

Bell Bend Nuclear Power Plant

Combined License Application

Part 2: Final Safety Analysis Report

Revision 0
October 2008

COPYRIGHT © 2008

©UniStar Nuclear Services, LLC in and to the Reference COLA, namely all text not in brackets.

All rights reserved.
COPYRIGHT PROTECTED

This document has been prepared by, or on behalf of UniStar Nuclear Services, LLC, in connection with the Bell Bend Nuclear Power Plant Combined License (COL) Application. No use of, or right to copy, any of this information, other than by the U.S. Nuclear Regulatory Commission (NRC) and its contractors in support of the COL application review, is authorized.

For additional Copyright information contact:

Mr. Greg Gibson
Vice President, UniStar Licensing
UniStar Nuclear Services, LLC
750 E. Pratt Street
Baltimore, Maryland 21202

Table of Contents

1.0	Introduction And General Description of the Plant	1-1
1.1	Introduction	1-1
1.1.1	Plant Location	1-2
1.1.2	Containment Type	1-3
1.1.3	Reactor Type	1-4
1.1.4	Power Output	1-4
1.1.5	Schedule	1-4
1.1.6	Format and Content	1-5
1.1.7	References	1-6
1.2	General Plant Description	1-17
1.2.1	Principal Design Criteria, Operating Characteristics, and Safety Considerations	1-17
1.2.2	Site Description	1-17
1.2.3	Plant Description	1-18
1.3	Comparisons with Similar Facility Designs	1-22
1.4	Identification of Agents and Contractors	1-23
1.4.1	Applicant – Program Manager	1-23
1.4.2	Other Contractors and Participants	1-24
1.5	Requirements for Further Technical Information	1-26
1.6	Material Referenced	1-26
1.7	Drawings and Other Detailed Information	1-27
1.7.1	Electrical and Instrumentation and Control Drawings	1-27
1.7.2	Piping and Instrumentation Diagrams	1-27
1.8	Interfaces with Standard Designs and Early Site Permits	1-29
1.8.1	COL Information Items	1-29
1.8.2	Departures	1-29
1.9	Conformance with Regulatory Criteria	1-50
1.9.1	Conformance with Regulatory Guides	1-50
1.9.2	Conformance with the Standard Review Plan	1-51
1.9.3	Generic Issues	1-51
1.9.4	Operational Experience (Generic Communications)	1-51
1.9.5	Advanced and Evolutionary Light-Water Reactor Design Issues	1-51
1.9.6	References	1-52
2.0	Site Characteristics	2-1
2.1	Geography and Demography	2-9
2.1.1	Site Location and Description	2-9
2.1.2	Exclusion Area Authority and Control	2-11
2.1.3	Population Distribution	2-12
2.1.4	References	2-18
2.2	Nearby Industrial, Transportation And Military Facilities	2-55
2.2.1	Location and Routes	2-55
2.2.2	Descriptions	2-57
2.2.3	Evaluation of Potential Accidents	2-64
2.2.4	References	2-79

2.3	Meteorology	2-101
2.3.1	Regional Climatology	2-101
2.3.2	Local Meteorology	2-113
2.3.3	Onsite Meteorological Measurement Program	2-122
2.3.4	Short Term Atmospheric Dispersion Estimates for Accident Releases	2-128
2.3.5	Long-term Atmospheric Dispersion Estimates for Routine Releases	2-132
2.3.6	References	2-135
2.4	Hydrologic Engineering	2-1079
2.4.1	Hydrologic Description	2-1079
2.4.2	Floods	2-1091
2.4.3	Probable Maximum Flood (PMF) on Streams and Rivers	2-1097
2.4.4	Potential Dam Failures, Seismically Induced	2-1103
2.4.5	Probable Maximum Surge and Seiche Flooding	2-1107
2.4.6	Probable Maximum Tsunami Flooding	2-1110
2.4.7	Ice Effects	2-1111
2.4.8	Cooling Water Canals and Reservoirs	2-1117
2.4.9	Channel Diversions	2-1123
2.4.10	Flooding Protection Requirements	2-1129
2.4.11	Low Water Considerations	2-1131
2.4.12	Ground Water	2-1137
2.4.13	Pathways of Liquid Effluents in Ground and Surface Waters	2-1164
2.4.14	Technical Specification and Emergency Operation Requirements	2-1177
2.5	Geology, Seismology, and Geotechnical Engineering	2-1415
2.5.1	Basic Geologic and Seismic Information	2-1416
2.5.2	Vibratory Ground Motion	2-1483
2.5.3	Surface Faulting	2-1530
2.5.4	Stability of Subsurface Materials and Foundations	2-1541
2.5.5	Stability of Slopes	2-1595
2.5.6	References	2-1601
3.0	Design Of Structures, Components, Equipment and Systems	3-1
3.1	Compliance with Nuclear Regulatory Commission General Design Criteria	3-1
3.1.1	Overall Requirements	3-1
3.1.2	Protection by Multiple Fission Product Barriers	3-2
3.1.3	Protection and Reactivity Control Systems	3-2
3.1.4	Fluid Systems	3-2
3.1.5	Reactor Containment	3-2
3.1.6	Fuel and Reactivity Control	3-2
3.1.7	References	3-2
3.2	Classification of Structures, Systems, and Components	3-3
3.2.1	Seismic Classification	3-3
3.2.2	System Quality Group Classification	3-4
3.2.3	References	3-4
3.3	Wind and Tornado Loadings	3-14
3.3.1	Wind Loadings	3-14
3.3.2	Tornado Loadings	3-15
3.3.3	References	3-16

3.4	Water Level (Flood) Design	3-17
3.4.1	Internal Flood Protection	3-17
3.4.2	External Flood Protection	3-17
3.4.3	Analysis of Flooding Events	3-17
3.4.4	Analysis Procedures	3-19
3.4.5	References	3-19
3.5	Missile Protection	3-20
3.5.1	Missile Selection and Description	3-20
3.5.2	Structures, Systems, and Components to be Protected from Externally Generated Missiles	3-26
3.5.3	Barrier Design Procedures	3-26
3.5.4	References	3-26
3.6	Protection Against Dynamic Effects Associated with Postulated Rupture of Piping . . .	3-28
3.6.1	Plant Design for Protection Against Postulated Piping Failures In Fluid Systems Outside Of Containment	3-28
3.6.2	Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping	3-28
3.6.3	Leak-Before-Break Evaluation Procedures	3-29
3.7	Seismic Design	3-30
3.7.1	Seismic Design Parameters	3-30
3.7.2	Seismic System Analysis	3-39
3.7.3	Seismic Subsystem Analysis	3-49
3.7.4	Seismic Instrumentation	3-52
3.8	Design of Category I Structures	3-175
3.8.1	Concrete Containment	3-175
3.8.2	Steel Containment	3-176
3.8.3	Concrete and Steel Internal Structures of Concrete Containment	3-176
3.8.4	Other Seismic Category I Structures	3-177
3.8.5	Foundations	3-187
3.8.6	References	3-193
3.9	Mechanical Systems and Components	3-201
3.9.1	Special Topics for Mechanical Components	3-201
3.9.2	Dynamic Testing and Analysis of Systems, Components, and Equipment . .	3-201
3.9.3	ASME Code Class 1, 2, And 3 Components, Component Supports, and Core Support Structures	3-203
3.9.4	Control Rod Drive System	3-206
3.9.5	Reactor Pressure Vessel Internals	3-206
3.9.6	Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints	3-206
3.10	Seismic and Dynamic Qualification of Mechanical and Electrical Equipment	3-213
3.10.1	Seismic Qualification Criteria	3-214
3.10.2	Methods and Procedures for Qualifying Mechanical, Electrical and I&C Equipment 3-215	
3.10.3	Methods and Procedures for Qualifying Supports of Mechanical and Electrical Equipment and Instrumentation	3-216
3.10.4	Test and Analysis Results and Experience Database	3-216
3.10.5	References	3-216

3.11 Environmental Qualification of Mechanical and Electrical Equipment	3-229
3.11.1 Equipment Identification and Environmental Conditions	3-229
3.11.2 Qualification Tests and Analysis	3-230
3.11.3 Qualification Test Results	3-230
3.11.4 Loss of Ventilation	3-230
3.11.5 Estimated Chemical and Radiation Environment	3-230
3.11.6 Qualification of Mechanical Equipment	3-231
3.11.7 References	3-231
3.12 Asme Code Class 1, 2, and 3 Piping Systems, Piping Components, and their Associated Supports	3-239
3.12.1 Introduction	3-239
3.12.2 Codes and Standards	3-239
3.12.3 Piping Analysis Methods	3-239
3.12.4 Piping Modeling Techniques	3-239
3.12.5 Piping Stress Analysis Criteria	3-240
3.12.6 Piping Support Design Criteria	3-241
3.12.7 References	3-241
3.13 Threaded Fasteners (ASME Code Class 1, 2, and 3)	3-242
3.13.1 Design Considerations	3-242
3.13.2 Inservice Inspection Requirements	3-242
3E.0 Critical Sections for Safety-Related Category I Structures	3-1
3E.1 Nuclear Island Structures	3-1
3E.2 Emergency Power Generating Buildings	3-1
3E.3 Essential Service Water Buildings	3-1
3E.4 {ESWEMS Pumphouse and ESWEMS Retention Pond	3-2
3E.4.1 References	3-6
4.0 Reactor	4-1
4.1 Summary Description	4-1
4.2 Fuel System Design	4-1
4.3 Nuclear Design	4-1
4.4 Thermal-hydraulic Design	4-1
4.5 Reactor Materials	4-1
4.6 Functional Design of Reactivity Control Systems	4-1
5.0 Reactor Coolant System and Connected Systems	5-1
5.1 Summary Description	5-1
5.2 Integrity of the Reactor Coolant Pressure Boundary	5-2
5.2.1 Compliance with Codes and Code Cases	5-2
5.2.2 Overpressure Protection	5-2
5.2.3 Reactor Coolant Pressure Boundary Materials	5-2
5.2.4 Inservice Inspection and Testing of the RCPB	5-3
5.2.5 RCPB Leakage Detection	5-4
5.2.6 References	5-4

5.3	Reactor Vessel	5-5
5.3.1	Reactor Vessel Materials	5-5
5.3.2	Pressure-Temperature Limits, Pressurized Thermal Shock, and Charpy Upper-Shelf Energy Data and Analyses	5-5
5.3.3	Reactor Vessel Integrity	5-6
5.3.4	References	5-6
5.4	Component and Subsystem Design	5-7
5.4.1	Reactor Coolant Pumps	5-7
5.4.2	Steam Generators (PWR)	5-7
5.4.3	Reactor Coolant Piping	5-9
5.4.4	Not Used in U.S. EPR Design	5-9
5.4.5	Not Used in U.S. EPR Design	5-9
5.4.6	Not Used in U.S. EPR Design	5-9
5.4.7	Residual Heat Removal System	5-9
5.4.8	Not Used in U.S. EPR Design	5-9
5.4.9	Not Used in U.S. EPR Design	5-9
5.4.10	Pressurizer	5-9
5.4.11	Pressurizer Relief Tank	5-9
5.4.12	Reactor Coolant System High Point Vents	5-9
5.4.13	Safety and Relief Valves	5-9
5.4.14	Component Supports	5-9
5.4.15	References	5-9
6.0	Engineered Safety Features	6-1
6.1	Engineered Safety Features Materials	6-1
6.1.1	Metallic Materials	6-1
6.1.2	Organic Materials	6-1
6.1.3	References	6-2
6.2	Containment Systems	6-4
6.2.1	Containment Functional Design	6-4
6.2.2	Containment Heat Removal Systems	6-4
6.2.3	Secondary Containment Functional Design	6-4
6.2.4	Containment Isolation System	6-4
6.2.5	Combustible Gas Control in Containment	6-4
6.2.6	Containment Leakage Testing	6-4
6.2.7	Fracture Prevention of Containment Pressure Vessel	6-4
6.2.8	References	6-4
6.3	Emergency Core Cooling System	6-5
6.3.1	Design Bases	6-5
6.3.2	System Design	6-5
6.3.3	Performance Evaluation	6-6
6.3.4	Tests and Inspections	6-6
6.3.5	Instrumentation Requirements	6-6
6.3.6	References	6-7
6.4	Habitability Systems	6-8
6.4.1	Design Basis	6-8
6.4.2	System Design	6-8
6.4.3	System Operational Procedures	6-10

6.4.4	Design Evaluations	6-10
6.4.5	Testing and Inspection	6-11
6.4.6	Instrumentation Requirements	6-11
6.4.7	References	6-11
6.5	Fission Product Removal and Control Systems	6-12
6.6	Inservice Inspection of Class 2 and 3 Components.	6-13
6.6.1	Components Subject to Examination	6-13
6.6.2	Accessibility	6-13
6.6.3	Examination Techniques and Procedures	6-13
6.6.4	Inspection Intervals.	6-14
6.6.5	Examination Categories and Requirements	6-14
6.6.6	Evaluation of Examination Results	6-14
6.6.7	System Pressure Tests.	6-14
6.6.8	Augmented ISI to Protect Against Postulated Piping Failures	6-14
6.6.9	References	6-14
6.7	Main Steamline Isolation Valve Leakage Control System (BWRS).	6-16
6.8	Extra Borating System.	6-16
7.0	Instrumentation and Controls	7-1
7.1	Introduction	7-1
7.2	Reactor Trip System	7-1
7.3	Engineered Safety Features Systems	7-1
7.4	Systems Required for Safe Shutdown.	7-1
7.5	Information Systems Important to Safety	7-1
7.6	Interlock Systems Important to Safety.	7-1
7.7	Control Systems Not Required for Safety	7-1
7.8	Diverse I&C Systems.	7-1
7.9	Data Communication Systems	7-1
8.0	Electric Power	8-1
8.1	Introduction	8-1
8.1.1	Offsite Power Description	8-1
8.1.2	Onsite Power System Description	8-1
8.1.3	Safety-Related Loads	8-1
8.1.4	Design Bases	8-2
8.1.5	References	8-2
8.2	Offsite Power System	8-6
8.2.1	Description	8-6
8.2.2	Analysis	8-11
8.2.3	References	8-20
8.3	Onsite Power Systems	8-25
8.3.1	Alternating Current Power Systems	8-25
8.3.2	DC Power Systems.	8-28
8.3.3	References	8-28

8.4	Station Blackout	8-37
8.4.1	Description	8-37
8.4.2	Analysis	8-37
8.4.3	References	8-39
9.0	Auxiliary Systems	9-1
9.1	Fuel Storage and Handling	9-2
9.1.1	Criticality Safety of New and Spent Fuel Storage and Handling	9-2
9.1.2	New and Spent Fuel Storage	9-2
9.1.3	Spent Fuel Pool Cooling and Purification System	9-3
9.1.4	Fuel Handling System	9-3
9.1.5	Overhead Heavy Load Handling System	9-3
9.2	Water Systems	9-7
9.2.1	Essential Service Water System	9-7
9.2.2	Component Cooling Water System	9-8
9.2.3	Demineralized Water Distribution System	9-8
9.2.4	Potable and Sanitary Water Systems (PSWS)	9-8
9.2.5	Ultimate Heat Sink	9-12
9.2.6	Condensate Storage Facilities	9-20
9.2.7	Seal Water Supply System	9-21
9.2.8	Safety Chilled Water System	9-21
9.2.9	Raw Water Supply System	9-21
9.3	Process Auxiliaries	9-36
9.4	Air Conditioning, Heating, Cooling and Ventilation Systems	9-36
9.4.1	Main Control Room Air Conditioning System	9-36
9.4.2	Fuel Building Ventilation System	9-38
9.4.3	Nuclear Auxiliary Building Ventilation System	9-38
9.4.4	Turbine Building Ventilation System	9-38
9.4.5	Safeguard Building Controlled-Area Ventilation System	9-38
9.4.6	Electrical Division of Safeguard Building Ventilation System (SBVSE)	9-38
9.4.7	Containment Building Ventilation System	9-38
9.4.8	Radioactive Waste Building Ventilation System	9-38
9.4.9	Emergency Power Generating Building Ventilation System	9-38
9.4.10	Switchgear Building Ventilation System	9-38
9.4.11	Essential Service Water Pump Building Ventilation System	9-38
9.4.12	Main Steam And Feedwater Valve Room Ventilation System	9-38
9.4.13	Smoke Confinement System	9-38
9.4.14	Access Building Ventilation System	9-39
9.4.15	{ESWEMS Pumphouse HVAC System	9-39
9.5	Other Auxiliary Systems	9-46
9.5.1	Fire Protection System	9-46
9.5.2	Communication System	9-52
9.5.3	Lighting System	9-53
9.5.4	Diesel Generator Fuel Oil Storage and Transfer System	9-53
9.5.5	Diesel Generator Cooling Water System	9-53
9.5.6	Diesel Generator Starting Air System	9-53
9.5.7	Diesel Generator Lubricating System	9-53
9.5.8	Diesel Generator Air Intake and Exhaust System	9-53

9.6	Fire Protection Analysis	9-64
9B	Fire Protection Analysis - Plant Specific Supplement	9B-1
9B.1	Introduction	9B-1
9B.1.1	Regulatory Bases	9B-1
9B.1.2	Defense-in-depth	9B-2
9B.1.3	Scope	9B-2
9B.2	Fire Protection Analysis Methodology	9B-3
9B.2.1	General Design Criteria	9B-3
9B.2.2	Specific Elements	9B-3
9B.2.3	Assumptions	9B-7
9B.3	Fire Area-by-Fire Area Evaluation	9B-11
9B.3.1	Turbine Building	9B-11
9B.3.2	Switchgear Building	9B-14
9B.3.3	Auxiliary Power Transformer Area	9B-15
9B.3.4	Generator Transformer Area	9B-17
9B.3.5	{Warehouse Building}	9B-18
9B.3.6	Security Access Facility	9B-18
9B.3.7	Central Gas Supply Building	9B-19
9B.3.8	{Grid Systems Control Building}	9B-19
9B.3.9	Fire Protection Building	9B-20
9B.3.10	{Circulating Water System Cooling Tower Structures	9B-20
9B.3.11	{Circulating Water System Pumphouse	9B-21
9B.3.12	{Essential Service Water Emergency Makeup System Pumphouse	9B-21
9B.3.13	{Circulating Water System Makeup Water Intake Structure	9B-22
9B.4	References	9B-23
10.0	Steam and Power Conversion System	10-1
10.1	Summary Description	10-1
10.2	Turbine-generator	10-2
10.2.1	Design Bases	10-2
10.2.2	General Description	10-2
10.2.3	Turbine Rotor Integrity	10-2
10.2.4	Safety Evaluation	10-3
10.2.5	References	10-3
10.3	Main Steam Supply System	10-4
10.3.1	Design Bases	10-4
10.3.2	System Description	10-4
10.3.3	Safety Evaluation	10-4
10.3.4	Inspection and Testing Requirements	10-4
10.3.5	Secondary Side Water Chemistry Program	10-4
10.3.6	Steam and Feedwater System Materials	10-4
10.3.7	References	10-6
10.4	Other Features of Steam And Power Conversion System	10-7
10.4.1	Main Condensers	10-7
10.4.2	Main Condenser Evacuation System	10-7
10.4.3	Turbine Gland Sealing System	10-7
10.4.4	Turbine Bypass System	10-8

10.4.5	Circulating Water System	10-8
10.4.6	Condensate Polishing System	10-16
10.4.7	Condensate and Feedwater System	10-16
10.4.8	Steam Generator Blowdown System (PWR)	10-16
10.4.9	Emergency Feedwater System.	10-16
11.0	Radioactive Waste Management	11-1
11.1	Source Terms	11-1
11.1.1	Reference	11-1
11.2	Liquid Waste Management System.	11-1
11.2.1	Design Basis.	11-1
11.2.2	System Description.	11-1
11.2.3	Radioactive Effluent Releases	11-1
11.2.4	Liquid Waste Management System Cost Benefit Analysis.	11-4
11.2.5	References	11-4
11.3	Gaseous Waste Management Systems	11-17
11.3.1	Design Basis.	11-17
11.3.2	System Description.	11-17
11.3.3	Radioactive Effluent Releases	11-17
11.3.4	Discharge Requirements	11-17
11.3.5	Estimated Annual Releases	11-17
11.4	Solid Waste Management Systems.	11-17
11.4.1	Design Basis.	11-17
11.4.2	System Description.	11-17
11.4.3	Radioactive Effluent Releases	11-17
11.4.4	Solid Waste Management System Cost-benefit Analysis.	11-18
11.4.5	Failure Tolerance	11-18
11.4.6	References	11-18
11.5	Process And Effluent Radiological Monitoring and Sampling Systems.	11-19
11.5.1	Design Basis.	11-19
11.5.2	System Description.	11-19
11.5.3	Effluent Monitoring and Sampling.	11-19
11.5.4	Process Monitoring and Sampling	11-19
11.5.5	References	11-19
12.0	Radiation Protection	12-1
12.1	Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA)	12-1
12.1.1	Policy Considerations	12-1
12.1.2	Design Considerations	12-1
12.1.3	Operational Considerations	12-1
12.1.4	References	12-1
12.2	Radiation Sources	12-2
12.2.1	Contained Sources	12-2
12.2.2	Airborne Radioactive Material Sources	12-3
12.2.3	References	12-3
12.3	Radiation Protection Design Features.	12-4
12.3.1	Facility Design Features	12-4

12.3.2	Shielding	12-4
12.3.3	Ventilation	12-4
12.3.4	Area Radiation And Airborne Radioactivity Monitoring Instrumentation	12-4
12.3.5	Dose Assessment	12-7
12.3.6	Minimization of Contamination	12-14
12.3.7	References	12-15
12.4	Dose Assessment	12-43
12.5	Operational Radiation Protection Program	12-44
12.5.1	References	12-44
13.0	Conduct Of Operations	13-1
13.1	Organizational Structure of Applicant	13-1
13.1.1	Management and Technical Support Organization	13-1
13.1.2	Operating Organization	13-8
13.1.3	Qualifications of Nuclear Plant Personnel	13-17
13.1.4	References	13-18
13.2	Training	13-24
13.2.1	Insert to Section 1 of NEI 06-13A	13-24
13.2.2	Insert to Section 1.1 of NEI 06-13A	13-24
13.2.3	Insert to Section 1.6 of NEI 06-13A	13-27
13.2.4	References	13-28
13.3	Emergency Planning	13-29
13.4	Operational Program Implementation	13-30
13.4.1	References	13-30
13.5	Plant Procedures	13-36
13.5.1	Administrative Procedures	13-36
13.5.2	Operating and Maintenance Procedures	13-39
13.5.3	References	13-43
13.6	Security	13-44
13.6.1	References	13-45
13.7	Fitness for Duty	13-46
13.7.1	References	13-46
13.8	References	13-47
14.0	Verification Programs	14-1
14.1	Specific Information to be Addressed for the Initial Plant Test Program	14-1
14.2	Initial Plant Test Program	14-2
14.2.1	Summary of Test Program and Objectives	14-2
14.2.2	Organization and Staffing	14-2
14.2.3	Test Procedures	14-4
14.2.4	Conduct of Test Program	14-6
14.2.5	Review, Evaluation, and Approval of Test Results	14-6
14.2.6	Test Records	14-8
14.2.7	Conformance of Test Programs with Regulatory Guides	14-8
14.2.8	Utilization of Reactor Operating and Testing Experience in Development of Initial Test Program	14-8
14.2.9	Trial Use of Plant Operating and Emergency Procedures	14-9

14.2.10	Initial Fuel Loading and Initial Criticality	14-9
14.2.11	Test Program Schedule	14-9
14.2.12	Individual Test Descriptions	14-10
14.2.13	References	14-10
14.2.14	Col Applicant Site-specific Tests	14-10
14.3	Inspection, Test, Analysis, and Acceptance Criteria	14-18
14.3.1	Tier 1, Chapter 1, Introduction	14-18
14.3.2	Tier 1, Chapter 2, System Based Design Descriptions and ITAAC	14-18
14.3.3	Tier 1, Chapter 3, Non-system Based Design Descriptions and ITAAC	14-19
14.3.4	Tier 1, Chapter 4, Interface Requirements	14-19
14.3.5	Tier 1, Chapter 5, Site Parameters	14-19
14.3.6	References	14-19
15.0	Transient and Accident Analysis	15-1
15.0.1	Radiological Consequence Analysis	15-1
15.0.2	Computer Codes Used in Analysis	15-1
15.0.3	Radiological Consequences of Design Basis Accidents	15-1
15.0.4	Post Chapter 15 Events Cooldown	15-5
15.0.5	Compliance with Section C.i.15, "transient And Accident Analyses," of Regulatory Guide 1.206	15-5
15.0.6	References	15-5
15.1	Increase in Heat Removal by the Secondary System	15-8
15.2	Decrease in Heat Removal by the Secondary System	15-8
15.3	Decrease in Reactor Coolant System Flow Rate	15-8
15.4	Reactivity and Power Distribution Anomalies	15-8
15.5	Increase in Reactor Coolant Inventory	15-8
15.6	Decrease in Reactor Coolant Inventory Events	15-8
15.7	Radioactive Release from a Subsystem or Component	15-8
15.8	Anticipated Transients without Scram	15-8
15.9	Boiling Water Reactor Stability	15-8
15.10	Spent Fuel Pool Criticality and Boron Dilution Analysis	15-9
16.0	Technical Specifications	16-1
17.0	Quality Assurance and Reliability Assurance	17-1
17.1	Quality Assurance During Design	17-1
17.2	Quality Assurance During the Operations Phase	17-1
17.3	Quality Assurance Program Description	17-1
17.4	Reliability Assurance Program	17-2
17.4.1	Reliability Assurance Program Scope, Stages, and Goals	17-2
17.4.2	Reliability Assurance Program Implementation	17-2
17.4.3	Organization, Design Control, Procedures and Instructions, Corrective Actions, and Audit Plans	17-2
17.4.4	Reliability Assurance Program Information Needed in a COL Application	17-2
17.4.5	References	17-13

17.5	Quality Assurance Program Guidance	17-44
17.5.1	QA Program Responsibilities	17-44
17.5.2	SRP Section 17.5 and the QA Program Description	17-44
17.5.3	Evaluation of the QAPD Against the SRP and QAPD Submittal Guidance	17-44
17.5.4	References	17-45
17.6	Description of Applicant's Program for Implementation of 10 CFR 50.65, the Maintenance Rule	17-46
17.6.1	Scoping Per 10 CFR 50.65(b)	17-46
17.6.2	Monitoring Per 10 CFR 50.65(A)	17-46
17.6.3	Periodic Evaluation Per 10 CFR 50.65(A)(3)	17-47
17.6.4	Risk Assessment and Management Per 10 CFR 50.65(A)(4)	17-47
17.6.5	Maintenance Rule Training and Qualification	17-47
17.6.6	Maintenance Rule Program Role in Implementation of Reliability Assurance Program (RAP) in the Operations Phase	17-48
17.6.7	Maintenance Rule Program Implementation	17-48
17.6.8	References	17-48
18.0	Human Factors Engineering	18-1
18.1	Human Factors Engineering Program Management	18-1
18.1.1	Human Factors Engineering Program Goals, Assumptions and Constraints, and Scope	18-1
18.1.2	Human Factors Engineering and Control Room Design Team Organization	18-2
18.1.3	Human Factors Engineering Processes and Procedures	18-2
18.1.4	Human Factors Engineering Issues Tracking	18-2
18.1.5	Technical Program	18-2
18.1.6	References	18-2
18.2	Operating Experience Review	18-3
18.3	Functional Requirements Analysis and Function Allocation	18-3
18.4	Task Analysis	18-3
18.5	Staffing and Qualifications	18-3
18.6	Human Reliability Analysis	18-3
18.7	Human System Interface Design	18-3
18.8	Procedure Development	18-4
18.9	Training Program Development	18-4
18.10	Verification And Validation	18-4
18.11	Design Implementation	18-4
18.12	Human Performance Monitoring	18-5
19.0	Probabilistic Risk Assessment and Severe Accident Evaluation	19-1
19.1	Probabilistic Risk Assessment	19-2
19.1.1	Uses and Application Of The PRA	19-2
19.1.2	Quality Of PRA	19-3
19.1.3	Special Design/operational Features	19-6
19.1.4	Safety Insights from the Internal Events PRA for Operations at Power	19-6
19.1.5	Safety Insights from the External Events PRA for Operations at Power	19-8
19.1.6	Safety Insights from the PRA for Other Modes of Operation	19-19

19.1.7 PRA-related Input to other Programs and Processes. 19–20
19.1.8 Conclusions and Findings. 19–20
19.1.9 References 19–20
19.2 Severe Accident Evaluations 19–24
19.3 Open, Confirmatory, and COL Action Items Identified as Unresolved. 19–25

List of Tables

Table 1.1-1	{Acronyms Used in this Document}	1-7
Table 1.6-1	Reports Referenced	1-26
Table 1.7-1	{I&C Functional and Electrical One Line Diagrams}	1-28
Table 1.7-2	{Piping and Instrumentation Diagrams}	1-28
Table 1.8-1	FSAR Sections that Demonstrate Conformance to U.S. EPR FSAR Interface Requirements	1-31
Table 1.8-2	{FSAR Sections that Address COL Items}	1-32
Table 1.9-1	{Conformance with Regulatory Guides}	1-53
Table 2.0-1	U.S. EPR Site Design Envelope Comparison	2-2
Table 2.0-2	Comparison of Inventory of Radionuclides Which Could Potentially Seep Into the Groundwater	2-7
Table 2.1-1	{BBNPP Specific Location of the Center of the Containment Structure}	2-19
Table 2.1-2	{Population for Counties Within 10 mi (16 km) Radius of BBNPP}	2-19
Table 2.1-3	{SECPOP Population Within 10 mi (16 km) Radius of BBNPP (2000 - 2060)}	2-19
Table 2.1-4	{SECPOP Population Within 50 mi (80 km) Radius of BBNPP (2000 - 2060)}	2-20
Table 2.1-5	{Population Census and Projections (2010-2060) for Counties Within 50 mile (80 km) Radius of BBNPP}	2-21
Table 2.1-6	{Transient Population Facilities - Major Employers Within 10 mi (16 km) Radius of BBNPP}	2-22
Table 2.1-7	{Transient Population Facilities - Major Recreational Areas and Attractions Within 10 mi (16 km) Radius of BBNPP}	2-22
Table 2.1-8	{Special Facilities - Hospitals and Nursing Homes Within the 10 mi (16 km) Zone} 2-23	
Table 2.1-9	{Special Facilities - Schools Within 10 mi (16 km) Zone}	2-24
Table 2.1-10	{Commuting Patterns To and From Columbia and Luzerne Counties (2000)}	2-25
Table 2.1-11	{SECPOP Actual (2000) and Projected (2010-2060) Population Within the 1 mi (1.6 km) to 30 mi (48 km) Zones}	2-27
Table 2.1-12	{SECPOP Actual (2000) and Projected (2010-2060) Population Density (persons/mi ²) within the 1 mi (1.6 km) to 30 mi (48 km) Zones}	2-27
Table 2.2-1	{Description of Facilities, Products, and Materials}	2-83
Table 2.2-2	{SSES and BBNPP Chemical Storage}	2-84
Table 2.2-3	{Hazardous Chemical Railway, Road, or Waterway Freight}	2-86
Table 2.2-4	{Aircraft Operations - Significance Factors}	2-87
Table 2.2-5	{SSES Site and BBNPP Site Chemical Disposition}	2-88
Table 2.2-6	{Hazardous Material, Nearby Facilities, Disposition}	2-90
Table 2.2-7	{Hazardous Material, Transported Chemicals, Disposition}	2-92
Table 2.2-8	{Explosion Event Analysis}	2-93
Table 2.2-9	{Flammable Vapor Cloud Events (Delayed Ignition) Analysis}	2-94
Table 2.2-10	{Toxic Vapor Cloud Analysis}	2-95
Table 2.2-11	{Description of Pipelines}	2-96
Table 2.2-12	{Description of Highways}	2-97
Table 2.3-1	National Ambient Air Quality Standards	2-136
Table 2.3-2	Tornados Reported in Luzerne County, Pennsylvania	2-137
Table 2.3-3	Tornadoes Reported in Columbia County, Pennsylvania	2-137
Table 2.3-4	Tropical Storms and Hurricanes Passing Within 100 Statute Miles (161 km) of BBNPP, Pennsylvania	2-138

Table 2.3-5	Total and Average Numbers of Tropical Storms and Hurricanes (1851-2004) . . .	
	2-140	
Table 2.3-6	Monthly Mean Number of Days with Thunderstorms	2-140
Table 2.3-7	Drought Events Reported in Luzerne County, Pennsylvania	2-141
Table 2.3-8	Drought Events Reported in Columbia County, Pennsylvania	2-143
Table 2.3-9	Fifty Knots or Greater High Wind Events in Luzerne County, Pennsylvania	2-145
Table 2.3-10	Winds Greater than 75 mph and Less than 124 mph in Luzerne County, Pennsylvania	2-146
Table 2.3-11	Fifty Knots or Greater High Wind Events in Columbia County, Pennsylvania	2-147
Table 2.3-12	Winds Greater than 75 mph and Less than 124 mph in Columbia County, Pennsylvania	2-148
Table 2.3-13	Hail Events in Luzerne County, Pennsylvania	2-149
Table 2.3-14	Hail Events in Columbia County, Pennsylvania	2-151
Table 2.3-15	Ice Storm Events in Luzerne County, Pennsylvania	2-152
Table 2.3-16	Ice Storm Events in Columbia County, Pennsylvania	2-153
Table 2.3-17	Snow Storm Events in Luzerne County, Pennsylvania	2-155
Table 2.3-18	Snow Storm Events in Columbia County, Pennsylvania	2-157
Table 2.3-19	Probable Maximum Winter Precipitation (PMWP) Values	2-159
Table 2.3-20	Design-Basis Tornado Characteristics for BBNPP	2-159
Table 2.3-22	Zero Percent Exceedance Temperature Values for Wilkes-Barre/ Scranton, Pennsylvania	2-160
Table 2.3-21	Annual Heating and Humidification Design Conditions for Wilkes-Barre/ Scranton, Pennsylvania	2-159
Table 2.3-23	Annual Cooling, Dehumidification, and Enthalpy Design Conditions for Wilkes-Barre/Scranton, Pennsylvania	2-161
Table 2.3-24	Extreme Annual Design Conditions for Wilkes-Barre/Scranton, Pennsylvania . . .	2-162
Table 2.3-25	Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperatures for Wilkes-Barre/Scranton, Pennsylvania	2-163
Table 2.3-26	Monthly Design Wet Bulb and Mean Coincident Dry Bulb Temperatures for Wilkes-Barre/Scranton, Pennsylvania	2-164
Table 2.3-27	Monthly Mean Daily Temperature Range for Wilkes-Barre/Scranton, Pennsylvania	2-164
Table 2.3-28	{SSES 33' (10-m) 2001-2007 Annual JFD}	2-165
Table 2.3-29	{SSES 197' (60-m) 2001-2007 Annual JFD}	2-181
Table 2.3-30	{SSES 33' (10-m) 2001-2006 Annual JFD}	2-197
Table 2.3-31	{SSES 197' (60-m) 2001-2006 Annual JFD}	2-213
Table 2.3-32	{SSES 33' (10-m) 2001-2006 Winter JFD}	2-229
Table 2.3-33	{SSES 33' (10-m) 2001-2006 Spring JFD}	2-245
Table 2.3-34	{SSES 33' (10-m) 2001-2006 Summer JFD}	2-261
Table 2.3-35	{SSES 33' (10-m) 2001-2006 Autumn JFD}	2-277
Table 2.3-36	{SSES 197' (60-m) 2001-2006 Winter JFD}	2-293
Table 2.3-37	{SSES 197' (60-m) 2001-2006 Spring JFD}	2-309
Table 2.3-38	{SSES 197' (60-m) 2001-2006 Summer JFD}	2-325
Table 2.3-39	{SSES 197' (60-m) 2001-2006 Autumn JFD}	2-341
Table 2.3-40	{SSES 33' (10-m) 2001-2006 January JFD}	2-357
Table 2.3-41	{SSES 33' (10-m) 2001-2006 February JFD}	2-373
Table 2.3-42	{SSES 33' (10-m) 2001-2006 March JFD}	2-389
Table 2.3-43	{SSES 33' (10-m) 2001-2006 April JFD}	2-405

Table 2.3-44	{SSES 33' (10-m) 2001-2006 May JFD}	2-421
Table 2.3-45	{SSES 33' (10-m) 2001-2006 June JFD}	2-437
Table 2.3-46	{SSES 33' (10-m) 2001-2006 July JFD}	2-453
Table 2.3-47	{SSES 33' (10-m) 2001-2006 August JFD}	2-469
Table 2.3-48	{SSES 33' (10-m) 2001-2006 September JFD}	2-485
Table 2.3-49	{SSES 33' (10-m) 2001-2006 October JFD}	2-501
Table 2.3-50	{SSES 33' (10-m) 2001-2006 November JFD}	2-517
Table 2.3-51	{SSES 33' (10-m) 2001-2006 December JFD}	2-533
Table 2.3-52	{SSES 197' (60-m) 2001-2006 January JFD}	2-549
Table 2.3-53	{SSES 197' (60-m) 2001-2006 February JFD}	2-565
Table 2.3-54	{SSES 197' (60-m) 2001-2006 March JFD}	2-581
Table 2.3-55	{SSES 197' (60-m) 2001-2006 April JFD}	2-597
Table 2.3-56	{SSES 197' (60-m) 2001-2006 May JFD}	2-613
Table 2.3-57	{SSES 197' (60-m) 2001-2006 June JFD}	2-629
Table 2.3-58	{SSES 197' (60-m) 2001-2006 July JFD}	2-645
Table 2.3-59	{SSES 197' (60-m) 2001-2006 August JFD}	2-661
Table 2.3-60	{SSES 197' (60-m) 2001-2006 September JFD}	2-677
Table 2.3-61	{SSES 197' (60-m) 2001-2006 October JFD}	2-693
Table 2.3-62	{SSES 197' (60-m) 2001-2006 November JFD}	2-709
Table 2.3-63	{SSES 197' (60-m) 2001-2006 December JFD}	2-725
Table 2.3-64	{Input Used to Determine JFD's}	2-741
Table 2.3-65	{Monthly Mean Wind Speed and Prevailing Wind Direction (tens of degrees) for Sites Around Bell Bend Nuclear Power Plant}	2-742
Table 2.3-66	{Monthly Maximum Two-Minute Wind Speed and Direction (tens of degrees) for Sites Around Bell Bend Nuclear Power Plant}	2-742
Table 2.3-67	{Monthly Maximum Five-Second Wind Speed and Direction (tens of degrees) for Sites Around Bell Bend Nuclear Power Plant}	2-742
Table 2.3-68	{SSES 33' (10-m) Wind Direction Persistence Summary for 2001}	2-743
Table 2.3-69	{SSES 33' (10-m) Wind Direction Persistence Summary for 2002}	2-745
Table 2.3-70	{SSES 33' (10-m) Wind Direction Persistence Summary for 2003}	2-747
Table 2.3-71	{SSES 33' (10-m) Wind Direction Persistence Summary for 2004}	2-749
Table 2.3-72	{SSES 33' (10-m) Wind Direction Persistence Summary for 2005}	2-751
Table 2.3-73	{SSES 33' (10-m) Wind Direction Persistence Summary for 2006}	2-753
Table 2.3-74	{SSES 33' (10-m) Average Wind Direction Persistence Summary for Years 2001-2006}	2-755
Table 2.3-75	{SSES 60m Wind Direction Persistence Summary for 2001}	2-757
Table 2.3-76	{SSES 60m Wind Direction Persistence Summary for 2002}	2-760
Table 2.3-77	{SSES 60m Wind Direction Persistence Summary for 2003}	2-763
Table 2.3-78	{SSES 60m Wind Direction Persistence Summary for 2004}	2-766
Table 2.3-79	{SSES 60m Wind Direction Persistence Summary for 2005}	2-768
Table 2.3-80	{SSES 60m Wind Direction Persistence Summary for 2006}	2-770
Table 2.3-81	{SSES 197' (60-m) Average Wind Direction Persistence Summary for Years 2001-2006}	2-773
Table 2.3-82	{SSES Daily Average and Extreme Temperatures (2001-2006)}	2-775
Table 2.3-83	{SSES Daily Average and Extreme Dew Point Temperatures (2001-2006)}	2-824
Table 2.3-84	{Williamsport, PA, Daily Average and Extreme Temperature and Dew Point Temperature Values (2000-2005)}	2-872
Table 2.3-85	{SSES Monthly Mean Temperatures (2001-2006)}	2-922
Table 2.3-86	{SSES Monthly Mean Extreme Maximum Temperatures (2001-2006)}	2-922
Table 2.3-87	{SSES Monthly Mean Extreme Minimum Temperatures (2001-2006)}	2-922

Table 2.3-88	{SSES Monthly Mean Daily Maximum Temperatures (2001-2006)}	2-922
Table 2.3-89	{SSES Monthly Mean Daily Minimum Temperatures (2001-2006)}	2-922
Table 2.3-90	{SSES Maximum Hourly Temperatures (2001-2006)}	2-922
Table 2.3-91	{SSES Minimum Hourly Temperatures (2001-2006)}	2-922
Table 2.3-93	{SSES Monthly Mean Relative Humidity (2001-2006)}	2-923
Table 2.3-92	{Number of SSES Hourly Temperature Values Greater Than or Less Than Indicated Value and Percent Frequency of Occurrence (2001-2006)}	2-923
Table 2.3-94	{Monthly Mean Temperatures (1971-2000) for Sites Around Bell Bend Nuclear Power Plant}	2-924
Table 2.3-95	{Monthly Mean Daily Maximum Temperatures (1971-2000) for Sites Around Bell Bend Nuclear Power Plant}	2-924
Table 2.3-96	{Monthly Mean Daily Minimum Temperatures (1971-2000) for Sites Around Bell Bend Nuclear Power Plant}	2-924
Table 2.3-97	{Monthly Mean Wet Bulb Temperatures (1978-2000) for Sites Around Bell Bend Nuclear Power Plant}	2-925
Table 2.3-98	{Monthly Mean Dew Point Temperatures (1978-2000) for Sites Around Bell Bend Nuclear Power Plant}	2-925
Table 2.3-99	{Mean Number of Days with Maximum Hourly Temperature Value Greater Than or Equal to 90°F (1971-2000) for Sites Around Bell Bend Nuclear Power Plant}	2-925
Table 2.3-100	{Mean Number of Days with Minimum Hourly Temperature Value Less Than or Equal to 32°F (1971-2000) for Sites Around BBNPP}	2-926
Table 2.3-101	{Mean Number of Days with Minimum Hourly Temperature Value Less Than or Equal to 0°F (1971-2000) for Sites Around BBNPP}	2-926
Table 2.3-102	{Monthly Mean Relative Humidity (1971-2000) for Sites Around BBNPP}	2-926
Table 2.3-103	{Daily Variation of Monthly Mean Relative Humidity (%) (1971-2000) for Sites Around BBNPP}	2-927
Table 2.3-104	Annual Heating and Humidification Design Conditions for Wilkes-Barre/Scranton, PA.	2-928
Table 2.3-105	Annual Cooling, Dehumidification, and Enthalpy Design Conditions for Wilkes-Barre/Scranton, PA.	2-928
Table 2.3-106	Extreme Annual Design Conditions for Wilkes-Barre/Scranton, PA.	2-929
Table 2.3-107	{Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperature Values for Wilkes-Barre/Scranton, PA (1972-2001)}	2-929
Table 2.3-108	{Monthly Design Wet Bulb and Mean Coincident Dry Bulb Temperature Values for Wilkes-Barre/Scranton, PA (1972-2001)}	2-930
Table 2.3-109	{Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperature Values for Allentown, PA (1972-2001)}	2-931
Table 2.3-110	{Monthly Design Wet Bulb and Mean Coincident Dry Bulb Temperature Values for Allentown, PA (1972-2001)}	2-932
Table 2.3-111	Monthly Mean Daily Temperature Range in Fahrenheit Degrees for Wilkes-Barre/Scranton, PA.	2-932
Table 2.3-112	SSES Monthly and Annual Precipitation (2001-2006)	2-933
Table 2.3-113	SSES Monthly and Annual Percent Frequency (%) of Precipitation Occurrence (2001-2006)	2-933
Table 2.3-114	SSES Hourly Rainfall Rate Distribution (2001-2006)	2-933
Table 2.3-115	SSES Measured Extreme Precipitation Hourly Values (2001-2006)	2-933
Table 2.3-118	{Monthly Mean Number of Days with Precipitation for Sites Around Bell Bend Nuclear Power Plant (1971-2000)}	2-934
Table 2.3-116	{Mean Monthly and Annual Precipitation for Sites Around Bell Bend	

	Nuclear Power Plant (1971-2000))	2-934
Table 2.3-117	{Mean Monthly and Annual Snowfall for Sites Around Bell Bend Nuclear Power Plant (1971-2000))	2-934
Table 2.3-119	{Monthly Mean Number of Days with Heavy Fog for Sites Around Bell Bend Nuclear Power Plant (1964-2006))	2-935
Table 2.3-120	{SSES 33' (10-m) Annual Stability Persistence Summary for Year 2001}	2-936
Table 2.3-121	{SSES 33' (10-m) Annual Stability Persistence Summary for Year 2002}	2-938
Table 2.3-122	{SSES 33' (10-m) Annual Stability Persistence Summary for Year 2003}	2-940
Table 2.3-123	{SSES 33' (10-m) Annual Stability Persistence Summary for Year 2004}	2-942
Table 2.3-124	{SSES 33' (10-m) Annual Stability Persistence Summary for Year 2005}	2-944
Table 2.3-125	{SSES 33' (10-m) Annual Stability Persistence Summary for Year 2006}	2-947
Table 2.3-126	{SSES 33' (10-m) Annual Stability Persistence Summary for Years 2001-2006}	2-950
Table 2.3-127	{SSES 197' (60-m) Annual Stability Persistence Summary for Year 2001}	2-951
Table 2.3-128	{SSES 197' (60-m) Annual Stability Persistence Summary for Year 2002}	2-953
Table 2.3-129	{SSES 197' (60-m) Annual Stability Persistence Summary for Year 2003}	2-955
Table 2.3-130	{SSES 197' (60-m) Annual Stability Persistence Summary for Year 2004}	2-957
Table 2.3-131	{SSES 197' (60-m) Annual Stability Persistence Summary for Year 2005}	2-959
Table 2.3-132	{SSES 197' (60-m) Annual Stability Persistence Summary for Year 2006}	2-962
Table 2.3-133	{SSES 197' (60-m) Annual Stability Persistence Summary for Years 2001-2006}	2-965
Table 2.3-134	SSES Monthly Atmospheric Stability Summary (2001-2006).	2-966
Table 2.3-135	Monthly and Annual Average Mixing Height Values (m)	2-967
Table 2.3-136	Monthly and Annual Average Mixing Height Values (ft).	2-967
Table 2.3-137	{Temperature Inversion Frequency and Persistence at SSES, Year 2001}.	2-968
Table 2.3-138	{Temperature Inversion Frequency and Persistence at SSES, Year 2002}.	2-969
Table 2.3-139	{Temperature Inversion Frequency and Persistence at SSES, Year 2003}.	2-970
Table 2.3-140	{Temperature Inversion Frequency and Persistence at SSES, Year 2004}.	2-971
Table 2.3-141	{Temperature Inversion Frequency and Persistence at SSES, Year 2005}.	2-972
Table 2.3-142	{Temperature Inversion Frequency and Persistence at SSES, Year 2006}.	2-973
Table 2.3-143	{National Ambient Air Quality Standards}.	2-974
Table 2.3-144	{Primary Meteorological Tower Instrument Types, Specifications and Accuracies for Pre-Operational and Operational Programs}	2-975
Table 2.3-145	Distances from Met Tower to Nearby Obstructions to Air Flow	2-976
Table 2.3-146	AEOLUS3 and ARCON96 Input.	2-977
Table 2.3-147	{EAB/LPZ Accident c/Q Values for Ground Level Release Using SSES 2001-2007 Meteorological Data}	2-978
Table 2.3-148	{50th Percentile BBNPP Site Atmospheric Dispersion Factors}.	2-979
Table 2.3-149	: Control Room/TSC c/Q Values for Stack Release Using SSES 2001-2007 Meteorological Data	2-980
Table 2.3-150	Control Room/TSC c/Q Values for Silencer Release Using SSES 2001-2007 Meteorological Data	2-981
Table 2.3-151	Control Room/TSC c/Q Values for Canopy Release Using SSES 2001-2007 Meteorological Data	2-981
Table 2.3-152	Control Room/TSC c/Q Values for Equipment Hatch Release Using SSES 2001-2007 Meteorological Data.	2-982
Table 2.3-153	Control Room/TSC c/Q Values for Depressurization Shaft Release Using SSES 2001-2007 Meteorological Data.	2-982
Table 2.3-154	AEOLUS3 Input	2-983
Table 2.3-155	{Normal Effluent Annual Average, Undecayed, Undepleted c/Q Values for	

Mixed Mode Release Using 242,458 cfm Flow Rate for Grid Receptors} . . . 2-992

Table 2.3-156 {Normal Effluent Annual Average, Undecayed, Undepleted c/Q Values for Mixed Mode Release Using 242,458 cfm Flow Rate for Site Boundary Receptors} 2-994

Table 2.3-157 {Normal Effluent Annual Average, Undecayed, Undepleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Residents}. . . 2-995

Table 2.3-158 {Normal Effluent Annual Average, Undecayed, Undepleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Gardens}. . . . 2-996

Table 2.3-159 {Normal Effluent Annual Average, Undecayed, Undepleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Milk Animals} 2-996

Table 2.3-160 {Normal Effluent Annual Average, Undecayed, Undepleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Meat Animals} 2-997

Table 2.3-161 {Normal Effluent Annual Average, Decayed, Depleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Grid Receptors}. 2-998

Table 2.3-162 {Normal Effluent Annual Average, Decayed, Depleted c/Q Values for Mixed Mode Release Using 242,458 cfm Flow Rate for Site Boundary Receptors}. 2-1000

Table 2.3-163 {Normal Effluent Annual Average, Decayed, Depleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Residents}. . . . 2-1001

Table 2.3-164 {Normal Effluent Annual Average, Decayed, Depleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Gardens}. 2-1002

Table 2.3-165 {Normal Effluent Annual Average, Decayed, Depleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Milk Animals}. . . 2-1002

Table 2.3-166 {Normal Effluent Annual Average, Decayed, Depleted c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Meat Animals}. . 2-1002

Table 2.3-167 {Normal Effluent Annual Average, Undecayed, Undepleted Gamma X/Q Values for Mixed Mode Release Using 242,458 cfm Flow Rate for Grid Receptors} 2-1003

Table 2.3-168 {Normal Effluent Annual Average, Undecayed, Undepleted Gamma c/Q Values for Mixed Mode Release Using 242,458 cfm Flow Rate for Grid Receptors} 2-1004

Table 2.3-169 {Normal Effluent Annual Average, Undecayed, Undepleted Gamma c/Q Values for Mixed Mode Release Using 242,458 cfm Flow Rate for Site Boundary Receptors} 2-1005

Table 2.3-170 {Normal Effluent Annual Average, Undecayed, Undepleted Gamma c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Residents} . . 2-1006

Table 2.3-171 {Normal Effluent Annual Average, Undecayed, Undepleted Gamma c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Gardens} . . . 2-1007

Table 2.3-172 {Normal Effluent Annual Average, Undecayed, Undepleted Gamma c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Milk Animals} 2-1007

Table 2.3-173 {Normal Effluent Annual Average, Undecayed, Undepleted Gamma c/Q Values (sec/m³) for Mixed Mode Release With Building Wake for Nearest Meat Animals} 2-1007

Table 2.3-174	{Normal Effluent Annual Average D/Q Values for Mixed Mode Release Using 242,458 cfm Flow Rate for Grid Receptors}	2-1008
Table 2.3-175	{Normal Effluent Annual Average D/Q Values (1/m2) for Mixed Mode Release Using 242,458 cfm Flow Rate for Site Boundary Receptors}	2-1010
Table 2.3-176	{Normal Effluent Annual Average D/Q Values (1/m2) for Mixed Mode Release With Building Wake for Nearest Residents}	2-1011
Table 2.3-177	{Normal Effluent Annual Average D/Q Values (1/m2) for Mixed Mode Release With Building Wake for Nearest Gardens}	2-1012
Table 2.3-178	{Normal Effluent Annual Average D/Q Values (1/m2) for Mixed Mode Release With Building Wake for Nearest Milk Animals}	2-1012
Table 2.3-179	{Normal Effluent Annual Average, D/Q Values (1/m2) for Mixed Mode Release With Building Wake for Nearest Meat Animals}	2-1012
Table 2.4-1	{Approximate Length and Average Gradient of Creeks Located near BBNPP}	2-1180
Table 2.4-2	{Annual Peak Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1787 through 2006)}	2-1181
Table 2.4-3	{Monthly Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}	2-1184
Table 2.4-4	{Mean Daily Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}	2-1188
Table 2.4-5	{Maximum Daily Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}	2-1189
Table 2.4-6	{Minimum Daily Streamflow for Wilkes-Barre, PA USGS Station No. 01536500, (1899 through 2006)}	2-1190
Table 2.4-7	{Annual Peak Streamflow for Danville, PA USGS Station No. 01540500, (1865 through 2006)}	2-1191
Table 2.4-8	{Monthly Streamflow for the Danville, PA USGS Station No. 01540500, (1905 through 2006)}	2-1194
Table 2.4-9	{Mean Daily Streamflow for Danville, PA USGS Station No. 01540500, (1905 through 2006)}	2-1198
Table 2.4-10	{Maximum Daily Streamflow for Danville, PA USGS Station No. 01540500, (1905 through 2006)}	2-1199
Table 2.4-11	{Minimum Daily Streamflow for Danville, PA USGS Station No. 01540500, (1905 through 2006)}	2-1200
Table 2.4-12	{Susquehanna River Basin Upstream Dam Information}	2-1201
Table 2.4-13	{Surface Water Users in Luzerne County}	2-1203
Table 2.4-14	SSES Units 1 and 2 Monthly Consumptive Water Use (Million Gallons per Month)	2-1205
Table 2.4-15	Major Public Water Suppliers within Luzerne and Columbia Counties}	2-1206
Table 2.4-16	SSES Units 1 and 2 Cooling Tower Blowdown Discharge Rate Permit NoI PA0047325	2-1207
Table 2.4-17	{Water Pollution Control Facilities in Luzerne County}	2-1208
Table 2.4-18	{1-Hour 1 mi2 Probable Maximum Precipitation (PMP) Depths}	2-1210
Table 2.4-19	{72-Hour 10 mi2 Probable Maximum Precipitation (PMP) Depths}	2-1210
Table 2.4-20	{Sub-Basin Drainage Areas for BBNPP (Site Drainage)}	2-1210
Table 2.4-21	{HEC-HMS Sub-Basin Site PMP Peak Discharges for BBNPP (Site Drainage)}	2-1210
Table 2.4-22	{Safety-Related Facility Entrance Elevation Summary}	2-1212
Table 2.4-23	{Walker Run Probable Maximum Precipitation Depths}	2-1213
Table 2.4-24	{Walker Run PMP Peak Flow Rates}	2-1213

Table 2.4-25	{Walker Run PMF Water Surface Elevations}	2-1214
Table 2.4-26	{Susquehanna River Basin Upstream Dam Information}.	2-1216
Table 2.4-27	Historical Tsunamis and Maximum Generated Wave Heights.	2-1218
Table 2.4-28	{Estimated Average Monthly Ice Thickness, Susquehanna River 2001-2007}	2-1219
Table 2.4-29	{Estimated Average Monthly Ice Thickness, ESW Emergency Makeup Retention Pond 2001-2007}.	2-1219
Table 2.4-31	{Data Input and Results for Wind Setup Calculations}.	2-1220
Table 2.4-30	{10 mi ² (25.9 km ²) Probable Maximum Precipitation Depths at the ESWEMS}.	2-1220
Table 2.4-32	{Wave Runup Results}	2-1221
Table 2.4-33	{Fastest Mile Quantities Using Fisher-Tippet Type I (Frechet) Distribution}	2-1221
Table 2.4-34	{Summary of Information of the Stations and Range of Data Used}	2-1222
Table 2.4-35	{Annual Minimum Water Levels at Danville, PA Station}.	2-1223
Table 2.4-36	{Annual Minimum Water Levels at Wilkes-Barre PA Station}.	2-1226
Table 2.4-37	{Annual Low Flow Statistics for Danville and Wilkes-Barre Stations}.	2-1228
Table 2.4-38	{Estimated Recurrence Interval for the Lowest Recorded Flow, Wilkes-Barre and Danville Stations}.	2-1228
Table 2.4-39	{Physical Characteristics of Ground Water Wells in the North Branch Susquehanna River Basin, Pennsylvania}.	2-1229
Table 2.4-40	{Yields and Specific Capacities of Wells in the North Branch Susquehanna River Basin, Pennsylvania}.	2-1230
Table 2.4-41	{Specific Capacities of Wells in the Berwick-Bloomsburg-Danville Area, Pennsylvania}.	2-1230
Table 2.4-42	{Effect of Lithology on Well Yields, Berwick-Bloomsburg - Danville Area, Pennsylvania}.	2-1231
Table 2.4-43	{Computed Water Budget Components for Selected Drainage Basins in the North Branch Susquehanna River Basin, Pennsylvania}.	2-1231
Table 2.4-44	{BBNPP Monitoring Wells and Construction Details}.	2-1232
Table 2.4-45	{Monthly Ground Water Elevation Measurements, BBNPP}	2-1234
Table 2.4-46	{Monthly Surface Water Elevation Measurements, BBNPP}	2-1238
Table 2.4-47	{Water Use in the Upper Susquehanna River Basin, Pennsylvania, in 1970}	2-1240
Table 2.4-48	{Ground Water Wells Located Within a 5-Mile (8 km) Radius of BBNPP}	2-1241
Table 2.4-49	{Ground Water Withdrawals Located Within a 25-Mile (40-km) Radius of BBNPP}	2-1264
Table 2.4-50	{Ground Water Withdrawals Located Within a 5-Mile (8-km) Radius of BBNPP}	2-1274
Table 2.4-51	{Drinking Water Wells Used for Public Water Supplies, Luzerne and Columbia Counties}	2-1275
Table 2.4-52	{Horizontal Hydraulic Gradients}	2-1293
Table 2.4-53	{Vertical Hydraulic Gradients and Flow Directions}	2-1294
Table 2.4-54	{Hydraulic Conductivity Values Based on Slug Tests}.	2-1296
Table 2.4-55	{Hydraulic Properties Based on Pumping Tests}.	2-1297
Table 2.4-56	{Hydraulic Conductivity Values of Bedrock (Mahantango Shale) Based on Packer Tests}	2-1298
Table 2.4-57	{Summary of Hydraulic Property Testing at the SSES}	2-1300
Table 2.4-58	Reactor Coolant Storage Tank Radionuclide Inventory	2-1302
Table 2.4-59	{Transport Analysis Considering Advection and Radioactive Decay - Equation Inputs}	2-1303

Table 2.4-60	{Transport Analysis Considering Advection and Radioactive Decay - Results} . . .	2-1306
Table 2.4-61	{BBNPP Site-Specific Radionuclide Adsorption (Kd) Values}	2-1308
Table 2.4-62	{Distribution Coefficients and Retardation Factors Used in Advection- Decay-Retardation Analysis}	2-1309
Table 2.4-63	{Transport Analysis Considering Advection, Radioactive Decay, and Retardation}	2-1310
Table 2.4-64	{Transport Analysis Considering Advection, Radioactive Decay, Retardation, and Dilution}.	2-1311
Table 2.4-65	{Compliance with 10 CFR Part 20, Appendix B, Table 2}	2-1312
Table 2.5-1	{USGS Earthquake Catalog for the CEUS with mb >= 3.0}	2-1602
Table 2.5-2	{Conversion Between Body-Wave (mb) and Moment (M) Magnitude}.	2-1667
Table 2.5-3	{Summary of Bechtel Group Seismic Sources}	2-1668
Table 2.5-4	{Summary of Dames & Moore Seismic Sources}.	2-1669
Table 2.5-5	{Summary of Law Engineering Seismic Sources}	2-1669
Table 2.5-6	{Summary of Rondout Associates Seismic Sources}.	2-1670
Table 2.5-7	{Summary of Weston Geophysical Seismic Sources}	2-1671
Table 2.5-8	{Summary of Woodward-Clyde Consultants Seismic Sources}	2-1672
Table 2.5-9	{Alternative New Madrid Fault Locations}	2-1673
Table 2.5-10	{Earthquake Frequencies for Repeating New Madrid Earthquake Sequences}.	2-1674
Table 2.5-11	{Controlling Earthquakes for BBNPP}	2-1675
Table 2.5-12	{Recommended Horizontal and Vertical SSE Amplitudes and common V/H Ratio}	2-1676
Table 2.5-13	{Amplification Factors for 10-4 and 10-5 Input Motions and HF and LF Rock Spectra}.	2-1677
Table 2.5-14	{Uniform Hazard Response Spectra (Hard Rock Conditions)}.	2-1679
Table 2.5-15	{Earthquake Frequencies for Repeating New Madrid Earthquake Sequences}.	2-1679
Table 2.5-16	{USGS 2008 Seismicity Smoothing Models}	2-1680
Table 2.5-17	{Selected Controlling Rock Motion Time Histories}	2-1681
Table 2.5-18	Comparison of Post-EPRI NP-6395-D 1989 Magnitude Estimates for the 1886 Charleston Earthquake	2-1685
Table 2.5-19	{Mean and Fractile Rock Hazard Curves for PGA}	2-1686
Table 2.5-20	{Mean and Fractile Rock Hazard Curves for 25 Hz}	2-1687
Table 2.5-21	{Mean and Fractile Rock Hazard Curves for 10 Hz}	2-1688
Table 2.5-22	{Mean and Fractile Rock Hazard Curves for 5 Hz}	2-1689
Table 2.5-23	{Mean and Fractile Rock Hazard Curves for 2.5 Hz}	2-1690
Table 2.5-24	{Mean and Fractile Rock Hazard Curves for 1 Hz}	2-1691
Table 2.5-25	{Mean and Fractile Rock Hazard Curves for 0.5 Hz}	2-1692
Table 2.5-26	{Summary Of Thicknesses And Termination Elevations For Various Strata}.	2-1693
Table 2.5-27	{Summary Of Geotechnical Field Tests}	2-1693
Table 2.5-28	{Boring Locations And Surface Elevations}	2-1694
Table 2.5-29	{Summary of Hammer-Rod Energy Measurements}	2-1696
Table 2.5-30	{Summary Of Field-Measured Standard Penetration Test (Spt) N-Values}	2-1696
Table 2.5-31	{Summary Of Adjusted Spt N-Values Based On Energy Measurements}	2-1696
Table 2.5-32	{Summary Of Borehole Pressuremeter Test Results}	2-1697
Table 2.5-33	{Summary Of Laboratory Tests}.	2-1698
Table 2.5-34	{Summary Of Moisture Content}	2-1699

Table 2.5-35	{Summary Of Unit Weight Tests Special Care Rock Samples And Undisturbed Samples}	2-1701
Table 2.5-36	{Summary Of Specific Gravity Tests Special Care Rock Samples And Undisturbed Samples}	2-1703
Table 2.5-37	{Chemical Test Results Of Soil And Rock Samples}	2-1704
Table 2.5-38	{Summary Of Unconfined Compressive Strength Tests Special Care Rock Samples}	2-1706
Table 2.5-39	{Hydraulic Conductivity Test Results}	2-1707
Table 2.5-40	{Dynamic Testing Program Samples}	2-1708
Table 2.5-41	{Resonant Column Low Strain Properties}	2-1709
Table 2.5-42	{"Free-Free" Test Results}	2-1711
Table 2.5-43	{Category 1 Structural Fill and Backfill Properties}	2-1712
Table 2.5-44	{Category 1 Structural Fill and Backfill Properties}	2-1713
Table 2.5-45	{Recommended Values Of Index Properties}	2-1714
Table 2.5-46	{Rock Mass Rating For Mahantango Formation}	2-1715
Table 2.5-47	{Recommended Values For Strength Properties}	2-1716
Table 2.5-47	{Recommended Values For Strength Properties}	2-1716
Table 2.5-48	{Recommended Values For Hydraulic Conductivity}	2-1717
Table 2.5-49	{Recommended Values For Elastic Modulus}	2-1718
Table 2.5-50	{Recommended Values For Static Elastic Properties}	2-1718
Table 2.5-51	{Recommended Values For Low Strain Dynamic Elastic Properties At Center Of Nuclear Island Footprint}	2-1719
Table 2.5-52	{Peak Ground Acceleration from FIRS Study}	2-1721
Table 2.5-53	{Soil Conditions For The U.S. EPR Standard Plant}	2-1722
Table 2.5-54	{Soil Conditions For The U.S. EPR Standard Plant}	2-1723
Table 2.5-55	{Foundation Elevations}	2-1725
Table 2.5-56	{Earth Pressure Coefficients}	2-1729
Table 2.5-57	{Bearing Capacity (Failure Controlled)}	2-1730
Table 2.5-58	{Elastic Settlement Analysis By Simplified Approximations}	2-1732
Table 2.5-59	{Detailed Elastic Settlement Analysis}	2-1734
Table 2.5-60	{Factor Of Safety Against Sliding}	2-1735
Table 3.2-1	{Classification Summary for Site-Specific SSCs}	3-5
Table 3.7-1	{Best Estimate Soil Modeling}	3-55
Table 3.7-2	{Lower Bound Soil Modeling}	3-56
Table 3.7-3	{Upper Bound Soil Modeling}	3-57
Table 3.7-4	{Comparison of Worst Case Maximum Accelerations in EPGB}	3-58
Table 3.7-5	{Comparison of Worst Case Maximum Accelerations in ESWB}	3-58
Table 3.7-6	{BBNPP Worst Case Maximum Accelerations - EPGB}	3-59
Table 3.7-7	{Comparison of Nodal Accelerations for Selected Critical Locations in the ESWEMS Pumphouse}	3-60
Table 3.8-1	{ESWEMS Pumphouse Base Mat & Pump Well Foundation Summary Table On the Building Stability}	3-195
Table 3.8-2	{ESWEMS Retention Pond - Summary of the Slope Stability}	3-196
Table 3.9-1	{Site-Specific Inservice Pump Testing Program Requirements}	3-210
Table 3.9-2	{Site-Specific Inservice Valve Testing Program Requirements}	3-211
Table 3.10-1	{Site-Specific Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment}	3-217
Table 3.10-2	Seismic Qualification Implementaiton Program	3-228
Table 3.11-1	{Site-Specific Environmentally Qualified Electrical/I&C Equipment}	3-232
Table 3E.4-1	{Response Spectrum Analysis - Design Load Combinations for ESWEMS	

	Pumphouse Structure}	3-7
Table 3E.4-2	{Required Factor Of Safety for ESWEMS Pumphouse Stability}	3-8
Table 3E.4-3	{ESWEMS Pumphouse Base Mat Resultant Membrane Forces and Moments}	3-8
Table 3E.4-4	{ESWEMS Pump Well Foundation Group Resultant Membrane Forces and Moments}	3-9
Table 3E.4-5	{ESWEMS Shear Keys Reaction Forces and Moments}	3-10
Table 3E.4-6	{ESWEMS Pumphouse Walls Resultant Membrane Forces & Moments}}	3-11
Table 3E.4-7	{Required Factor of Safety for the ESWEMS Retention Pond Slope Stability}	3-12
Table 6.6-1	{Inservice Inspection Requirements for Class 3 Site-Specific ESWEMS}	6-15
Table 8.1-1	{Division 1 Emergency Diesel Generator Nominal Loads}	8-3
Table 8.1-2	{Division 2 Emergency Diesel Generator Nominal Loads}	8-3
Table 8.1-3	{Division 3 Emergency Diesel Generator Nominal Loads}	8-4
Table 8.1-4	{Division 4 Emergency Diesel Generator Nominal Loads}	8-4
Table 8.2-1	{PPL EU Transmission System Circuits Connected to the BBNPP Site}	8-22
Table 8.3-1	{BBNPP Onsite AC Power System Component Data Nominal Values}	8-29
Table 8.3-2	{BBNPP EPSS Switchgear, Load Center, and Motor Control Center Numbering and Nominal Voltage}	8-29
Table 8.3-3	{BBNPP Normal Power Supply System Switchgear Numbering and Nominal Voltage}	8-29
Table 9.5-1	Fire Protection Program Compliance with Regulatory Guide 1.189	9-54
Table 9B.4-1	Predefined Severities for Common Plant Ignition Source Fires	9B-24
Table 9B.4-2	Fire Area Parameters	9B-25
Table 10.4-1	{Circulating Water System Cooling Tower Design Specifications}	10-17
Table 11.2-1	{Input Parameters for PWR GALE Computer Code}	11-6
Table 11.2-2	{GALE Liquid Release Rates (Ci/yr)}	11-10
Table 11.2-3	{GALE Gaseous Release Rates (Ci/yr)}	11-11
Table 11.2-4	{Carbon - 14 Release Data from PWRs from GALE}	11-13
Table 11.2-5	{Carbon-14 Gaseous Release Chemical Form Reported at Two U.S. PWRs}	11-13
Table 11.2-6	{GALE Liquid Release for U.S. EPR at Bell Bend (Ci/yr)}	11-14
Table 11.2-7	{GALE Gaseous Release for U.S. EPR at Bell Bend (Ci/yr)}	11-16
Table 12.3-1	{Radiation Sources at SSES Units 1 and 2}	12-17
Table 12.3-2	{Historical All-Source Compliance for Offsite General Public}	12-19
Table 12.3-3	{FTE for BBNPP Construction Workers}	12-20
Table 12.3-4	{Gaseous Dose Rate Type and Coefficients}	12-20
Table 12.3-5	{Historic Gaseous Releases For 2001 Through 2006}	12-21
Table 12.3-6	{Historical Liquid Releases for Input to LADTAPII}	12-22
Table 12.3-7	{Historical Dilutions for Input to LADTAPII}	12-23
Table 12.3-8	{Historical Shoreline Dose}	12-23
Table 12.3-9	{Historic and Projected Loading of SSES ISFSI}	12-24
Table 12.3-10	{Condensate Storage Tank Source Terms}	12-25
Table 12.3-11	{LLRWHF Source Term}	12-26
Table 12.3-12	{SEALAND Container Source Term}	12-26
Table 12.3-13	{Occupancy by Construction Zone}	12-27
Table 12.3-14	{Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14	{Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14	{Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14	{Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14	{Collective Dose to BBNPP Construction Workers}	12-28

Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 12.3-14 {Collective Dose to BBNPP Construction Workers}	12-28
Table 13.1-1 {BBNPP Position/Site Specific Position Cross Reference}	13-19
Table 13.1-2 Minimum Shift Crew Composition	13-22
Table 13.4-1 Operational Programs Required by NRC Regulations and Program Implementation	13-31
Table 14.3-1 {Site Specific Analyses (Safety Significant Features)}	14-20
Table 14.3-2 {Site Specific SSC ITAAC Screening Summary}	14-21
Table 14.3-3 Interface Requirements Screening Summary	14-22
Table 15.0-1 {BBNPP Atmospheric Dispersion Factors}	15-6
Table 15.0-2 {BBNPP Radiological Consequences of Design Basis Accidents (rem TEDE)}	15-7
Table 15.0-3 {BBNPP Offsite Receptor Variables}	15-7
Table 17.4-1 Definitions of Component Failure Modes	17-14
Table 17.4-2 Risk Significant SSCs Ranked by FV for "At Power" Events, All Components with FV Greater Than or Equal to 0.005	17-15
Table 17.4-3 Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2	17-19
Table 17.4-4 Risk Significant SSCs Common Cause Failure (CCF) Ranked by RAW, All CCFs with RAW Greater Than or Equal to 2	17-22
Table 17.4-5 Risk Significant SSCs for "Shutdown" Events, All Components with FV ³ 0.005	17-31
Table 17.4-6 Risk-Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW ³ 2	17-35
Table 17.4-7 Risk-Significant CCFs Ranked by RAW for "Shutdown" Events, CCFs with RAW ³ 20	17-42
Table 19.1-1 {Summary of External Events Evaluated for BBNPP}	19-22

List of Figures

Figure 1.1-1	{Site Area Map and Exclusion Area Boundary}	1-13
Figure 1.1-2	{Combined Exclusion Area Boundaries}	1-14
Figure 1.1-3	{10 mi (16 km) Surrounding Area}	1-15
Figure 1.1-4	{50 mi (80 km) Surrounding Area}	1-16
Figure 1.2-1	{BBNPP Nuclear and Turbine Building Island Layout}.	1-21
Figure 2.1-1	{BBNPP Site Area Map}.	2-28
Figure 2.1-2	{BBNPP Site 50 Mile (80 km) Radius}	2-29
Figure 2.1-3	{BBNPP Site 10 Mile (16 km) Radius}	2-30
Figure 2.1-4	{BBNPP Exclusion Area Boundary}	2-31
Figure 2.1-5	{BBNPP Principle Plant Structures}	2-32
Figure 2.1-6	{BBNPP 10 Mile (16 km) Radius Map}.	2-33
Figure 2.1-7	{BBNPP 10 Mile (16 km) 2000 Population Distribution}.	2-34
Figure 2.1-8	{BBNPP 10 Mile (16 km) 2010 Population Distribution}.	2-35
Figure 2.1-9	{BBNPP 10 Mile (16 km) 2020 Population Distribution}.	2-36
Figure 2.1-10	{BBNPP 10 Mile (16 km) 2030 Population Distribution}.	2-37
Figure 2.1-11	{BBNPP 10 Mile (16 km) 2040 Population Distribution}.	2-38
Figure 2.1-12	{BBNPP 10 Mile (16 km) 2050 Population Distribution}.	2-39
Figure 2.1-13	{BBNPP 10 Mile (16 km) 2060 Population Distribution}.	2-40
Figure 2.1-14	{BBNPP 10 Mile (16 km) 2018 Population Distribution}.	2-41
Figure 2.1-15	{BBNPP 10 Mile (16 km) 2058 Population Distribution}.	2-42
Figure 2.1-16	{BBNPP 50 Mile (80 km) Radius Map}.	2-43
Figure 2.1-17	{BBNPP 50 Mile (80 km) 2000 Population Distribution}.	2-44
Figure 2.1-18	{BBNPP 50 Mile (80 km) 2010 Population Distribution}.	2-45
Figure 2.1-19	{BBNPP 50 Mile (80 km) 2020 Population Distribution}.	2-46
Figure 2.1-20	{BBNPP 50 Mile (80 km) 2030 Population Distribution}.	2-47
Figure 2.1-21	{BBNPP 50 Mile (80 km) 2040 Population Distribution}.	2-48
Figure 2.1-22	{BBNPP 50 Mile (80 km) 2050 Population Distribution}.	2-49
Figure 2.1-23	{BBNPP 50 Mile (80 km) 2060 Population Distribution}.	2-50
Figure 2.1-24	{BBNPP Low Population Zone}	2-51
Figure 2.1-25	{BBNPP 50 Mile (80 km) 2018 Population Distribution}.	2-52
Figure 2.1-26	{BBNPP 50 Mile (80 km) 2058 Population Distribution}.	2-53
Figure 2.2-1	{Site Vicinity Map}	2-98
Figure 2.2-2	{Airports and Airway Routes within 10 mi (16 km) of the BBNPP Site}	2-99
Figure 2.3-1	{Annual Average Number of Tornadoes, 1950-1995}	2-1013
Figure 2.3-2	{Annual Average Number of Strong-Violent (F2-F5) Tornadoes, 1950-1995}	2-1013
Figure 2.3-3	{Annual Thunderstorm Frequency}	2-1014
Figure 2.3-4	{Five-Year Lightning Flash Density Map}.	2-1015
Figure 2.3-5	{Plotted PMWP Values for BBNPP}.	2-1016
Figure 2.3-6	{BBNPP 33' (10-m) Annual Wind Rose}.	2-1017
Figure 2.3-7	{BBNPP 197' (60-m) Annual Wind Rose}.	2-1018
Figure 2.3-8	{BBNPP 33' (10-m) Seasonal Wind Roses}.	2-1019
Figure 2.3-9	{BBNPP 197' (60-m) Seasonal Wind Roses}.	2-1020
Figure 2.3-10	{BBNPP 33' (10-m) January Wind Rose}.	2-1021
Figure 2.3-11	{BBNPP 33' (10-m) February Wind Rose}.	2-1022
Figure 2.3-12	{BBNPP 33' (10-m) March Wind Rose}	2-1023
Figure 2.3-13	{BBNPP 33' (10-m) April Wind Rose}.	2-1024
Figure 2.3-14	{BBNPP 33' (10-m) May Wind Rose}.	2-1025

Figure 2.3-15	{BBNPP 33' (10-m) June Wind Rose}	2-1026
Figure 2.3-16	{BBNPP 33' (10-m) July Wind Rose}	2-1027
Figure 2.3-17	{BBNPP 33' (10-m) August Wind Rose}	2-1028
Figure 2.3-18	{BBNPP 33' (10-m) September Wind Rose}	2-1029
Figure 2.3-19	{BBNPP 33' (10-m) October Wind Rose}	2-1030
Figure 2.3-20	{BBNPP 33' (10-m) November Wind Rose}	2-1031
Figure 2.3-21	{BBNPP 33' (10-m) December Wind Rose}	2-1032
Figure 2.3-22	{BBNPP 197' (60-m) January Wind Rose}	2-1033
Figure 2.3-23	{BBNPP 197' (60-m) February Wind Rose}	2-1034
Figure 2.3-24	{BBNPP 197' (60-m) March Wind Rose}	2-1035
Figure 2.3-25	{BBNPP 197' (60-m) April Wind Rose}	2-1036
Figure 2.3-26	{BBNPP 197' (60-m) May Wind Rose}	2-1037
Figure 2.3-27	{BBNPP 197' (60-m) June Wind Rose}	2-1038
Figure 2.3-28	{BBNPP 197' (60-m) July Wind Rose}	2-1039
Figure 2.3-29	{BBNPP 197' (60-m) August Wind Rose}	2-1040
Figure 2.3-30	{BBNPP 197' (60-m) September Wind Rose}	2-1041
Figure 2.3-31	{BBNPP 197' (60-m) October Wind Rose}	2-1042
Figure 2.3-32	{BBNPP 197' (60-m) November Wind Rose}	2-1043
Figure 2.3-33	{BBNPP 197' (60-m) December Wind Rose}	2-1044
Figure 2.3-34	{Wilkes-Barre/Scranton, Pennsylvania, Wind Rose}	2-1045
Figure 2.3-35	{Allentown, Pennsylvania, Wind Rose}	2-1046
Figure 2.3-36	{Williamsport, Pennsylvania, Wind Rose}	2-1047
Figure 2.3-37	{BBNPP 33' (10-m) Annual Precipitation Wind Rose}	2-1048
Figure 2.3-38	{BBNPP 197' (60-m) Annual Precipitation Wind Rose}	2-1049
Figure 2.3-39	{BBNPP 33' (10-m) January Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1050
Figure 2.3-40	{BBNPP 33' (10-m) February Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1051
Figure 2.3-41	{BBNPP 33' (10-m) March Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1052
Figure 2.3-42	{BBNPP 33' (10-m) April Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1053
Figure 2.3-43	{BBNPP 33' (10-m) May Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1054
Figure 2.3-44	{BBNPP 33' (10-m) June Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1055
Figure 2.3-45	{BBNPP 33' (10-m) July Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1056
Figure 2.3-46	{BBNPP 33' (10-m) August Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1057
Figure 2.3-47	{BBNPP 33' (10-m) September Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1058
Figure 2.3-48	{BBNPP 33' (10-m) October Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1059
Figure 2.3-49	{BBNPP 33' (10-m) November Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1060
Figure 2.3-50	{BBNPP 33' (10-m) December Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1061
Figure 2.3-51	{BBNPP 197' (60-m) January Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1062

Figure 2.3-52	{BBNPP 197' (60-m) February Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1063
Figure 2.3-53	{BBNPP 197' (60-m) March Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1064
Figure 2.3-54	{BBNPP 197' (60-m) April Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1065
Figure 2.3-55	{BBNPP 197' (60-m) May Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1066
Figure 2.3-56	{BBNPP 197' (60-m) June Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1067
Figure 2.3-57	{BBNPP 197' (60-m) July Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1068
Figure 2.3-58	{BBNPP 197' (60-m) August Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1069
Figure 2.3-59	{BBNPP 197' (60-m) September Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1070
Figure 2.3-60	{BBNPP 197' (60-m) October Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1071
Figure 2.3-61	{BBNPP 197' (60-m) November Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1072
Figure 2.3-62	{BBNPP 197' (60-m) December Precipitation Wind Rose for Rate Class 0.1-0.2 in/hr}	2-1073
Figure 2.3-63	{Monthly Average Mixing Heights}	2-1074
Figure 2.3-64	{Topography Within 1-Miles of the BBNPP Site}	2-1075
Figure 2.3-65	{Topography Within 5-Miles of the BBNPP Site}	2-1076
Figure 2.3-66	{Topography Within 50-Miles of the BBNPP Site}	2-1077
Figure 2.3-67	{Maximum Elevation versus Distance Within 50 Miles of the BBNPP Site}	2-1078
Figure 2.4-1	{Susquehanna River Basin and Sub-basins}	2-1314
Figure 2.4-2	{Site Area Topographic Map 5 Mile (8 km) Radius}	2-1315
Figure 2.4-3	{Walker Run Watershed}	2-1316
Figure 2.4-4	{Site Drainage Flow Pattern}	2-1317
Figure 2.4-5	{Site Utilization Plant Layout}	2-1318
Figure 2.4-6	{Susquehanna River Profile}	2-1319
Figure 2.4-7	{USGS Stream Gauges within a 50 Mile (80 Km) Radius}	2-1320
Figure 2.4-8	{Mean, Maximum & Minimum Monthly Streamflows for Wilkes-Barre, PA USGS 01536500, (1900 through 2007)}	2-1321
Figure 2.4-9	{Mean, Maximum & Minimum Monthly Streamflows for Danville, PA USGS 01540500 (1905 through 2007)}	2-1321
Figure 2.4-10	{Susquehanna River Bathymetry near Intake & Blowdown Structures}	2-1322
Figure 2.4-11	{Flood Insurance Map Panel 1 of 4}	2-1323
Figure 2.4-12	{Flood Insurance Map Panel 2 of 4}	2-1324
Figure 2.4-13	{Flood Insurance Map Panel 3 of 4}	2-1325
Figure 2.4-14	{Flood Insurance Map Panel 4 of 4}	2-1326
Figure 2.4-15	{Dams within the Susquehanna River Basin}	2-1327
Figure 2.4-16	{Surface Water Withdrawal in Luzerne County}	2-1328
Figure 2.4-17	{Surface Water Withdrawal within 5-mile (8 km) Radius}	2-1329
Figure 2.4-18	{Water Pollution Control Facilities Locations within a 5-mile (8-km) Radius}	2-1330
Figure 2.4-19	{Water Pollution Control Facilities Locations within Luzerne County}	2-1331
Figure 2.4-20	{Peak Streamflow at Wilkes-Barre and Danville Gauging Stations}	2-1332

Figure 2.4-21	{Sub-basin Site Drainage Delineation}	2-1333
Figure 2.4-22	{HEC-HMS Hydrologic Diagram}	2-1334
Figure 2.4-23	{BBNPP Site Location}	2-1335
Figure 2.4-24	{HEC-HMS Model Setup of Walker Run Watershed}	2-1336
Figure 2.4-25	{Junction 1 Hydrograph}	2-1337
Figure 2.4-26	{Junction 2 Hydrograph}	2-1337
Figure 2.4-27	{Sub-Basin A1 Hydrograph}	2-1338
Figure 2.4-28	{Sub-Basin A2 Hydrograph}	2-1338
Figure 2.4-29	{Sub-Basin A3 Hydrograph}	2-1339
Figure 2.4-30	{HEC-RAS Cross Section Locations Near Power Block}	2-1340
Figure 2.4-31	{HEC-RAS Cross Section Locations}	2-1341
Figure 2.4-32	{Complete HEC-RAS Cross Section Locations}	2-1342
Figure 2.4-33	{Walker Run PMF Water Surface Profile}	2-1343
Figure 2.4-34	{Susquehanna River Basin and Sub-Basins}	2-1344
Figure 2.4-35	{Major and Minor Dams Upstream from BBNPP}	2-1345
Figure 2.4-36	{Digital Tectonic Activity Map of the Earth}	2-1346
Figure 2.4-37	{Pennsylvania Landslide Susceptibility}	2-1347
Figure 2.4-38	{Ice Jams within 50 Mile (80 km) Radius}	2-1348
Figure 2.4-39	{ESWEMS Schematic Layout}	2-1349
Figure 2.4-40	{Glacial Deposits of Pennsylvania, 25-mile (40 km) and 5-mile (8 km) Radii}	2-1350
Figure 2.4-41	{Mean Monthly Minimum Streamflows, 1905 to 2006}	2-1351
Figure 2.4-42	{Low Flow Frequency Distribution for Danville Station}	2-1352
Figure 2.4-43	{Low Flow Frequency Distribution for Wilkes-Barre Station}	2-1353
Figure 2.4-44	{Flow Discharge Curve for Danville Station}	2-1354
Figure 2.4-45	{Flow Discharge Curve for Wilkes-Barre Station}	2-1355
Figure 2.4-46	{SRBC Water Consumptive Use}	2-1356
Figure 2.4-47	{30-Day Moving Average for Danville Station}	2-1357
Figure 2.4-48	{30-Day Moving Average for Wilkes-Barre Station}	2-1358
Figure 2.4-49	{Geologic Map of the BBNPP Site and Vicinity}	2-1359
Figure 2.4-50	{Stratigraphy and Geologic Cross Section of Berwick Anticlinorium}	2-1360
Figure 2.4-51	{Surficial Deposits at BBNPP Site and Vicinity}	2-1361
Figure 2.4-52	{Legend for Figure 2.4-51}	2-1362
Figure 2.4-53	{Frequency Distribution of Nondomestic Well Yields Grouped According to Dominant Rock Type}	2-1363
Figure 2.4-54	{Frequency Distribution of Nondomestic Well Yields Grouped According to Topographic Setting}	2-1364
Figure 2.4-55	{Distribution of Water-Bearing Zones with Depth}	2-1365
Figure 2.4-56	{Average Annual Precipitation in the North Branch Susquehanna River Basin (1941-1970)}	2-1366
Figure 2.4-57	{Percent Frequency Distribution of Annual Precipitation in the Southern Part of the North Branch Susquehanna River Basin (1931-1980)}	2-1367
Figure 2.4-58	{Locations of Drainage Basins Where Long-Term Water Budget Analyses Have Been Performed}	2-1368
Figure 2.4-59	{Percent Frequency Distribution of Annual Runoff from Wapwallopen Creek, Pennsylvania (1920-1980)}	2-1369
Figure 2.4-60	{Hydrographs of Two USGS Monitoring Wells in Luzerne County Screened in Glacial Overburden}	2-1370
Figure 2.4-61	{Hydrographs of Two USGS Monitoring Wells in Luzerne County Screened in the Catskill Formation}	2-1371

Figure 2.4-62	{Locations of Ground Water Monitoring Wells}	2-1372
Figure 2.4-63	{Locations of BBNPP Surface Water Monitoring Stations}	2-1373
Figure 2.4-64	{Location of Hydrogeological Cross Sections}	2-1374
Figure 2.4-65	{Hydrogeological Cross Section A-A'}	2-1375
Figure 2.4-66	{Hydrogeological Cross Section B-B'}	2-1376
Figure 2.4-67	{Saturated Thickness Map of the Glacial Overburden Aquifer}	2-1377
Figure 2.4-68	{Topography of the Bedrock Surface}	2-1378
Figure 2.4-69	{Topography of the Bedrock Surface in the Power Block Area}	2-1379
Figure 2.4-70	{Sole Source Aquifers Located in USEPA Region 3}	2-1380
Figure 2.4-71	{Ground Water Use in the Susquehanna River Basin 1995}	2-1381
Figure 2.4-72	{Ground Water Well Locations within a 25-Mile (40 km) Radius (PaGWIS Data)}	2-1382
Figure 2.4-73	{Ground Water Well Locations within a 5 Mile (8 km) Radius (PaGWIS Data)}	2-1383
Figure 2.4-74	{Ground Water Withdrawal within a 25-Mile (40-km) Radius (PaGWIS Data)}	2-1384
Figure 2.4-75	{Ground Water Withdrawal within a 5-Mile (8-km) Radius (PaDEP Data)}	2-1385
Figure 2.4-76	{Ground Water Production Wells at SSES}	2-1386
Figure 2.4-77	{Potentially Stressed Areas and Water Challenged Areas in the Susquehanna River Basin}	2-1387
Figure 2.4-78	{Ground Water Elevations versus Time, Well Clusters MW301 and MW302}	2-1388
Figure 2.4-79	{Ground Water Elevations versus Time, Well Clusters MW303 and MW304}	2-1389
Figure 2.4-80	{Ground Water Elevations versus Time, Well Clusters MW305 and MW306}	2-1390
Figure 2.4-81	{Ground Water Elevations versus Time, Well Clusters MW307 and MW308}	2-1391
Figure 2.4-82	{Ground Water Elevations versus Time, Well Clusters MW309 and MW310}	2-1392
Figure 2.4-83	{Water Level Fluctuations in MW301 Cluster Area Based on Pressure Transducer Data}	2-1393
Figure 2.4-84	{Water Level Fluctuations in MW302 Cluster Area Based on Pressure Transducer Data}	2-1394
Figure 2.4-85	{Potentiometric Surface Map of Glacial Overburden Aquifer, October 2007}	2-1395
Figure 2.4-86	{Potentiometric Surface Map of Glacial Overburden Aquifer, January 2008}	2-1396
Figure 2.4-87	{Potentiometric Surface Map of Glacial Overburden Aquifer, March 2008}	2-1397
Figure 2.4-88	{Potentiometric Surface Map of Glacial Overburden Aquifer, July 2008}	2-1398
Figure 2.4-89	{Potentiometric Surface Map of Shallow Bedrock Aquifer, October 2007}	2-1399
Figure 2.4-90	{Potentiometric Surface Map of Shallow Bedrock Aquifer, January 2008}	2-1400
Figure 2.4-91	{Potentiometric Surface Map of Shallow Bedrock Aquifer, March 2008}	2-1401
Figure 2.4-92	{Potentiometric Surface Map of Shallow Bedrock Aquifer, July 2008}	2-1402
Figure 2.4-93	{Potentiometric Map of Deep Bedrock Aquifer, October 2007}	2-1403
Figure 2.4-94	{Potentiometric Map of Deep Bedrock Aquifer, January 2008}	2-1404
Figure 2.4-95	{Potentiometric Map of Deep Bedrock Aquifer, March 2008}	2-1405
Figure 2.4-96	{Potentiometric Map of Deep Bedrock Aquifer, July 2008}	2-1406
Figure 2.4-97	{Areas Known or Suspected of Having Upward-Flowing Ground Water from Bedrock}	2-1407

Figure 2.4-98 {Vertical Distribution of Fractures in MW301C Between 45 and 345 Feet Below Ground Surface}	2-1408
Figure 2.4-99 {Distribution of Fracture Dip Directions in Monitoring Well MW301C}	2-1409
Figure 2.4-100{Distribution of Fracture Dip Angles in Monitoring Well MW301C}.	2-1410
Figure 2.4-101{Vertical Distribution of Fractures in MW301C Between 45 and 345 Feet Below Ground Surface}	2-1411
Figure 2.4-102{Hypothetical Point of Release and Subsurface Migration Path of Accidental Spill}	2-1412
Figure 2.4-103{Distribution of Fracture Dip Directions in Monitoring Well MW310C}	2-1413
Figure 2.4-104{Distribution of Fracture Dip Angles in Monitoring Well MW310C}.	2-1414
Figure 2.5-1 {Site Region Topographic Map 200-mile (322 km) Radius}.	2-1736
Figure 2.5-2 {Site Vicinity Topographic Map 25-mile (40 km) Radius}.	2-1737
Figure 2.5-3 {Site Topographic Map 5-Mile (8 km) Radius}	2-1738
Figure 2.5-4 {Site Topographic Map 0.6-mile (1 km) Radius}.	2-1739
Figure 2.5-5 {Regional Geology Map 200-Mile (322 km) Radius}	2-1740
Figure 2.5-6 {Physiographic Provinces of Pennsylvania (Geologic Map of Pennsylvania) 25-mile (40 km) and 5-mile (8 km) Radii}	2-1741
Figure 2.5-7 {Physiographic Provinces (National) 200-mile (322 km) Radius}.	2-1742
Figure 2.5-8 {Physiographic Provinces of Pennsylvania with Sections 25-mile (40 km) and 5-mile (8 km) Radii}.	2-1743
Figure 2.5-9 {Glacial Deposits of Pennsylvania 25-Mile (40 km) and 5-Mile (8 km) Radii}	2-1744
Figure 2.5-10 {Evolution of the Appalachian Orogen}	2-1745
Figure 2.5-11 {Cross Section Showing the Cambrian and Ordovician Rocks of the Appalachian Basin}	2-1746
Figure 2.5-12 {Map Showing the Location of the Appalachian Basin Cross Section}	2-1747
Figure 2.5-13 {Correlation Chart of Appalachian Basin}.	2-1748
Figure 2.5-14 {Precambrian Basement Map of Appalachian Basin 25 mile (40 km) and 5 mile (8 km) Radii}	2-1749
Figure 2.5-15 {Site Region Tectonic Features}.	2-1750
Figure 2.5-16 {Seismic Zones and Seismicity in CEUS}	2-1751
Figure 2.5-17 {Regional Bouguer Gravity anomaly Map}.	2-1752
Figure 2.5-18 {Regional Magnetic Anomaly Map}	2-1753
Figure 2.5-19 {Regional Cross Section}	2-1754
Figure 2.5-20 {Stratigraphic Description for Regional Cross Section}	2-1755
Figure 2.5-21 {Site Specific Stratigraphic Column}.	2-1756
Figure 2.5-22 {Mesozoic Basins with Faults}	2-1757
Figure 2.5-23 {Bedrock Geologic Map Pennsylvania}	2-1758
Figure 2.5-24 {Surficial Geologic Map of Berwick Quadrangle}	2-1759
Figure 2.5-25 {Surficial Sediments Description}	2-1760
Figure 2.5-26 {Cross Section of Berwick Anticlinorium - Bedrock Geology of the Berwick Quadrangle}	2-1761
Figure 2.5-27 {Site Area Geologic Map 5-mile (8 km) Radius}.	2-1762
Figure 2.5-28 {Site Cross Section A-A'}.	2-1763
Figure 2.5-29 {Site Cross Section B-B'}.	2-1764
Figure 2.5-30 {Site Cross Section C-C'}.	2-1765
Figure 2.5-31 {Site Cross Section D-D'}.	2-1766
Figure 2.5-32 {Site Cross Section E-E'}.	2-1767
Figure 2.5-33 {Site Cross Section F-F'}.	2-1768
Figure 2.5-34 {Bechtel Group EPRI Source Zones}.	2-1769

Figure 2.5-35	{Dames & Moore EPRI Source Zones}	2-1770
Figure 2.5-36	{Law Engineering EPRI Source Zones}	2-1771
Figure 2.5-37	{Rondout Associates EPRI Source Zones}	2-1772
Figure 2.5-38	{Weston Geophysical EPRI Source Zones}	2-1773
Figure 2.5-39	{Woodward-Clyde Consultants EPRI Source Zones}	2-1774
Figure 2.5-40	{Seismic Zones and Seismicity in CEUS}	2-1775
Figure 2.5-41	{System Activity at the New Madrid Fault System}	2-1776
Figure 2.5-42	{Logic Tree of New Madrid Fault System}	2-1777
Figure 2.5-43	{Uniform Hazard Spectra for Hard Rock at 7 Structural Frequencies}	2-1778
Figure 2.5-44	{Mean 10-4 Rock Deaggregation for 1 and 2.5 Hz}	2-1779
Figure 2.5-45	{Mean 10-4 Rock Deaggregation for 5 and 10 Hz}	2-1780
Figure 2.5-46	{Mean 10-5 Rock Deaggregation for 1 and 2.5 Hz}	2-1781
Figure 2.5-47	{Mean 10-5 Rock Deaggregation for 5 and 10 Hz}	2-1782
Figure 2.5-48	{10-4 Smooth Hard Rock UHRS Spectra}	2-1783
Figure 2.5-49	{10-5 Smooth Hard Rock UHRS Spectra}	2-1783
Figure 2.5-50	{Shear-Wave Velocity Vs and its Coefficient of Variation for Depth to 350 ft (107 m)}	2-1784
Figure 2.5-51	{Best Estimate Shear-Wave Velocity Vs and its Coefficient of Variation for Depth to 190 ft (57.9 m)}	2-1785
Figure 2.5-52	{Shear-wave Velocity Vs. Depth for Profiles 1 through 60}	2-1786
Figure 2.5-53	{Mean \pm Standard Deviation of Shear-wave Velocity (Vs) Vs. Depth for all 60 Profiles, Compared to Best Estimate Profile described in Section 2.5.2.5.1.2}	2-1787
Figure 2.5-54	{G/Gmax Curves Representing Uncertainty in Damping for Layer: Backfill within Depth 0-20 ft}	2-1788
Figure 2.5-55	{Damping Curves Representing Uncertainty in Damping for Layer Backfill within Depth 0-20 ft}	2-1789
Figure 2.5-56	{Mean Site Amplification Factor and Coefficient of Variation at the Top of Concrete for 10-4 HF DEM Input Motion}	2-1790
Figure 2.5-57	{Maximum Strains Vs. Depth for 10-4 HF DEM Input Motion}	2-1791
Figure 2.5-58	{Mean Site Amplification Factor and Coefficient of Variation at the Top of Concrete for 10-4 LF DEM Input Motion}	2-1792
Figure 2.5-59	{Maximum Strains Vs. Depth for 10-4 LF DEM Input Motion}	2-1793
Figure 2.5-60	{Mean Site Amplification Factor and Coefficient of Variation at the Top of Concrete for 10-5 HF DEM Input Motion}	2-1794
Figure 2.5-61	{Maximum Strains Vs. Depth for 10-5 HF DEM Input Motion}	2-1795
Figure 2.5-62	{Mean Site Amplification Factor and Coefficient of Variation at the Top of Concrete for 10-5 LF DEM Input Motion}	2-1796
Figure 2.5-63	{Maximum Strains Vs. Depth for 10-5 LF DEM Input Motion}	2-1797
Figure 2.5-64	{HF and LF Site Spectra, and Envelopes for 10-4 and 10-5}	2-1798
Figure 2.5-65	{Recommended Horizontal and Vertical SSE Spectra}	2-1799
Figure 2.5-66	{V/H Ratios from Several Publications and Recommended V/H Ratios}	2-1800
Figure 2.5-67	{Mean and Fractile Rock Hazard Curves for PGA}	2-1801
Figure 2.5-68	{Mean and Fractile Rock Hazard Curves for 25 Hz}	2-1802
Figure 2.5-69	{Mean and Fractile Rock Hazard Curves for 10 Hz}	2-1803
Figure 2.5-70	{Mean and Fractile Rock Hazard Curves for 5.0 Hz}	2-1804
Figure 2.5-71	{Mean and Fractile Rock Hazard Curves for 2.5 Hz}	2-1805
Figure 2.5-72	{Mean and Fractile Rock Hazard Curves for 1.0 Hz}	2-1806
Figure 2.5-73	{Mean and Fractile Rock Hazard Curves for 0.5 Hz}	2-1807
Figure 2.5-74	{Location of the Arms of the New Madrid Fault System}	2-1808

Figure 2.5-75	{Logic Tree of Ground Motion Models for Non-General Sources}	2-1809
Figure 2.5-76	{Logic Tree of Ground Motion Models for General Area Sources}	2-1810
Figure 2.5-77	{10-4 Response Spectra of Controlling Events at BBNPP}	2-1811
Figure 2.5-78	{10-5 Response Spectra of Controlling Events at BBNPP}	2-1812
Figure 2.5-79	{Response Spectra of Selected Time Histories for 10-4 Controlling Events LF, DEL and DEH after Spectral Matching}	2-1813
Figure 2.5-80	{10-4 Smooth Hard Rock Reference Spectra}	2-1814
Figure 2.5-81	{10-5 Smooth Hard Rock Reference Spectra}	2-1815
Figure 2.5-82	{UCSS Map}	2-1816
Figure 2.5-83	{Updated Charleston Seismic Sources (UCSS) Logic Tree}	2-1817
Figure 2.5-84	{Comparison Vs Profiles Between 10 Generic S I Profiles and Average BBNPP Profile}	2-1818
Figure 2.5-85	{Mean 10-6 Rock Deaggregation for 1 and 2.5 Hz}	2-1819
Figure 2.5-86	{Mean 10-6 Rock Deaggregation for 5 and 10 Hz}	2-1820
Figure 2.5-87	{Earthquake Epicenters In and Near Pennsylvania}	2-1821
Figure 2.5-88	{Bedrock Geologic Map Pennsylvania}	2-1822
Figure 2.5-89	{Correlation Chart of Appalachian Basin}	2-1823
Figure 2.5-90	{Map Showing the Location of Appalachian Basin Cross Section}	2-1824
Figure 2.5-91	{Cross Section Showing the Cambrian and Ordovician Rocks of the Appalachian Basin}	2-1825
Figure 2.5-92	{Precambrian Basement Map of Appalachian Basin 25 Mile (40 km) and 5 Mile (8 km) Radii}	2-1826
Figure 2.5-93	{Tectonic Features}	2-1827
Figure 2.5-94	{Site Area Geologic Map 5 Mile (8 km) Radius}	2-1828
Figure 2.5-95	{Cross Section Showing the Berwick Anticlinorium - Bedrock Geology of the Berwick Quadrangle}	2-1829
Figure 2.5-96	{Site Cross Section A-A'}	2-1830
Figure 2.5-97	{Site Cross Section B-B'}	2-1831
Figure 2.5-98	{Site Cross Section C-C'}	2-1832
Figure 2.5-99	{Site Cross Section D-D'}	2-1833
Figure 2.5-100	{Site Cross Section E-E'}	2-1834
Figure 2.5-101	{Surficial Sediments of the Berwick Quadrangle}	2-1835
Figure 2.5-102	{Surficial Sediments Description}	2-1836
Figure 2.5-103	{Site Geotechnical Investigation Plan}	2-1837
Figure 2.5-104	{Seismic Velocity Contours}	2-1838
Figure 2.5-105	{Bedrock Elevation Contour Map}	2-1839
Figure 2.5-106	{Boring Location Plan}	2-1840
Figure 2.5-107	{Geotechnical Cross Sections}	2-1841
Figure 2.5-108	{Geotechnical Subsurface Section A-A'}	2-1842
Figure 2.5-109	{Geotechnical Subsurface Section B-B'}	2-1843
Figure 2.5-110	{Geotechnical Subsurface Section C-C'}	2-1844
Figure 2.5-111	{Geotechnical Subsurface Section D-D'}	2-1845
Figure 2.5-112	{Surface Elevation Contours}	2-1846
Figure 2.5-113	{Thickness of Overburden}	2-1847
Figure 2.5-114	{Thickness of Weathered Rock}	2-1848
Figure 2.5-115	{Elevation of Competent Rock}	2-1849
Figure 2.5-116	{Overburden Thickness and Elevation of Rock (Area near Essential Service Water Emergency Makeup System - ESWEMS)}	2-1850
Figure 2.5-117	{Location of Shelby Tubes}	2-1851
Figure 2.5-118	{Location of Special Care Samples}	2-1852

Figure 2.5-119{Standard Penetration Test (SPT) Variability}	2-1853
Figure 2.5-120{Geophysical Tests B-301}	2-1854
Figure 2.5-121{Geophysical Tests G-301}	2-1855
Figure 2.5-122{{Geophysical Tests G-302}}	2-1856
Figure 2.5-123{Geophysical Tests G-303}	2-1857
Figure 2.5-124{Refraction Survey Page 1 of 7}	2-1858
Figure 2.5-125{Refraction Survey Page 2 of 7}	2-1859
Figure 2.5-126{Refraction Survey Page 3 of 7}	2-1860
Figure 2.5-127{Refraction Survey Page 4 of 7}	2-1861
Figure 2.5-128{Refraction Survey Page 5 of 7}	2-1862
Figure 2.5-129{Refraction Survey Page 6 of 7}	2-1863
Figure 2.5-130{Refraction Survey Page 7 of 7}	2-1864
Figure 2.5-131{Resonant Column Test A B331-ST-2}	2-1865
Figure 2.5-132{Resonant Column Test A B310-U3}	2-1866
Figure 2.5-133{Resonant Column Test Pit Face}	2-1867
Figure 2.5-134{NI Soil Velocity Profile}	2-1868
Figure 2.5-135{Recommended Strain Dependent Properties}	2-1869
Figure 2.5-136{Excavation Plan}	2-1870
Figure 2.5-137{Excavation West Profile}	2-1871
Figure 2.5-138{Excavation East Profile}	2-1872
Figure 2.5-139{Excavation Cross Section}	2-1873
Figure 2.5-140{Liquefaction Analysis Vs Method}	2-1874
Figure 2.5-141{Liquefaction Analysis, SPT Method}	2-1875
Figure 2.5-142{NI Settlement Analysis Service Loads}	2-1876
Figure 2.5-143{NI Settlement Analysis Results}	2-1877
Figure 2.5-144{Examples of Earth Pressure Diagrams}	2-1878
Figure 2.5-145{ESWEMS and Cross Sections}	2-1879
Figure 2.5-146{North Side Natural Slope}	2-1880
Figure 2.5-147{Permanent Slope Cross Sections}	2-1881
Figure 2.5-148{Temporary Slopes Cross Sections}	2-1882
Figure 3.7-1 {Comparison of BBNPP GMRS and EUR CSDRS, 5% Damping (Horizontal)} . . .	3-61
Figure 3.7-2 {Comparison of BBNPP GMRS and EUR CSDRS, 5% Damping (Vertical)} .	3-62
Figure 3.7-3 {BBNPP Horizontal SSE Ground Motion and EUR CSDRS Anchored at 0.1g PGA Horizontal Direction, 5% Damping}	3-63
Figure 3.7-4 {Comparison of BBNPP FIRS (EPGB 1 and 2) and EUR CSDRS, Horizontal Direction, 5% Damping}	3-63
Figure 3.7-5 {Comparison of BBNPP FIRS (EPGB 1 and 2) and EUR CSDRS, Vertical Direction, 5% Damping}	3-64
Figure 3.7-6 {Comparison of BBNPP FIRS (EPGB 3 and 4) and EUR CSDRS, Horizontal Direction, 5% Damping}	3-64
Figure 3.7-7 {Comparison of BBNPP FIRS (EPGB 3 and 4) and EUR CSDRS, Vertical Direction, 5% Damping}	3-65
Figure 3.7-8 {Comparison of BBNPP FIRS (ESWB 1 & 2) and EUR CSDRS, Horizontal Direction, 5% Damping}	3-65
Figure 3.7-9 {Comparison of BBNPP FIRS (ESWB 1 &2) and EUR CSDRS, Vertical Direction, 5% Damping}	3-66
Figure 3.7-10 {Comparison of BBNPP FIRS (ESWB 3) and EUR CSDRS, Horizontal Direction, 5% Damping}	3-66
Figure 3.7-11 {Comparison of BBNPP FIRS (ESWB 3) and EUR CSDRS, Vertical Direction, 5%	

	Damping}	3-67
Figure 3.7-12	{Comparison of BBNPP FIRS (ESWB 4) and EUR CSDRS, Horizontal Direction, 5% Damping}	3-67
Figure 3.7-13	{Comparison of BBNPP FIRS (ESWB 4) and EUR CSDRS, Vertical Direction, 5% Damping}	3-68
Figure 3.7-14	{Shear Wave Velocity Profiles Below NI Base Mat for BBNPP}.	3-68
Figure 3.7-15	{EPR DC Soil Cases (Uniform) vs BBNPP Soil Cases for SSI Analysis of NI} 3-69	
Figure 3.7-16	{EPR DC Soil Cases (Layered) vs BBNPP Soil Cases for SSI Analysis of NI} 3-69	
Figure 3.7-17	{NI Base Mat (Node 417) X- Direction Response Spectra at 5% Damping}	3-70
Figure 3.7-18	{NI Base Mat (Node 417) Y- Direction Response Spectra at 5%Damping}	3-70
Figure 3.7-19	{NI Base Mat (Node 417) Z- Direction Response Spectra at 5%Damping}	3-71
Figure 3.7-20	{EPGB 1 & 2 Base Mat X- Direction Response Spectra at 5% Damping}	3-71
Figure 3.7-21	{EPGB 1 & 2 Base Mat Y- Direction Response Spectra at 5% Damping}	3-72
Figure 3.7-22	{EPGB 1 & 2 Base Mat Z- Direction Response Spectra at 5% Damping}	3-72
Figure 3.7-23	{EPGB 3 & 4 Base Mat X- Direction Response Spectra at 5% Damping}	3-73
Figure 3.7-24	{EPGB 3 & 4 Base Mat Y- Direction Response Spectra at 5% Damping}	3-73
Figure 3.7-25	{EPGB 3 & 4 Base Mat Z- Direction Response Spectra at 5% Damping}	3-74
Figure 3.7-26	{ESWB 1 Base Mat X- Direction Response Spectra at 5% Damping}	3-74
Figure 3.7-27	{ESWB 1 Base Mat Y- Direction Response Spectra at 5% Damping}	3-75
Figure 3.7-28	{ESWB 1 Base Mat Z- Direction Response Spectra at 5% Damping}	3-75
Figure 3.7-29	{ESWB 2 Base Mat X- Direction Response Spectra at 5% Damping}	3-76
Figure 3.7-30	{ESWB 2 Base Mat Y- Direction Response Spectra at 5% Damping}	3-76
Figure 3.7-31	{ESWB 2 Base Mat Z- Direction Response Spectra at 5% Damping}	3-77
Figure 3.7-32	{ESWB 3 Base Mat X- Direction Response Spectra at 5% Damping}	3-77
Figure 3.7-33	{ESWB 3 Base Mat Y- Direction Response Spectra at 5% Damping}	3-78
Figure 3.7-34	{ESWB 3 Base Mat Z- Direction Response Spectra at 5% Damping}	3-78
Figure 3.7-35	{ESWB 4 Base Mat X- Direction Response Spectra at 5% Damping}	3-79
Figure 3.7-36	{ESWB 4 Base Mat Y- Direction Response Spectra at 5% Damping}	3-79
Figure 3.7-37	{ESWB 4 Base Mat Z- Direction Response Spectra at 5% Damping}	3-80
Figure 3.7-38	{Reactor Bldg Internal Structure, Elev. 5.15m, X (E-W) Direction, 5% Damping}	3-80
Figure 3.7-39	{Reactor Bldg Internal Structure, Elev. 5.15m, Y (N-S) Direction, 5%Damping}	3-81
Figure 3.7-40	{Reactor Bldg Internal Structure, Elev. 5.15m, Z (Vert) Direction, 5%Damping}	3-82
Figure 3.7-41	{Reactor Bldg Internal Structure, Elev. 19.5m, X (E-W) Direction, 5%Damping}	3-83
Figure 3.7-42	{Reactor Bldg Internal Structure, Elev. 19.5m, Y (N-S) Direction, 5%Damping}	3-84
Figure 3.7-43	{Reactor Bldg Internal Structure, Elev. 19.5m, Z (Vert) Direction, 5% Damping}	3-85
Figure 3.7-44	{Safeguard Building 1, Elev. 8.1m, X (E-W) Direction, 5% Damping}	3-85
Figure 3.7-45	{Safeguard Building 1, Elev. 8.1m, Y (N-S) Direction, 5% Damping}	3-86
Figure 3.7-46	{Safeguard Building 1, Elev. 8.1m, Z (Vert) Direction, 5% Damping}	3-87
Figure 3.7-47	{Safeguard Building 1, Elev. 21.0m, X (E-W) Direction, 5% Damping}	3-87
Figure 3.7-48	{Safeguard Building 1, Elev. 21.0m, Y (N-S) Direction, 5% Damping}	3-88
Figure 3.7-49	{Safeguard Building 1, Elev. 21.0m, Z (Vert) Direction, 5% Damping}	3-88
Figure 3.7-50	{Safeguard Building 2/3, Elev. 8.1m, X (E-W) Direction, 5% Damping}	3-89
Figure 3.7-51	{Safeguard Building 2/3, Elev. 8.1m, Y (N-S) Direction, 5% Damping}	3-89
Figure 3.7-52	{Safeguard Building 2/3, Elev. 8.1m, Z (Vert) Direction, 5% Damping}	3-90

Figure 3.7-53	{Safeguard Building 2/3, Elev. 15.4m, X (E-W) Direction, 5% Damping}	3-90
Figure 3.7-54	{Safeguard Building 2/3, Elev. 15.4m, Y (N-S) Direction, 5% Damping}	3-91
Figure 3.7-55	{Safeguard Building 2/3, Elev. 15.4m, Z (Vert) Direction, 5% Damping}	3-91
Figure 3.7-56	{Safeguard Building 4, Elev. 21.0m, X (E-W) Direction, 5% Damping}	3-92
Figure 3.7-57	{Safeguard Building 4, Elev. 21.0m, Y (N-S) Direction, 5% Damping}	3-92
Figure 3.7-58	{Safeguard Building 4, Elev. 21.0m, Z (Vert) Direction, 5% Damping}	3-93
Figure 3.7-59	{Containment Building, Elev. 37.6m, X (E-W) Direction, 5% Damping}	3-93
Figure 3.7-60	{Containment Building, Elev. 37.6m, Y (N-S) Direction, 5% Damping}	3-94
Figure 3.7-61	{Containment Building, Elev. 37.6m, Z (Vert) Direction, 5% Damping}	3-94
Figure 3.7-62	{Containment Building, Elev. 58.0m, X (E-W) Direction, 5% Damping}	3-95
Figure 3.7-63	{Containment Building, Elev. 58.0m, Y (N-S) Direction, 5% Damping}	3-95
Figure 3.7-64	{Containment Building, Elev. 58.0m, Z (Vert) Direction, 5% Damping}	3-96
Figure 3.7-65	{EPBG, Elev. 0.0m X (E-W) Direction, 5% Damping}	3-97
Figure 3.7-66	{{EPGB, Elev. 0.0m, Y (N-S) Direction, 5% Damping}}	3-98
Figure 3.7-67	{{EPGB, Elev. 0.0m, Z (Vert) Direction, 5% Damping}}	3-99
Figure 3.7-68	{ESWB, Elev. 19.20m, X (E-W) Direction, 5% Damping}	3-100
Figure 3.7-69	{ESWB, Elev. 19.20m, Y (N-S) Direction, 5% Damping}	3-101
Figure 3.7-70	{ESWB, Elev. 19.20m, Z (Vert) Direction, 5% Damping}	3-102
Figure 3.7-71	{ESWB, Elev. 4.27m, X (E-W) Direction, 5% Damping}	3-103
Figure 3.7-72	{ESWB, Elev. 4.27m, Y (N-S) Direction, 5% Damping}	3-104
Figure 3.7-73	{ESWB, Elev. 4.27m, Z (Vert) Direction, 5% Damping}	3-105
Figure 3.7-74	{Stick vs. FEM Spectrum Comparison at Elev. 58.00m – Containment Dome Apex (Without Polar Crane), 5% Damping X-Direction}	3-106
Figure 3.7-75	{Stick vs. FEM Spectrum Comparison at Elev. 58.00m – Containment Dome Apex (Without Polar Crane), 5% Damping Y-Direction}	3-106
Figure 3.7-76	{Stick vs. FEM Spectrum Comparison at Elev. 58.00m – Containment Dome Apex (Without Polar Crane), 5% Damping Z-Direction}	3-107
Figure 3.7-77	{Stick vs. FEM Spectrum Comparison at Elev. 37.60m – Containment Building (Without Polar Crane), 5% Damping X-Direction}	3-108
Figure 3.7-78	{Stick vs. FEM Spectrum Comparison at Elev. 37.60m – Containment Building (Without Polar Crane), 5% Damping Y-Direction}	3-109
Figure 3.7-79	{Stick vs. FEM Spectrum Comparison at Elev. 37.60m – Containment Building (Without Polar Crane), 5% Damping Z-Direction}	3-110
Figure 3.7-80	{Spectrum Comparison at Elev. 19.50m – Reactor Building Internal Structure, 4% Damping X-Direction}	3-111
Figure 3.7-81	{Spectrum Comparison at Elev. 19.50m – Reactor Building Internal Structure, 4% Damping Y-Direction}	3-111
Figure 3.7-82	{Spectrum Comparison at Elev. 19.50m – Reactor Building Internal Structure, 4% Damping Z-Direction}	3-112
Figure 3.7-83	{Spectrum Comparison at Elev. 5.15m – Reactor Building Internal Structure, 4% Damping X-Direction}	3-113
Figure 3.7-84	{Spectrum Comparison at Elev. 5.15m – Reactor Building Internal Structure, 4% Damping Y-Direction}	3-113
Figure 3.7-85	{Spectrum Comparison at Elev. 5.15m – Reactor Building Internal Structure, 4% Damping Z-Direction}	3-114
Figure 3.7-86	{3D Finite Element Model of Balance of NI Common Base Mat Structures Perspective View}	3-115
Figure 3.7-87	{Section Cutoff of Dynamic FE Model}	3-116
Figure 3.7-88	{Balance of NI Individual Component of Dynamic FE Model}	3-117
Figure 3.7-89	{Reactor Building Internal Structure of Dynamic FE Model}	3-118

Figure 3.7-90 {Reactor Containment Building of Dynamic FE Model}	3-119
Figure 3.7-91 {Reactor Coolant System of Dynamic FE Model}	3-120
Figure 3.7-92 {Isometric View of FEM for EPGB}	3-121
Figure 3.7-93 {BBNPP Response Spectra at NI Common Base Mat Structure (Node 417) – 5% Damping, X - Direction}	3-122
Figure 3.7-94 {BBNPP Response Spectra at NI Common Base Mat Structure (Node 417) – 5% Damping, Y - Direction}	3-122
Figure 3.7-95 {BBNPP Response Spectra at NI Common Base Mat Structure (Node 417) – 5% Damping, Z - Direction}	3-123
Figure 3.7-96 {BBNPP Response Spectra at Centers of Footprints of EPGB and ESWB – 5% Damping, X - Direction}	3-124
Figure 3.7-97 {BBNPP Response Spectra at Centers of Footprints of EPGB and ESWB – 5% Damping, Y - Direction}	3-124
Figure 3.7-98 {BBNPP Response Spectra at Centers of Footprints of EPGB and ESWB – 5% Damping, Z - Direction}	3-125
Figure 3.7-99 {Comparison of Response Spectra – Dynamic Versus Static Model, Reactor Shield Building, X-Direction}	3-126
Figure 3.7-100{Comparison of Response Spectra – Dynamic Versus Static Model, Reactor Shield Building, Y-Direction}	3-127
Figure 3.7-101{Comparison of Response Spectra – Dynamic Versus Static Model, Reactor Shield Building, Z-Direction}	3-128
Figure 3.7-102{Comparison of Response Spectra – Dynamic Versus Static Model, Reactor Building Internal Structure, X-Direction}	3-129
Figure 3.7-103{Comparison of Response Spectra – Dynamic Versus Static Model, Reactor Building Internal Structure, Y-Direction}	3-129
Figure 3.7-104{Comparison of Response Spectra – Dynamic Versus Static Model, Reactor Building Internal Structure, Z-Direction}	3-130
Figure 3.7-105{Comparison of Response Spectra – Dynamic Versus Static Model, Containment Building, X-Direction}	3-130
Figure 3.7-106{Comparison of Response Spectra – Dynamic Versus Static Model, Containment Building, Y-Direction}	3-131
Figure 3.7-107{Comparison of Response Spectra – Dynamic Versus Static Model, Containment Building, Z-Direction}	3-131
Figure 3.7-108{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Building 1, X-Direction}	3-132
Figure 3.7-109{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Building 1, Y-Direction}	3-133
Figure 3.7-110{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Building 1, Z-Direction}	3-134
Figure 3.7-111{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Buildings 2 and 3, X-Direction}	3-135
Figure 3.7-112{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Buildings 2 and 3, Y-Direction}	3-136
Figure 3.7-113{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Buildings 2 and 3, Z-Direction}	3-137
Figure 3.7-114{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Building 4, X-Direction}	3-138
Figure 3.7-115{Comparison of Response Spectra – Dynamic Versus Static Model, Safeguard Building 4, Y-Direction}	3-139
Figure 3.7-116{Comparison of Response Spectra – Dynamic Versus Static Model,	

Safeguard Building 4, Z-Direction}	3-140
Figure 3.7-117{Spectrum Envelope of Reactor Bldg Internal Structure, Elev. 5.15m, X (E-W) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-141
Figure 3.7-118{Spectrum Envelope of Reactor Bldg Internal Structure, Elev. 5.15m, Y (N-S) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-141
Figure 3.7-119{Spectrum Envelope of Safeguard Building 1, Elev. 8.1m, X (E-W) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-142
Figure 3.7-120{Spectrum Envelope of Safeguard Building 1, Elev. 8.1m, Y (N-S) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-142
Figure 3.7-121{Spectrum Envelope of Safeguard Building 2/3, Elev. 8.1m, X (E-W) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-143
Figure 3.7-122{Spectrum Envelope of EPGB, Elev. 0.0m, X (E-W) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-144
Figure 3.7-123{Spectrum Envelope of EPGB, Elev. 0.0m, Y (N-S) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-145
Figure 3.7-124{Spectrum Envelope of EPGB, Elev. 0.0m, Z (Vert) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-146
Figure 3.7-125{Spectrum Envelope of ESWB, Elev. 19.20m, X (E-W) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-147
Figure 3.7-126{Spectrum Envelope of ESWB, Elev. 19.20m, Y (N-S) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-148
Figure 3.7-127{Spectrum Envelope of ESWB, Elev. 19.20m, Z (Vert) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-149
Figure 3.7-128{Spectrum Envelope of ESWB, Elev. 4.27m, X (E-W) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-150
Figure 3.7-129{Spectrum Envelope of ESWB, Elev. 4.27m, Y (N-S) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-151
Figure 3.7-130{Spectrum Envelope of ESWB, Elev. 4.27m, Z (Vert) Direction, 2%, 3%, 4%, 5%, 7%, and 10% Damping}	3-152
Figure 3.7-131{Horizontal and Vertical FIRS at Elevation 669 ft msl (203.9 m)}	3-153
Figure 3.7-132{N-S Direction Time Histories Matching ESWEMS Foundation Level FIRS}	3-154
Figure 3.7-133{E-W Direction Time Histories Matching ESWEMS Foundation Level FIRS}	3-155
Figure 3.7-134{Vertical Direction Time Histories Matching ESWEMS Foundation Level FIRS}	3-156
Figure 3.7-135{Response Spectra Computed from the Time History and Target FIRS in N-S Direction}	3-157
Figure 3.7-136{Response Spectra Computed from the Time History and Target FIRS in E-W Direction}	3-158
Figure 3.7-137{Response Spectra Computed from the Time History and Target FIRS in Vertical Direction}	3-159
Figure 3.7-138{Low-Strain Body Wave Velocity Profile Below the Pumphouse}	3-160
Figure 3.7-139{Strain-Compatible Soil Properties for the Lower Bound, Best Estimate and Upper Bound Profiles}	3-161
Figure 3.7-140{In-Structure Floor Response Spectra in E-W Direction at First Floor Level of the ESWEMS Pumphouse}	3-162
Figure 3.7-141{In-Structure Floor Response Spectra in N-S Direction at First Floor Level of the ESWEMS Pumphouse}	3-163
Figure 3.7-142{In-Structure Floor Response Spectra in Vertical Direction at First Floor Level of the ESWEMS Pumphouse}	3-164
Figure 3.7-143{In-Structure Floor Response Spectra in E-W Direction at Mezzanine Level	

of the ESWEMS Pumphouse}	3-165
Figure 3.7-144{In-Structure Floor Response Spectra in N-S Direction at Mezzanine Level of the ESWEMS Pumphouse}	3-166
Figure 3.7-145{In-Structure Floor Response Spectra in Vertical Direction at Mezzanine Level of the ESWEMS Pumphouse}	3-167
Figure 3.7-146{In-Structure Floor Response Spectra in E-W Direction at Roof Level of the ESWEMS Pumphouse}	3-168
Figure 3.7-147{In-Structure Floor Response Spectra in N-S Direction at Roof Level of the ESWEMS Pumphouse}	3-169
Figure 3.7-148{In-Structure Floor Response Spectra in Vertical Direction at Roof Level of the ESWEMS Pumphouse}	3-170
Figure 3.7-149{Isometric View of the ESWEMS Pumphouse GT-Strudl Finite Element Model - Exterior Wall, Roof and Apron}	3-171
Figure 3.7-150{Isometric View of the ESWEMS Pumphouse GT-Strudl Finite Element Model - Exterior Wall, Roof and Apron}	3-172
Figure 3.7-151{BBNPP Buried Pipe Horizontal FIRS}.	3-173
Figure 3.7-152{BBNPP Buried Pipe Vertical FIRS}.	3-174
Figure 3.8-1 {Schematic Site Plan of Seismic Category I Buried Utilities at the NI (Electrical Duct Banks)}	3-197
Figure 3.8-2 {Schematic Site Plan of Seismic Category I Buried Utilities at the NI (Underground Piping)}	3-198
Figure 3.8-3 {Isometric View of the GT Strudl Finite Element Model for the ESWEMS Pumphouse Structure (Partial View of Base Mat, Exterior Walls, and Interior Walls)} 3-199	3-199
Figure 3.8-4 {Isometric View of the GT Strudl Finite Element Model for the ESWEMS Pumphouse Structure (Partial View of Pump Wells, Wing Walls and Apron)}	3-200
Figure 3E.4-1 {Isometric View of ESWEMS Pumphouse Main Base Mat & Pump Well Base - Finite Element Mesh}	3-13
Figure 3E.4-2 {Isometric View of ESWEMS Pumphouse GT Strudl Finite Element Model - Exterior Wall, Roof and Apron}	3-14
Figure 3E.4-3 {GT Strudl Finit Element Planar Reference System}	3-15
Figure 3E.4-4 {Plant Arrangement - ESWEMS Pumphouse Excavation Cut & Backfill}.	3-16
Figure 3E.4-5 {Plant Arrangement - ESWEMS Retention Pond & Pumphouse Location Plan} . . . 3-17	3-17
Figure 3E.4-6 {Plant Arrangement - ESWEMS Retention Pond Typical Riprap Detail}	3-18
Figure 3E.4-7 {Plant Arrangement - ESWEMS Retention Pond Spillway Plan}	3-19
Figure 3E.4-8 {Plant Arrangement - ESWEMS Retention Pond Spillway Section}.	3-20
Figure 3E.4-9 {Plant Arrangement - ESWEMS Retention Pond Section at Embankment}.	3-21
Figure 3E.4-10{Plant Arrangement - ESWEMS Retention Pond Section at Embankment}.	3-22
Figure 3E.4-11{Plant Arrangement - ESWEMS Retention Pond Section at Embankment}.	3-23
Figure 3E.4-12{Plant Arrangement - ESWEMS Pumphouse Rebar}.	3-24
Figure 8.1-1 {BBNPP Site 500 kV Circuit Corridors}	8-5
Figure 8.2-1 {BBNPP Unit 3 500kV Switchyard and Transmission Line Layout}	8-23
Figure 8.2-2 {BBNPP 500kV Switchyard Single Line Diagram}	8-24
Figure 8.3-1 {BBNPP Emergency Power Supply System Single Line Drawing}	8-30
Figure 8.3-2 {BBNPP Normal Power Supply System Single Line Drawing}.	8-33
Figure 9.2-1 {Potable Water}	9-25
Figure 9.2-2 {Sanitary Waste Water System}.	9-26
Figure 9.2-3 {ESWEMS Schematic}	9-27
Figure 9.2-4 {Plant Arrangement - ESWEMS Pumphouse Floor Plan}	9-28

Figure 9.2-5	{Plant Arrangement - ESWEMS Pumphouse Section A-A}	9-29
Figure 9.2-6	{Plant Arrangement - ESWEMS Pumphouse Section B-B}	9-30
Figure 9.2-7	{Plant Arrangement - ESWEMS Pumphouse Section C-C}	9-31
Figure 9.2-8	{Plant Arrangement - ESWEMS Pumphouse Pumpwell Plan}	9-32
Figure 9.2-9	{Plant Arrangement - ESWEMS Pumphouse Mezzanine Plan}	9-33
Figure 9.2-10	{Plant Arrangement - ESWEMS Pumphouse Roof Plan}	9-34
Figure 9.2-11	{Raw Water System}	9-35
Figure 9.4-1	{ESWEMS Pumphouse HVAC}	9-44
Figure 9.4-2	{ESWEMS Pumphouse HVAC Duct and Instrumentation Diagram}	9-45
Figure 9.5-1	Fire Protection Organization.	9-63
Figure 9B-1	{Fire Barrier Location, Turbine Building Plan at Elevation (-)23 ft}	9B-42
Figure 9B-2	{Fire Barrier Location, Turbine Building Plan at Elevation 0 ft}	9B-43
Figure 9B-3	{Fire Barrier Location, Turbine Building Plan at Elevation +38 ft}	9B-44
Figure 9B-4	{Fire Barrier Location, Turbine Building Plan at Elevation +65 ft}	9B-45
Figure 9B-5	{Fire Barrier Location, Turbine Building Plan at Elevation (-)43 ft}	9B-46
Figure 9B-6	{Fire Barrier Location, Turbine Building Roof Plan}	9B-47
Figure 9B-7	{Fire Barrier Location, Turbine Building Section A-A}	9B-48
Figure 9B-8	{Fire Barrier Location, Turbine Building Section B-B}	9B-49
Figure 9B-9	{Fire Barrier Location, Turbine Building Section C-C}	9B-50
Figure 9B-10	{Fire Barrier Location, SWGR-SBO Buildings Plan View at Elevation (-)13 ft}	9B-51
Figure 9B-11	{Fire Barrier Location, SWGR-SBO-AUX BLR Buildings Plan View at Elevation 0 ft}	9B-52
Figure 9B-12	{Fire Barrier Location, SWGR-SBO-AUX BLR Buildings Plan View at Elevation 13 ft}	9B-53
Figure 9B-13	{Fire Barrier Location, SWGR-SBO-AUX BLR Buildings Plan View at Elevation 24.5 ft}	9B-54
Figure 9B-14	{Fire Barrier Location, SWGR-SBO-AUX BLR Buildings Plan View Section A-A}	9B-55
Figure 9B-15	{Fire Barrier Location, Transformer Area Plan View at Elevation 0 ft}	9B-56
Figure 9B-16	{Fire Barrier Location, Warehouse Building Plan}	9B-57
Figure 9B-17	{Fire Barrier Location, Security Access Facility Plan}	9B-58
Figure 9B-18	{Fire Barrier Location, Central Gas Supply Building Plan View at Elevation 85'0"}	9B-59
Figure 9B-19	{Fire Barrier Location, Grid Systems Control Building}	9B-60
Figure 9B-20	{Fire Barrier Location, Fire Protection Building Plan View at Elevation 85'0"}	9B-61
Figure 9B-21	{Fire Barrier Location, Cooling Tower Structure, Plan View and Section A-A}	9B-62
Figure 9B-22	{Fire Barrier Location, Circulating Water System Pumphouse}	9B-63
Figure 9B-23	{Fire Barrier Location, ESWEMS Ground Floor and Mezzanine Plan}	9B-64
Figure 9B-24	{Fire Barrier Location, Circulating Water System Makeup Water Intake Structure}	9B-65
Figure 10.4-1	{Circulating Water System P&ID (at Cooling Tower)}	10-18
Figure 10.4-2	{CWS Pumphouse (Plan View)}	10-19
Figure 10.4-3	{CWS Pumphouse (Section View)}	10-20
Figure 10.4-4	{Circulating Water System Cooling Tower}	10-21
Figure 10.4-5	{Circulating Water System P&ID (Makeup System)}	10-22
Figure 10.4-6	{CWS Makeup Water Intake Structure (Plan View)}	10-23
Figure 10.4-7	{CWS Makeup Water Intake Structure (Section View)}	10-24

Figure 10.4-8 {Circulating Water System P&ID (Blowdown System)}	10–25
Figure 10.4-9 {Discharge Diffuser}	10–26
Figure 12.3-1 {Site Layout}	12–29
Figure 12.3-2 {CST and RWST Locations on Plant Grid}	12–30
Figure 12.3-3 {Source Location}	12–31
Figure 12.3-4 {Annual Dose Rate in 2017 in Units of mrem 8760 hours}	12–32
Figure 12.3-5 {Worker Zone Locations}	12–33
Figure 12.3-6 {ISFSI Distance Equation}	12–34
Figure 12.3-7 {ISFSI Satellite Image}	12–35
Figure 12.3-8 {SSES ISFSI (blue border) with TLDs and Grid}	12–36
Figure 12.3-9 {TLD (ID 13S2) Data Verifying Time Correlation Function}	12–37
Figure 12.3-10{Dose vs Distance for CSTs}	12–38
Figure 12.3-11{Dose vs Distance for LLRWHF}	12–39
Figure 12.3-12{Dose vs Distance for SEALAND Containers}	12–40
Figure 12.3-13{Dose vs Distance for Steam Dryer Storage Vault}	12–41
Figure 12.3-14{Dose vs Distance for Turbine Building}	12–42
Figure 13.1-1 {BBNPP Organization Chart}	13–23

