

CHAPTER 19—PRA AND SEVERE ACCIDENT TABLE OF CONTENTS

19.0	PROBABILISTIC RISK ASSESSMENT AND SEVERE ACCIDENT EVALUATION	19.0-1
19.0.1	NRC Regulatory Requirements and Related Policies	19.0-1
19.0.2	Uses of PRA and Severe Accident Evaluations	19.0-2
19.0.3	Structure of Chapter 19	19.0-3
19.0.4	References	19.0-4
19.1	Probabilistic Risk Assessment	19.1-1
19.1.1	Uses and Applications of the PRA.....	19.1-1
19.1.1.1	Design Phase	19.1-1
19.1.1.2	Combined License Application Phase.....	19.1-2
19.1.1.3	Construction Phase	19.1-2
19.1.1.4	Operational Phase.....	19.1-2
19.1.2	Quality of PRA	19.1-2
19.1.2.1	PRA Scope.....	19.1-3
19.1.2.2	PRA Level of Detail	19.1-4
19.1.2.3	PRA Technical Adequacy.....	19.1-5
19.1.2.4	PRA Maintenance and Upgrade.....	19.1-7
19.1.3	Special Design/Operational Features.....	19.1-10
19.1.3.1	Design/Operational Features for Preventing Core Damage	19.1-10
19.1.3.2	Design/Operational Features for Mitigating the Consequences of Core Damage and Preventing Releases from Containment.....	19.1-12
19.1.3.3	Design/Operational Features for Mitigating the Consequences of Releases from Containment.....	19.1-13
19.1.3.4	Uses of the PRA in the Design Process.....	19.1-14
19.1.4	Safety Insights from the Internal Events PRA for Operations at Power	19.1-15
19.1.4.1	Level 1 Internal Events PRA for Operations at Power	19.1-15

19.1.4.2	Level 2 Internal Events PRA for Operations at Power	19.1-65
19.1.5	Safety Insights from the External Events PRA for Operations at Power	19.1-115
19.1.5.1	Seismic Risk Evaluation	19.1-115
19.1.5.2	Internal Flooding Risk Evaluation	19.1-139
19.1.5.3	Internal Fires Risk Evaluation	19.1-157
19.1.5.4	Other Externals Risk Evaluation	19.1-178
19.1.6	Safety Insights from the PRA for Other Modes of Operation	19.1-181
19.1.6.1	Description of the Low-Power and Shutdown Operations PRA	19.1-181
19.1.6.2	Results from the Low-Power and Shutdown Operations PRA.	19.1-191
19.1.6.3	Description of Level 2 PRA for Low-Power and Shutdown Operations	19.1-198
19.1.6.4	Results of the Low Power and Shutdown Level 2 Evaluation	19.1-210
19.1.7	PRA-Related Input to Other Programs and Processes	19.1-217
19.1.7.1	PRA Input to Design Programs and Processes	19.1-217
19.1.7.2	PRA Input to the Maintenance Rule Implementation	19.1-218
19.1.7.3	PRA Input to the Reactor Oversight Process	19.1-218
19.1.7.4	PRA Input to the Reliability Assurance Program	19.1-218
19.1.7.5	PRA Input to the Regulatory Treatment of Non-Safety-Related Systems Program	19.1-218
19.1.8	Conclusions and Findings	19.1-219
19.1.8.1	Risk Metrics:	19.1-219
19.1.8.2	Risk Distribution:	19.1-220
19.1.8.3	Importance Ranking:	19.1-220
19.1.8.4	Sensitivity and Uncertainty:	19.1-221
19.1.9	References	19.1-222
19.2	Severe Accident Evaluations	19.2-1
19.2.1	Introduction	19.2-1

19.2.2	Severe Accident Prevention	19.2-1
19.2.2.1	Anticipated Transient Without Scram	19.2-1
19.2.2.2	Mid-Loop Operations	19.2-2
19.2.2.3	Station Blackout	19.2-2
19.2.2.4	Fire Protection	19.2-3
19.2.2.5	Intersystem Loss of Coolant Accident	19.2-4
19.2.2.6	Other Severe Accident Preventative Features	19.2-5
19.2.3	Severe Accident Mitigation	19.2-5
19.2.3.1	Overview of Containment Design	19.2-5
19.2.3.2	Severe Accident Progression	19.2-6
19.2.3.3	Severe Accident Mitigation Features	19.2-9
19.2.4	Containment Performance Capability	19.2-25
19.2.4.1	Introduction	19.2-25
19.2.4.2	Analytical Methodology	19.2-25
19.2.4.3	Assumptions	19.2-30
19.2.4.4	Severe Accident Evaluations	19.2-30
19.2.4.5	Conditional Containment Failure Probability	19.2-57
19.2.4.6	Summary	19.2-57
19.2.5	Accident Management	19.2-57
19.2.5.1	Accident Management through Design	19.2-59
19.2.5.2	OSSA Directed Actions	19.2-59
19.2.5.3	Interface with Emergency Procedures	19.2-59
19.2.5.4	Measurable Safety Objectives	19.2-60
19.2.5.5	RPV Integrity Management	19.2-60
19.2.5.6	Post-RPV Failure - Short-Term Response	19.2-61
19.2.5.7	Post RPV Failure - Long-Term Response	19.2-61
19.2.6	Consideration of Potential Design Improvements under 10 CFR 50.34(f)	19.2-61
19.2.6.1	Introduction	19.2-61
19.2.6.2	Estimate of Risk for Design	19.2-62
19.2.6.3	Identification of Potential Design Improvements ...	19.2-62
19.2.6.4	Risk Reduction Potential of Design Improvements	19.2-64

19.2.6.5	Cost Impacts of Candidate Design Improvements.....	19.2-65
19.2.6.6	Cost-Benefit Comparison	19.2-65
19.2.6.7	Conclusions.....	19.2-65
19.2.7	Beyond Design Basis Large Commercial Aircraft Impact Assessment	19.2-65
19.2.7.1	Introduction.....	19.2-65
19.2.7.2	Assessment Scope.....	19.2-65
19.2.7.3	Methodology.....	19.2-66
19.2.7.4	Design Features Credited for Conformance with 10 CFR 50.150.....	19.2-66
19.2.7.5	Evaluation of U.S. EPR Performance.....	19.2-70
19.2.7.6	Conclusions.....	19.2-72
19.2.8	Beyond Design Basis Extended Loss of AC Power Assessment.....	19.2-73
19.2.9	References	19.2-73
19.3	Open, Confirmatory, and COL Action Items Identified as Unresolved	19.3-1
19.3.1	Resolution of Open Items	19.3-1
19.3.2	Resolution of Confirmatory Items	19.3-1
19.3.3	Resolution of COL Action Items	19.3-1
19A	Event Trees for Core Damage Sequences Initiated During Power Operation.....	19A-1
19B	Event Trees for Core Damage Sequences Initiated During Low Power Operation	19B-1
19C	Containment Event Trees (CET) for Containment Performance Sequences Initiated During Power Operation	19C-1