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Subject: Transmittal of ESBWR DCD Tier 2, Chapter 5 Markups Related to GEH Internal Corrective Action

The purpose of this letter is to submit markups to the ESBWR DCD, Tier 2, Chapter 5, Revision 6, which are the result of GEH internal review. These markups will be incorporated into the DCD, Revision 7. The markup pages are contained in Enclosure 1. The changes are summarized below.

Affected Section(s)	Description of Change
Section 5.2.4, 4th paragraph	Change "COL Applicant" in second sentence to "licensee".
Section 5.2.4.3.1	Delete extraneous reference to COL Applicant in first paragraph statement-of-fact.
Section 5.2.4.11	In first sentence, replace term "COL Applicant" with the term "licensee".
Section 5.2.5.9, 2nd and 3 rd paragraphs	Replace term "COL Applicant" with the term "licensee".
Table 5.2-5	New Note 2 added to address inconsistency with Chapter 10, and notes renumbered

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston
Vice President, ESBWR Licensing

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NRO

Enclosure:

1. Transmittal of ESBWR DCD Tier 2, Chapter 5 Markups Related to GEH Internal Corrective Action – DCD Markups

cc: AE Cabbage USNRC (with enclosure)
JG Head GEH/Wilmington (with enclosure)
DH Hinds GEH/Wilmington (with enclosure)
TL Enfinger GEH/Wilmington (with enclosure)
eDRF Section 0000-0112-3021
 0000-0112-3041

Enclosure 1

MFN 10-041

**Transmittal of ESBWR DCD Tier 2, Chapter 5 Markups
Related to GEH Internal Corrective Action**

DCD Markups

fabrication requirements specified in ASME B&PV Code Section III and with the requirements of Section IX invoked by Section III, supplemented by the following requirements:

- The welder performance qualification test assembly required by ASME Section IX shall be welded under simulated access conditions. An acceptable test assembly will provide a Section IX welder performance qualification required by this regulatory guide.
- If the test assembly weld is to be judged by bend tests, a test specimen shall be removed from the location least favorable for the welder. If this test specimen cannot be removed from a location prescribed by Section IX, an additional bend test specimen is required. If the test assembly weld is to be judged by radiography or UT, the length of the weld to be examined shall include the location least favorable for the welder.
- Records of the results obtained in welder accessibility qualification shall be as certified by the manufacturer or installer, shall be maintained and shall be made accessible to authorized personnel.
- For accessibility, when restricted access conditions obscure the welder's line of sight, the use of visual aids such as mirrors shall be used. The qualification test assembly shall be welded under the more restricted access conditions using the visual aid required for production welding.
- Surveillance of accessibility qualification requirements is performed along with normal surveillance of ASME Section IX performance qualification requirements.

5.2.3.4.3 Nondestructive Examination of Tubular Products

For discussion of nondestructive examination of tubular products, refer to Subsection 5.2.3.3.3.

5.2.4 Preservice and In-service Inspection and Testing of Reactor Coolant Pressure Boundary

This subsection describes the preservice and in-service inspection and system pressure test programs for NRC Quality Group A, ASME B&PV Code, Class 1 items. It describes these programs implementing the requirements of Subsection IWB of the ASME B&PV Code Section XI.¹

According to the ASME B&PV Code, Section XI, either UT or radiographic (RT) examination may be used for in-service inspection of welds in ASME B&PV Code Class 1 and 2 austenitic and dissimilar metal (DM) welds. The COL Applicant is responsible for developing a plan and providing a full description of its use during construction, preservice inspection, in-service inspection, and during design activities for components that are not included in the referenced certified design, to preserve accessibility to piping systems to enable NDE of ASME B&PV Code Class 1 austenitic and DM welds during in-service inspection (COL item 5.2-3-A).

10 CFR 50.55a prescribes Section XI Editions and Addenda applicable to in-service inspection programs, subject to limitations and modifications found therein. Additionally, 10 CFR 50.55a provides an allowance to request alternatives to or relief from ASME B&PV Code requirements.

¹ Items as used in this subsection are products constructed under a certificate of authorization (NCA-3120) and material (NCA-1220). See Section III, NCA-1000, footnote 2.

Section XI requirements can be modified by invoking approved Section XI ASME B&PV Code Cases. Approved ASME B&PV Code Cases are listed in RG 1.147.

The ESBWR is designed for the performance of preservice and in-service inspections including consideration of the requirements of the ASME B&PV Code, Section XI, Edition/Addenda as specified in Table 1.9-22. The development of preservice and in-service inspection programs is the responsibility of the COL Applicant/ licensee and shall be based on the ASME B&PV Code, Section XI, Edition and Addenda approved in 10 CFR 50.55a(b) 12 months before initial fuel load. (See Subsection 5.2.6 for COL information requirements). The requirements are described in Subsections 5.2.4.1 through 5.2.4.10.

5.2.4.1 Class 1 System Boundary

Definition

The Class 1 system boundary for both preservice and in-service inspection programs and the system pressure test program includes all those items within the Class 1 and Quality Group A boundary on the piping and instrumentation schematics. Based on 10 CFR 50 and RG 1.26, the boundary includes the following:

- Reactor pressure vessel;
- Portions of the Main Steam System;
- Portions of the Feedwater System;
- Portions of the Standby Liquid Control System;
- Portions of the RWCU/SDC system;
- Portions of the ICS; and
- Portions of the GDCS.

Those portions of the above systems within the Class 1 boundary are those items that are part of the RCS up to and including any and all of the following:

- The outermost containment isolation valve in the system piping which penetrates reactor containment;
- The second of two valves normally closed during normal reactor operation in system piping which does not penetrate reactor containment;
- The reactor coolant system SRVs and DPVs; and
- The Main Steam and Feedwater systems up to and including the outermost containment isolation valve.

Exclusions

Portions of the system within the RCPB, as defined above, that are excluded from the Class 1 boundary in accordance with 10 CFR 50, Section 50.55a, are as follows:

- Those components where, in the event of postulated failure of the component during normal reactor operation, the reactor can be shut down and cooled down in an orderly manner, assuming makeup is provided by the reactor coolant makeup system only.

- Pump to Valve.

Straight sections of pipe and spool pieces are added between fittings. The minimum length of the spool piece has been determined by using the formula $L = 2T + 152$ mm, where L equals the length of the spool piece (not including weld preparation) and T equals the pipe wall thickness.

Text sections that are bracketed and italicized with an asterisk following the brackets are designated as Tier 2. Prior NRC approval is required to change.

5.2.4.3 Examination Categories and Methods

5.2.4.3.1 Examination Categories

The examination category of each item in accordance with ASME Section XI, IWB-2500 is listed in the preservice and in-service inspection programs ~~prepared by the COL Applicant~~. The items are listed by system and line number where applicable. The preservice and in-service inspection programs state the method of examination for each item.

The preservice examination is performed once in accordance with ASME Section XI, IWB-2200, with the exception of examinations specifically excluded by ASME Section III NB-5283 and Section XI from preservice requirements, such as VT-3 examination of valve body and pump casing internal surfaces (B-L-2 and B-M-2 examinations categories, respectively) and the visual VT-2 examinations for category B-P.

5.2.4.3.2 Examination Methods

Ultrasonic Examination of the Reactor Vessel

Ultrasonic examination for the RPV is conducted in accordance with the ASME B&PV Code, Section XI. There are currently no known access limitations for UT examination of the ESBWR reactor vessel. It is, therefore, expected that the reactor vessel may be completely examined by UT. The design to perform preservice inspection on the reactor vessel is based on the requirements of the ASME B&PV Code Section XI, specified in Table 1.9-22. For the required preservice examinations, the reactor vessel meets the acceptance standards of Section XI, IWB-3510. The RPV shell welds are designed for 100% accessibility for both preservice and in-service inspection. RPV shell welds may be examined from the inside or outside diameter surfaces (or a combination of those techniques) using automated ultrasonic examination equipment. The RPV nozzle-to-shell welds are 100% accessible for preservice inspection but might have limited areas that may not be accessible from the outer surface for inservice examination techniques.

In most cases, inner radius examinations are performed from the outside of the nozzle using several compound angle transducer wedges to obtain complete coverage of the required examination volume. Alternatively, nozzle inner radius examinations may be performed using enhanced visual techniques, as allowed by 10 CFR 50.55a(b)(2)(xxi).

Visual Examination

Visual examination methods VT-1, VT-2 and VT-3 are to be conducted in accordance with ASME Section XI, IWA-2210. In addition, VT-2 examinations meet the requirements of IWA-5240.

Components exempt from preservice inspection and inservice inspection requirements are identified in the inservice inspection program. However, 10 CFR 50.55a(b)(2)(xi) eliminates the use of IWB-1220(d) by requiring the use of the 1989 Edition of Section XI. If any Class 1 welds are inaccessible due to being encased in concrete, buried underground, located inside a penetration, or encapsulated by a guard pipe, they are still considered to be within the scope of ASME B&PV Code, Section XI and are subject to examination requirements.

5.2.4.8 Code Cases

ASME B&PV Code, Section XI requirements can be modified by invoking approved ASME B&PV Code Cases, Section XI. Approved ASME B&PV Code Cases for inservice inspection are listed in RG 1.147. As applicable, the provisions of the ASME B&PV Code Cases listed in Table 5.2-1 may be used for preservice and in-service inspections, evaluations, and repair and replacement activities.

5.2.4.9 Preservice Examination

Preservice examinations required by design specification and preservice documentation are in accordance with ASME Section III, NB-5281. Examination requirements are in accordance with Section III NB-5282 and Section XI, Table IWB-2500-1. Components exempt from preservice examination are described in ASME Section III, NB-5283.

5.2.4.10 Relief Requests

10 CFR 50.55a prescribes Section XI Editions and Addenda applicable to in-service inspection programs, subject to limitations and modifications found therein. Additionally, 10 CFR 50.55a provides an allowance to request alternatives to or relief from ASME B&PV Code requirements. Section XI requirements can be modified by invoking approved Section XI ASME B&PV Code Cases. Approved ASME B&PV Code Cases are listed in RG 1.147.

The specific areas where the applicable ASME B&PV Code requirements cannot be met are identified after the examinations are performed. Should relief requests be required, they will be developed through the regulatory process and submitted to the NRC for approval in accordance with 10 CFR 50.55a(g)(5). The relief requests include appropriate justifications and proposed alternative inspection methods.

5.2.4.11 COL Information for Preservice and In-service Inspection and Testing of Reactor Coolant Pressure Boundary

<p>The COL Applicant/licensee is responsible for the development of the preservice and in-service inspection programs that are based on the ASME B&PV Code, Section XI, Edition and Addenda approved in 10 CFR 50.55a(b) 12 months before initial fuel load. The requirements are described above in Subsections 5.2.4.1 through 5.2.4.10. The COL Applicant is responsible for providing a full description of the preservice inspection/in-service inspection programs and augmented inspection programs, by supplementing, as necessary, the information in Subsection 5.2.4, and to provide milestones for their implementation (Subsection 5.2.6, COL item 5.2-1-A).</p>

The monitoring instrumentation of the drywell floor drain sump, the air particulate radioactivity, and the drywell air cooler condensate flow rate are equipped with provisions to readily permit testing for operability and calibration during plant operation, thus satisfying RG 1.45, Position C.8.

Limiting conditions for identified and unidentified leakage and for the availability of various types of leakage detection instruments are established in the technical specifications. This satisfies Position C.9 of RG 1.45.

The additional isolation functions performed by LD&IS that are not a part of the primary RCPB leakage detection and containment isolation functions are not required to conform with the above stated methods for satisfying 10 CFR 50, Appendix A, GDC 30 and RG 1.45. Design of the control logic that activates the additional isolation functions is described in Section 7.3.3.

5.2.5.9 COL Information for Leak Detection Monitoring

The COL Applicant will include in its operating procedure development program:

- Procedures to convert different parameter indications for identified and unidentified leakage into common leak rate equivalents and leak rate rate-of-change values.
- Procedures for monitoring, recording, trending, determining the source(s) of leakage, and evaluating potential corrective action plans.
- Milestone for completing this category of operating procedures (COL 5.2-2-A).

<p>The COL Applicant licensee is responsible for the development of a procedure to convert different parameter indications for identified and unidentified leakage common leak rate equivalents (volumetric or mass flow) and leak rate rate-of-change values. Typical monitoring includes parameters such as sump pump run time, sump level, condensate transfer rate, process chemistry/radioactivity. The monitored leakage equivalents provides information used by the plant operators to manage the leakage and establish whether the leakage rates are within the allowable Technical Specifications and determine the trend.</p>

<p>The COL Applicant licensee is responsible for the development of procedures for monitoring, recording, trending, determining the source(s) of leakage, and evaluating potential corrective action plans. An unidentified leakage rate-of-change alarm provides operators an early alert to initiate response actions prior to reaching the Technical Specifications limit.</p>
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5.2.6 COL Information

5.2-1-A Preservice and In-service Inspection Program Description

The COL Applicant is responsible for providing a full description of the preservice and in-service inspection programs and augmented inspection programs by supplementing, as necessary, the information in Subsection 5.2.4 and to provide milestones for their implementation. The requirements are described in Subsections 5.2.4.1 through 5.2.4.10 and are based on the ASME B&PV Code, Section XI (Subsection 5.2.4.11).

5.2-2-A Leak Detection Monitoring

The COL Applicant will include in its operating procedure development program:

**Table 5.2-5
Expected ESBWR Water Chemistry**

	Concentration ⁽¹⁾ (ppb)					Conductivity
	Iron	Copper	Chloride	Sulfate	Oxygen ⁽²⁾	$\mu\text{S/cm}$ at 25°C (77°F)
Condensate ⁽²⁾	< 20	< 2.0	< 4.0	< 4.0	30-200 Target < 100	~0.075
Condensate Treatment Effluent and Feedwater	< 0.50	< 0.010	< 0.16	< 0.16	30-200 Target < 100	< 0.057
Reactor Water:						
(a) Normal Operation	< 5.0	< 0.50	< 5.0	< 5.0	-	< 0.10
(b) Shutdown	< 20	< 1.0	< 5.0	< 5.0	-	< 1.2
(c) Hot Standby	< 5.0	< 0.50	< 5.0	< 5.0	< 300	< 0.10
(d) Depressurized	< 5.0	< 0.50	< 5.0	< 5.0	< 300	< 0.10
Control Rod Drive Cooling Water	< 0.50	< 0.010	< 0.16	< 0.16	30-200 Target < 100	\leq 0.057

Notes:

⁽¹⁾ These limits should be met at least 90% of the time.

⁽²⁾ Condensate is deaerated during normal power operation by the condenser (see Section 10.4.1) and oxygen injection (see Section 9.3.10) is used to maintain condensate system through final feedwater oxygen concentration within the specified chemistry limits.

⁽²⁾⁽³⁾ Some revision of oxygen values may be established after hydrogen water chemistry has been established.