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Introduction for Design Control Document

1.0 Purpose of the DCD

The Design Control Document (DCD) contains information from various documents comprising the design certification application for the Advanced Boiling Water Reactor (ABWR) standard design. The purpose of the DCD is to provide, in a single document, design-related information to be incorporated by reference in the design certification rule for the ABWR standard design.

This Introduction describes the purpose, contents, and uses of the DCD, and is consistent with the design certification rule. However, this Introduction is not incorporated into the design certification rule and does not constitute a legal requirement. Licensing decisions shall be based upon the legal requirements in the design certification rule and 10 CFR Part 52. Additional guidance is provided in the Statement of Consideration for the design certification rule and 10 CFR Part 52.

2.0 Contents of the DCD

This document contains the DCD Introduction, the Certified Design Material (i.e., Tier 1), and the approved safety analysis material (i.e., Tier 2). Each is summarized below.

The Introduction describes the purpose, contents and uses of the DCD.

The Certified Design Material (Tier 1) for the ABWR includes the following information: (1) Definitions and General Provisions; (2) Design Descriptions; (3) Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC); (4) Significant Interface Requirements for interfaces of systems that are wholly or partially outside the scope of the ABWR standard design; and (5) Significant Site Parameters for the ABWR standard design plant. For ease of reference, Tier 1 includes a Table of Contents.

The approved safety analysis material (Tier 2) includes, to the extent applicable for the ABWR standard design, the following information: (1) the information required for a final safety analysis report under 10 CFR 50.34(b); and (2) other relevant information identified in 10 CFR 52.47(a), such as information related to the Three Mile Island requirements under 10 CFR 50.34(f); technical resolutions of the Unresolved Safety Issues and medium and high priority Generic Safety Issues; and important features identified from the assessments for the ABWR design. For ease of reference, Tier 2 contains a general Table of Contents at the beginning, as well as a detailed Table of Contents before each chapter.

The Design Descriptions, Interface Requirements, and Site Parameters in Tier 1 are derived entirely from the provisions of Tier 2, but may be more general than the provisions in Tier 2. Therefore, compliance with the more detailed Tier 2 material provides a sufficient method, but not the only acceptable method, for complying with the more general design provisions in Tier

1. The methods specified in Tier 2 shall be followed unless a change is made in accordance with the change processes specified in the design certification rule for the ABWR.

3.0 Uses of the DCD

3.1 In General

The design certification rule for the ABWR can be referenced in an application for a combined license (COL) under 10 CFR Part 52, and in the subsequently issued COL. Because the DCD is incorporated by reference in the design certification rule for the ABWR, the provisions of the DCD are effective with respect to an application or license that references that rule, with certain exceptions as provided in the rule and described in Sections 3.2, 3.3 and 3.4 below.

The DCD describes structures, systems, and components (including any associated programmatic provisions) within the scope of the ABWR standard design, and the requirements governing the interfaces between the ABWR standard design and the plant-specific design. An application for a COL that references the design certification rule for the ABWR must provide a plant-specific safety analysis report (SAR) which shall include information about the part of the plant that is outside the scope of the ABWR standard design or which is otherwise required by a relevant provision of 10 CFR Part 52, but is not included in the DCD (see Section 3.6 below). Together, the DCD and plant-specific SAR will provide the technically relevant information required for a COL, or for an application for a COL, that references the design certification rule for the ABWR.

3.2 Uses of the Certified Design Material

The following provisions describe the scope and uses of Tier 1 material:

- Design Descriptions - The Design Descriptions pertain only to the design of structures, systems, and components of an ABWR standard plant and not to its operation, maintenance and administration. In the event of an inconsistency between the Design Descriptions and the Tier 2 material, the Design Descriptions shall govern.
- ITAAC - An applicant or holder of a COL shall perform and demonstrate conformance with the ITAAC prior to fuel load. An applicant for a COL may proceed at its own risk with design and procurement activities, and a holder of a COL may proceed at its own risk with design, procurement, construction and preoperational activities, even though the NRC Staff may not yet have agreed that any particular ITAAC have been satisfied. In the event of a noncompliance with an ITAAC, the applicant or holder of a COL shall either take corrective actions to successfully complete the ITAAC or request a change in the ITAAC in accordance with the change processes specified in the design certification rule for the ABWR.
- Interface Requirements - The Tier 1 Interface Requirements identify the significant criteria for interfaces between systems within the scope of the ABWR standard design and other systems that are wholly or partially outside the scope of the ABWR standard design. The Tier 1 Interface Requirements define the significant attributes and performance characteristics that the out-of-scope portion of the plant must have in order to support the certified design. The plant-specific SAR shall contain provisions which implement the Interface Requirements in accordance with 10CFR 52.79(d). Additionally, the plant-specific application for COL shall contain additional ITAAC corresponding to these implementing provisions. In the event of an inconsistency between the Tier 1 Interface Requirements and the Tier 2 material, the Tier 1 Interface Requirements shall govern.
- Site Parameters - The Tier 1 Site Parameters identify the significant design values for site-related information used for the ABWR standard design plant. Detailed design activities for structures, systems, and components within the scope of the ABWR standard design shall be performed with reference to the Site Parameters. For cases where a site-specific characteristic is not bounded by a Site Parameter, the COL applicant may request a change in the Site Parameters in accordance with the change processes in the design certification rule for the ABWR. Design activities for structures, systems, and components outside the scope of the ABWR standard design may be performed using site-specific design basis parameters. In the event of an inconsistency between the Tier 1 Site Parameters and the Tier 2 material, the Tier 1 Site Parameters shall govern.

3.3 Uses of the Approved Safety Analysis Material

The following provisions describe the scope and uses of Tier 2 material:

- Effect of Tier 2 - All of the information in Tier 2 is approved by the NRC, is applicable (except as described below with respect to COL License Information items and Conceptual Designs) to a license application or license that references the ABWR design certification rule, and is among the “matters resolved” under 10 CFR 52.63. Compliance with Tier 2 material is a sufficient but not a necessary method for complying with Tier 1 material. The methods specified in Tier 2 shall be followed unless a change is made in accordance with the change processes specified in the design certification rule for the ABWR.
- COL License Information Items - Tier 2 identifies certain matters that need to be addressed by an applicant or licensee that references the design certification for the ABWR. These matters are designated as “COL License Information.”

The purpose of the COL License Information items is to identify the type of information that must be addressed in plant-specific SARs that reference the design certification rule for the ABWR. These COL License Information items do not establish requirements; rather they identify an acceptable set of information, but not the only acceptable set of information, for inclusion in a plant-specific SAR. An applicant may deviate from or omit these COL License Information items, provided that the deviation or omission is identified and justified in the plant-specific SAR. After issuance of a license, the COL License Information items have no further effect to that licensee; instead, the corresponding provisions in the plant-specific SAR are applicable.

- Conceptual Designs - Conceptual designs for those portions of the plant which are outside the scope of the ABWR standard design are described in various places throughout Tier 2 (see, for example, the conceptual designs referenced in Tier 2 Section 1.1.2). As provided by 10 CFR 52.47(a)(24), these conceptual designs are not a part of the design certification for the ABWR and are not applicable to a COL, nor to an application for a COL, that references the design certification rule for the ABWR.

3.4 Use of ITAAC During Operation

In accordance with 10 CFR 52.103(g), the Commission must find that the acceptance criteria in the ITAAC are met prior to operation. After the NRC has issued its finding in accordance with 10 CFR 52.103(g), the ITAAC do not, by virtue of their inclusion in the DCD, constitute regulatory requirements for the COL holder or for renewals of the COL. However, subsequent modifications must comply with Tier 1 Design Descriptions, unless changes are made in the Tier 1 Design Descriptions in accordance with the change processes in the design certification rule for the ABWR.

3.5 Plant-Specific Changes to Certain Designated Material in Tier 2 (Tier 2*)

Certain information within sections of Tier 2 identified in Table 1 is designated with brackets, italicized text, and an asterisk (or similar symbol). A plant-specific change to any of this designated information shall require NRC Staff approval prior to implementing the change. A request for departure from Tier 2* will be treated as a request for license amendment under 10 CFR 50.90 and 50.92. The requirement for prior NRC Staff approval will expire for some of the designated information, as indicated in Table 1, when the plant first achieves 100% power.

3.6 Proprietary and Safeguards Information

The proprietary and safeguards information referenced in the DCD must be included as part of an application for a COL.

3.7 Not Used

3.8 Severe Accident Issues

A proposed plant-specific departure from Tier 2, under Section B.5 of the change process in the design certification rule, affecting resolution of a severe accident issue involves an unreviewed safety question if:

- (1) there is a substantial increase in the probability of a severe accident such that a particular severe accident previously reviewed and determined to be not credible could become credible; or
- (2) there is a substantial increase in the consequences to the public of a particular severe accident previously reviewed.

Table 1 Designated Tier 2 Material Which May Not be Changed Without Prior NRC Staff Approval

Designated Reference ⁽¹⁾	Designated Material	Expiration ⁽²⁾
Table 2	ASME Boiler and Pressure Vessel Code, Section III, Division 2, Subsection CC/ACI 359 and Division 1, Subsection NE	First Full Power
Tables 3 and 4	ANSI/AISC N-690 and ACI 349	First Full Power
Table 5	Motor-Operated Valves	First Full Power
Table 6	Equipment Seismic Qualification Methods	First Full Power
Table 7	Piping Design Acceptance Criteria	First Full Power
Table 8	Fuel System: Design Criteria and First Cycle Design and Methods	See Table 8
Table 9	Instrument Setpoint Methodology; Regulatory Guide 1.105	First Full Power
Table 10	ECF Performance Specifications and Architecture	First Full Power
Table 11	SSLC Hardware and Software Qualification	First Full Power
Tier 2, Subsections 7.1.1.2, 7.1.2.1.6, Table 1.8-21	Self-test System Design Testing Features and Commitments	First Full Power
Tier 2, Appendix 18E and Table 1.8-21	HFE Design and Implementation Process	First Full Power

Note:

- (1) Tables 1 through 11 identify those Tier 2 sections, tables, and figures which, in whole or part, contain Tier 2* information. Within the identified sections and tables, the part which is Tier 2* is designated by means of italicized print, brackets, and an asterisk (or similar symbol). The identified figures are designated as Tier 2* in their entirety (although only the titles of the figures are italicized, bracketed, and asterisked).

In some cases, the designated Tier 2* information contains references to other sections, tables, or figures in Tier 2. A referenced section, table, or figure itself is not Tier 2*, unless the referenced section, table, or figure is designated somewhere in Tables 1 through 11.

In some cases, the designated Tier 2* information contains references to external documents. The applicable provisions within the external documents shall be treated as Tier 2*. The particular edition or revision of the external reference is identified with the external reference itself. If the reference does not identify a particular edition or revision, the applicable provisions of the edition or revision identified in Tier 2 Table 1.8-19, 1.8-20, or 1.8-21 shall be treated as Tier 2*.

- (2) The requirement for prior NRC Staff approval expires as noted.

Table 2 ASME Code for Concrete Containment and Buckling Analysis of Drywell Head⁽¹⁾

Commitment	Tier 2 Sections⁽²⁾	Tier 2 Tables⁽²⁾
ASME III, Division 2, Subsection CC/ACI 359 Code Edition for Concrete Containment	3.8.1.2.2, 3H.1.4.1.1	3.8-4, 1.8-21
ASME III, Division 1, Subsection NE Code Edition for Buckling Analysis for Drywell Head	3.8.2.4.1.4., 3.8.2.2.3	1.8-21

Notes:

- (1) See Tier 2, Subsection 3.8.1.1.1.
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.

Table 3 ACI-349 Code for Concrete Structures and Foundations⁽¹⁾

Commitment	Tier 2 Sections⁽²⁾	Tier 2 Tables⁽²⁾
Concrete Internal Structures of Containment	3.8.3.5.2, 3H.1.4.1.1	3.8-4, 3.8-10, 1.8-21
Other Seismic Category I Structures	3.8.4.2.1, 3.8.4.2.2, 3.8.4.2.3, 3.8.4.4.1, 3.8.4.5.1.2, 3.8.4.5.2, 3.8.4.5.3, 3H.2.4.1, 3H.3.4.1	3.8-10, 1.8-21
Concrete Foundations	3.8.1.2.2, 3.8.5.2, 3.8.4.2.1	3.8-10, 1.8-21

Notes:

- (1) See Tier 2, Subsection 3.8.3.2.
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.

Table 4 Standard ANSI/AISC N690 for Seismic Category I Structures⁽¹⁾

Commitment	Tier 2 Sections⁽²⁾	Tier 2 Tables⁽²⁾
Internal Structures of Containment	3.8.3.5.1, 3.8.3.5.2, 3H.1.4.1.1	3.8-4, 3.8-9, 1.8-19, 1.8-21
Other Seismic Category I Structures	3.8.4.2.1, 3.8.4.2.2, 3.8.4.2.3, 3.8.4.4.1, 3.8.4.5.1.2, 3.8.4.5.2, 3.8.4.5.3, 3H.2.4.1, 3H.3.4.1	3.8-9, 1.8-19, 1.8-21

Notes:

- (1) See Tier 2, Subsection 3.8.3.2.
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.

Table 5 Design, Qualification, and Preoperational Testing for MOVs⁽¹⁾

Commitment	Tier 2 Sections⁽²⁾	Tier 2 Tables⁽²⁾
Design and Qualifications	3.9.6.2.2(1)	
Preoperational Testing	3.9.6.2.2(2)	
Prototype Qualification Testing	3.9.6.2.2(1)	

Notes:

- (1) See Tier 2, Subsection 3.9.6.2.2.
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.

Table 6 Equipment Seismic Qualification Methods⁽¹⁾

Commitment	Tier 2 Sections ⁽²⁾	Tier 2 Tables⁽²⁾
Standards and Regulatory Guides	3.10.1.3	1.8-20, 1.8-21
Experience Data	3.10.1.1, 3K.7 ⁽³⁾	
Tests and Analyses	3.9.2.2.1, 3.10.1.1, 3K.1, 3K.7, 3K.8	
Pump and Valve Operability	3.9.3.2.3.1.4, 3.9.3.2.1.1, 3.9.3.2.5.1.2	3.9-2
Testing Condition	3K.1, 3K.2(a)	
Test Input Motion	3.9.2.2.1, 3K.3(b), 3K.9, 3K.10	
Multi-Frequency Input Motion	3.9.3.2.3.1.4, 3K.3(a), 3K.5	1.8-20
Biaxial Test Input Motion	3K.1, 3K.4	
Dynamic Coupling of Systems	3.9.2.2.1, 3.10.1.1	
Test Loads	3.9.3.2.1.1, 3.9.3.2.3.1.4, 3.9.3.2.5.1.2	3.9-2
Damping	3K.6	
Qualification of Relays	3.10.2.1	
Multiple Commitments	3.9.8 (Ref. 3.9-6), 3.11.7 (Ref. 3.11-2)	

Notes:

- (1) See Tier 2, Section 3.10. The change restriction noted in the second paragraph of this section applies to the designated commitments only in their application to seismic and dynamic qualification of equipment.
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.
- (3) Appendix 3K is introduced in Tier 2 for supplying necessary information from the proprietary Reference 3.11-2 (Subsection 3.11.7), same as Reference 3.9-6 (Subsection 3.9.8).

Table 7 Piping Design Acceptance Criteria⁽¹⁾

Commitment	Tier 2 Sections⁽²⁾	Tier 2 Tables and Figures^{(2) (3)}
ASME III Code Edition and Code Cases	3.9.3.4.1	Tables 1.8-21, 3.2-3, 5.2-1
Response Spectrum Method and Low and high Frequency Modes	3.7.3.6, 3.7.3.7.1, 3.7.3.7.2, 3.7.3.8.1.6	Table 1.8-20
Interdependent Support Motion and Damping Code Case	3.7.2.1.4, 3.7.3.8.1.10, 3.7.3.8.1.7	
Time History Methods	3.7.3.1	
Small-Bore Piping Method	3.7.3.8.1.9	
Non-Seismic/Seismic Piping Transition/Interaction	3.7.3.13	
Mainsteam Leakage Path	3.2.5.3	
Dynamic Piping Model	3.7.3.3.1.2	
Modeling of Piping Supports	3.7.3.3.1.6	
Amplified Response Spectra	3.7.3.3.1.8	
Piping Benchmark Program	3.9.1.2, 3.9.8 (Ref. 3.9-11)	
Branch Line Decoupling	3.7.3.3.1.3, 3.7.3.8.1.9	
Design Transients	3.9.3.1	
Environmental Effects on Carbon Steel Piping	3.9.3.1.1.7, 3.9.8 (Ref. 3.9-9)	
Fatigue Evaluation of ASME Code Class 2 and 3 Piping	3.9.3.1	
Fatigue Evaluation of SRV Discharge Piping	3.9.3.1	
Thermal Oscillations	3.9.3.1	Figures 5.4-10 (note 32) , 6.3-7 (note 29)
Thermal Stratification	3.9.3.1	
Safety-Relief Valve Design, Installation and Testing	1A.2.9	
Functional Capability	3.9.8 (Ref. 3.9-7)	Table 3.9-2
Seismic Anchor Motion	3.7.3.8.1.8, 3.9.3.1.1.9	Table 3.9-1
Earthquake Cycles	3.7.3.2	Table 1.8-21
Modal Damping	3.7.3.8.1.7	
Minimum Temperature for Thermal Analyses	3.9.3.1	
Intersystem LOCA	3.9.3.1	
Pipe Support Jurisdictional Boundaries	3.9.3.4.1	
Pipe Support Baseplate and Anchor Bolt Design	3.9.3.4	

Table 7 Piping Design Acceptance Criteria⁽¹⁾

Commitment	Tier 2 Sections⁽²⁾	Tier 2 Tables and Figures^{(2) (3)}
Use of Energy Absorbers and Limit Stops	3.7.3.3.1.7, 3.9.3.4.1(6)(a)	Table 1.8-20
Use of Snubbers	3.9.3.4.1	
Decoupled Branch Pipe — Displacement Criteria	3.7.3.3.1.4	
Seismic Self-Weight Excitation	3.7.3.3.4	
Supplementary Steel	3.9.3.4	
Friction Forces	3.7.3.3.4	
Gaps Between Pipe and Supports	3.7.3.3.4	
Instrumentation Line Support Criteria	3.7.3.8.1.9, 3.9.3.4.1	
Pipe Deflection Limits	3.9.3.4.1	
Pipe-Mounted Equipment Allowable Loads	3.9.3.1.21	
As-Built Piping Verification	3.9.3.1.20, 3.9.8 (Ref. 3.9-10)	
Pipe Interferences	3.9.3.1.22	
Postulated Break and Crack Location and Configuration	3.6.2.1.4.1 through 3.6.2.1.4.5, 3.6.2.1.5.2, 3.6.2.1.5.3	
Dynamic Analysis for Postulated Break	3.6.2.3.1, 3.6.2.3.2	

Notes:

- (1) See Tier 2, Subsection 3.9.1.7. The change restriction noted in this subsection applies to the delineated commitments only in their application to piping design.
- (2) The applicable portions of these sections, tables and figures are italicized on the sections, tables and figures themselves. See Note (1) of Table 1.
- (3) Tables 1.8-21 and 3.2-3 are applicable to a commitment involving the ASME Code, Section III, and Tables 5.2-1 and 1.8-21 are applicable to a commitment involving the ASME Code, Section III, Code Cases.

Table 8 Fuel System: Design Criteria and First Cycle Design and Methods ⁽¹⁾

Commitment	Tier 2 Sections ⁽²⁾	Tier 2 Tables and Figures⁽²⁾	Expiration⁽³⁾
Fuel System Design	4.2.2.1, 4.2.5 (Reference 4.2-1)		First Full Power
Fuel Assembly Design	4.2.2, 4.2.5 (Reference 4.2-1)	Figures 4.2-1a, 4.2-1b, 4.2-2	First Full Power
Nuclear Design	4.3.2.1	Figure 4.3-1	First Full Power
Fuel Evaluation Methods and Results	4.2.3 (References 4.2-2, 4.2-3)	Table 1.8-19	None
Equilibrium Cycle and Control Rod Patterns	4A.1, 4A.2, 4A.3		First Full Power
Fuel Licensing Acceptance Criteria and Fuel Burnup Limits	4.2, App. 4B	Table 1.8-19, Table 1.8-21	None
Control Rod Licensing Acceptance Criteria	App. 4C		First Full Power

Notes:

- (1) See Tier 2, Section 4.2.
- (2) The applicable portions of these sections, tables and figures are italicized on the sections, tables, and figures themselves. See Note (1) of Table 1.
- (3) The requirement for prior NRC Staff approval expires as noted.

Table 9 Instrument Setpoint Methodology⁽¹⁾

Commitment	Tier 2 Sections⁽²⁾	Tier 2 Tables⁽²⁾
Instrument Setpoint Methodology	7.1.2.10.9, 7.2.2.2.1(6), 7.3.2.1.2(3)(f), 7.3.4.(Ref. 7.3-2), 7.4.2.3.2(3)(f), 7.6.2.1.2(3)(f), 7.6.2.6.2(3)(f)	1.8-20

Notes:

- (1) See Tier 2, Subsection 7.1.2.10.9.
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.

Table 10 ECF Performance Specifications and Architecture⁽¹⁾

Commitment	Tier 2 Sections ⁽²⁾	Tier 2 Tables ⁽²⁾
ECF Performance Specifications and Architecture	App. 7A (except Section 7A.4), App. 7B, App. 7C (except Section 7C.4), 20.3.8 (Q420.92)	1.8-20, 1.8-21

Notes:

- (1) See Tier 2, Section 7A.1(1).
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.

Table 11 SSLC Hardware and Software Qualification ⁽¹⁾

Commitment	Tier 2 Sections ⁽²⁾	Tier 2 Tables ⁽²⁾
SSLC Hardware and Software Qualification	7A.2(4), 7A.2(10), 7A.2 (11), 7A.5(1), 7B.1, 7B.2, 7B.3, 7C.2(h), 20.3.8 (Q420.69), 20.3.8 (Q420.92)	1.8-21

Notes:

- (1) See Tier 2, Section 7A.1(2).
- (2) The applicable portions of these sections and tables are italicized on the sections and tables themselves. See Note (1) of Table 1.