



GE Energy  
Nuclear

**Enclosure 2**

**MFN 07-226**

**NEDO-33315 Advanced Boiling Water Reactor (ABWR)  
Reactor Pressure Vessel Material Surveillance Program**

**Non-Proprietary Version**



GE Energy  
Nuclear

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**LICENSING TOPICAL REPORT**  
**Advanced Boiling Water Reactor (ABWR)**  
**Reactor Pressure Vessel (RPV)**  
**Material Surveillance Program**

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## 1.0 Scope

This report describes the Reactor Pressure Vessel (RPV) Material Surveillance Program for the ABWR. The radiation-induced changes in the mechanical properties of the core beltline region materials of the RPV shall be monitored periodically by the test of RPV surveillance test specimens. This report includes description of program for monitoring test specimens as well as type and number of prepared surveillance test specimens. Provided in this report are surveillance specimen sketches and requirements, [[.....<sup>{3}</sup>]].

This report addresses the COL License Information Item in ABWR DCD Section 5.3.4.2, which states: The following will be identified: (1) the specific materials in each surveillance capsule; (2) the capsule lead factors; (3) the withdrawal schedule for each surveillance capsule; (4) the neutron fluence to be received by each capsule at the time of its withdrawal; and (5) the vessel end-of-life peak neutron fluence (Subsection 5.3.1.6.4).

## 2.0 Codes and Standards

<b>Code</b>	<b>Code Title</b>	<b>Code Year/ Edition</b>
<b>American Society of Mechanical Engineers (ASME)</b>		
ASME B&PV Code Section III	Rules for Construction of Nuclear Power Plants	1989 Edition, (Excluding Addenda)
ASME Boiler and Pressure Vessel Code Section XI	Rules for Inservice Inspection of Nuclear Power Plant Components	Edition as permitted by the Construction Code
<b>American Society for Testing and Materials (ASTM) Standards</b>		
ASTM E185-82	Practice for Conducting Surveillance Tests for Light Water – Cooled Nuclear Power Reactors	
<i>Regulatory Guides</i>		
1.99, Rev. 2	Effects of Residual Elements on Predicted Radiation Damage to Reactor Vessel Material	
<i>Code of Federal Regulations</i>		
10CFR50	Appendix H	

### 3.0 Description

#### 3.1 Description

The radiation-induced changes in the mechanical properties of the core beltline region materials of the Reactor Pressure Vessel (RPV) shall be monitored periodically by the testing of RPV Surveillance test specimens. The surveillance test specimens are installed in removable specimen containers at the inside vessel wall opposite the active core.

This section describes the type and number of prepared surveillance test specimens. The surveillance test specimens are in compliance with the requirements of GE's Specifications, [[.....<sup>{3}</sup>]]. Surveillance test program shall be planned in accordance with the requirements of the Applicable Codes and Standards that are referenced in Section 2, Codes and Standards.

#### 3.2 Surveillance Capsule and Withdrawal Schedule

Four surveillance specimen capsules are provided for each RPV. Each of the capsules contains identical numbers and types of surveillance specimens.

The following information is identified for each surveillance capsule: [[.....

.....<sup>{3}</sup>]]

The capsule withdrawal schedule (based on ASTM E185-82 and considering a 60-year life for the RPV) is as follows:

- First Capsule: After 15 effective full-power years. [[.....<sup>{3}</sup>]] (E> 1 MeV)
- Second Capsule: After 30 effective full-power years. [[.....<sup>{3}</sup>]] (E> 1 MeV)
- Third Capsule: With an exposure not to exceed the vessel peak end of life (EOL) fluence [[.....<sup>{3}</sup>]] (E> 1 MeV)
- Fourth Capsule: Schedule determined based on results of first three capsules per ASTM E-185, Paragraph 7.6.2.

Testing of irradiated capsule specimens will be in accordance with the requirements of ASTM E-185-82 as required by 10CFR50 Appendix H.

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In accordance with 10 CFR 50.71(e), a Final Safety Analysis Report that references this report will be updated to identify the specific materials in each capsule and to provide a plant-specific replacement for the Pressure-Temperature limits provided in Figure 5-1 of this report.

## 4.0 RPV Material Surveillance Program

### 4.1 Surveillance Test Specimens

The type and number of prepared surveillance test specimens are summarized in Table 4-1.

The configuration and dimension of each specimen type are shown in Figure 4-1 and Figure 4-2.  
[[.....

.....<sup>{3}</sup>]]

Surveillance specimen holders are attached on the inside vessel wall opposite the active core. The surveillance test specimens are contained in the specimen containers. The specimen containers are installed in each specimen holder at site. The specimen containers are fixed to the holder by a spring. The main material of the specimen containers and holders is stainless steel. The specimen containers can be removed by using a special tool.

**Table 4-1 Type and Number of Surveillance Test Specimens (per ABWR Unit)**

[[.....

.....<sup>{3}</sup>]]

[[.....

.....<sup>(3)</sup>]]

**Figure 4-1 Impact Test Specimens**

[[.....

.....<sup>(3)</sup>]]

**Figure 4-2 Tension Test Specimens**

## 4.2 Location of Installed Surveillance Test Specimen

The irradiated specimens listed in Table 4-1 are placed into four specimen containers (capsules). The specimen containers are installed on the wall inside the RPV inside the [[.....<sup>{3}</sup>]] specimen holders.

[[.....  
.....<sup>{3}</sup>]]

The baseline specimens and the spare specimens listed in Table 4-1 are packed and supplied in a wooden box. These products are kept in the warehouse until they are required.

[[.....  
.....<sup>{3}</sup>]]

[[.....

.....<sup>(3)</sup>]]

**Figure 4-3 Outline of Specimen Container and Holder**

[[.....

.....<sup>(3)</sup>]]

**Figure 4-4 Locations of Installed Surveillance Holders**

## 5.0 Operation

The Reactor shall be operated in accordance with the following required thermal considerations:

### 5.1 Operation of Reactor

The operational cautions for the safe operation of the reactor associated with fracture toughness are as follows.

#### 5.1.1 Normal Heating and Temperature Change Rate

In the process of normal heating and cooling, the average rate of change of reactor cooling water temperature shall not exceed 55°C during any one hour.

#### 5.1.2 [[.....<sup>{3}</sup>]]

[[.....

.....<sup>{3}</sup>]]

#### 5.1.3 [[.....<sup>{3}</sup>]]

[[.....

.....<sup>{3}</sup>]]

[[.....

.....<sup>(3)</sup>]]

**Figure 5-1 Pressure-Temperature (P-T) Limit Diagram for Reactor Pressure Vessel for a Typical ABWR**