September 24, 2004

TVA-BFN-TS-405

10 CFR 50.90

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 Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - UNITS 1, 2, AND 3 – RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI) RELATED TO TECHNICAL SPECIFICATION (TS) CHANGE NO. TS-405 – ALTERNATE SOURCE TERM (AST) (TAC NOS. MB5733, MB5734, AND MB5735)

By letter dated July 31, 2002, as supplemented in letters dated December 9, 2002; February 12, March 26, July 11 and 17, 2003; May 17, July 2, and August 24, 2004; the Tennessee Valley Authority (TVA) submitted a request to revise the licensing and design basis to reflect the application of the alternate source term (AST) methodology for Browns Ferry Units 1, 2, and 3. As part of its review of TVA's request, the NRC staff identified questions, by letter dated August 19, 2004, where additional information is needed to complete their review.

The enclosure to this letter contains the specific NRC request for additional information and the corresponding TVA response.

If you have any questions regarding this information, please contact me at (256) 729-2636.

Sincerely,

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ENCLOSURE

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3
TECHNICAL SPECIFICATION (TS) CHANGE NO. TS-405
ALTERNATE SOURCE TERM (AST)

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)

(SEE ATTACHED)

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3
TECHNICAL SPECIFICATION (TS) CHANGE NO. TS-405
ALTERNATE SOURCE TERM (AST)

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)

By letter dated July 31, 2002, as supplemented in letters dated December 9, 2002; February 12, March 26, July 11 and 17, 2003; May 17, July 2, and August 24, 2004; the Tennessee Valley Authority (TVA) submitted a request to revise the licensing and design basis to reflect the application of the alternate source term (AST) methodology for Browns Ferry Units 1, 2, and 3. As part of its review of TVA's request, the NRC staff identified questions, by letter dated August 19, 2004, where additional information is needed to complete their review.

NRC Request For Additional Information

Recently, several indications were identified in the nonsafety portion of the main steam piping at Browns Ferry Nuclear Plant (BFN) Unit 1. Tennessee Valley Authority has determined that the indications were the result of the manufacturing process of the pipe and not service-induced. The alternative source term submittal and its supplements did not contain any discussion of these flaws and their potential impact on the structural integrity of that portion of the main steam piping system. Provide your response to the following questions:

1. At BFN, Unit 1, several indications were identified in the nonsafety portion of the main steam piping. One of the flaws identified showed a reduction in the wall thickness up to 34 percent. Provide a discussion on the impact of these localized reductions in the wall thickness on the existing structural and seismic calculations and how conformance to the existing and proposed licensing basis for that portion of the main steam piping is and will be maintained.

2. Given that flaws have been found in the main steam piping of Unit 1, discuss what assurances exist that other flaws that represent a 34 percent or greater reduction in wall thickness do not exist, not only on Unit 1, but Units 2 and 3 as well.

TVA Response to NRC Request No. 1

TVA is performing a voluntary sample examination of Class 1 and 2 piping in addition to inspection of those piping welds required to complete the first interval to be examined prior to Unit 1 restart. The voluntary sample is 25 percent for Class 1 welds and 7.5 percent for Class 2 welds and is equivalent to a normal 10-year inservice inspection scope.

There are 114 welds in the Class 2 portion of the Main Steam line and the initial 7.5 percent sample size for Class 2 Main Steam was 9 welds. Two welds, Dravo shop welds DSMS-1-30 and DSMS-1-13, were identified as containing unacceptable indications in the initial sample of Class 2 Main Steam piping welds.

The Class 2 Main Steam weld sample was then expanded in accordance with ASME Section XI rules to include 16 more welds (both shop and field welds). Weld DSMS-1-43, a Dravo shop weld, was identified as containing an unacceptable indication and weld DSMS 1-44, also a Dravo shop weld, was identified as containing an acceptable indication.

The indications in these four shop welds were discovered by surface examination and their corresponding depth was initially determined ultrasonically. The indication at weld DSMS-1-30 was sized as a 34 percent though wall, the indication at weld DSMS-1-13 was sized as 23.9 percent through wall, and the indication at weld DSMS-1-43 was sized as 13.9 percent through wall. The through wall percentage calculations are based on actual wall thickness as determined by ultrasonic examination. The indications are all outside diameter connected and the maximum through wall is given where multiple indications were identified.

An additional examination of the remaining 29 accessible Class 2 Main Steam shop welds 18-inches and greater was conducted with no further unacceptable indications located. The total number of Class 2 Main Steam welds examined in the three samples was 54 welds. The Class 2 Main Steam piping initial sample and the first additional sample included both shop and field welds, with no indications noted in the field welds. The piping material is ASTM A-106, Grade B.

Five “boat samples” were removed from the three identified weld locations with unacceptable indications. These samples were submitted to TVA’s Central Laboratories Services where a failure analysis was performed on the samples. Central Laboratories issued Technical Report No. 24-0897, “Boat Samples From Main Steam

Line – ISI Indications," documenting their examinations, findings, and conclusions. The report showed major differences between the reported UT indication depth verses the depth established by metallurgical analysis. The UT technique used to size the depth of the linear surface flaws in the main steam line was a Performance Demonstration Initiative (PDI) qualified procedure for ferritic materials utilizing time-of-flight from tip diffraction signals for sizing planar flaws. The reported and actual depth of the unacceptable surface flaws were as follows:

Weld No.	**Dia**	**Nominal Wall Thickness**	**Mfg Tolerance**	**Reported UT Depth**	**Actual Wall Thickness**	**Metallurgical Flaw Depth**
DSMS-1-13	24"	1.219"	± 0.152"	0.280"	1.17"	0.043"
DSMS-1-30	18"	0.938"	± 0.117"	0.320"	0.940"	0.067"
DSMS-1-43	24"	1.219"	± 0.152"	0.164"	1.18"	0.102"

As evidenced by the major differences in the reported UT depth readings verses actual metallurgical flaw depth, the PDI qualified time-of-flight from tip diffraction signals method may not be the best approach for depth sizing axially oriented flaws associated with laps being formed into the pipe material during the manufacturing process. Sizing of flaws utilizing the time-of-flight from tip diffraction signals method does exceedingly well for planar type flaws; however, these flaws were not planar flaws but were more laminar in nature. Adding to the problem was the fact that calibration for time-of-flight sizing is typically performed on a flat surface calibration standard utilizing known reflectors at specific depths. For near surface flaw tips, a high angle 70 degree shear wave was utilized. This method performs well when used on flat surfaces, i.e., flaws oriented in the circumferential direction of the pipe or other relatively flat surfaces. Because these flaws were oriented in the axial direction along the pipe, the high angle 70 degree shear waves, when directed in the circumferential direction of the pipe, tend to create a focusing effect of the sound beam toward the surface of the pipe as the transducer is moved away from the flaw to obtain the "tip" signal. The instrument readings do not adjust for the pipe curvature.

Because the flaws were associated with laps being formed into the pipe material during the manufacturing process, they are more like a laminar type flaw as described in ASME Section XI, IWA-3360. Laminar flaws are described as being oriented within 10 degrees of a plane parallel to the surface of the component.

The metallurgical analysis indicated that the flaws were more laminar than planar in orientation. The PDI qualified procedure used to size the flaws in ferritic materials utilizing time-of-flight from tip diffraction signals for sizing planar flaws should not have been utilized for sizing laminar type flaws. Laminar type (laps) flaw depths should be determined with UT straight beam.

The metallurgical report confirmed that the ultrasonic depth sizing to be conservative based on flaw orientation in the axial direction and current PDI requirements. The metallurgical report identified the flaws as mill defects which were not service induced.

Based on the metallurgical report, the actual depth was 0.102 inches for the indication associated with weld DSMS-1-43 equaling an 8.6 percent reduction in wall thickness and is acceptable in accordance with ASME Section XI, Table IWB-3514-1 for Inservice Examination Flaws. The ASTM A-106, Grade B material specification specifies that "…surface imperfections that penetrate more than 12-½ percent of the wall thickness or encroach on the minimum wall thickness shall be considered defects." The flaws associated with components DSMS-1-13 and DSMS-1-30 have reductions in wall thickness of 3.6 percent and 7.1 percent respectively and are also acceptable in accordance with ASME Section XI.

Based on the metallurgical results described above and the extensive sampling of both Class 1 and Class 2 piping for Browns Ferry Unit 1, TVA has determined there is no structural integrity concern regarding the main steam piping, and no additional examinations are required to address this issue.

TVA Response to NRC Request No. 2

In response to the BFN Unit 1 main steam piping indications, previous examinations (approximately 35 volumetric and surface examinations) were reviewed of the Units 2 and 3 18-inch and 24-inch main steam piping in the same areas as the indications identified on Unit 1. This review identified one similar surface

indication identified during Unit 2 Cycle 7 operation (Spring 1994). This indication was removed by buffing, while maintaining minimum wall thickness for structural integrity. The Units 2 and 3 examination results taken with the metallurgical results from the Unit 1 samples provide assurance that no flaws representing reduction in wall thickness, in excess of that allowed by ASME Section XI, exist for BFN Units 2 and 3.