Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

October 22, 1999

10 CFR 50.55a(a)(3)(i)

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

Gentlemen:

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

BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 3 - REQUEST FOR RELIEF, 3-ISI-1, REVISION 1, REGARDING REACTOR PRESSURE VESSEL SHELL WELDS, AUGMENTED AND AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI INSPECTIONS - REVISED PAGES

This letter submits revised pages to request for relief, 3-ISI-1, Revision 1, transmitted to NRC by TVA letter dated June 25, 1999. In that letter, TVA requested permanent relief from inservice inspection requirements to perform volumetric examination of the BFN Unit 3 reactor pressure vessel (RPV) circumferential shell welds. TVA also requested relief from performing successive examinations of the Unit 3 reactor RPV circumferential shell weld flaws that were previously identified during the Unit 3 extended outage (Fall 1993). The revised pages provide clarification of the BFN Unit 3 RPV neutron fluence values used in TVA's evaluation for the request for relief and miscellaneous editorial changes.

The basis of TVA's request for relief is consistent with the guidance and criteria described in NRC Generic Letter (GL) 98-05, "Boiling Water Reactor Licensees Use of the BWRVIP-05 Report to Request Relief from Augmented Examination

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Requirements on Reactor Pressure Vessel Circumferential Shell Welds." The staff completed its review of the Boiling Water Reactor Vessel and Internals Project (BWRVIP) BWRVIP-05 Report and issued the final Safety Evaluation Report (SER) by letter dated July 30, 1998. The SER authorizes permanent relief from inservice inspection requirements for BWR RPV circumferential shell welds. The staff's SER also accepted the BWRVIP-05 Report's recommendation to eliminate successive examinations for "non threatening" flaws (e.g., such as embedded flaws from material manufacturing or vessel fabrication which experience negligible or no growth during the life of the vessel) provided certain conditions are met.

The revised pages for request for relief 3-ISI-1, Revision 1, are contained in the enclosure of this letter. Submission of the revised pages was discussed with the NRC staff during a teleconference on September 21, 1999. As previously stated in its initial letter dated June 25, 1999, TVA requests approval of this request for relief by December 31, 1999. This is to allow for resource planning for the Unit 3 Cycle 9 (Spring 2000) refueling outage to support scheduled ASME Section XI outage activities.

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

Sincerely,

T. E. Abney
Manager of Licensing
and Industry Affairs

Enclosure
cc: See page 3

Enclosure:
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ENCLOSURE

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

REQUEST FOR RELIEF 3-ISI-1, REVISION 1
REVISED PAGES

Please replace pages E-2 through E-25 of BFN Request for Relief 3-ISI-1, Revision 1, submitted by TVA letter dated June 25, 1999, with pages E-2 through E-27 of this enclosure.

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNIT 3
AUGMENTED AND ASME SECTION XI INSERVICE INSPECTION PROGRAM
(SECOND TEN YEAR INSPECTION INTERVAL)

REQUEST FOR RELIEF 3-ISI-1, REVISION 1

Executive Summary: In accordance with 10 CFR 50.55a(a)(3)(i) TVA requests permanent relief (i.e., for the remaining term of operation under the existing license) from the inservice inspection requirements of 10 CFR 50.55a(g) for the volumetric examination of the reactor pressure vessel circumferential welds (ASME Code Section XI, Table IWB-2500-1, Examination Category B-A, Item No. B1.11, Circumferential Shell Welds). This request for relief is consistent with the guidance provided in NRC Generic Letter 98-05, "Boiling Water Reactor Licensees Use of the BWRVIP-05 Report to Request Relief From Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds" dated November 10, 1998. As part of this relief request, TVA also requests elimination of the successive examinations required by the ASME Code paragraph IWB-2420(b) for the RPV circumferential shell weld flaw areas. Section 2.8.1 of the Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report dated July 28, 1998, permits the elimination of the successive examinations if certain outlined conditions are satisfied. TVA has met the stated conditions of the NRC SER for the BWRVIP-05 Report for the BFN Unit 3 RPV.

TVA has previously requested relief, for one operating cycle (Cycle 8), from performing successive examinations of the Unit 3 reactor pressure vessel (RPV) circumferential shell weld flaw areas and was granted relief by NRC in a letter dated August 17, 1998. In accordance with the existing approved relief request, these 15 flaws would be required to be reexamined during the BFN Unit 3 Cycle 9 refueling outage (Spring 2000).

This request for relief addresses the Code required scheduled circumferential shell weld examinations and the successive examinations required by IWB-2420(b) applicable to the RPV flaws identified (Fall 1993) during the BFN Unit 3 extended outage. The ASME Section XI Code paragraph IWB-2420(b) requires that RPV shell welds with flaws that were evaluated as being acceptable for continued service be reexamined in the next three inspection periods. To comply with this requirement, TVA must reexamine the Unit 3 RPV shell weld flaws during the Cycle 9 refueling outage, unless relief is granted.

The Code of Record for the Second Ten Year Inservice Inspection Interval is the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, 1989 Edition (no addenda).

TVA performed Unit 3 augmented RPV examinations (Fall 1993) during the extended outage as required by 10 CFR 50.55a(g)(6)(ii)(A). The intent of 10 CFR 50.55a(g)(6)(ii)(A) was to require licensees to perform an expanded RPV shell weld examination, as specified in the 1989 Edition of ASME Section XI, on an "expedited" basis. "Expedited," in this context, effectively means during the inspection interval that the rule was approved or the first period of the next inspection interval. The final rule was published in the Federal Register on August 6, 1992.

The BFN Unit 3 RPV examination results identified fifteen flaws, located in circumferential shell welds, that exceeded the ASME Section XI Code acceptance criteria specified in Subarticle IWB-3500. TVA performed an evaluation of the indications in accordance with the ASME Section XI Code, paragraph IWB-3600, and determined that the BFN Unit 3 RPV was acceptable for continued service. The indications, all in the RPV shell welds, were oriented in the weld areas in such a manner as to indicate they were related to the fabrication of the vessel, and were characterized as subsurface flaws. The size and location of the flaws are such that the NDE techniques and capabilities used at the time of the vessel fabrication would not have readily identified the flaws.

One flaw located in the circumferential shell weld area (C-3-4) within the overlapping region of the longitudinal shell weld (V-4-B) examination boundary will be examined during the performance of the longitudinal weld examinations (Note: The flaw is reported in both the circumferential and longitudinal examination data report, numbers 12-015 and 14-002 respectfully). TVA is scheduled to perform all Code required and augmented RPV weld examinations in the Third Period (Spring 2004) of the Second Inspection Interval.

Justification for this request for relief is based upon, (1) TVA's previous evaluation of the flaws that determined an acceptable level of quality and safety exists, (2) NRC's concurrence with TVA's evaluation dated August 17, 1998, (3) TVA's determination that the BFN Unit 3 RPV flaws satisfy the criteria outlined in the NRC Final Safety Evaluation Report (SER) dated July 28, 1998, for the BWRVIP-05 Report, and (4) the BWRVIP-05 report supports justification for excluding the examinations of the RPV circumferential shell welds. Therefore, in accordance with the guidance provided in GL 98-05 and pursuant to 10 CFR 50.55a(a)(3)(i), TVA asks that request for relief 3-ISI-1, Revision 1, be authorized for BFN Unit 3.

Unit: Three (3)

System: Reactor Pressure Vessel

Components: The components list for this request for relief is divided into two parts. The first list is for the permanent relief from examination of the BFN Unit 3 RPV circumferential welds. The second list comprises the Unit 3 RPV circumferential weld flaws that TVA is requesting relief from successive inspections.

Listed below are the BFN Unit 3 RPV circumferential welds from which TVA is requesting permanent relief from volumetric examination:

TVA/GE RPV Weld Designation	Examination Category and Exam Method	Table IWB-2500-1 Item Number
Vessel to Flange Weld C-5-FLG Circumferential vessel to vessel shell weld, (GE designation VFW)	B-A, Volumetric	B1.11
Vessel Shell Weld - C-4-5 Circumferential vessel shell weld, (GE Designation H45)	B-A, Volumetric	B1.11
Vessel Shell Weld - C-3-4 Circumferential vessel shell weld, (GE designation H34)	B-A, Volumetric	B1.11

Vessel Shell Weld - C-2-3 Circumferential vessel shell weld, (GE designation H23)	B-A, Volumetric	B1.11
Vessel shell weld - C-1-2, Circumferential vessel shell weld, (GE designation H12)	B-A, Volumetric	B1.11
Vessel Shell Weld - C-BH-1, Circumferential vessel shell weld, (GE designation BHW-1)	B-A, Volumetric	B1.11

Listed below are the BFN Unit 3 RPV circumferential weld flaws that TVA is requesting relief from successive volumetric examinations.

TVA/GE RPV Weld Designation	**Exam Category and Exam Method**	**Table IWB-2500-1 Item Number**	**Flaw Indication Report No.**
C-5FLG/VFW	B-A, Volumetric	B1.11	20-007 20-008 20-009 20-011 20-012
C-4-5/H45	B-A, Volumetric	B1.11	16-075 16-076
C-3-4/H34	B-A, Volumetric	B1.11	12-015* 12-069 12-116 12-144 12-145 12-148
C-2-3/H23	B-A, Volumetric	B1.11	08-026 08-067

*- Same flaw reported in Exam Summary Report 12-015 for RPV circumferential weld C-3-4 and Exam Summary Report 14-002 for RPV longitudinal weld V-4-B.

ASME Code Class: ASME Code Class 1

Section XI Edition: 1989 Edition, no addenda

Code Table: IWB-2500-1

Examination Category: B-A, Pressure Retaining Welds in Reactor Vessel

Examination Item Number: See Table Above

Code Requirement: (1) ASME Section XI, 1989 Edition (no addenda), Table IWB-2500-1, Examination Category B-A, Item No. B1.11, volumetric examination of reactor pressure vessel circumferential welds.

(2) ASME Section XI, 1989 Edition (no addenda), Subarticle IWB-2420(b) "If flaw indications or relevant conditions are evaluated in accordance with IWB-3132.4 or IWB-3142.4, respectively, and the component qualifies as acceptable for continued service, the areas containing such flaw indications or relevant conditions shall be reexamined during the next three inspection periods listed in the schedule of the inspection program for IWB-2410."

Code Requirement From Which Relief Is Requested: In accordance with 10 CFR 50.55a(a)(3)(i) TVA is requesting relief from the ASME Code requirements shown below. TVA's proposed alternative provides an acceptable level of quality and safety and is consistent with the NRC's SER for the BWRVIP-05 Report and the guidance provided in GL 98-05.

(1) Permanent relief (i.e., for the remaining term of operation under the existing license) is requested from the inservice inspection requirements for the volumetric examination of reactor pressure vessel circumferential welds, ASME Section XI, Table IWB-2500-1, Examination Category B-A, Item B1.11, Circumferential Shell Welds, as outlined in the NRC SER for the BWRVIP-05 Report and as permitted by GL 98-05.

(2) Relief is also requested from the ASME Code Subarticle IWB-2420(b) requirement which states that flaw indications or relevant conditions, evaluated to be acceptable for continued service, be reexamined during the next three inspection periods.

List Of Items Associated With The Relief Request: See Tables Above

Basis for Relief: The basis for this request for relief is outlined in the NRC SER for the BWRVIP-05 Report and the guidance outlined in GL 98-05. These documents provide the basis for the elimination of inspections of the BWR RPV circumferential shell welds. The BWRVIP-05 Report SER concluded that the probability of failure of the BWR RPV circumferential shell welds is orders of magnitude lower than that of the axial shell welds. In addition, NRC conducted an independent risk-informed assessment of the analysis contained in the BWRVIP-05 Report SER. The NRC assessment and GL 98-05 concluded that the inspection of BWR RPV circumferential shell welds does not measurably affect the probability of failure. The industry examination results identified in the BWRVIP-05 topical report

(Reference EPRI report No. TR-105697), indicate that the necessity for performance of the circumferential shell weld volumetric examinations is not warranted based upon the low probability of failure of these welds. The basis for relief from performing successive examinations of the Unit 3 RPV circumferential shell weld flaw areas is outlined in the three conditions of Section 2.8.1 of the BWRVIP-05 Report SER. The alternative criteria outlined in Section 2.8.1 eliminates examinations for "non-threatening" flaws (e.g., such as embedded flaws from material manufacturing or vessel fabrication which experience negligible or no growth during the design life of the vessel) provided the conditions below are satisfied.

- The flaw is characterized as subsurface.

- The NDE technique and evaluation that detected and characterized the flaw as originating from material manufacture or vessel fabrication is documented in a flaw evaluation report.

- The vessel containing the flaw is acceptable for continued service in accordance with IWB-3600 and the flaw is demonstrated acceptable for the intended service life of the vessel.

Justification, not to perform the successive examinations required by the ASME Code IWB-2420(b) is based upon TVA's compliance with the conditions specified above in section 2.8.1 of the NRC SER for the BWRVIP-05 Report.

- The flaws are subsurface. NRC concluded the flaws were subsurface in Section 4.0 of its SER dated August 17, 1998, for BFN Request for Relief 3-ISI-1, Revision 0.
- The GE flaw evaluation shows that the maximum indication depths (2a) will not exceed the ASME Code allowable flaw depths during the intended service life of the vessel.

These conditions are also addressed in a memorandum from General Electric to TVA, dated November 21, 1997, on the subject "Extension of Unit 3 Vessel Flaw Handbook Results to 40 Years." The referenced memorandum summarizes the Ultrasonic (UT) Indication Evaluations as stated below:

"The indications found during the 1993 UT exam which exceeded the IWB-3500 acceptance standards were all subsurface flaws, and all were circumferentially oriented. The allowable subsurface flaw plots are reproduced as Figures 8-10 (See Attachment 1) with the UT exam indications plotted against the allowable circumferential flaw curves. The maximum indication depths (2a) for each seam weld are well within the allowables. The indications are acceptable when compared to the allowable flaw curves, which show allowables which are conservative for up to 40 years of operation. Therefore, the indications are acceptable without further inspection when considering vessel fatigue and irradiation embrittlement degradation mechanisms."

A listing of the fifteen flaws (as designated in the inspection report) and their associated shell welds is as follows:

TVA/GE RPV Weld Designation	**Flaw Indication Report Nos.**
C-5FLG / VFW	20-007 20-008 20-009 20-011 20-012
C-4-5 / H45	16-075 16-076

C-3-4 / H34	12-015* 12-069 12-116 12-144 12-145 12-148
C-2-3 / H23	08-026 08-067
V-4-B / V4	14-002*

* - Same flaw reported in Exam Summary Reports 12-015 and 14-002.

The flaw area located in the circumferential shell weld and the overlapping longitudinal shell weld boundary is located above the beltline region of the reactor vessel. A schematic map/sketch of the Unit 3 RPV and the weld locations is shown in Attachment 2. A table compiling the fifteen flaws with the results of their ASME Code IWB-3600 evaluation data and copies of the GE Examination Summary Report sheets for the indicated welds, showing the report terms and definitions and the flaw sizing data for the 15 analyzed flaws, are shown in Attachments 3, 4, and 5 and were previously reviewed by NRC for 3-ISI-1 Revision 0, and documented in the staff's SER dated August 17, 1998.

NRC Information Notice (IN) 97-63 provided guidance regarding evaluations that should be considered when asking for relief. The NRC fracture analysis report dated August 14, 1997, Table 7-1, contained three reference cases used in their analysis. Using this guidance, TVA's evaluation found that the Unit 3 RPV fracture mechanics analysis was within the NRC bounding analysis.

TVA has addressed the two areas of concern outlined in the Permitted Action Section of Generic Letter 98-05: (1) the Unit 3 RPV level of embrittlement expected at the end of the period for which relief is requested in the most limiting RPV circumferential shell-weld areas, (2) the probability and expected frequency of the occurrence of a low temperature/high pressure transient on the Unit 3 RPV.

It is TVA's position that the low probability of failure and growth of the subsurface flaws does not warrant the additional expenditures and man-rem exposures that would result from performing the ASME Code required successive examinations. TVA's compliance with NRC Generic Letter 98-05 Permitted Action Items one and two is described below.

(1) Comparison of the BFN Unit 3 RPV Brittle Fracture Information to the BWRVIP-05 and NRC Assessments of the Probability of Failure of BWR RPV Circumferential Welds:

The BWRVIP-05 Report and the NRC Staff's independent risk-informed assessment of the initiative reports concluded that the probability of failure of the BWR RPV circumferential shell welds is orders of magnitude lower than that of the axial shell welds. Additionally, the NRC assessment demonstrated that inspection of the RPV circumferential shell welds does not measurably affect the probability of failure.

The independent NRC assessment included a Probabilistic Fracture Mechanics (PFM) analysis to estimate RPV failure probabilities. Three key assumptions in the PFM are: (1) the neutron fluence was that estimated to be the end-of-license mean fluence; (2) the chemistry values are mean values based on vessel types; and (3) the potential for beyond design basis events is considered. Although the BWRVIP-05 Report provided the technical basis supporting the relief request, the information previously submitted in TVA's response (Attachments 4 and 5) dated June 12, 1998, and July 31, 1998, to NRC request for additional information shows the conservatism of the NRC analysis for the Browns Ferry Unit 3 RPV. For plants with RPVs fabricated by Babcock and Wilcox the mean end-of-license neutron fluence used in the NRC PFM analysis was

0.053×10^{19} n/cm^2. However, the highest fluence anticipated at the end of the period of 32 EFPY for BFN Unit 3 (in the RPV belt line region) is 0.11×10^{19} n/cm^2 (see NRC "Reactor Vessel Integrity Database") on the inside vessel surface. This fluence calculation was based on the power uprate 32 EFPY operating curve information submitted in TVA's response dated June 12, 1998, and July 31, 1998, (Attachments 4 and 5) to NRC's request for additional information. Thus, embrittlement for the BFN Unit 3 RPV due to fluence effects is less than the value obtained in the NRC analysis shown in the SER (Table 2.6-4) for the BWRVIP-05 Report. Additional BFN Unit 3 RPV shell weld information requested by the NRC staff to be included in the relief request is provided in Attachments 4 and 5. However, no flaws that required additional evaluation in accordance with the ASME Section XI Code, Subarticles IWB-3132.4 and IWB-3600 were recorded for the RPV axial welds or the C-1-2 circumferential weld in the beltline region.

The beltline region circumferential shell weld (C-1-2) was chosen for analysis to provide a basis for comparison to the NRC bounding analysis and as the Unit 3 RPV region where these calculated parameters would result in comparatively conservative values. The materials would also be representative of the Unit 3 RPV circumferential shell welds in general. The flaws in the Unit 3 RPV that required evaluation were located in circumferential shell welds designated as C-5-FLG, C-4-5, C-3-4 (flaw in weld C-3-4 is actually located in the circumferential shell weld area within the overlapping region of the longitudinal shell weld V-4-B examination boundary), and C-2-3. The weld areas in question are located above and out of the RPV beltline region with expected fluence levels in varying degrees lower than those calculated for the beltline region. Therefore, any embrittlement and subsequent calculated ΔRT_{NDT} for the welds containing the flaws would be less than that calculated for the welds in the beltline region. The calculated ΔRT_{NDT} for the circumferential weld in the beltline region is 51.23 °F. This value assumes that the fluence at the flaw is equivalent to the inside surface fluence and does not take credit for attenuation. By comparison, using the mean fluence value and the weld chemistry assumed for the Babcock & Wilcox RPVs shown in Table 2.6-4 of the BWRVIP-05 Report SER, ΔRT_{NDT} for the NRC analysis and BWRVIP limiting plant specific analysis would be 79.8 °F. In addition, the calculated upper bound RT_{NDT} value for the BFN Unit 3 beltline welds is 62.46 °F; while the Mean Adjusted RT_{NDT} value [i.e., Inner Surface °F], shown in Table 2.6-4 of the BWRVIP-05 Report SER, is 99.8 °F. A compilation of the Unit 3 RPV calculated ΔRT_{NDT} values at the estimated fluence values for 32 EFPY is shown in Table 1 on the following page.

Additional conservatism is present in the above calculations since the changes in the calculated Upper Bound RT_{NDT} value assume that the fluence factors at the inside surface of the vessel were representative of the fluence in the flaw regions. The fifteen flaws for the Unit 3 RPV are subsurface flaws and the additional thickness of RPV wall material would result in a lessened effect on the change in the RT_{NDT} values. Thus, the calculated values for the BFN Unit 3 RPV circumferential welds are substantially less than the corresponding values computed using the NRC's bounding analysis and there is conservatism in the already low circumferential weld failure probabilities for the BFN Unit 3 circumferential welds containing the flaws.

These calculations support TVA's position that any growth in the existing Unit 3 RPV circumferential weld flaws is highly unlikely and the performance of the successive examinations is not warranted. It should also be noted that the BWRVIP-05 Report is a statistically based analysis that assumes the RPV augmented examinations have not been

TABLE 1
BROWNS FERRY UNIT 3 RPV SHELL WELD INFORMATION
FOR 32 EFFECTIVE FULL-POWER YEARS (EFPY)

	Beltline Region Circumferential Shell Weld, C-1-2, between Unit 3 RPV Shells Course 1 and Course 2 (Mk-57/58) Weld Material Heat No. D51852 and D55733
Neutron fluence at the end of 32 EFPY (inside surface at weld C-1-2)	0.11×10^{19} n/cm^2
Initial (unirradiated) reference temperature	-40 °F
Weld Chemistry Factor (CF)	117.45
Weld copper content	0.09%
Weld Nickel content	0.67%
Increase in reference temperature due to irradiation (ΔRT_{NDT})	51.23 °F
Margin term	51.23 °F
Mean adjusted reference temperature (ART)	11.23 °F
Upper bound adjusted reference temperature (ART)	62.46 °F

performed and, therefore, uses the premise that the distribution of flaw sizes follows a normal distribution and range of sizes. TVA has performed the required RPV augmented examinations. As a result, the presence of flaws in the Unit 3 RPV and their size and distribution is a known quantity. The flaws encountered in the Unit 3 RPV are bounded in the BWRVIP-05 Report and the NRC assessment. Thus, for TVA, there is additional assurance of the validity of these analyses compared to the inherent uncertainty, when applying the same results to other plants which have not performed the examinations.

In addition, should unexpected growth in the RPV flaws occur, a margin exists between the calculated flaw sizes and the allowable ASME Section XI limits calculated using the requirements of Subarticle IWB-3600. This is shown in the summary of the Unit 3 RPV inspection results table in Attachment 3. The summary indicates that the smallest margin is a factor of 3.1 below the initial flaw size which would be acceptable for the service lifetime of the RPV under the ASME Section XI Subarticle IWB-3600 acceptance criteria. In summary, the analysis supports TVA's proposed request for relief 3-ISI-1, Revision 1, and demonstrates that the BFN Unit 3 RPV vessel welds are bounded by the NRC's Generic Letter 98-05, the BWRVIP-05 Report SER, and the staff's independent assessment.

(2) Review of BFN Unit 3 Procedural and Administrative Controls to Prevent RPV Low-Temperature / High-Pressure Transient Events

The NRC staff stated in GL 98-05 that beyond design-basis events occurring during plant shutdown could lead to cold over-pressure events that could challenge vessel integrity. Although unlikely, the industry concluded that condensate and control rod drive pumps could cause conditions that could lead to cold over-pressure events that could challenge vessel integrity. For a BWR to experience such an event, the plant would require several operator errors. The NRC staff's assessment described several types of events that could be precursors to BWR RPV cold over-pressure transients. These were identified as precursors because no cold over-pressure event has occurred at a U.S. BWR. The staff assessment identified one actual cold over-pressure event that occurred during shutdown at a non-U.S. BWR. This event apparently included several operator errors that resulted in a maximum RPV pressure of 1150 psi with a temperature range of 79°F to 88°F. The operating procedures for BFN Unit 3 are sufficient to prevent a cold over-pressure event from occurring during activities such as the system leak test performed at the conclusion of each refueling outage. Thus, the challenge to the BFN Unit 3 RPV from a non-design basis cold over-pressure transient is unlikely. The following discussion will provide further information to support TVA's conclusion.

BFN Operations procedures and administrative control processes are in place to minimize the potential for occurrence of RPV cold over-pressurization events. These processes include plant operating procedures, plant evolution planning and scheduling, administrative controls, and operator training.

Since cold over-pressurization events are most likely to occur during normal cold shutdown conditions, BFN operating procedures are written to require that RPV water level, pressure, and temperature are established and maintained in well controlled bands. Plant licensed Unit Operators frequently monitor these parameters for abnormalities and indications of unwanted transients. Also, any plant evolution which requires changes in these critical parameters is performed under the oversight of the Shift Manager who is also notified immediately of any abnormalities in the indications. Therefore, any deviation of these parameters from the established bands are promptly identified and corrected. In addition to these procedures, unit conditions for on-going activities which potentially can effect the maintenance of acceptable operating conditions and available contingency systems and plans are discussed by unit operations personnel at the time of shift turnover. These administrative controls and procedures provide assurance that activities which could adversely affect RPV water level, temperature, and pressure are precluded. Nuclear experience reviews and industry operating histories have shown that inadequate work-control processes and procedures can precipitate a cold over-pressurization event. For BFN, outage work is controlled through planning and scheduling activities performed by the Outage Management and Work Control Team. Unit and system work activities are carefully reviewed and coordinated to avoid conditions which could adversely affect the unit's RPV water level, temperature, and pressure. Plant activities are routinely coordinated through the use of a Plan-of-the Day (POD) which contains a list of activities to be performed and frequently contains cautionary notes on the activities. These PODs are reviewed and discussed with station management and copies are maintained in appropriate locations. Changes to these PODs are approved through the Operations Department Management and the Shift Manager. In addition, during outages, work on unit systems and components is coordinated through work control centers which provide an additional level of unit operations oversight.

In the Main Control Room, the Shift Manager is required to maintain cognizance of any activity which could potentially affect reactivity, reactor water level, or decay heat removal. Unit reactor operators are required to provide positive control of reactor water level, temperature, and pressure within the specified bands, promptly report when operation outside the required bands occurs, and notify the Shift Manager of any restoration corrective measures being taken. As part of the outage work control process, special procedures such as hydrostatic testing require pre-job briefings conducted with operations personnel for any activity which could potentially affect critical plant parameters. The pre-job briefing includes all cognizant individuals involved in the work activities. Expected plant system and component responses and contingency actions to mitigate unexpected conditions are also discussed. When the plant is in cold shutdown, plant procedures require that the RPV head vent valves be opened after the reactor has been cooled to less than 212°F. Administrative and plant operations control procedures for this evolution and for controlling reactor water level, temperature, and pressure are an integral part of operator initial and requalification training. Responses to abnormal water level and RPV conditions are also part of the operator's training. In addition, unit-specific brittle-fracture operating pressure-temperature limit curves and procedures have been developed to provide the appropriate guidance for compliance with the operating limits and the associated Technical Specification requirements.

Review of High Pressure Injection Sources:

RPV water injection sources during cold shutdown conditions include three systems. During normal cold shutdown, RPV water level and pressure are controlled through the Control Rod Drive (CRD) and the Reactor Water Cleanup (RWCU) Systems. RPV conditions are controlled through a "feed and bleed" process using these two systems. The RPV and its piping system are not placed in solid water conditions and after the plant is cooled below 212°F, the head vent valves are opened. If either one of the RWCU or CRD Systems fail, the licensed Unit Operator would adjust the other system to maintain the proper water level and pressure. In addition, BFN also has water level instrumentation with setpoints for high and low water levels that alarm at 39 inches high and 27 inches low to alert operators that a level transient is in progress and action is required. During these plant activities the CRD system typically injects water at a rate of less than 60 gallons per minute (gpm). Injection rates at this level allow the operator sufficient time to compensate for unanticipated level and pressure changes. Therefore, the probability of an occurrence of a high-pressure/low temperature event, from these two systems, that places RPV conditions outside the pressure-temperature curve limits is low. In addition to the RWCU and CRD Systems, the Standby Liquid Control System is another high-pressure source to the RPV. For BFN, SLC System operation occurs only if the system is manually initiated by operator action in accordance with emergency operating procedures. Thus, SLC operation will not occur during cold shutdown operations except under stringently controlled test conditions. In the event of an inadvertent injection, the SLC injection rate (approximately 50 gpm) is sufficiently low to allow operators to intervene and control the reactor pressure.

During cold shutdown periods following refueling, the RPV is pressure tested in accordance with the applicable ASME Code Section XI requirements. BFN hydrostatic tests of the RPV and the reactor coolant system are designated as complex and infrequently performed tests. For these type of tests, BFN requires a detailed pre-job briefing with all individuals participating in the test. Also, BFN has a dedicated operator for RPV water level and pressure control. RPV and reactor coolant system pressure testing is a carefully controlled plant evolution which receives special operations management oversight and utilizes procedural controls to ensure that the test does not precipitate a transient outside the specified safety limits. These tests are also performed after the RPV and system are heated to the proper system inservice pressure test temperatures prior to increasing the system pressure. During these tests the RPV pressure, water level, and temperature are controlled through the CRD and RWCU Systems using the "feed and bleed" process. Increases (or decreases) in system pressure are limited to 50 pounds per square inch (psi) per minute. For example, if any RWCU valve fails, then the CRD pump is tripped and the RPV is depressurized. This practice minimizes the probability of exceeding the specified Technical Specification pressure-temperature limits during the system pressure test.

During plant startup following a cold shutdown, the High Pressure Coolant Injection (HPCI) and the Reactor Core Isolation Cooling (RCIC) pumps do not pose a threat to over-pressurize the RPV. For BFN, these systems have high pressure steam-driven pumps, which have automatic isolation set-points of 100 psi and 50 psi, respectively; and will not function when the plant is in cold shutdown.

In the case of low pressure system initiation, the shutoff head for the BFN Core Spray, Residual Heat Removal, and Condensate system Pumps are sufficiently low that the potential for an over-pressurization event which would significantly exceed Technical Specification pressure-temperature limits, due to an inadvertent actuation of these systems, is very low. As previously stated, procedural control is in place to respond to an unexpected or unexplained rise in reactor water level which could result from a spurious actuation of an injection system. Actions specified in plant procedures include preventing Condensate System pump injection, securing ECCS System injection, tripping CRD pumps, terminating all other injection sources, and lowering RPV water level via the RWCU system.

Based upon the above evaluation the likelihood of a cold over-pressure transient event placing the Unit 3 RPV in non-design conditions is very low. In addition, the probability of the occurrence of a cold over-pressure transient precipitating extremely accelerated growth of the indicated Unit 3 RPV subsurface flaws is sufficiently low to provide an acceptable level of quality and safety. Therefore, the probability of an occurrence of a cold over-pressure transient is considered to be less than or equal to the probability used in the analysis described in the NRC independent evaluation performed in the assessment of the BWRVIP-05 Report.

Additional Supporting Evaluations and Industry Experience

TVA's analysis supports an evaluation that, in the case of the Unit 3 RPV, the number of flaws, their size, location, and characterization as subsurface and "non-threatening" indications makes their reexamination less significant. The GE analysis of the Unit 3 RPV flaws supports continued operation of the BFN Unit 3, without further inspection and when considering vessel fatigue and irradiation embrittlement degradation mechanisms, for the current licensing period (40 years). GE's analysis indicates that the margin of safety for these flaws, under assumed aggressive growth for the service life of the vessel, is a factor of 3.1 times the maximum allowable by ASME Section XI Code analysis under Subarticle IWB-3600. The GE Vessel Flaw Handbook analysis, GENE-523-B1301869-129, is shown in Attachment 1. The TVA technical evaluation of the GE report data, as it affects the IWB-3600 calculations, is shown in the compiled tables shown in Attachments 3, 4 and 5. The BFN Unit 3 RPV indications are subsurface flaws and not exposed to the plant water chemistry environment directly. The probability of crack growth induced in the vessel materials as the result of water-borne stress-crack corrosion agents is extremely low.

The 15 indications recorded and analyzed in the BFN Unit 3 RPV four shell weld areas, are located in the circumferential welds and oriented in the weld areas as to indicate that they were most probably related to the fabrication of the vessel. In addition, the flaws were identified as being subsurface flaws, as characterized in the GE Vessel Flaw Analysis and as detailed in the TVA response to NRC Request for Additional Information (Attachments 4 and 5) and as concurred with in the NRC SER to TVA dated August 17, 1998. The size of the flaws and their locations are such that the NDE techniques and capabilities used at the time of the vessel fabrication would not have readily identified the presence of these flaws. As stated in the original augmented inspection results (TVA letter to the NRC, dated March 6, 1995), TVA performed a review of the Unit 3 RPV fabrication radiographs and determined that less than 50 percent of the currently recorded flaws were discernible in the fabrication radiographs. However, correlation between the discernible flaws in the radiographs and the indications from the current ultrasonic examination was determined to be within plus or minus two inches. Given the relative sensitivity and improvements in the NDE techniques since the fabrication of the vessel, the correlation between the two sets of examinations supports the technical judgment that the flaws were present in the RPV weld areas from the time of fabrication. In addition, the flaw sizes and projected flaw sizes at the end of the Unit 3 RPV service-life, assuming aggressive flaw growth, are such that large margins of safety are present for the expected operating conditions. This is supported by the GE analysis shown in Attachment 1 and accepted by the NRC Safety Evaluation Report dated August 17, 1998, and confirmed by the BWRVIP-05 Report SER dated July 28, 1998. Projected flaw sizes at the end of service-life are judged to be several factors below the ASME allowable limits resulting from calculations performed in accordance with Subarticle IWB-3600. It should also be noted that the limits on allowable flaw sizes imposed in the ASME

Code in Subarticle IWB-3600 result in flaw sizes that are below those that would be allowed using materials fracture mechanics applied to the design accident conditions.

This additional margin of safety is an integral part of the ASME calculation processes and provides further justification that there is sufficient margin to support not having to perform the additional successive examinations, in accordance with ASME Section XI, IWB-2420(b).

In conjunction, TVA is proposing that the scheduled ASME Section XI Code RPV circumferential shell weld examinations be permanently eliminated in accordance with Generic Letter 98-05 and BWRVIP-05 guidance. TVA's safe operating period for the BFN Unit 3 RPV, as shown by the GE analysis in Attachment 3, has been extended to the full 40 year service-life as described in GL 98-05 Permitted Action Item Number (1). Based upon industry experience and TVA's position that the flaws have been present since the fabrication of the vessel, the performance of a reexamination of the BFN RPV circumferential weld flaw areas is not warranted in Cycle 9. The flaw area located in the circumferential shell weld (C-3-4) area within the overlapping longitudinal weld boundary (V-4-B) will be examined in conjunction with the longitudinal weld examinations performed in the Third Inspection Period scheduled with other ASME Section XI Code and Augmented RPV examinations.

The GERIS 2000 system previously used to perform the RPV augmented examinations would be utilized for reexamination of the flaw areas and is projected to cost $800,000 for the reexaminations. In addition, man-rem radiation exposures encountered during the conduct of a RPV examination for one outage has been estimated from industry experience to be on the order of 12.2 man-rem per unit inspection. Any additional weld examination data obtained for the BFN Unit 3 RPV from the successive examinations would not warrant the increased cost to TVA and the additional exposure to personnel with no apparent increase in the margin of safety.

Therefore, in accordance with the guidance provided in GL 98-05 and supported by the BWRVIP-05 Report SER, considering the increased costs and personnel exposure, it is TVA's position that the performance of the successive examinations during the Unit 3 Cycle 9 outage to comply with the ASME Section XI Code requirements of Subarticle IWB-2420(b), is not technically warranted and would not provide an apparent increase in quality and safety.

Alternative Examination:

As an alternative, TVA proposes to perform only the RPV longitudinal weld examinations during the Third Inspection Period (Spring 2004) of the Second Ten-Year Inservice Inspection Interval in conjunction with the scheduled ASME Section XI Code and Augmented RPV Examinations.

This relief would be in effect for the BFN Unit 3 circumferential shell weld examinations and the ASME Section XI Code required circumferential shell weld flaw successive examinations of IWB-2420(b) for the remaining term of operation under the existing license.

Justification For The Granting Of Relief:

Based upon the previous stated technical justifications, performance of the successive examination of the Unit 3 RPV weld flaws, in accordance with the ASME Code requirements, is not warranted. This position is supported by actual industry inspection experience, industry initiatives, and their supporting calculations that these type of flaws have an extremely low probability of propagation to failure. TVA has determined through evaluation, reviews, and engineering judgment that these flaws are fabrication related and have been present since the construction of the vessel. Further, the additional costs and personnel exposure that would be incurred without any apparent increase in safety does not warrant the performance of the examinations. All of these combined factors provide reasonable assurance of the continued structural integrity of the BFN Unit 3 RPV. In addition, it is TVA's position that any additional knowledge and data obtained during successive examinations performed during the Unit 3 Cycle 9 outage would not provide any increase in the quality of the RPV or increase the margin of safety associated with the RPV flaws identified in the circumferential shell welds.

Therefore, pursuant to 10 CFR 50.55a (a)(3)(i), TVA requests that relief be granted for; (1) permanent relief from the inservice inspection requirements for volumetric examination of reactor pressure vessel circumferential shell welds, ASME Section XI, Table IWB-2500-1, Examination Category B-A, Item B1.11, Circumferential Shell Welds as permitted by Generic Letter 98-05, and (2) elimination of the Code required successive examinations of IWB-2420(b) for the RPV circumferential shell welds as outlined in the NRC SER, Section 2.8.1, for the BWRVIP-05 Report.

Further, in accordance with the guidance specified in the NRC SER, Section 4.0 for the BWRVIP-05 Report, TVA intends to examine the RPV circumferential welds should axial weld examinations reveal an active mechanistic mode of degradation. The scope and schedule of these examinations would be submitted to NRC for approval.

Implementation Schedule:

This Request for Relief will be implemented during the Second Ten Year ISI Inspection Interval for Browns Ferry Unit 3 and continue in effect for the remaining term of operation under the existing license.

ATTACHMENTS

ATTACHMENT 1	GE Analysis to Extend Unit 3 RPV Flaw Evaluation Through 40 Years of Operation
ATTACHMENT 2	Browns Ferry Unit 3 RPV Weld Location Schematic
ATTACHMENT 3	TVA Flaw Evaluation Summary and GE Examination Summary Report Sheets for the Shell Welds with Flaws
ATTACHMENT 4	Browns Ferry Nuclear Plant, Unit 3 Revised Relief Request 3-ISI-1, Reactor Pressure Vessel (RPV) Shell Welds, Augmented Examination and ASME Section XI Inspections, Response to NRC Request for Additional Information dated June 12, 1998
ATTACHMENT 5	Browns Ferry Nuclear Plant, Unit 3 Revised Relief Request 3-ISI-1, Reactor Pressure Vessel (RPV) Shell Welds, Augmented Examination and ASME Section XI Inspections, Response to NRC Request for Additional Information, Correction of Data, dated July 31, 1998.