPORTANCE AND SENSITIVITY ANALYSIS

19.51 UNCERTAINTY ANALYSIS

19.52 NOT USED

19.53 NOT USED

19.54 LOW POWER AND SHUTDOWN PRA ASSESSMENT

19.55 SEISMIC MARGIN ANALYSIS

19.56 PRA INTERNAL FLOODING ANALYSIS

19.57 INTERNAL FIRE ANALYSIS

19.58 WINDS, FLOODS, AND OTHER EXTERNAL EVENTS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

19.58.2.1 Severe Winds and Tornadoes

Replace the text of DCD Subsection 19.58.2.1 with the following:

PTN DEP 19.58-1 The overall methodology recommended by NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities" for analyzing plant risk due to high winds and tornadoes is a progressive screening approach. This approach is modified to consider hazards occurrence, likelihood and risk.

High winds (including tornadoes) can affect plant structures in at least two ways: (1) If wind forces exceed the load capacity of a building or other external facility, the walls or framing might collapse or the structure might overturn from the excessive loading; and (2) If the wind is strong enough, as in a tornado or hurricane, it may be capable of lifting materials and thrusting them as missiles against the plant structures that house safety related equipment. Critical components or other contents of plant structures not designed to resist missile penetration might be damaged and lose their ability to function.

NUREG-1407, Section 2.3, High Winds and Tornados, states that "For plants designed against NRC's current criteria, these events pose no significant threat of a severe accident because the current design criteria for wind are dominated by tornadoes having an annual frequency of exceedance of about 10⁻⁷." This is interpreted to mean that external events with an annual frequency less than about 1.0E–07 may be screened from further consideration and events with an annual frequency greater than 1.0E–07 may require further evaluation. However, the NUREG-1407 screening criterion was developed for current operating plants.

If the external event category cannot be screened out on the basis of its annual frequency, a second screening criterion based on the annual core damage frequency (CDF) associated with that external event category can be used. If the CDF can be demonstrated to not exceed 1.0E–08, the external event category can be screened out.

The AP1000 design basis wind speed is 300 mph, as described in DCD Chapter 2. This value is assumed to be the maximum wind speed that will not challenge the safety related structures. The AP1000 operating basis wind speed is 145 mph, also described in DCD Chapter 2. This value is assumed to be the maximum wind speed that will not challenge the non-safety related structures.

The structures protecting safety related features of the AP1000 are designed for extreme winds and missiles associated with these winds. As long as the external event wind speeds are less than the design basis value, the safety features of the AP1000 will be unaffected. If the winds exceed the design values, then the integrity of the safety related structures may be compromised.

The structures protecting non-safety related features of the AP1000 are designed according to the Uniform Building Code that provides some level of protection against seismic and high wind events. As long as the external event winds are less than the operating basis wind speed, the non-safety features of the AP1000 will be unaffected. If the winds exceed the operating basis values, then the integrity of the non-safety related structures may be compromised.

Per the Enhanced Fujita (EF) Scale for Tornadoes, no tornadoes are expected to have wind speeds that exceed 300 mph; however, EF3, EF4, and EF5 tornado wind speeds do exceed the operating basis wind speed. Per the Saffir-Simpson Scale for Hurricanes, no hurricanes are expected to reach 300 mph winds; however, Category 3, Category 4, and Category 5 hurricane winds may exceed the operating basis wind speed.

The evaluation of the high winds hazard uses the two screening criteria established from the previous description. The first criterion is that if the high wind event category annual frequency does not exceed 1.0E–07, the event category can be screened out from the requirement to perform further analysis. If the first criterion is not met, the second criterion is that if the annual CDF for the event category is assessed to not exceed 1.0E–08, the event category can be screened out. As can be seen from Table 19.58-201, the annual frequency of tornado and hurricane events exceeds 1.0E–07 per year. Therefore, the screening CDF is calculated for high winds to determine if detailed analysis is required.

Risk assessment studies for nuclear power plants typically assume that high wind events cause a Loss of Offsite Power (LOSP) because the site switchyard is not designed to withstand hurricane and tornado wind speeds. For wind speeds greater than the operating basis wind speed, additional structures, systems and components (SSC) may also be damaged. Two analyses were performed to

Revision 0

calculate the conditional core damage probability (CCDP) for two plant states resulting from high wind events and are presented in Reference 201. One analysis considered only a LOSP with all plant systems available and the other analysis considered a LOSP along with failure of all standby non-safety systems. These two plant states are defined by the maximum wind speed experienced during the event being either (1) less than or equal to the plant operating basis wind speed or (2) greater than the plant operating basis wind speed. The CCDP for the case of maximum wind speed less than or equal to the operating basis wind speed is 9.81E–09 and the CCDP for the case of maximum wind speed greater than the operating basis wind speed is 5.85E–08.

Risk (CDF) due to the event can then be estimated using the equation:

where IEF is the initiating event frequency. If this evaluation indicates an acceptably small contribution to risk (e.g., CDF not greater than about 1.0E–08 events/yr) then the progressive screening is complete and a detailed PRA is not required.

Three studies (Case 1, Case 2, and Case 3) are presented to evaluate CDF for the high wind events for Units 6 & 7. These studies utilize the process described in **Reference 201** along with event frequencies specifically for Units 6 & 7.

In the Case 1 study, plant response is a LOSP induced by high wind, with all plant equipment available. All tornados and hurricanes are considered in this Case 1 as they may challenge the switchyard. Extratropical cyclones are normal storms and thunderstorms that typically have wind speeds below the operating basis, but they can, however, regain winds of hurricane or tropical storm force and are also included in the Case 1 analysis, assuming that they cause a LOSP. In Case 1, the CCDP of 9.81E–09 is applied to all storms.

The Case 2 study was performed by modifying Case 1 to apply the CCDP of 5.85E–08 to events that could expose the plant to wind speed greater than the operating basis wind speed.

Category 2 and lower hurricanes and EF0, EF1, and EF2 tornadoes have a CCDP of 9.81E–09 applied.

The range of sustained wind speed for Category 3 hurricanes is 111 mph to 130 mph. Although this range of wind speed is less than the operating basis wind speed, Category 3 hurricanes can have wind gusts that do exceed the operating

Revision 0

basis wind speed. Hurricanes labeled as "Category 3" had a maximum wind speed that was within the Category 3 range but some storms were below the Category 3 level for some of the time. To more appropriately represent the effect of Category 3 hurricanes in this Case 2 study, the Category 3 hurricane data for Units 6 & 7 was subdivided on the basis of the fraction of time, while within the 100 nautical mile radius of the site, that the storms were at or below Category 3. If the storm intensity decayed below the Category 3 level, then even wind gusts from the storm would not generate wind speeds that exceed operating basis wind speed and for this fraction of the time that Category 3 hurricanes resided in the 100 nautical mile radius of interest, they would not pose a threat to AP1000 non-safety systems. For the 13 documented Category 3 hurricanes, there are a total of 42 data points reported. Of these 42 data points, 13 indicate that the storm was below Category 3 hurricane intensity. On this basis, 13/42, or 31 percent of the Category 3 event frequency will have a CCDP of 9.81E–09 applied and 69 percent of the Category 3 event frequency will have a CCDP of 5.85E–08 applied.

Category 4 and higher hurricanes and EF3, EF4, and EF5 tornados have a CCDP of 5.85E–08 applied.

Case 3 is a conservative study where all high wind events are evaluated as a LOSP with failure of all non-safety systems. The CCDP of 5.85E–08 was applied to all events. This case was created to represent the risk to the plant if the non-safety structures were not designed to any code. This is a very conservative sensitivity study because all of the structures are designed to the Uniform Building Code.

Results of the calculation of CDF, using the appropriate value of CCDP and the tornado and hurricane occurrence frequencies for Units 6 & 7, are shown in Table 19.58-201. As can be seen from Table 19.58-201, both Cases 1 and 2 have CDF not greater than 1.0E–08 per year. Case 3 has a CDF slightly higher than 1.0E–08 per year.

Case 2 is the "base case" and is considered to be the representative conservative model for high winds, with Case 1 and Case 3 being treated as sensitivity studies. Case 3 is very conservative in that it assumes total failure of the standby non-safety systems (CVS, RNS, SFW, automatic DAS, and Diesel Generators) for all high wind events. Non-safety structures are designed to the Uniform Building Code that offers a degree of robustness such that the above failures are considered extreme and conservative. Therefore, while the total Case 3 CDF does fall slightly above the 1.0E–08 per year CDF screening criterion, the results are considered very conservative for the above reasons. The CDF for Case 2 is

Revision 0

1.0E–08 and, consequently, further detailed PRA is not necessary for the Units 6 & 7 High Winds and Tornados analysis.

19.58.4 REFERENCES

201. APP-GW-GLR-101, "AP1000 Probabilistic Risk Assessment Site-Specific Considerations," Revision 1, Section 3.0, High Winds Evaluation.

			CDF (events/yr)		
Category	Event	Limiting Initiating Event Freq. (events/yr)	LOSP (Case 1) (events/yr)	LOSP with Non-Safety Systems Unavailable for Select Events (Case 2) (events/yr)	LOSP with Non-Safety Systems Unavailable for All Events (Case 3) (events/yr)
High Winds	EF0 Tornado	2.56E-06	2.51E-14	2.51E-14	1.50E–13
	EF1 Tornado	4.56E-06	4.47E-14	4.47E-14	2.67E-13
	EF2 Tornado	1.41E–05	1.38E-13	1.38E-13	8.25E-13
	EF3 Tornado	5.37E–06	5.27E–14	3.14E–13	3.14E–13
	EF4 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EF5 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
		•	·	·	•
	Cat. 1 Hurricane	1.01E–01	9.91E–10	9.91E–10	5.91E-09
	Cat. 2 Hurricane	5.10E-02	5.00E-10	5.00E-10	2.98E-09
	Cat. 3A Hurricane	2.50E-02	2.45E-10	2.45E-10	1.46E-09
	Cat. 3B Hurricane	5.70E-02	5.59E-10	3.33E-09	3.33E-09
	Cat. 4 Hurricane	7.00E-02	6.87E–10	4.10E–09	4.10E-09
	Cat. 5 Hurricane	1.30E-02	1.28E-10	7.61E–10	7.61E–10
	Extratropical Cyclones	1.90E-02	1.86E-10	1.86E–10	1.11E-09
Totals			3.3E-09	1.0E-08	2.0E-08

Table 19.58-201High Winds and Tornadoes Results for Units 6 & 7

DEP 19.58-1

19.59 PRA RESULTS AND INSIGHTS

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

19.59.10.5 Combined License Information

STD COL 19.59.10-1 A review of the differences between the as-built plant and the design used as the basis for the AP1000 seismic margins analysis will be completed prior to fuel load. A verification walkdown will be performed with the purpose of identifying differences between the as-built plant and the design. Any differences will be evaluated to determine if there is a significant adverse effect on the seismic margins analysis results. A comparison of the as-built SSC high confidence, low probability of failures (HCLPFs) to those assumed in the AP1000 seismic margin evaluation will be performed prior to fuel load. Deviations from the HCLPF values or assumptions in the seismic margin evaluation due to the as-built configuration and final analysis will be evaluated to determine if vulnerabilities have been introduced.

The requirements to which the equipment is to be purchased are included in the equipment specifications. Specifically, the equipment specifications include:

- 1. Specific minimum seismic requirements consistent with those used to define the Table 19.55-1 HCLPF values. This includes the known frequency range used to define the HCLPF by comparing the required response spectrum (RRS) and test response spectrum (TRS). The range of frequency response that is required for the equipment with its structural support is defined.
- 2. Hardware enhancements that were determined in previous test programs and/or analysis programs will be implemented.
- STD COL 19.59.10-2 A review of the differences between the as-built plant and the design used as the basis for the AP1000 PRA and DCD Table 19.59-18 will be completed prior to fuel load. The plant specific PRA-based insight differences will be evaluated and the plant specific PRA model modified as necessary to account for plant-specific design and any design changes or departures from the design certification PRA.

It has been confirmed that the Winds, Floods, and Other External Events analysis documented in DCD Section 19.58 is applicable to the site. The site-specific design has been evaluated and is consistent with the AP1000 PRA assumptions. Therefore, Chapter 19 of the AP1000 DCD is applicable to this design.

STD COL 19.59.10-3 A review of the differences between the as-built plant and the design used as the basis for the AP1000 internal fire and internal flood analysis will be completed prior to fuel load. Differences will be evaluated to determine if there is significant adverse effect on the internal fire and internal flood analysis results.

STD COL 19.59.10-4 The AP1000 Severe Accident Management Guidance (SAMG) from APP-GW-GLR-070, Reference 1 of DCD Section 19.59, is implemented on a sitespecific basis. Key elements of the implementation include:

- SAMG based on APP-GW-GLR-070 is provided to Emergency Response Organization (ERO) personnel in assessing plant damage, planning and prioritizing response actions and implementing strategies that delineate actions inside and outside the control room.
- Severe accident management strategies and guidance are interfaced with the Emergency Operating Procedures (EOP's) and Emergency Plan.
- Responsibilities for authorizing and implementing accident management strategies are delineated as part of the Emergency Plan.
- SAMG training is provided for ERO personnel commensurate with their responsibilities defined in the Emergency Plan.
- STD COL 19.59.10-5 A thermal lag assessment of the as-built equipment required to mitigate severe accidents (hydrogen igniters and containment penetrations) will be performed to provide additional assurance that this equipment can perform its severe accident functions during environmental conditions resulting from hydrogen burns associated with severe accidents. This assessment will be performed prior to fuel load and is required only for equipment used for severe accident mitigation that has not been tested at severe accident conditions. The ability of the as-built equipment to perform during severe accident hydrogen burns will be assessed using the Environment Enveloping method or the Test Based Thermal Analysis method discussed in EPRI NP-4354 (DCD Section 19.59 Reference 3).

Add the following new information after DCD Subsection 19.59.10.5:

STD SUP 19.59-1 19.59.10.6 PRA Configuration Controls

PRA configuration controls contain the following key elements:

- A process for monitoring PRA inputs and collecting new information.
- A process that maintains and updates the PRA to be reasonably consistent with the as-built, as operated plant.
- A process that considers the cumulative impact of pending changes when applying the PRA.
- A process that evaluates the impact of changes on currently implemented riskinformed decisions that have used the PRA.
- A process that maintains configuration control of computer codes used to support PRA quantification.
- A process for upgrading the PRA to meet PRA standards that the NRC has endorsed.
- Documentation of the PRA.

PRA configuration controls are consistent with the regulatory positions on maintenance and upgrades in Regulatory Guide 1.200.

Schedule for Maintenance and Upgrades of the PRA

The PRA update process is a means to reasonably reflect the as designed and as operated plant configurations in the PRA models. The PRA upgrade process includes an update of the PRA plus a general review of the entire PRA model, and as applicable the application of new software that implements a different methodology, implementation of new modeling techniques, as well as a comprehensive documentation effort.

 During construction, the PRA is upgraded prior to fuel load to cover those initiating events and modes of operation contained in NRC-endorsed consensus standards on PRA in effect one year prior to the scheduled date of the initial fuel load for a Level 1 and Level 2 PRA.

- Prior to license renewal the PRA is upgraded to include all modes of operation.
- During operation, PRA updates are completed as part of the upgrade process at least once every four years.
- A screening process is used to determine whether a PRA update should be performed more frequently based upon the nature of the changes in design or procedures. The screening process considers whether the changes affect the PRA insights. Changes that do not meet the threshold for immediate update are tracked for the next regulatory scheduled update. If the screening process determines that the changes do warrant a PRA update, the update is made as soon as practicable consistent with the required change importance and the applications being used.

PRA upgrades are performed in accordance with 10 CFR 50.71(h).

Process for Maintenance and Upgrades of the PRA

Various information sources are monitored to determine changes or new information that affects the model assumptions or quantification. Plant specific design, procedure, and operational changes are reviewed for risk impact. Information sources include applicable operating experience, plant modifications, engineering calculation revisions, procedure changes, industry studies, and NRC information.

The PRA upgrade includes initiating events and modes of operation contained in NRC-endorsed consensus standards on PRA in effect one year prior to each required upgrade.

This PRA maintenance and update incorporates the appropriate new information including significant modeling errors discovered during routine use of the PRA.

Once the PRA model elements requiring change are identified, the PRA computer models are modified and appropriate documents revised. Documentation of modifications to the PRA model include the changes as well as the upgraded portions clearly indicating what has been changed. The impact on the risk insights is clearly indicated.

PRA Quality Assurance

Maintenance and upgrades of the PRA are subject to the following quality assurance provisions:

Procedures identify the qualifications of personnel who perform the maintenance and upgrade of the PRA.

Procedures provide for the control of PRA documentation, including revisions.

For updates of the PRA, procedures provide for independent review, or checking of the calculations and information.

Procedures provide for an independent review of the model after an upgrade is completed. Additionally, after the PRA is upgraded, the PRA is reviewed by outside PRA experts such as industry peer review teams and the comments incorporated to maintain the PRA current with industry practices. Peer review findings are entered into a tracking system. PRA upgrades receive a peer review for those aspects of the PRA that are upgraded.

PRA models and applications are documented in a manner that facilitates peer review as well as future updates and applications of the PRA by describing the processes that were used, and provide details of the assumptions made and their bases. PRA documentation is developed such that traceability and reproducibility is maintained. PRA documentation is maintained in accordance with Regulatory Position 1.3 of Regulatory Guide 1.200.

Procedures provide for appropriate attention or corrective actions if assumptions, analyses, or information used previously are changed or determined to be in error. Potential impacts to the PRA model (i.e., design change notices, calculations, and procedure changes) are tracked. Errors found in the PRA model between periodic updates are tracked using the site tracking system.

PRA-Related Input to Other Programs and Processes

The PRA provides input to various programs and processes, such as the Maintenance Rule implementation, reactor oversight process, the RAP, and the RTNSS program. The use of the PRA in these programs is discussed below, or cross-references to the appropriate FSAR sections are provided.

PRA Input to Design Programs and Processes

The PRA insights identified during the design development are discussed in DCD Subsection 19.59.10.4 and summarized in DCD Table 19.59-18. DCD Section 14.3 summarizes the design material contained in AP1000 that has been incorporated into the Tier 1 information from the PRA. A discussion of the plant features important to reducing risk is provided in DCD Subsection 19.59.9.

PRA Input to the Maintenance Rule Implementation

The PRA is used as an input in determining the safety significance classification and bases of in-scope SSCs. SSCs identified as risk-significant via the Reliability Assurance Program for the design phase (DRAP, Section 17.4) are included within the initial Maintenance Rule scope as high safety significance SSCs.

For risk-significant SSCs identified via DRAP, performance criteria are established, by the Maintenance Rule expert panel using input from the reliability and availability assumptions used in the PRA, to monitor the effectiveness of the maintenance performed on the SSCs.

The Maintenance Rule implementation is discussed in Section 17.6.

PRA Input to the Reactor Oversight Process

The mitigating systems performance indicators (MSPI) are evaluated based on the indicators and methodologies defined in NEI 99-02.

The Significance Determination Process (SDP) uses risk insights, where appropriate, to determine the safety significance of inspection findings.

PRA Input to the Reliability Assurance Program

The PRA input to the Reliability Assurance Program is discussed in DCD Subsection 19.59.10.1.

PRA Input to the Regulatory Treatment of Nonsafety-Related Systems Programs

The importance of nonsafety-related SSCs in the AP1000 has been evaluated using PRA insights to identify SSCs that are important in protecting the utility's investment and for preventing and mitigating severe accidents. These investment protection systems, structures and components are included in the D-RAP/MR Program (refer to Subsection 17.4), which provides confidence that availability and reliability are designed into the plant and that availability and reliability are
maintained throughout plant life through the maintenance rule. Technical Specifications are not required for these SSCs because they do not meet the selection criteria applied to the AP1000 (refer to Subsection 16.1.1).

MOV Program

The MOV Program includes provisions to accommodate the use of risk-informed inservice testing of MOVs (Subsection 3.9.6).

APPENDIX 19A THERMAL HYDRAULIC ANALYSIS TO SUPPORT SUCCESS CRITERIA

APPENDIX 19B EX-VESSEL SEVERE ACCIDENT PHENOMENA

APPENDIX 19C ADDITIONAL ASSESSMENT OF AP1000 DESIGN FEATURES

APPENDIX 19D EQUIPMENT SURVIVABILITY ASSESSMENT

APPENDIX 19E SHUTDOWN EVALUATION

APPENDIX 19F MALEVOLENT AIRCRAFT IMPACT