TVA

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

March 24, 2000

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. 50-260
Tennessee Valley Authority	)	

BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 2 - AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) SECTION XI AND AUGMENTED INSPECTIONS - REQUEST FOR RELIEF, 2-ISI-9, REGARDING REACTOR PRESSURE VESSEL (RPV) CIRCUMFERENTIAL SHELL WELDS, (TAC NO. MA8424)

In accordance with 10 CFR 50.55a(a)(3)(i), TVA is requesting permanent relief from inservice inspection requirements of 10 CFR 50.55a(g) for the volumetric examination of the BFN Unit 2 reactor pressure vessel circumferential welds. This relief is for the remaining term of operation under the existing license. The alternative in TVA's request for relief provides an acceptable level of quality and safety and 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 Requirements on Reactor Pressure Vessel Circumferential Shell Welds."

NRC issued GL 98-05 on November 10, 1998, which stated that licensees of BWRs may request permanent relief from the inservice inspection requirements of 10 CFR 50.55a(g) for the volumetric examination of circumferential reactor pressure vessel shell welds by demonstrating that: (1) at the expiration of the operating license, the circumferential welds will continue to satisfy the limiting conditional failure probability for circumferential welds in the NRC staff's safety evaluation (SER) of the BWRVIP-05 Report dated July 28, 1998, and (2) licensee has implemented operator training and established procedures that limit the frequency

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of cold over-pressure events to the amount specified in the staff's July 28, 1998, SER. The enclosed request for relief demonstrates that TVA meets the guidance in GL 98-05 for permanent relief from the inservice inspection requirements of 10 CFR 50.55a(g) for the volumetric examination of the BFN Unit 2 RPV circumferential welds.

TVA requests approval of this request for relief by December 31, 2000. This is to allow for resource planning for the Unit 2 Cycle 11 (Spring 2001) refueling outage to support scheduled ASME Section XI outage activities.

This request for relief is consistent with one submitted to NRC for BFN Unit 3 by TVA letters dated June 25, 1999, and October 22, 1999. NRC letter to TVA dated November 18, 1999, approved the BFN Unit 3 request for relief.

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 2
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
SECTION XI, INSERVICE (ISI) AND AUGMENTED INSPECTION PROGRAM
(SECOND TEN YEAR INSPECTION INTERVAL)

REQUEST FOR RELIEF 2-ISI-9

(SEE ATTACHED)

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNIT 2
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
SECTION XI, INSERVICE (ISI) AND AUGMENTED INSPECTION PROGRAM
(SECOND TEN YEAR INSPECTION INTERVAL)

REQUEST FOR RELIEF 2-ISI-9

Executive Summary:

TVA is requesting permanent relief from the inservice inspection requirements for volumetric examination of reactor pressure vessel (RPV) circumferential shell welds. This request applies to the remaining term of operation under the existing license.

This request for relief will eliminate examination of the BFN Unit 2 RPV circumferential shell welds and 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.

The intent of 10 CFR 50.55a rule change was to require licensees to perform an expanded RPV shell weld examination as specified in the 1989 Edition of the ASME Section XI Code, 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 change was published in the Federal Register on August 6, 1992.

The examination schedule for the RPV axially oriented welds shall continue as required by the ASME Section XI Code.

TVA is scheduled to perform the RPV shell weld examinations required by the ASME Section XI Code and the expedited RPV

shell weld examinations in the third period (Spring 2001) of the Second Inservice Inspection Interval.

The BWRVIP-05 Report and the associated NRC SER supports exclusion of the examinations of the RPV circumferential shell welds provided certain limiting conditions regarding end of license vessel embrittlement and cold over-pressurization events are satisfied. TVA has satisfied the limiting conditions specified in GL-98-05 for BFN Unit 2.

This request for relief is consistent with one submitted to NRC for BFN Unit 3 by TVA letters dated June 25, 1999, and October 22, 1999. NRC letter to TVA dated November 18, 1999, approved the BFN Unit 3 request for relief.

Therefore, in accordance with the guidance provided in GL 98-05 and pursuant to 10 CFR 50.55a(a)(3)(i), TVA requests that relief be granted from performing the volumetric examinations of the BFN Unit 2 RPV circumferential shell welds.

Unit: Two (2)

System: Reactor Pressure Vessel (RPV)

Components: Table 1 lists the BFN Unit 2 RPV circumferential welds for which TVA is requesting permanent relief from volumetric examination. The proposed relief is for the remaining term of operation under the existing license.

TABLE 1

Weld Description	**Category and Exam Method**	**Table IWB-2500-1 Item Number**
Vessel Shell to Flange Weld No. C-5-FLG	B-A, Volumetric	B1.11
Vessel Shell to Shell Weld No.C-4-5	B-A, Volumetric	B1.11
Vessel Shell to Shell Weld No. C-3-4	B-A, Volumetric	B1.11
Vessel Shell to Shell Weld No. C-2-3	B-A, Volumetric	B1.11
Vessel Shell to Shell Weld No. C-1-2 (Located in Belt-line Region)	B-A, Volumetric	B1.11
Vessel Shell to Bottom Head Weld No. C-BH-1	B-A, Volumetric	B1.11

ASME Code Class: ASME Code Class 1

Section XI Edition: 1986 Edition, no addenda

Code Table: IWB-2500-1

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

Examination Item Number: B1.11 (Circumferential Shell Welds)

Code Requirement From Which Relief Is Requested: The inservice inspection requirements for the volumetric examination of RPV circumferential welds, ASME Section XI, Table IWB-2500-1, Examination Category

B-A, Item B1.11, Circumferential Shell Welds, and the (expedited) augmented examination requirements of 10 CFR 50.55a(g)(6)(ii)(A) for vessel circumferential welds.

List Of Items Associated With The Relief Request: See Table 1

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 examinations 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 Electric Power Research Institute 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.

TVA has addressed the two areas of concern outlined in the Permitted Action Section of Generic Letter 98-05: (1) the Unit 2 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 2 RPV.

(1) Generic Letter 98-05 Permitted Action Item No. 1, Comparison Of The BFN Unit 2 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. For plants with RPVs fabricated by Babcock and Wilcox (B & W), the mean end-of-license neutron fluence used in the NRC PFM analysis was 0.053×10^{19} n/cm^2. The highest fluence anticipated at the end of the period of 32 EFPY for BFN Unit 2 (in the RPV belt line region, weld C-1-2) is 0.11×10^{19} n/cm^2 on the inside vessel surface. This fluence value was based on the BFN Unit 2 power uprate 32 EFPY operating curve information. The embrittlement for the BFN Unit 2 RPV due to fluence effects is less than the value obtained in the NRC limiting analysis for B & W RPVs shown in the SER (Table 2.6-4) for the BWRVIP-05 Report. A comparison of the limiting BFN Unit 2 RPV circumferential shell weld analysis versus the NRC limiting analysis for B & W RPVs is provided in Table 2 below.

The BFN Unit 2 beltline region circumferential shell weld (C-1-2) was chosen for analysis to provide a basis for comparison to the NRC limiting analysis and as the Unit 2 RPV region where these calculated parameters would result in comparatively conservative values. The materials would also be representative of the Unit 2 RPV circumferential shell welds in general. The information in Table 2 represents the beltline region circumferential shell weld C-1-2, located between Unit 2 RPV shells course 1 and course 2. As shown in Table 2, the RT_{NDT} for BFN Unit 2 is much lower than the NRC limiting case. Therefore, the conditional failure probability for BFN Unit 2 circumferential welds is bounded by the conditional failure probabilities in the NRC SER through the end of the current license period.

TABLE 2

PARAMETER	BFN UNIT 2 Weld C-1-2	LIMITING B&W RPV
Fluence (10^{19} n/cm^2)	0.11	0.095
Initial RT_{NDT}	- 40^{0}F	20^{0}F
Chemistry Factor	116.8	196.7
Cu (Wt %)	0.09%	0.31%
Ni (Wt %)	0.65%	0.59%
ΔRT_{NDT}	50.9^{0}F	79.8%
Mean RT_{NDT} [Initial RT_{NDT} + ΔRT_{NDT}]	10.9^{0}F	99.8^{0}F

(2) Generic Letter 98-05 Permitted Action Item No. 2, Review Of BFN Unit 2 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 2 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 2 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 Operation 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 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 effect RPV water level, temperature, and pressure are precluded.

Nuclear Experience reviews and industry operating histories have shown that inadequate work-control processes and procedures could 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 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 re-qualification 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 Unit Operator would adjust the other system to maintain the proper water level and pressure. In addition, BFN also has water level instrumentation with set-points 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 Section XI Code requirements. BFN hydrostatic tests of the RPV and the reactor coolant system are designated as complex and infrequently performed tests. For these types 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 provide a possible means to over-pressurize the RPV. However, 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.

Based upon the above evaluation the likelihood of a cold over-pressure transient event placing the Unit 2 RPV in non-design conditions is very low. 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.

Alternative Examination:

As an alternative, TVA proposes to perform only the RPV longitudinal shell weld examinations during the third inspection period (Spring 2001) of the Second Ten-Year ISI Interval in conjunction with the scheduled ASME Section XI Code and augmented RPV Examinations.

Justification For The Granting Of Relief:

Based upon the previous stated technical justifications, performance of the examination of the Unit 2 RPV circumferential shell welds 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. 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. These factors provide reasonable assurance of the continued structural integrity of the

BFN Unit 2 RPV. Therefore, pursuant to 10 CFR 50.55a (a)(3)(i), TVA requests that permanent relief be granted from the inservice inspection and the augmented inspection requirements of 10 CFR 50.55a(g)(6)(ii)(A), 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 GL 98-05.

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 shell 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.

This request for relief is consistent with one submitted to NRC for BFN Unit 3 by TVA letters dated June 25, 1999, and October 22, 1999. NRC accepted TVA's request for relief by letter dated November 18, 1999.

Implementation Schedule: This Request for Relief will be implemented during the Second Ten Year ISI Inspection Interval for Browns Ferry Unit 2 and continue in effect for the remaining term of operation under the existing license.

Attachment: Brown Ferry Unit 2 RPV shell weld location schematic drawing

2-ISI-9

Attachment

NOZZLE GROUP	DISTANCE TO MATING SURFACE
N3X	86.5"
N12X	146"
N11X	228"
N4X	246.5"
N5X	259.5"
N9	296.5"
N16X	379"
N2X	564"
N1X	583.5"
N8X	610"

REFERENCE DRAWINGS (GE)

SKETCHES - RPV EXAMINATION PLAN (GE)

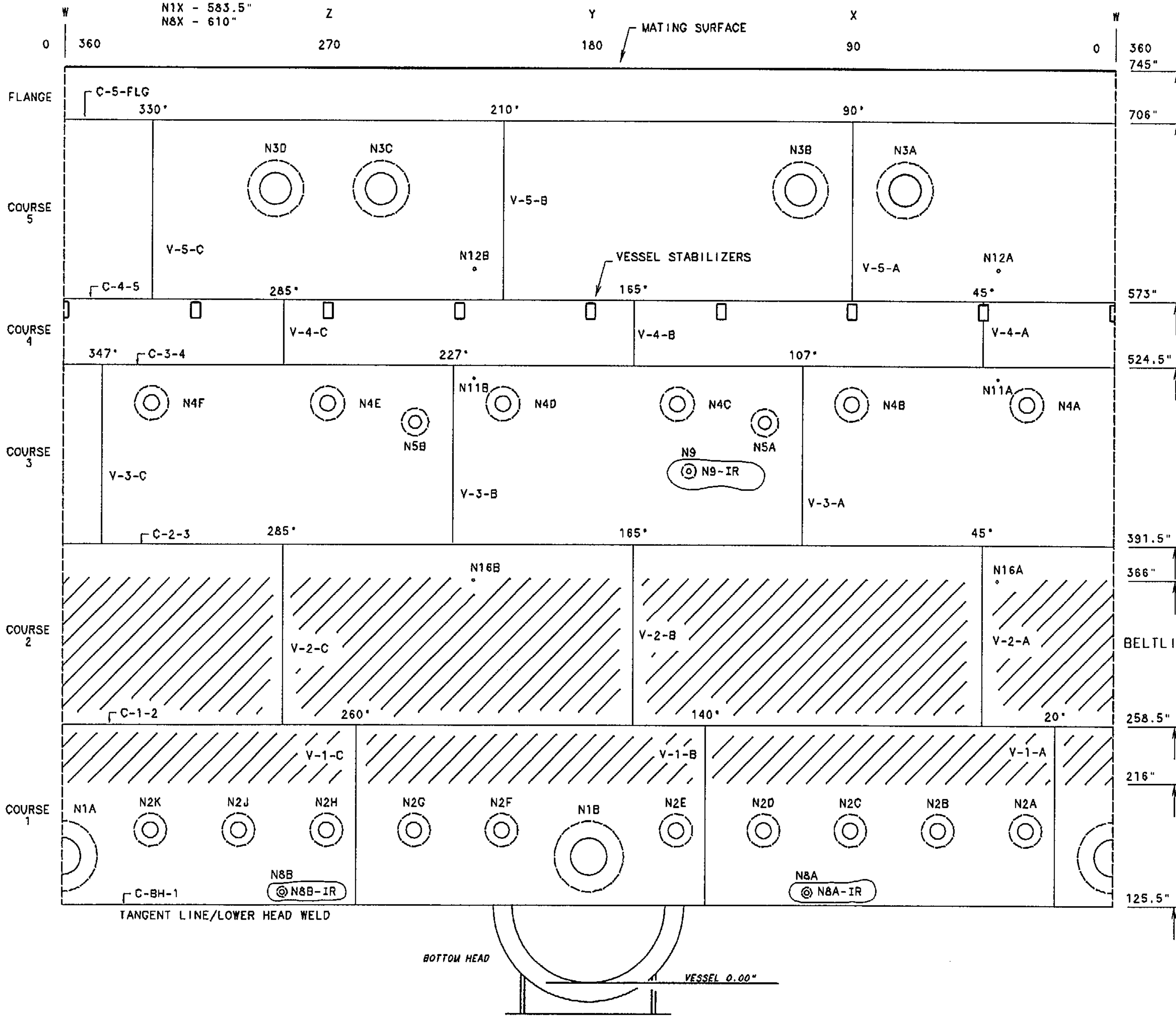
SK-B2001 SK-B2005 SK-B2010
SK-B2003 SK-B2007
SK-B2004 SK-B2006

LEGEND

○ VESSEL NOZZLE
◌ FULL PENETRATION NOZZLE WELD

ASME CC-1 (EQUIVALENT)

2-ISI-9
ATTACHMENT



NOTES:
1. REFER TO RPV MANUAL FOR MATERIAL SPECIFICATION AND MATERIAL THICKNESS.
2. NOZZLES N-11A, N-11B, N-12A, N-12B, N-16A, AND N-16B ARE CATEGORY B-E.

REV NO	CHANGE REF	DATE	DFTR	CHKR	DSGN	RVWR	1APPD	2APPD	3APPD	ISSD
002	ADMIN		RDL		N/A		N/A	N/A		
	REVISED PER RIMS MEMO R14 970505 302									

TENNESSEE VALLEY AUTHORITY

S BROWNS FERRY NUCLEAR PLANT
UNIT 2
REACTOR PRESSURE VESSEL (RPV)
SHELL COURSE WELD/NOZZLE LOCATIONS (OUTSIDE VIEW)

DRAWN: N/A	DATE: N/A	SCALE: NTS	CADAM/ISICMP
CHECKED: N/A	APPROVED:	SHEET 01 OF 02	REV
SUBMITTED: N/A	GLB	2-CHM-2046-C	002
		CCD	

CADAM

ALL A/D HISTORY RESEARCHED AT R000