April 9, 2008

10 CFR 50.55a

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: OWFN P1-35
Washington, D.C. 20555-0001

Gentlemen:

In the Matter of	)	Docket No. 50-296
Tennessee Valley Authority	)	

BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 3 - AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI, INSERVICE INSPECTION PROGRAM FOR THE THIRD TEN-YEAR INSPECTION INTERVAL - REQUEST FOR RELIEF 3-ISI-23 - RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI) (TAC NO. MC6749)

By letter dated August 24, 2007, TVA submitted BFN Unit 3 request for relief 3-ISI-23. Request for relief 3-ISI-23 addresses nine (9) reactor Pressure Vessel (RPV) nozzle-to-vessel full penetration welds and seven (7) RPV nozzle inner radius sections. The design configuration of the RPV nozzle-to-vessel welds precludes a 100 percent ultrasonic (UT) examination of the required volume for the full penetration welds of the nozzles.

During its review of the BFN Unit 3, request for relief 3-ISI-23, the NRC staff identified questions, by letter dated March 13, 2008. As a result, TVA is providing responses to the NRC questions in the enclosure to this letter.

There are no new regulatory commitments in this letter. If you have any questions, please contact me at (256) 729-2636.

Sincerely,

Original signed by

D. T. Langley
Manager of Licensing
and Industry Affairs

Enclosure
cc: See Page 3

cc (Enclosure):

Ms. Rebecca L. Nease, Branch Chief
U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, Georgia 30303-8931

NRC Resident Inspector
Browns Ferry Nuclear Plant
10833 Shaw Road
Athens, Alabama 35611-6970

Ms. Eva A. Brown, Project Manager
U.S. Nuclear Regulatory Commission
One White Flint, North
(MS 08G9)
11555 Rockville Pike
Rockville, Maryland 20852-2739

JEE:JWD:BAB
Enclosure
cc (Enclosure): w/o enclosure
G. P. Arent, EQB 1B-WBN
W. R. Campbell, LP 3R-C
S. M. Douglas, POB 2C-BFN
D. C. Matherly, Jr., BFT 2A-BFN
R. F. Marks, Jr., PAB 1C-BFN
L. E. Nicholson, BR 4X-C
R. G. West, NAB 2A-BFN
B. A. Wetzel, BR 4X-C
S. A. Vance, WT 6A-K
E. J. Vigluicci, ET 11A-K
NSRB Support, LP 5M-C
EDMS WT CA–K,

s:\licensing\everyone\U3 ASME ISI 3rd Int 3-ISI-23 RAI Response.doc

ENCLOSURE

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNIT 3
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
SECTION XI, INSERVICE INSPECTION (ISI) PROGRAM,
THIRD TEN-YEAR INSPECTION INTERVAL

REQUEST FOR RELIEF 3-ISI-23

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)

(SEE ATTACHED)

ENCLOSURE

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNIT 3
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
SECTION XI, INSERVICE INSPECTION (ISI) PROGRAM,
THIRD TEN-YEAR INSPECTION INTERVAL

REQUEST FOR RELIEF 3-ISI-23

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)

Background

American society of Mechanical Engineers (ASME) Boiler & Pressure Code, Section XI, Table IWB-2500-1, Examination Category B-D, Item No. B3.90 requires a volumetric examination of essentially 100 percent of the reactor pressure vessel (RPV) nozzle welds as depicted in ASME Code Section XI, Figure IWB-2500-7(a). ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, Item No. B3.100 requires a volumetric examination of essentially 100 percent of the RPV nozzle inner radius as depicted in ASME Code, Section XI, Figure IWB-2500-7(a). The licensee invoked ASME Code Case N-648-1, which allows one to perform an enhanced VT-1 visual examination of the inner radius of the RPV nozzles in lieu of a volumetric examination as required by the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-D, Item No. B3.100.

NRC Request No. 1

The volumetric examination for all the RPV nozzle-to-vessel welds and the enhanced VT-1 visual examinations of the inner radii of all the RPV nozzles provided in Table 1 of the original submittal and Weld Examination Report R-057 appear to be inconsistent. Further, the information in Table 1 and Weld Examination Report R-057 appear to be inconsistent with the list of RPV nozzle-to-vessel welds and RPV nozzle inner radii listed on page E2-4 of the relief request (RR) as components addressed under RR 3-23.

Provide two separate tables listing the results of the volumetric examinations for all the RPV nozzle-to-vessel welds and the enhanced VT-1 visual examinations of the inner radii of all the RPV nozzles.

TVA Response to NRC Request No. 1

The scope of items associated with request for relief 3-ISI-23 is provided on page E2-4 of the relief request. Weld examination Report R-057 also examined RPV nozzle inner radius sections for nozzles N2G, N2H, N2J, N2K, N3C, N3D, and N8B during the Unit 3 Cycle 12 refueling outage. However, these examinations were credited to the Unit 3 Second Ten-Year inspection interval and submitted to NRC by letter dated February 21, 2007, under request for relief 3-ISI-7, Revision 2. NRC letter dated February 27, 2008, approved BFN request for relief 3-ISI-7, Revision 2.

Attachment A of this enclosure provides the two separate tables as requested by NRC.

NRC Request No. 2

In reviewing the examination results, it appears that the volumetric examination coverages were in the range of 22-42 percent and a number of enhanced VT-1 visual examination results were in the 40 percent range. If this is correct, provide further basis why these limited examination provide reasonable assurance of structural integrity of the subject welds and components. As part of this basis, address whether there are any mechanisms that may be expected to cause service-induced degradation of the subject components.

TVA Response to NRC Request No. 2

Volumetric (UT) examination coverages of Nozzle-To-Vessel (NV) welds for which relief is requested ranges from 22 percent (N1A) to 64 percent (N8A) with the majority of the welds falling into the 36 to 42 percent range (N2B, N2D, N2F, N3B, N4B, N4C, N5A). The access limitations imposed by the design of the plant and geometry of the components to be examined precludes achieving essentially 100% coverage of these components. Volumetric inspections are performed using the latest ultrasonic techniques, procedures, equipment, and personnel qualified to the requirements of the Performance Demonstration Initiative (PDI) Program. These UT examinations were performed on accessible areas to the maximum extent practical given the physical limitations of the subject welds. No significant flaws have been detected in NV welds and nozzle inner radii at BFN. Industry experience has shown that, other than early cracking in BWR feedwater nozzles and CRDM nozzles, no other significant flaws have been detected in NV and nozzle inner radii. Thermal fatigue has been identified as a degradation mechanism for RPV nozzles. Feedwater and CRD

Return nozzle cracking has been observed in the industry and was caused by cyclic stresses due to mixing of hot and cold water in these locations. NUREG-0619 was issued to address cracking in these locations. BFN has completed the NUREG-0619 commitments. Based on BFN examination history, the large number of examinations performed in the industry, and the substantially improved examination techniques capable of detecting significant cracking if present provide reasonable assurance that structural integrity of the subject components will be maintained.

The RPV nozzles inner radius sections are the only non-welded areas (excluding the RPV head bolts) requiring examination on the reactor vessel. This requirement was deterministically made early in the development of ASME Section XI. For all nozzles other than Feedwater, there is no significant thermal cycling during operation. From a risk perspective, there is no need to perform a volumetric examination on any nozzle other than the Feedwater and CRD Return nozzles. No service related cracking has ever been discovered in any BWR in the fleet other than on Feedwater and CRD Return lines.

There are no mechanisms of damage other than fatigue for the nozzle inner radius, and for other than Feedwater nozzles, there is no cause for significant thermal cycling. Therefore, the primary flaw of concern would be a flaw that was not detected during the manufacturing process. The BFN Unit 3 RPV nozzles were examined during and after manufacturing by surface and volumetric techniques. Additionally, preservice and inservice examinations have detected no flaws. It is unlikely that flaws would be initiated by the fatigue mechanism.

After approximately 22 years of operation (Unit 3 was shut down from March 1985 to November 1995), no cracking in the subject BFN Unit 3 RPV nozzles inner radius region has been found. Fracture toughness testing performed at Oak Ridge National Labs (ORNL) indicate that there is a large flaw tolerance for BWR nozzle inner radius regions. Even if flaw propagation was assumed, test results indicate a leak before break scenario would occur, which would not result in a significant increase in core damage frequency. In addition, system pressure testing continues to be performed each refueling outage and during plant operation, the containment is monitored for changes in unidentified leakage.

More than 50 percent of the total RPV nozzle population receives a complete (i.e., essentially 100 percent) nozzle inner radius examination.

Visual examination of the accessible nozzle inner radius surface (zone M-N) provides reasonable assurance deep flaws are not present. Additionally, when flaws are initiated by the flaw mechanism, they typically are encountered over a significant portion of the circumference as was the case for Feedwater nozzle cracking addressed in NUREG-0619.

In summary, fatigue cracking is the only relevant degradation mechanism for the RPV nozzle inner radius region, and for all nozzles other than Feedwater, there is no significant thermal cycling during operation.

Therefore, from an industry experience perspective, there is no need to perform volumetric examination on any nozzles other than Feedwater and CRD Return lines. This is supported by the fact that no service induced cracking has ever been discovered in any of the BWR fleet RPV nozzles other than Feedwater and CRD.

Attachment A

BFN Unit 3, Cycle 12 Refueling Outage Request for Relief 3-ISI-23,
Reactor Pressure Vessel Nozzle-To-Vessel Weld Ultrasonic Examinations

COMPONENT#	CODE CATEGORY	ITEM NO.	NPS	CYCLE	DATE	EXAM	REPORT#	RESULTS	COVERAGE%
N1A-NV	B-D	B3.90	28"	12	03/10/2006	UT	R-079	A	22%
N2B-NV	B-D	B3.90	12"	12	03/10/2006	UT	R-080	A	42%
N2D-NV	B-D	B3.90	12"	12	03/09/2006	UT	R-081	A	42%
N2F-NV	B-D	B3.90	12"	12	03/10/2006	UT	R-082	A	42%
N3B-NV	B-D	B3.90	26"	12	03/07/2006	UT	R-083	A	36%
N4B-NV	B-D	B3.90	12"	12	03/09/2006	UT	R-085	A	39%
N4C-NV	B-D	B3.90	12"	12	03/08/2006	UT	R-087	A	39%
N5A-NV	B-D	B3.90	10"	12	03/07/2006	UT	R-088	A	38%
N8A-NV	B-D	B3.90	4"	12	03/01/2006	UT	R-089	A	64%

BFN Unit 3, Cycle 12 Refueling Outage Request for Relief 3-ISI-23,
Reactor Pressure Vessel Nozzle Inner Radius Section Enhanced Visual Examination (EVT-1)

COMPONENT#	CODE CATEGORY	ITEM NO.	NPS	CYCLE	DATE	EXAM	REPORT#	RESULTS	COVERAGE%
N1A-IR	B-D	B3.100	28"	12	03/09/2006	EVT-1	R-057	A	90%
N2B-IR	B-D	B3.100	12"	12	03/11/2006	EVT-1	R-057	A	40%
N2D-IR	B-D	B3.100	12"	12	03/11/2006	EVT-1	R-057	A	40%
N2F-IR	B-D	B3.100	12"	12	03/10/2006	EVT-1	R-057	A	42%
N3B-IR	B-D	B3.100	26"	12	03/02/2006	EVT-1	R-057	A	90%
N5A-IR	B-D	B3.100	10"	12	03/07/2006	EVT-1	R-057	A	40%
N8A-IR	B-D	B3.100	4"	12	03/11/2006	EVT-1	R-057	A	40%

NOTE: THE FOLLOWING RPV NOZZLE TO INNER RADIUS SECTIONS IN REPORT NUMBER R-057 WERE EXAMINED IN UNIT 3 CYCLE 12 OUTAGE BUT WERE CREDITED TO UNIT 3 SECOND INTERVAL THIRD PERIOD AND ARE NOT PART OF THIS REQUEST FOR RELIEF.

N2G-IR
N2H-IR
N2J-IR
N2K-IR
N3C-IR
N3D-IR
N8B-IR