Tennessee Valley Authority, 1101 Market Street, LP 5A, Chattanooga, Tennessee 37402-2801

December 19, 2008

10 CFR 52.79

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

In the Matter of)
Tennessee Valley Authority)

Docket No. 52-014 and 52-015

BELLEFONTE COMBINED LICENSE APPLICATION – RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION – REACTOR VESSEL MATERIALS SURVEILLANCE SUPPLEMENTAL INFO

References: 1) Letter from Ravindra G. Joshi (NRC) to Andrea L. Sterdis (TVA), Request for Additional Information Letter No. 002 Related to SRP Section 05.03.01 for the Bellefonte Units 3 and 4 Combined License Application, dated April 17, 2008

2) Letter from Andrea L. Sterdis (TVA) to Document Control Desk (NRC), Bellefonte Combined License Application – Response to Request for Additional Information – Reactor Vessel Materials Surveillance, dated May 30, 2008

3) Letter from Andrea L. Sterdis (TVA) to Document Control Desk (NRC), Bellefonte Combined License Application – Response to Request for Additional Information – Reactor Vessel Materials Surveillance Supplemental Information, dated July 10, 2008

This letter provides supplemental information for the Tennessee Valley Authority's (TVA) responses (References 2 and 3) to the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) items included in Reference 1. The supplemental information is based on verbal discussions with the NRC staff.

A revised response to each NRC request in the subject letter is addressed in the enclosure which also identifies any associated changes that will be made in a future revision of the BLN application.

If you should have any questions, please contact Thomas Spink at 1101 Market Street, LP5A, Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7062, or via email at tespink@tva.gov.

D085
NRO

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 19th day of DEC, 2008.

Andrea L. Sterdis
Manager, New Nuclear Licensing and Industry Affairs
Nuclear Generation Development & Construction

Enclosure
cc: See Page 3

cc: (w/Enclosure)
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Enclosure
TVA letter dated December 19, 2008
RAI Responses

Supplemental responses to NRC Request for Additional Information letter No. 002 dated April 17, 2008 (5 pages, including this list)

Subject: Reactor Vessel Materials Surveillance in the Final Safety Analysis Report

RAI Number	Date of TVA Response
05.03.01-01(a)	July 10, 2008, revised by this letter – see following pages
05.03.01-01(b)	July 10, 2008, revised by this letter – see following pages

Attachments / Enclosures	Pages Included
None	

Enclosure
TVA letter dated December 19, 2008
RAI Responses

NRC Letter Dated: April 17, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 05.03.01-01(a)

a. Program Description:

The purpose of the reactor vessel (RV) surveillance capsule program, as described in ASTM E 185, is to monitor radiation effects on RV materials under operating conditions. Section C.III.1, Chapter 5, C.I.5.3.1.6 of Regulatory Guide (RG) 1.206 states, "because the material surveillance program is an operational program, as discussed in SECY-05-0197, the applicant must describe the program and its implementation in sufficient scope and level of detail for the staff to make a reasonable assurance finding on its acceptability." The NRC staff recognizes that certain information about the program, such as actual material properties of the RV, is not currently known, but in order to complete its review of the adequacy of the RV surveillance capsule program, the staff needs the following information at this time:

> Describe the process for preparing the capsule specimens. This description will confirm that the materials selected for the capsules are samples of those materials most likely to limit the operation of the RV.

BLN RAI ID: 1177

BLN RESPONSE:

Following the Supplemental response to this RAI, NRC requested that additional information be provided in the FSAR. This additional information is provided in the Application Revisions section below. Revisions to the July 10, 2008, supplemental response are indicated by change bars.

While "the material surveillance program is an operational program," the selection of materials for the capsules is a design function, and as such, it is addressed in the AP1000 design control document (DCD). The reactor vessel material surveillance program specimens will be taken directly from the vessel materials during vessel manufacturing and, as stated in the DCD, the program conforms to ASTM E185. The location of the capsules is shown in DCD Figure 5.3-4 which is referenced from the second paragraph of DCD Subsection 5.3.2.6. The first four paragraphs of DCD Subsection 5.3.2.6 describe the contents of the surveillance capsules including reactor vessel weld metal, base metal, and heat-affected zone metal specimens and the basis for the selection of the specimens included. The figure and DCD Subsection are incorporated by reference into the FSAR. Additional details for conformance with ASTM E185 and "the process for preparing the capsule specimens" are included in the identified FSAR changes below.

This response is expected to be STANDARD for the S-COLAs.

ASSOCIATED BLN COL APPLICATION REVISIONS:

COLA Part 2, FSAR, Chapter 5, Subsection 5.3.2.6, will be revised from (as provided in July 10, 2008, supplemental response – expected to be incorporated in FSAR annual update):

Add the following information between the first and second paragraphs of DCD Subsection 5.3.2.6.

[New paragraph(s) to provide description of "the process for preparing the capsule specimens" by a COLA revision to be developed and provided following NRC review of Westinghouse specification that will document conformance with ASTM E185.]

Reactor materials do not begin to be affected by neutron fluence until the reactor begins critical operation. Table 13.4-201 provides milestones for reactor vessel material surveillance program implementation.

The reactor vessel material surveillance program specimens are taken directly from the vessel materials during vessel manufacturing.

The above revised FSAR text will be further revised in a future update (after first FSAR annual update) to read:

Add the following information between the first and second paragraphs of DCD Subsection 5.3.2.6.

Surveillance test materials are prepared from the actual materials used in fabricating the beltline region of the reactor vessel. Records are maintained of the chemical analyses, fabrication history, mechanical properties and other essential variables pertinent to the fabrication process of the shell forging and weld metal from which the surveillance test materials are prepared. The test materials are processed so that they are representative of the material in the completed reactor vessel.

Three metallurgically different materials prepared from sections of reactor vessel shell forging are used for test specimens. These include base metal, weld metal and heat affected zone (HAZ) material.

Base metal test material is manufactured from a section of ring forging, either the intermediate shell course, the lower shell course, or the transition ring of the reactor pressure vessel. Selection is based on an evaluation of initial toughness (characterized by the reference temperature (RT_{NDT}) and Upper Shelf Energy (USE)), and the predicted effect of chemical composition (nickel and residual copper) and neutron fluence on the toughness (RT_{NDT} shift and decrease in USE) during reactor operation. The ring forging with the highest predicted adjusted RT_{NDT} temperature (initial RT_{NDT} plus RT_{NDT} shift) or that with USE predicted to approach close to the minimum limit of 50 ft-lb at end-of-license (EOL) is selected as the surveillance base metal test material. The means for measuring initial toughness and for predicting irradiation induced toughness changes is consistent with applicable procedures in force at the time the material is being selected. The section of shell forging used for the base metal test block is adjacent to the test material used for fracture toughness tests.

Weld metal and HAZ test material is produced by welding together sections of the forgings from the beltline of the reactor vessel. The HAZ test material is manufactured from a section of the same shell course forging used for base metal test material. The sections of shell course forging used for weld metal and HAZ test material are adjacent to the test material used for fracture toughness tests. The heat of wire or rod and lot of flux are from the same heat and lot used in making the beltline region welds. Welding parameters duplicate those used for the beltline region welds. The procedures for inspection of the reactor vessel welds are followed for the inspection of the welds in test materials. The surveillance weld and HAZ material are heat-treated to metallurgical conditions which are representative of the final metallurgical conditions of similar materials in the completed reactor vessel.

Test Specimens are marked to identify the type of materials and the orientation with respect to the test materials. Drawings specify the identification system to be used and include plant identification, type of material, orientation of specimen and sequential number.

Baseline test specimens are provided for establishing the baseline (unirradiated) properties of the reactor vessel materials. The data from tests of these specimens provides the basis for determining the radiation induced property changes of the reactor vessel materials.

Drop weight test specimens of each of base metal, weld metal, and HAZ metal are provided for establishing the nil-ductility transition temperature (NDTT) of the unirradiated surveillance materials. These data form the basis for RT_{NDT} determination from which subsequent radiation induced changes are determined.

Standard Charpy impact test specimens each of base metal (longitudinal (tangential) and transverse (axial)), weld metal, and HAZ material are provided for developing a Charpy impact energy transition curve from fully brittle to fully ductile behavior for defining specific index temperatures for these materials. These data, together with the drop weight NDTT, are used to establish and RT_{NDT} for each material.

Tensile test specimens each of base metal (longitudinal (tangential) and transverse (axial)), weld metal, and HAZ metal are provided to permit a sufficient number of tests for accurately establishing the tensile properties for these materials at a minimum of three test temperatures (e.g., ambient, operating and one intermediate temperature) to define the strength of the material.

The above described test specimens are to be used for determining changes in the strength and toughness of the surveillance materials resulting from neutron irradiation. Sufficient Charpy impact, compact tension and tensile test specimens are provided for establishing the changes in the properties of the surveillance materials over the lifetime of the reactor vessel. The type and quantity of test specimens exceed the minimum requirements of EI85-82.

Reactor materials do not begin to be affected by neutron fluence until the reactor begins critical operation. Table 13.4-201 provides milestones for reactor vessel material surveillance program implementation.

ATTACHMENTS/ENCLOSURES:

None

NRC Letter Dated: April 17, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 05.03.01-01(b)

b. RV Surveillance Capsule Program:

In order for the NRC staff to complete its review of the RV surveillance capsule program for Bellefonte Units 3 and 4, the COL applicant must fully describe its RV surveillance capsule program in accordance with ASTM E 185 and other requirements listed in 10 CFR Part 50, Appendix H. Specifically, the NRC staff still needs detailed information on the RV surveillance capsule program associated with the AP1000 design, including, but not limited to, the capsule environment and the material types of the capsule specimens. This information will need to be included in the RV surveillance capsule program in order to support planning and conduct of NRC inspections. Discuss whether this information will be provided before the NRC's determination on issuance of the COL, or, if this information will not be available until after the RV is procured, explain whether a license condition requiring that this information be provided by the COL holder (i.e., included in Bellefonte COLA Part 10, Section 2, "COL Holder Items.") would be necessary and sufficient for COL issuance.

BLN RAI ID: 1225

BLN RESPONSE:

A portion of the intended response was apparently omitted from the July 10, 2008, revision to this response. The intended wording is shown below and identified by the change bar.

While "the material surveillance program is an operational program," the requested details including "the capsule environment and the material types of the capsule specimens" are determined by the design, and as such, much of the material surveillance program information is addressed in the AP1000 design control document (DCD). The first four paragraphs of DCD Subsection 5.3.2.6 describe the contents of the surveillance capsules including reactor vessel weld metal, base metal, and heat-affected zone metal specimens. The orientation of base metal specimens relative to the principal rolling direction is defined. The basis for the selection of the specimens is included, and conformance to ASTM E185 and 10 CFR 50 Appendix H is noted in the DCD write-up. As noted in the DCD write-up, the complete capsule is helium leak tested. The DCD subsection is incorporated by reference in the FSAR.

Additional program description information will be included in the FSAR as described in the response to part (a) of this request. Further, the final reactor vessel material surveillance program will include the necessary details to conduct the program including the capsule environment and the material types of the capsule specimens. This program document is not expected to be available prior to issuance of the COL; however, no later than 12 months after issuance of the COL, schedule information will be provided to support "planning for and conduct of NRC inspections of operational programs" listed in FSAR Table 13.4-201.

This response is expected to be STANDARD for the S-COLAs.

ASSOCIATED BLN COL APPLICATION REVISIONS:

No COLA revisions have been identified associated with this response.

ATTACHMENTS/ENCLOSURES:

None