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Subject: **Submittal of ABWR Licensing Topical Report (LTR)  
NEDO-33321 "Advanced Boiling Water Reactor (ABWR)  
Life Cycle Management"**

Reference: Letter MFN 017-97, J. Quirk to NRC, *ABWR Design Control Document, Revision 4*, dated March 28, 1997, Docket No. 52-001

The enclosed Licensing Topical Report (LTR) is submitted for NRC generic review and approval as a Combined License (COL) license information item as required by the current ABWR design certification (referenced), Docket No. 52-001. The regulatory basis for this submittal is discussed below.

This LTR is one of a series of ABWR-related LTRs GE plans to submit and which have been discussed in South Texas Project 3&4 project meetings with the NRC. In support of the ABWR Design Centered Working Group (DCWG) plans, GE requests a generic review and approval of the subject LTR in advance of any future combined license applications (COLA) submittals. Note that the submittal is the result of design detailing performed for ABWRs in the US and in Asia and provides for the generic resolution of a COL license information item, thereby contributing to standardization.

This LTR is submitted in response to DCD Tier 2, Section 1.2.3.1, COL license information item - 1.1a. The design certification material deferred discussion of plant design and aging management to the COL applicant. The information contained in this LTR is typical for a Life Cycle Management program at existing operating plants. The proposed supplementary information will replace the current COL license information item 1.1a (Subsection 1.2.3.1) with program requirements for plant design

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life and aging management, which will be described in Appendix 1D to the DCD. The proposed changes promote increased standardization of the ABWR design certification material.

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If you have any questions about the information provided here, please contact me at 910-602-1885.

Sincerely,



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Enclosure: NEDO-33321 "*Advanced Boiling Water Reactor (ABWR)  
Life Cycle Management*" May 2007 – Non-Proprietary

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**Revision 0**

**LICENSING TOPICAL REPORT**  
**Advanced Boiling Water Reactor (ABWR)**  
**Life Cycle Management**

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## **1.0 Introduction**

The purpose of this Licensing Topical Report (LTR) is to obtain Nuclear Regulatory Commission (NRC) approval of a generic change in the design certification for the U.S. Advanced Boiling Water Reactor (ABWR) design, in accordance with planned revisions to 10 CFR 52.63. The change involves replacement of certain portions of the present Tier 2 of the ABWR Design Control Document (DCD) revision 4, NRC Docket #52-001.

As the regulatory processes for generic amendment of approved and certified reactor designs such as the ABWR (10CFR52 Appendix A) are currently in a state of flux, GE understands that it may not be feasible for the NRC to grant a generic change until the planned revision to 10 CFR 52.63 becomes effective. If NRC does not make the planned revisions to 10 CFR 52.63, future COL applicants would then intend to seek site-specific supplements based on the content of this LTR. NRC review of the technical content of this LTR is requested with the understanding that this LTR and subsequent discussions between GE and NRC staff may form the basis for site-specific supplements requested in future Combined License Applications.

## **2.0 Description of Design Certification**

Tier 2 of the DCD Subsection 1.2.1.3 deferred discussion of plant design and aging management to the COL applicant. Subsection 1.2.3.1 established a COL license information item to initiate a life cycle management program early in the design process and to develop an aging management plan to maintain the plant's original design basis throughout its life.

## **3.0 Description of Proposed Change**

Appendix A describes the proposed change to the design certification. This change will replace the current COL license information item 1.1a (Subsection 1.2.3.1) with a requirement to develop and implement a program for plant design life and aging management, which will be described in Appendix 1D to the DCD.

## **4.0 Justification for Change**

This change provides the information required for closure of COL license information item 1.1a. Therefore, this change in the DCD contributes to standardization by adding information to the ABWR DCD.

## **5.0 Conclusion**

The proposed amendment provides the requirements for development and implementation of plant design and aging management.

## Appendix A

### PROPOSED CHANGES

#### 1.2.1.3 Plant Design and Aging Management

~~A~~ ~~The COL applicant shall initiate the life cycle management program~~ will be initiated early enough in the design process to aid in the application, selection and procurement of components with optimum design life characteristics, and to develop an aging management plan capable of assuring the plant's original design basis throughout its life. The design life for ABWR is 60 years.

The aging management plan ~~will~~ shall cover containment structures, liner plates, embedded or buried structure components, piping and components. The plan ~~will~~ shall consider the potential causes of corrosion which ultimately may be present at the site, including the potential corrosion from copper ground mats. The plan ~~will~~ shall be initiated early in the design process so that adequate provision for mitigation~~ne~~ measures can be made.

~~In developing the life cycle management program, the COL applicant shall consider the design life requirements described in the EPRI Utility Requirements Document (URD) and the insights gained from the USNRC Nuclear Plant Aging Research (NPAR) Program (e.g. NUREG/CRs 4731 and 5314).~~

The life cycle management program will utilize the plant design life requirements as described in EPRI Utility Requirements Document (URD). The aging management plan will implement the provisions as described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, or alternatives thereto.

Appendix 1D provides the ABWR plant design and aging management plan.

~~See Subsection 1.2.3.1 for COL license information.~~

#### 1.2.3 COL License Information

1.2.3.1 Plant Design and Aging Management

~~The COL applicant shall initiate the life cycle management program early in the design process and shall consider the design life requirements as outlined in Subsection 1.2.1.3. In addition, the aging management plan shall cover the structures and components, and the plan shall consider the potential causes of corrosion as outlined in Subsection 1.2.1.3.~~

**Appendix 1D**

**PLANT DESIGN AND AGING MANAGEMENT**

## **1D Plant Design and Aging Management**

### **1D.1 Purpose**

The Life Cycle Management (LCM) Program is designed to manage the risk of long-term aging effects on structures, systems and components (SSCs) for the life of the station. The LCM Program is an integrated program to optimize the economics, manage aging, and control the aging of equipment over the lifetime of the plant and its systems, structures and components. The LCM Program will be initiated early enough in the design phase to aid in the application, selection, and procurement of components and to develop an aging management plan (AMP) capable of maintaining the plant's original design basis throughout its life. The early initiation will also allow for providing adequate mitigation measures.

The plant design life for ABWR is 60 years. The plant design will identify long-lived passive structures and components that are subject to an aging management review. Long-lived means the item is not subject to replacement based on a qualified life or specified time period. The passive structures and components are those that can perform their intended function without moving parts or without a change in configuration or properties.

Guidance for aging management programs for license renewal applications is summarized in NUREG-1801 (Reference 1D-1). As described in NUREG-1801, the AMPs credited to support license renewal are included within, or are extensions of, existing operating plant preventative maintenance, chemistry, or condition monitoring programs. The AMP will implement the generic aging lessons learned (GALL) or acceptable alternatives thereto.

### **1D.2 Life Cycle Management Program**

The following design life requirements will be implemented in ABWR design:

#### **5.1.1 1D.2.1 Design Life and Classification System**

A 60-year ABWR design life is an EPRI requirement (Reference 1D-2) for all major plant components with reasonable expectation of meeting this design life. However, all plant operational components and equipment, except the reactor vessel, are designed to be replaceable, design life notwithstanding. The design life requirement allows for refurbishment and repair, as appropriate, to assure that the design life of the plant is achieved. Events that the plant might credibly experience are evaluated to establish design basis for plant equipment. The ABWR plant operating events and dynamic loading events are summarized in Table 3.9-1 of FSAR. The design requirements of the safety-related piping and equipment subjected to specific applicable thermal hydraulic transients derived from the system behavior during the events listed in this table are documented in the design specifications and/or stress reports of the respective equipment.

To achieve the design life objective, the design requirements and guidelines for mechanical equipment are summarized as follows:

- Design margins: Adequate margins are included in the original design to prevent unplanned reanalysis and possible modifications when deviation from design value occurs during the equipment manufacture or construction.
- Water quality: The water quality requirements are used in the material selection and design of the water treatment systems, water storage systems, and associated water containing systems. The operating limits contained in the water quality requirements are provided to help prevent corrosion and cracking of reactor internals and to reduce the corrosion products produced from water containing systems. These requirements are specified in the procurement documents.
- Materials: Materials and process requirements are specified in procurement documents to prevent intergranular stress corrosion cracking (IGSCC) of austenitic stainless steel in mechanical systems. In addition, materials and process requirements considering prior BWR experience are specified in hardware designs and component procurement documents to provide for required fracture toughness.
- Corrosion design requirements: equipment design, material selection, and water chemistry are important to minimize both internal and external erosion and corrosion at the temperature, moisture content, and velocity of the fluids being processed. General corrosion allowance is used with additional margin in the design, and other corrosion mechanisms such as flow-accelerated corrosion are also considered.

System design documentation contains a system description and intended function, interfaces/boundaries, environment, and requirements that major components have to meet. The documentation also provides the description of the material for system equipment and piping, and control equipment and devices. The locations of the equipment, piping and control devices, environmental and seismic conditions for these components are also included.

The ABWR SSCs are classified as nuclear safety-related or non-nuclear safety-related as described in Section 3.2 of FSAR. The design life classification system is used to identify the long-lived passive components that will be in the aging management review as required by license renewal rule.

Equipment and component design life requirements will be incorporated into equipment purchase specifications. The purchase specifications will specify the component design life requirements, applicable expected transients in the design life, the environmental conditions to which the equipment will be exposed during plant operation, and the properties of the working fluid, to allow the equipment supplier to evaluate the design life of their supplied equipment.

Equipment suppliers will be required to provide the recommended frequencies of replacement and/or maintenance activities for any component for which the design life is less than 60 years. These recommended replacement and maintenance activities will be considered as inputs to develop the preventive maintenance program.

## **1D.3 Additional Requirements to Support a 60-Year ABWR Plant Design:**

### **5.1.2 1D.3.1 Condition Monitoring**

Condition monitoring is used to gather data so that component condition or performance can be monitored and trended, and deterioration of a structure or component may be detected before the loss of an intended design function. Condition monitoring implements the preventive maintenance identified tasks and consists of the visual or non-destructive testing inspections for the structures and passive type components.

The capability to monitor selected equipment and system performance will be identified and included in the system design of those systems not already designed.

### **5.1.3 1D.3.2 Defined Transients**

The expected transients for 60-year plant life have been established in the design specifications and stress reports.

The ABWR design features provide a high confidence that the cumulative plant and system transients will be kept well within the limits of occurrences as designed.

### **5.1.4 1D.3.3 Instrumentation and Control**

The instrument and control (I&C) are designed to ensure system performance monitoring and system functions can be achieved.

A sequence of events recording capability will enable plant personnel to evaluate the plant transients quickly. The transient recording and analyses will allow the operator to manually retrieve previously stored data for post-trip root cause analysis and to support system testing. These recording capabilities and the installed instruments will enable the operator to monitor and trend significant transients over the design lifetime.

### **5.1.5 1D.3.4 Environment**

The environmental conditions applicable to safety-related mechanical and electrical equipment and qualification tests are described in Section 3.11 of FSAR. Environmental conditions for the areas where safety-related equipment are located are calculated for normal, abnormal, test, and post-accident conditions and are documented in Appendix 3I of FSAR.

Provisions will be developed as needed for plant environmental monitoring to be used to ensure that plant environments are maintained within design values throughout the life of the plant.

### **5.1.6 1D.3.5 Documentation**

Documentation will be maintained under the configuration management program in a readily accessible form over the life of the plant. Design life, environmental limits,

acceptance criteria for condition indicators, and related parameters will be explicitly identified in the design documents.

#### **1D.4 Aging Management Plan**

Aging management planning for the long-lived passive structures and components will include information regarding the materials of construction, environment, aging effects requiring management, and aging management activities to monitor and to control aging effects. The aging management plan will cover containment structures, liner plates, embedded or buried structural components, piping and components.

#### **1D.5 Life Cycle Management Program Implementation Plan**

The guidelines for monitoring the performance or condition of SSCs against established goals will be developed to provide reasonable assurance: 1) that they are capable of performing their intended function, and 2) that they are at acceptable levels of safety, thermal, and economic performance. Maintenance Rule will be implemented to monitor the performance or condition of the SSCs within the scope of the rule.

Maintaining SSCs in a reliable condition involves the implementation and coordination of various programs, including selective portions of existing programs and activities to meet regulatory commitments and requirements. These programs which include, but are not limited to:

- Inservice Test and Inspection Program
- Check Valve Program
- Motor-Operated Valve Program
- Containment Leakage Test Program
- Erosion/Corrosion Program
- Environmental Qualification Program
- Individual Plant Examination/Probabilistic Risk Assessment
- Structural Monitoring Program
- Maintenance Rule Program
- Plant Performance Monitoring Program
- Surveillance Test Program
- Preventive Maintenance Program
- Radioactive Effluent Monitoring Program
- Chemistry Analysis
- Fatigue Management Program

The aging management will follow GALL established AMPs to monitor the long-lived passive components, or acceptable alternatives thereto. The time limited aging analysis (TLAA) programs described in GALL or alternatives will be monitored and trended to ensure the component or structure design limits are not exceeded. Because of ABWR design life is 60 years, the evaluation for time limited aging analyses (TLAA) programs as described in NUREG-1801 is not required.

## **1D.6 References**

1D-1 NUREG-1801, Generic Aging Lessons Learned (GALL) Report

1D-2 EPRI Utility Requirement Document Section 11.3, Volume II, Chapter 1, Design Life