Chapter 1 Table of Contents

Chapter 1 List of Tables

Chapter 1 List of Figures

Chapter 1 Introduction and General Description of the Plant

1.1 Introduction

This Site Safety Analysis Report (SSAR) supports the Exelon Nuclear Texas Holdings, LLC (Exelon) Early Site Permit (ESP) application. The SSAR addresses site suitability issues and complies with the applicable portions of 10 CFR 52, Subpart A, Early Site Permits.

The site selected for the ESP is the Victoria County Station (VCS) site located in the southern part of Victoria County, Texas, approximately 13.3 miles south of the city of Victoria, Texas. The VCS site is comprised of approximately 11,500 acres of land.

Exelon has not selected a particular reactor design to be constructed at the VCS site. Thus, in order to provide sufficient design information to enable the NRC to determine that the site is suitable for new units, a set of bounding plant parameters, termed the plant parameters envelope (PPE), has been provided (see Section 2.0). The combination of PPE design parameter and site characteristic values that would form the basis for the NRC's issuance of an ESP is identified in this SSAR.

The SSAR contains information about site safety, emergency preparedness, and quality assurance. The following paragraphs briefly describe the contents of the SSAR:

- Chapter 1, Introduction and General Description of the Plant, includes a general site description, an overview of reactor technologies considered, and a summary of regulatory compliance.
- Chapter 2, Site Characteristics, includes a discussion of the PPE approach, geography and demography, nearby industrial installations, transportation and military facilities, and meteorologic, hydrologic, geologic, and seismic characteristics of the site, including information about aircraft hazards. It also includes descriptions of effluents, thermal discharges, and conformance with 10 CFR 100, Reactor Site Criteria, requirements.
- Chapter 3, Design of Structures, Components, Equipment, and Systems, contains a pointer to information on aircraft hazards located in Chapter 2.
- Chapter 11, Radioactive Waste Management, contains an analysis of liquid and gaseous effluents from normal operations.
- Chapter 13, Conduct of Operations, includes emergency planning and industrial security information.
- Chapter 15, Accident Analyses, includes accident and dose consequence analyses required by 10 CFR 52.17(a)(1), 50.34(a)(1), and 100.21(c)(2), applying the PPE approach.

- Chapter 17, Quality Assurance, includes a description of the quality assurance program (QAP) under which the ESP application has been prepared and provides a proposed Quality Assurance Program Description (QAPD) to address the requirements of 10 CFR 52.17(a)(1)(xi).

1.2 General Plant Description

1.2.1 Site Location

The VCS site is comprised of approximately 11,500 acres of land and is approximately 13.3 miles south of the city of Victoria, in the southern part of Victoria County, Texas. Victoria County lies in the Coastal Plain region in the southeastern part of Texas and is bounded to the south by Calhoun and Refugio Counties, to the west by Goliad County, to the east by Jackson County, and to the north by DeWitt and Lavaca Counties. The northwest corner of the site boundary lies adjacent to U.S. Highway 77. The southeast site boundary runs parallel to the Union Pacific railway. Situated to the east is the unincorporated town of Bloomington, the largest community within 10 miles of the VCS site, with a population of 2562 (during the 2000 census).

Figures 2.1-1 and 2.1-2 show the VCS site location and the local area within 50 and 10 miles, respectively. A more detailed description of the VCS site location can be found in Section 2.1

1.2.2 Site Development

No specific plant design has been chosen for the VCS site. Instead, a set of bounding plant parameters is presented in Section 2.0 to envelop future VCS site development. This PPE is based on the addition of power generation consisting of one or more reactors or reactor modules. These reactors or groups of modules (the number of which may vary depending on the reactor type selected) would be distinct operating units. Each unit would consist of a plant of one or more modules that would not exceed 4500 MWth of nuclear generating capacity. Because a specific design has not been selected, boundaries have been established for the placement of the new units. The VCS site and the power block area boundaries are shown in Figures 1.2-1 and 1.2-2.

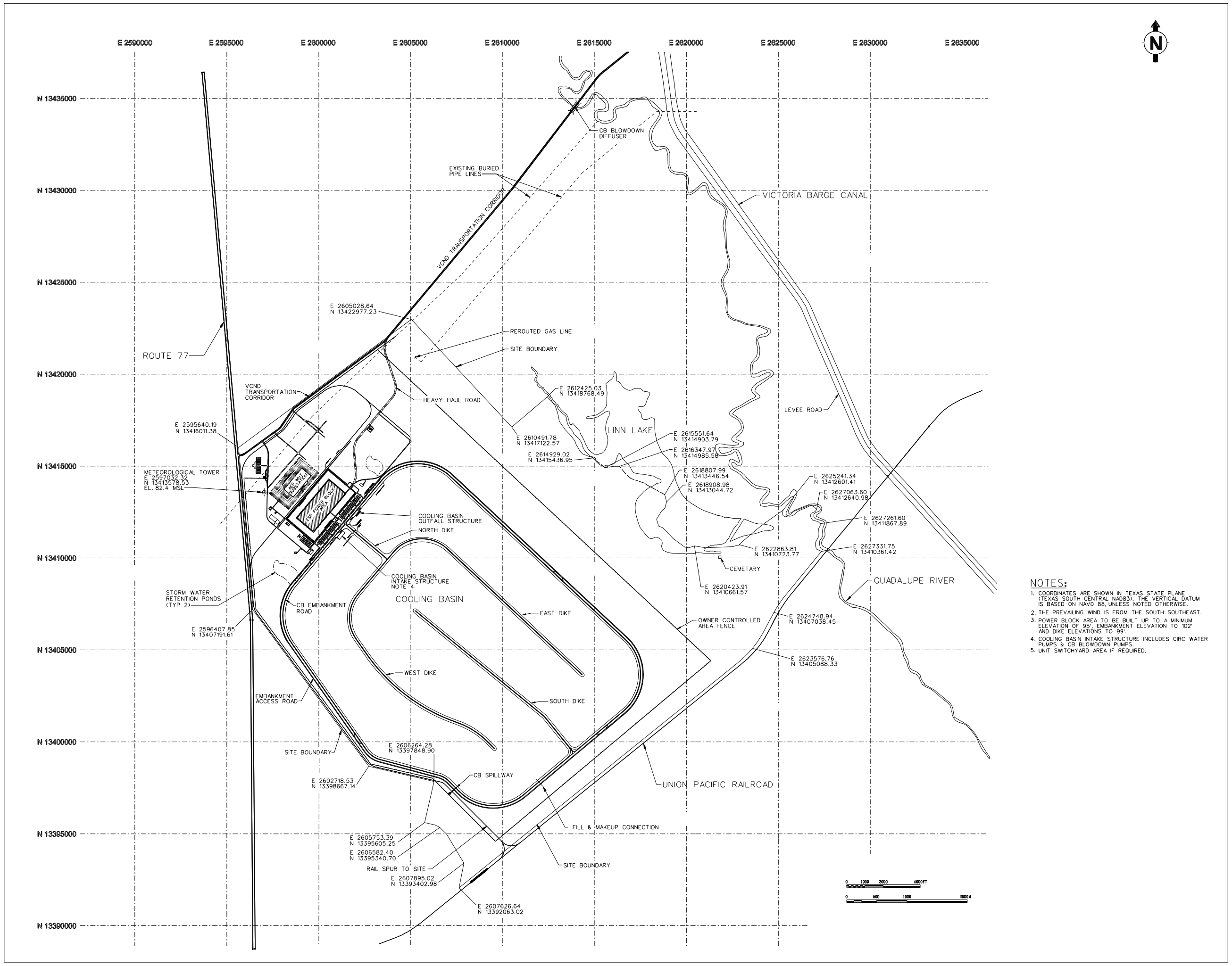

Figure 1.2-1 Victoria County Station Site

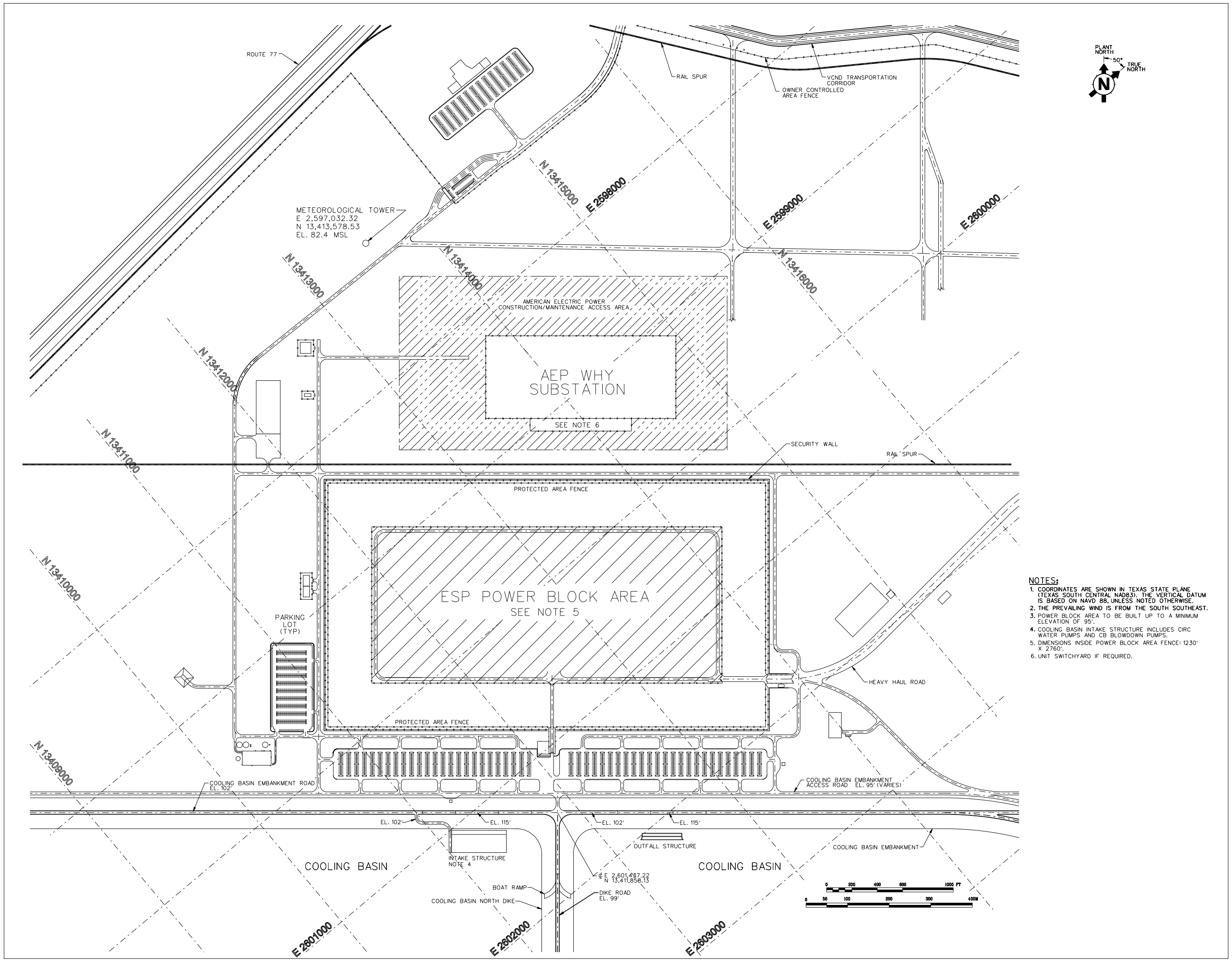

Figure 1.2-2 Victoria County Station Power Block Area

1.3 Comparison With Other Facilities

This section is not applicable to an ESP application using a PPE approach.

1.4 Identification of Agents and Contractors

Exelon selected Bechtel Power Corporation (Bechtel) as its primary contractor to assist with the preparation of the ESP application. In this role, Bechtel supplied personnel, systems, project management, and resources to work on an integrated team with Exelon.

1.4.1 Bechtel Power Corporation

Bechtel is responsible for the engineering and licensing efforts to coordinate and prepare the ESP application content and support the NRC's review of the ESP application. Founded in 1898, Bechtel is one of the world's premier engineering, construction, and project management companies. Bechtel has a history of supporting the nuclear power industry, beginning with the construction in 1950 of the EBR-1 reactor. Since then, Bechtel has constructed more than 60,000 MWe of nuclear power capacity worldwide.

1.4.2 Other Contractors

In addition to Bechtel, contractual relationships were established with several specialized consultants to assist in developing the ESP application. These include but are not limited to the following:

1.4.2.1 Tetra Tech NUS, Inc.

Tetra Tech NUS, Inc. (TtNUS) performed field investigations to characterize the VCS site and prepared portions of the SSAR and the Environmental Report. TtNUS also provided general National Environmental Policy Act (NEPA) consultation. TtNUS is an environmental and engineering consulting company with a history of service to the nuclear power industry since the inception of its predecessor company, Nuclear Utility Services (NUS) Corporation in 1960. TtNUS currently has 20 offices and approximately 700 employees throughout the country. TtNUS is a wholly owned subsidiary of Tetra Tech, Inc., which has approximately 9000 employees worldwide.

1.4.2.2 MACTEC Engineering and Consulting, Inc.

MACTEC Engineering and Consulting, Inc. (MACTEC) performed geotechnical field investigations and laboratory testing in support of SSAR Chapter 2. The scope of services provided by MACTEC included performing soil borings with standard penetration tests, obtaining undisturbed soil samples, performing cone penetrometer tests, performing geophysical and sonic logging of selected borings, drilling, installation and development of observation wells, performing field permeability tests for observation wells, performing laboratory tests of samples, providing as-drilled location surveys, and preparing final boring logs and other data reports. MACTEC is a leading engineering and design, environmental, and construction services company headquartered in Alpharetta, Georgia. The services provided for the VCS site are managed by MACTEC's office in Raleigh, North Carolina.

1.4.2.3 William Lettis and Associates, Inc.

William Lettis and Associates, Inc. (WLA) performed geotechnical field investigations, geologic mapping and characterization of seismic sources, and sensitivity analyses for the ESP application. They also provided support for the ESP application preparation. WLA is a consulting firm based in Walnut Creek, California specializing in applied earth sciences. WLA provides a range of services to support clients in developing ESP and COL applications, including detailed site characterization, assessment of capable tectonic features and seismic source zones, preparation of seismic source models for Probabilistic Seismic Hazard Assessment (PSHA) studies during project design, and preparation of Safety Analysis Reports. WLA developed new regulatory guidelines for the U.S. NRC (NUREG/CR-5562, Dating and Earthquakes: Review of Quaternary Geochronology and its Application to Paleoseismology, March 1998 and NUREG/CR-5503, Techniques for Identifying Faults and Determining Their Origins, July 1999) and has provided input and guidance for various international agencies to review or develop new regulatory criteria pertaining to seismic and geologic hazard studies.

1.4.2.4 Risk Engineering, Inc.

Risk Engineering, Inc. performed PSHAs and related sensitivity analyses in support of SSAR Chapter 2. These assignments included sensitivity analyses of seismic source parameters and updated ground motion attenuation relationships, development of updated safe shutdown earthquake ground motion values, and preparation of the related sections.

1.4.2.5 Murray and Trettel, Inc.

Murray and Trettel, Inc. of Palatine, Illinois installed the onsite meteorological tower and performed data collection and validation.

1.5 Requirements for Further Technical Information

No technical information development programs remain to be performed to support this ESP application.

1.6 Material Incorporated by Reference

No material has been incorporated by reference in this ESP application.

1.7 Drawings and Other Detailed Information

No such information has been submitted separately as part of this ESP application.

1.8 Interfaces With Standard Design

This section is not applicable to an ESP application using a PPE approach.

1.9 Conformance With Regulatory Criteria

This section addresses the conformance of the ESP application SSAR with applicable NRC regulations and guidance. NRC regulations are contained in Title 10 of the Code of Federal Regulations. NRC guidance is contained in NRC Regulatory Guides (RGs) and NUREG-0800, Standard Review Plan (SRP).

NRC regulations are legally binding requirements. If a legally binding requirement applicable to the ESP cannot be met, an exemption from the applicable regulation is needed. No exemptions to NRC regulations are required to support this ESP application.

Exception is identified when the guidance cannot be met as stated, but the intent or objective can be achieved by an acceptable alternative.

Table 1.9-1 lists the applicable regulations. This table provides the NRC regulation numbers, statements of conformance, and affected SSAR sections. Table 1.9-2 lists the applicable RGs. This table provides the RG numbers, titles, statements of conformance, and affected SSAR sections. Exceptions to conformance with the guidance in a RG are noted, as appropriate. The regulations and RGs listed in Table 1.9-1 and Table 1.9-2 are identified through the Acceptance Criteria and Evaluation Findings sections of the applicable SRP sections. Table 1.9-3 lists the applicable SRP sections. This table provides the SRP section numbers, titles, and statements of conformance.

Table 1.9-1
Conformance with Regulations

Regulation	Conformance	Affected SSAR Sections
10 CFR 20.1301	Conforms	11.2.3, 11.3.3
10 CFR 20.1302	Conforms	11.2.3, 11.3.3
10 CFR 20, Appendix B	Conforms	11.2.3, 11.3.3
10 CFR 50.34(a)(1)	Conforms	2.1.1, 2.1.2, 2.1.3, 2.3.5, 11.2.3, 11.3.3, Chapter 15
10 CFR 50.47	Conforms	2.3.3, 13.3
10 CFR 50.55a	Conforms	2.5.4, 2.5.5
10 CFR 50, Appendix A, GDC 2	Conforms	2.3.1, 2.3.2, 2.5.1, 2.5.2, 2.5.3, 2.5.4, 2.5.5
10 CFR 50, Appendix B	Conforms	2.5.4, 2.5.5, 17.1
10 CFR 50, Appendix E	Conforms	2.3.3, 13.3, Chapter 15
10 CFR 50, Appendix I	Conforms	2.3.3, 2.3.5, 11.2.3, 11.3.3
10 CFR 50, Appendix S	Conforms	2.5.4, 2.5.5
10 CFR 52.17(a)(1)	Conforms	Chapter 1, 2.0, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.5, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13, 2.5.1, 2.5.2, 2.5.3, 2.5.4, 2.5.5, 3.5.1.6, 11.2.3, 11.3.3, 13.6, Chapter 15, 17.1
10 CFR 52.17(b)(1)	Conforms	13.3
10 CFR 52.17(b)(2)	Conforms	13.3
10 CFR 52.17(b)(3)	Conforms	13.3
10 CFR 52.17(b)(4)	Conforms	13.3
10 CFR 73.55	Conforms	13.6
10 CFR 100	Conforms	2.0, 2.1.3, 2.5.2, 2.5.4, 2.5.5
10 CFR 100.3	Conforms	2.1.1, 2.1.2, 2.1.3
10 CFR 100.20(a)	Conforms	2.1.3
10 CFR 100.20(b)	Conforms	2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 3.5.1.6
10 CFR 100.20(c)	Conforms	2.3.1, 2.3.2, 2.3.3, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13
10 CFR 100.21(b)	Conforms	2.1.3
10 CFR 100.21(c)	Conforms	2.3.3, 2.3.4, 2.3.5, Chapter 15
10 CFR 100.21(d)	Conforms	2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13
10 CFR 100.21(e)	Conforms	2.2.3, 3.5.1.6
10 CFR 100.21(f)	Conforms	13.6
10 CFR 100.21(g)	Conforms	13.3
10 CFR 100.23	Conforms	2.5.1, 2.5.2, 2.5.3, 2.5.4, 2.5.5
10 CFR 100.23(d)	Conforms	2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13
40 CFR 190	Conforms	11.2.3, 11.3.3

Table 1.9-2 (Sheet 1 of 2)
Conformance with Regulatory Guides

Number	Regulatory Guide Title	Conformance	Affected SSAR Sections
1.23	Meteorological Monitoring Programs for Nuclear Power Plants, Rev. 1, 03/07	Conforms	2.3.2, 2.3.3, 2.3.4, 2.3.5
1.27	Ultimate Heat Sink for Nuclear Power Plants, Rev. 2, 01/76	Conforms	2.3.1, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.11, 2.4.12, 2.5.4, 2.5.5
1.28	Quality Assurance Program Requirements (Design and Construction), Rev. 3, 08/85	Conforms	2.5.4, 2.5.5
1.29	Seismic Design Classification, Rev. 4, 03/07	Conforms	2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11
1.59	Design Basis Floods for Nuclear Power Plants (Errata Published 7/30/80), Rev. 2, 08/77	Conforms	2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10
1.60	Design Response Spectra for Seismic Design of Nuclear Power Plants, Rev. 1,12/73	Conforms	2.5.2
1.76	Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants, Rev. 1, 03/07	Conforms	2.3.1
1.78	Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release, Rev. 1, 12/01	Conforms	2.2.1
1.91	Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants, Rev. 1, 02/78	Conforms	2.2.1, 2.2.2, 2.2.3
1.101	Emergency Response Planning and Preparedness for Nuclear Power Reactors, Rev. 5, 06/05	Conforms	13.3
1.102	Flood Protection for Nuclear Power Plants, Rev. 1, 09/76	Conforms	2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10
1.109	Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Rev. 1, 10/77	Conforms	2.3.5, 11.2.3, 11.3.3
1.111	Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, Rev. 1, 07/77	Conforms	2.3.3, 2.3.4, 2.3.5, 11.3.3
1.112	Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Nuclear Power Reactors, Rev. 1, 03/07	Conforms	2.3.5
1.113	Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I, Rev. 1, 04/77	Conforms	2.4.13
1.125	Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants, Rev. 2, 03/09	Conforms	2.4.8
1.132	Site Investigations for Foundations of Nuclear Power Plants, Rev. 2, 10/03	Conforms	2.5.1, 2.5.2, 2.5.3, 2.5.4, 2.5.5
1.138	Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants, Rev. 2, 12/03	Conforms	2.5.1, 2.5.4, 2.5.5

Table 1.9-2 (Sheet 2 of 2)
Conformance with Regulatory Guides

Number	Regulatory Guide Title	Conformance	Affected SSAR Sections
1.145	Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants, Rev. 1, 11/82	Conforms	2.3.4, 2.3.5, Chapter 15
1.165	Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion, Rev. 0, 03/97	Conforms	2.5.1, 2.5.2, 2.5.3
1.183	Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, Rev. 0, 07/00	Conforms	Chapter 15
1.198	Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites, Rev. 0, 11/03	Conforms	2.5.1, 2.5.3, 2.5.4, 2.5.5
1.206	Combined License Applications for Nuclear Power Plants (LWR Edition), Rev. 0, 06/07	Conforms Exception	Chapter 1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.3, 2.3.4, 2.3.5, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13, 2.5.1, 2.5.3, 2.5.4, 2.5.5, 3.5.1.6, 11.2.3, 11.3.3, 13.3, 13.6, Chapter 15, 17.1 2.3.2: 1) Neither the number of hours with precipitation nor rainfall rate distribution is presented. Precipitation wind roses also were not developed. 2) Fog duration is not included. 2.5.2: 1) Source mechanisms, source dimensions, and moment tensor are not provided routinely for all the events. They were presented when they were available. Distances between earthquakes and the site were not routinely calculated. 2) Time histories are not needed for the RVT procedure of P-SHAKE.
1.208	A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion, Rev. 0, 03/07	Conforms Exception	2.5.1, 2.5.3 2.5.2: 1) The fractile hazard curves are presented as graphical format. The curves adequately show the hazard with sufficient detail. 2) The UHRS for annual exceedance frequency of 10^{-6} is not required for development of GMRS.
4.7	General Site Suitability Criteria for Nuclear Power Stations, Rev. 2, 04/98	Conforms	2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.5.1, 2.5.2, 2.5.3, 13.6

Note: RGs not identified in Table 1.9-2 are not applicable to this ESP application.

**Table 1.9-3 (Sheet 1 of 2)
Conformance with Standard Review Plan**

SRP Section	Title	Conformance
1.0	Introduction and Interfaces, Rev. 1, 11/07	Conforms
2.0	Site Characteristics and Site Parameters, Rev. 0, 03/07	Conforms
2.1.1	Site Location and Description, Rev. 3, 03/07	Conforms
2.1.2	Exclusion Area Authority and Control, Rev. 3, 03/07	Conforms
2.1.3	Population Distribution, Rev. 3, 03/07	Conforms
2.2.1-2.2.2	Identification of Potential Hazards in Site Vicinity, Rev. 3, 03/07	Conforms
2.2.3	Evaluation of Potential Accidents, Rev. 3, 03/07	Conforms
2.3.1	Regional Climatology, Rev. 3, 03/07	Conforms
2.3.2	Local Meteorology, Rev. 3, 03/07	Conforms
2.3.3	Onsite Meteorological Measurements Programs, Rev. 3, 03/07	Conforms
2.3.4	Short-Term Atmospheric Dispersion Estimates for Accident Releases, Rev. 3, 03/07	Exception[a]
2.3.5	Long-Term Atmospheric Dispersion Estimates for Routine Releases, Rev. 3, 03/07	Conforms
2.4.1	Hydrologic Description, Rev. 3, 03/07	Conforms
2.4.2	Floods, Rev. 4, 03/07	Conforms
2.4.3	Probable Maximum Flood (PMF) on Streams and Rivers, Rev. 4, 03/07	Conforms
2.4.4	Potential Dam Failures, Rev. 3, 03/07	Conforms
2.4.5	Probable Maximum Surge and Seiche Flooding, Rev. 3, 03/07	Conforms
2.4.6	Probable Maximum Tsunami Hazards, Rev. 3, 03/07	Conforms
2.4.7	Ice Effects, Rev. 3, 03/07	Conforms
2.4.8	Cooling Water Canals and Reservoirs, Rev. 3, 03/07	Conforms
2.4.9	Channel Diversions, Rev. 3, 03/07	Conforms
2.4.10	Flooding Protection Requirements, Rev. 3, 03/07	Conforms
2.4.11	Low Water Considerations, Rev. 3, 03/07	Conforms
2.4.12	Groundwater, Rev. 3, 03/07	Conforms
2.4.13	Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters, Rev. 3, 03/07	Conforms
2.5.1	Basic Geologic and Seismic Information, Rev. 4, 03/07	Conforms
2.5.2	Vibratory Ground Motion, Rev. 4, 03/07	Conforms
2.5.3	Surface Faulting, Rev. 4, 03/07	Conforms
2.5.4	Stability of Subsurface Materials and Foundations, Rev. 3, 03/07	Conforms
2.5.5	Stability of Slopes, Rev. 3, 03/07	Conforms
3.5.1.6	Aircraft Hazards, Rev. 3, 03/07	Conforms
11.2	Liquid Waste Management System, Rev. 3, 03/07	Conforms
11.3	Gaseous Waste Management System, Rev. 3, 03/07	Conforms
13.3	Emergency Planning, Rev. 3, 03/07	Conforms
13.6.3[b]	Physical Security - Early Site Permit, Rev. 0, 03/07	Conforms

**Table 1.9-3 (Sheet 2 of 2)
Conformance with Standard Review Plan**

SRP Section	Title	Conformance
15.03[c]	Design Basis Accident Radiological Consequence Analyses for Advanced Light Water Reactors, Rev. 0, 03/07	Conforms
17.5[d]	Quality Assurance Program Description - Design Certification, Early Site Permit, and New License Applicants, Rev. 0, 03/07	Conforms

(a) The atmospheric diffusion parameters, such as lateral and vertical plume spread, are handled internally by the PAVAN model.
(b) This SRP Section applies to SSAR Section 13.6.
(c) This SRP Section applies to SSAR Chapter 15.
(d) This SRP Section applies to SSAR Section 17.1.

Note: SRP sections not identified in Table 1.9-3 are not applicable to this ESP application.

1.10 Overview of Reactor Types

Six reactor designs have been used to develop the site-related design parameter values listed in Part 2 of Table 2.0-1. These reactor designs are:

- Advanced Boiling Water Reactor (ABWR) (General Electric and Toshiba designs)
- Advanced Passive Pressurized Water Reactor (AP1000) (Westinghouse design)
- Economic Simplified Boiling Water Reactor (ESBWR) (General Electric–Hitachi design)
- Advanced Pressurized Water Reactor (APWR) (Mitsubishi design)
- mPower (Babcock & Wilcox design)

1.10.1 **Advanced Boiling Water Reactor**

The ABWR is an evolutionary design of the boiling water reactor (BWR), with designs by General Electric and Toshiba. The General Electric ABWR design has been certified by the NRC (under 10 CFR 52, Appendix A). The certified design is rated at 3926 MWt, with an estimated gross electrical output of 1356 MWe, and is a single-cycle, forced circulation BWR. The design is based on existing BWR designs operating in the United States, but incorporates several advanced features, including in-vessel-mounted recirculation pumps, fine motion control rod drives and an advanced digital and multiplexed instrumentation and control system. Additional changes have added a third division of safety-related equipment and improved the containment design. Electrical power generation is through the use of a standard steam turbine cycle.

To date, four ABWR units have been constructed and are currently in operation in Japan. Additional units are under construction in Taiwan (two) and Japan (one), with nine others in various stages of design in Japan. The ABWR is designed as a single-unit, stand-alone configuration. Two units would be placed on the VCS site.

1.10.2 **Advanced Passive Pressurized Water Reactor**

The Westinghouse AP1000 is a 3400 MWt pressurized water reactor (PWR) with an estimated gross electrical output of 1117 MWe. The AP1000 design has been certified by the NRC (under 10 CFR 52, Appendix D). The AP1000 is a two-loop, four-reactor-coolant-pump design that uses fuel, reactor vessel, and internals similar to those in service today at South Texas Project Units 1 and 2. The reactor coolant pumps are canned-type pumps to reduce the probability of leakage and to improve reliability.

The AP1000 is designed to use passive features for accident mitigation. An externally cooled steel containment building, in-containment refueling water storage tank, rapid depressurizing capability, and other design features allow the elimination of all safety-related alternating current powered equipment. Electrical power generation would be through the use of a standard steam turbine cycle.

The AP1000 is designed in a single-unit, stand-alone configuration. Two units would be placed on the VCS site.

1.10.3 Economic Simplified Boiling Water Reactor

The ESBWR, designed by General Electric–Hitachi Nuclear Energy, is a further evolution of previous BWR designs. The ESBWR is a 4500 MWt single-cycle BWR with an estimated gross electrical output of 1594 MWe. The ESBWR relies on the use of natural circulation and passive safety features to enhance plant performance and simplify the design. The use of natural circulation has allowed the elimination of several BWR systems. This has also increased plant accident reliability by eliminating active safety systems for emergency plant cooling.

The ESBWR has achieved its plant simplification by using innovative adaptations of operating plant systems, such as combining shutdown cooling and reactor water cleanup systems. It has also incorporated features used in other operationally-proven reactors, which include passive containment cooling, isolation condensers, natural circulation, and debris resistant fuel.

The ESBWR is designed as a single, stand-alone unit. Two units would be placed on the VCS site.

1.10.4 Advanced Pressurized Water Reactor

The APWR is an advanced light water reactor plant designed by Mitsubishi Heavy Industries, Ltd. It is a four-loop PWR with a gross electrical power rating of 1600 MWe to 1700 MWe. The rated core thermal power level is 4451 MWt. The APWR features highly reliable prevention functions, well-established mitigation systems with active safety functions and passive safety functions, and measures that protect against beyond design basis accidents. These three functions are integrated in a balanced APWR design, which has been developed using a deterministic design approach and the application of risk management technology and probabilistic risk assessment. Furthermore, the reliability of the physical barriers and the protection level are improved based on the concept of defense-in-depth, which is applied from normal operation to beyond design basis accidents.

The APWR is designed as a single, stand-alone unit. Two units would be placed on the VCS site.

1.10.5 mPower

The Babcock & Wilcox mPower is a modular advanced light water reactor design. It is a PWR that generates 425 MWt, with an estimated power output of 125 MWe. The mPower uses standard PWR fuel. It is a passive design with the reactor and steam generator located in a single reactor vessel, which is located in an underground containment.

The mPower is a passively safe design. The design precludes the possibility of a large pipe break loss of coolant accident because there are no large diameter primary loop penetrations. A design basis accident would not uncover the core. Emergency decay heat removal is done through the use of gravity-fed water tanks.

The mPower is a scalable design that is designed to be built in multiples of two or four reactors. Up to 12 reactors would be placed on the VCS site.