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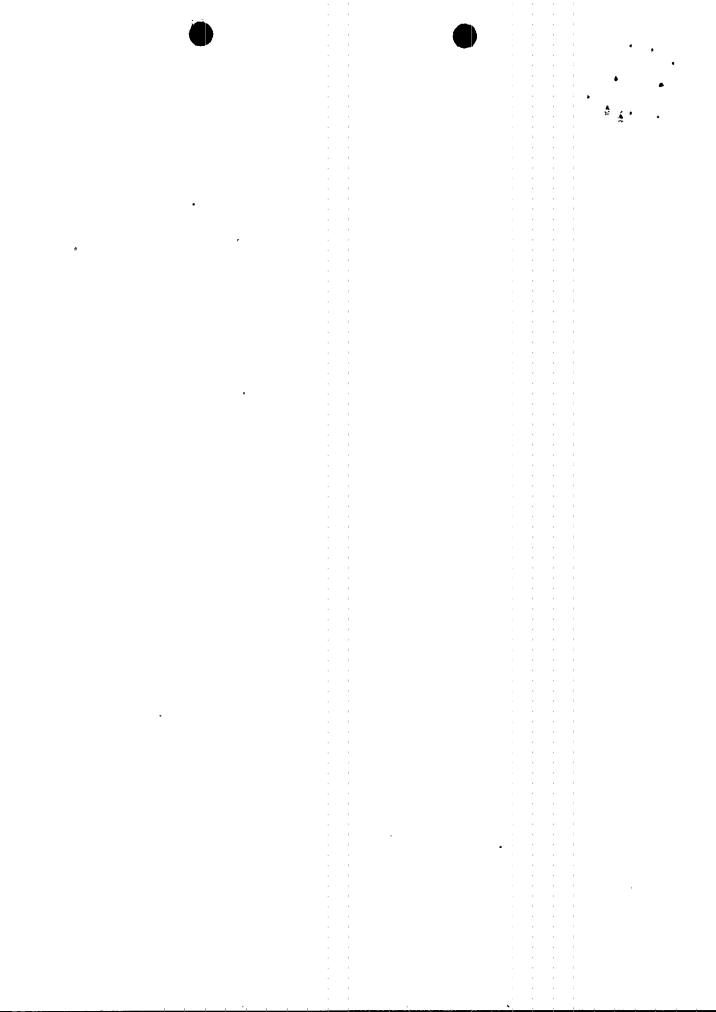
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November 18, 1994

U.S. Nuclear Regulatory Commission 10CFR50.54(f) ATTN: Document Control Desk Washington, D.C. 20555

Gentlemen: In the Matter of) Tennessee Valley Authority) Docket No. 50-260

BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 2 - RESULTS OF CORE SHROUD INSPECTION (TAC NO. M90082)

This letter provides the results of the Unit 2 core shroud inspection committed to in TVA's August 23, 1994, response to Generic Letter (GL) 94-03, "Intergranular Stress Corrosion Cracking (IGSCC) of Shrouds in Boiling Water Reactors." The inspection was performed during the Unit 2 Cycle 7 refueling outage and completed on October 22, 1994.

The results of the inspection indicate that severe core shroud cracking is not occurring in Unit 2. Minor surface connected planar indications were found on three welds. No through wall cracks were identified. The inspection results were obtained by qualified personnel using the best available technology. TVA performed non-destructive examinations (NDE) of 100% of the accessible areas on the horizontal welds using the GE Smart-2000 system and suction cup scanners. An enhanced video system (Westinghouse 1250 camera) was used in selected areas to look for obstructions and assist in setting up ultrasonic test equipment.

TVA evaluated the Unit 2 inspection results and determined that Unit 2 can safely be returned to service and operated for at least two additional operating cycles without repairs. The analysis indicates that postulated crack growth during the next two operating cycles will be less than the safety criteria established by General Electric (GE) and the Boiling Water Reactors Owners Group (BWROG) (GE NE-523-A107P-0794 and BWROG letters to NRC dated July 13 and 14, 1994). TVA's analysis used conservative

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assumptions for such factors as crack growth and uncertainties in the amount of cracking identified. Summaries of the inspection results and TVA's safety analysis that supports restart and operation of the Unit 2 core shroud are provided in the enclosure.

TVA is continuing to work with the BWROG and GE to develop acceptable repair methodologies when repair becomes necessary, and develop inspection plans for conducting weld examinations on the remaining core shroud welds. TVA will keep NRC informed about future repair and inspection activities as information becomes available and plans are finalized.

There are no commitments contained in this letter. If you have any question please telephone me at (205) 729-2636.

Sincerely

Pedro Salas Site Licensing Manager

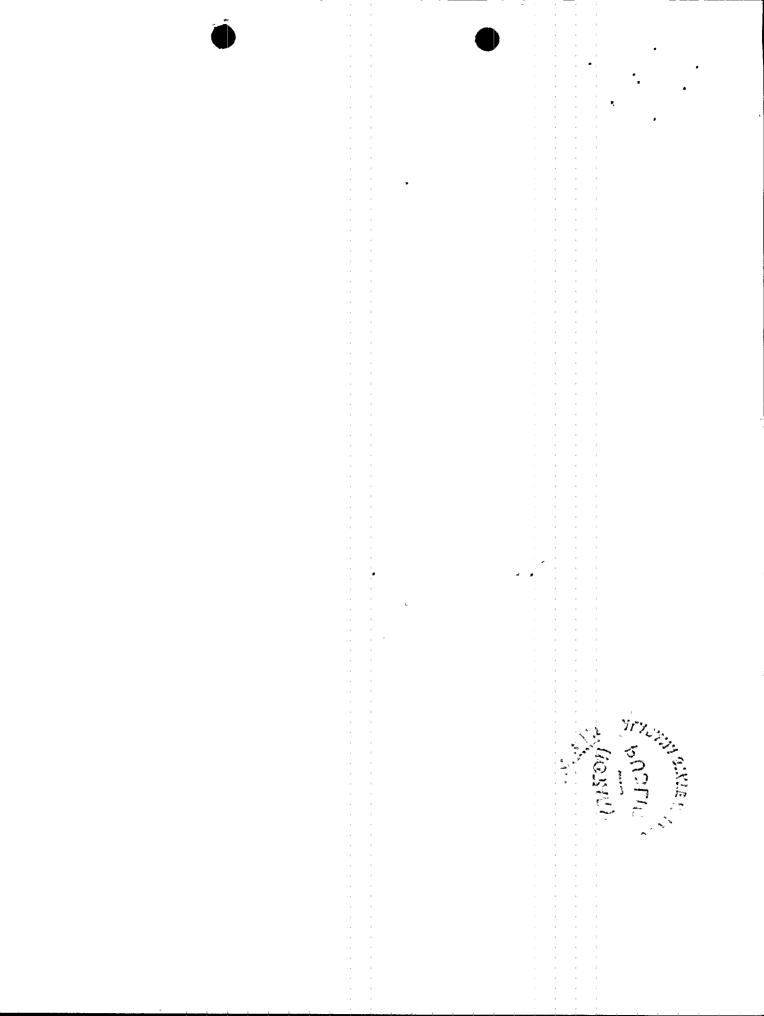
Subscribed and sworn to before me on this <u>18th</u> day of <u>Noumber</u>1994.

arbara H wyen

Notary Public My Commission Expires My Commission Expires 10/06/98

Enclosure cc: see page 2





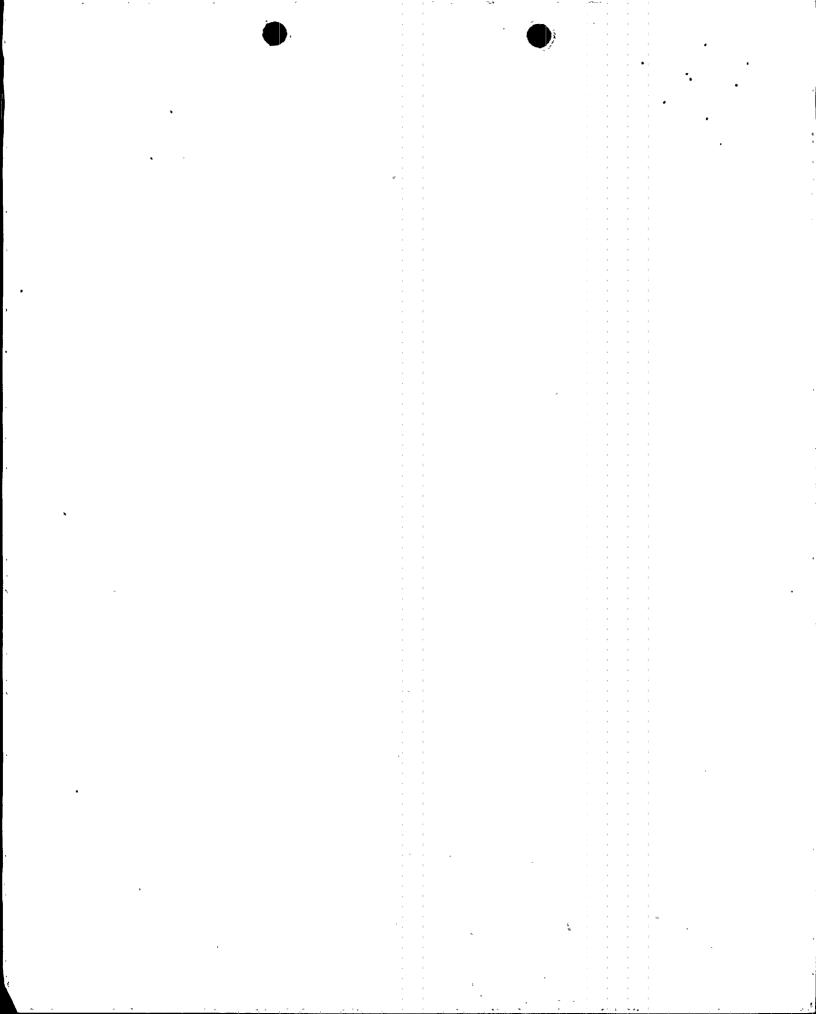
U.S. Nuclear Regulatory Commission Page 3 November 18, 1994

Enclosure cc (Enclosure): Regional Administrator U.S. Nuclear Regulatory Commission Region II 101 Marietta Street, NW, Suite 2900 Atlanta, Georgia 30323

> Mr. Mark S. Lesser, Section Chief U.S. Nuclear Regulatory Commission Region II 101 Marietta Street, NW, Suite 2900 Atlanta, Georgia 30323

NRC Resident Inspector Browns Ferry Nuclear Plant Route 12, Box 637 Athens, Alabama 35611

Mr. J. F. Williams, Project Manager U.S. Nuclear Regulatory Commission One White Flint, North 11555 Rockville Pike Rockville, Maryland 20852



ENCLOSURE

TENNESSEE VALLEY AUTHORITY BROWNS FERRY NUCLEAR PLANT (BFN) UNIT 2

BFN UNIT 2 REACTOR CORE SHROUD INSPECTION RESULTS AND ANALYSIS

I. BACKGROUND

Intergranular stress corrosion cracking (IGSCC) of boiling water reactor (BWR) internals has been identified as a technical issue of concern by NRC and the nuclear industry. TVA has been fully aware of IGSCC concerns in the core shroud and has been working closely with General Electric (GE) and the Boiling Water Reactor Owners Group (BWROG) to address this issue.

As a result of the IGSCC concerns, NRC issued Generic Letter (GL) 94-03, "Intergranular Stress Corrosion Cracking (IGSCC) of Shrouds in Boiling Water Reactors," on July 24, 1994. Among other things in the GL, NRC requested that BWR licensees inspect their core shrouds for cracking at the next scheduled refueling outage and provide the inspection results within 30 days of completing the inspection.

In response to the GL (TVA letter to NRC dated August 23, 1994), TVA committed to inspect 100% of the <u>accessible</u> areas on welds H1 through H7 (see Figure E-1) using the best available non-destructive examination (NDE) technology. The inspections were performed during the BFN Unit 2 Cycle 7 refueling outage that began on October 1, 1994. In addition, TVA's response provided details about the construction of the BFN core shrouds and discussed the risk factors that affect BFN.

II. INSPECTION SUMMARY

TVA and GE inspected 100% of the accessible areas on the Unit 2 core shroud welds H1 through H7 using NDE methods. The inspections were completed on October 22, 1994. The inspections were performed by qualified personnel using the best available technology in accordance with approved BFN procedures. The full inspection report is available on-site for review.

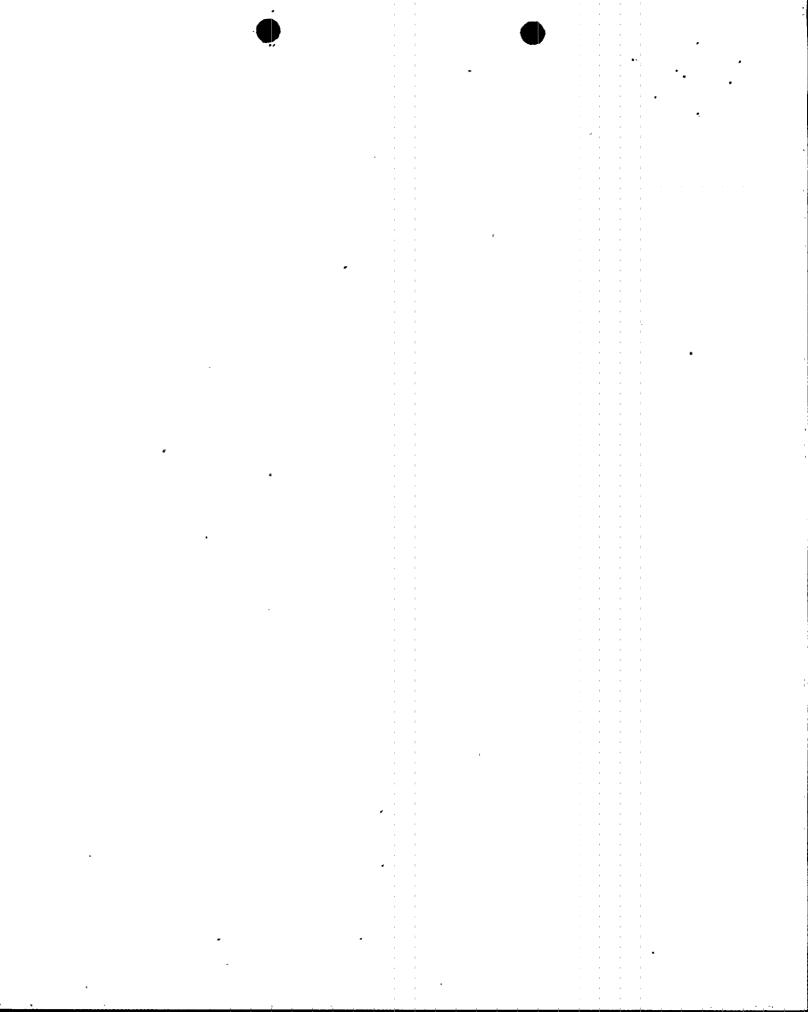
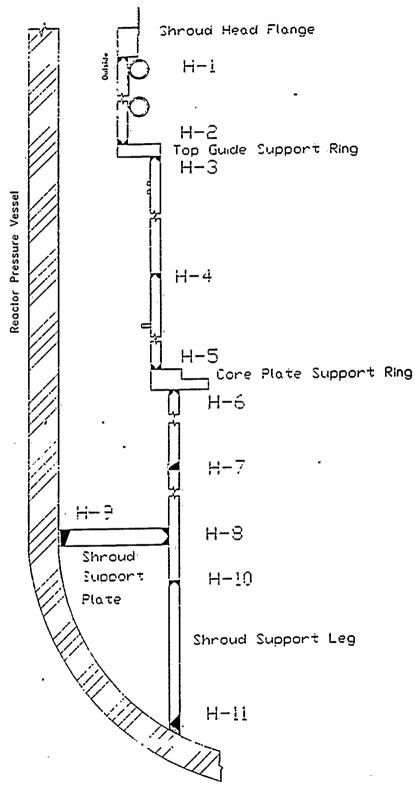


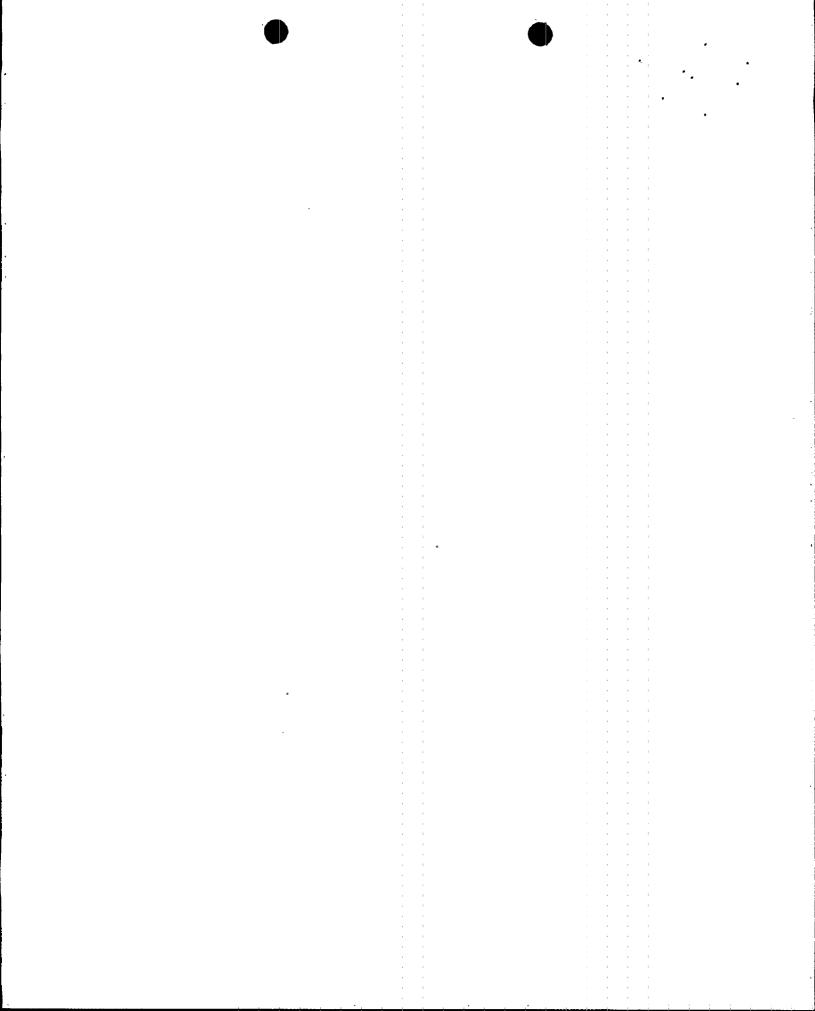
FIGURE E-1

BFN CORE SHROUD CONSTRUCTION DETAILS



2.

E-2



. Personnel performing the examinations were certified to at least Level II status in accordance with SNT-TC-1A, 1984 Edition. Additionally, personnel performing ultrasonic (UT) examinations were qualified through the Electric Power Research Institute (EPRI) NDE Center in accordance with the Coordination Plan for NRC/EPRI/BWROG Training and Qualification Activities of NDE Personnel.

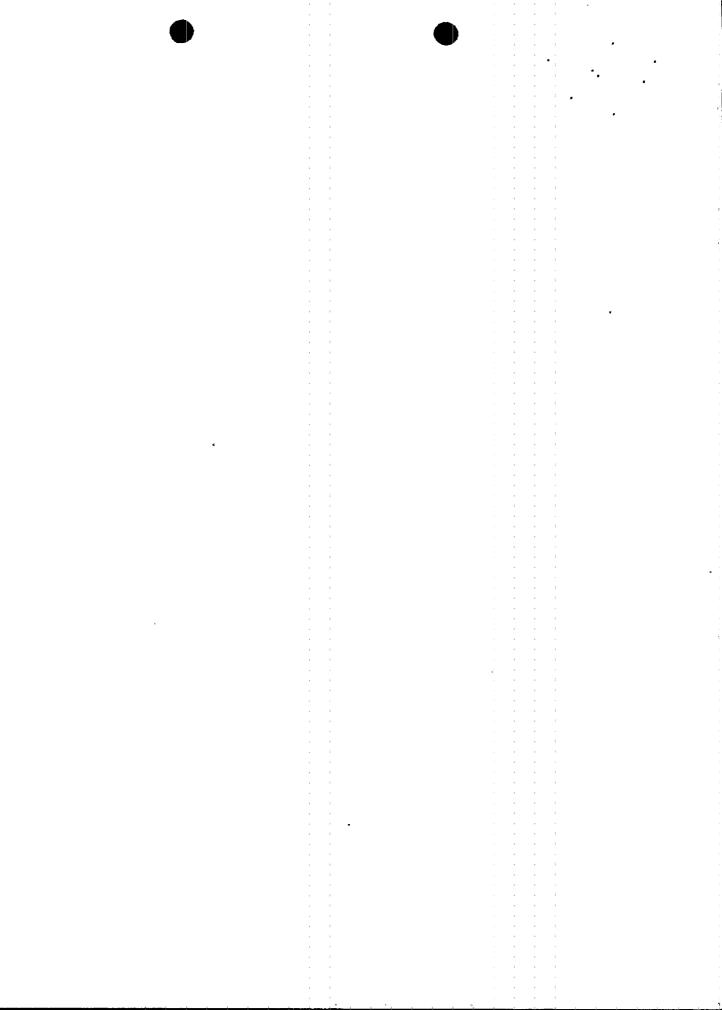
Ultrasonic examinations (UT) were performed using the GE Smart-2000 system and suction cup scanners. UT was performed on 100% of the accessible areas on all seven welds. Visual examinations were performed in selected areas to locate obstructions and assist in setting up ultrasonic test equipment.

Inspection procedures were prepared to implement the applicable portions of ASME Section V and XI recommendations, the NRC/EPRI/BWROG Coordination Plan, and General Electric (GE) Service Information Letter (SIL)-572. The inspection procedures were approved by TVA.

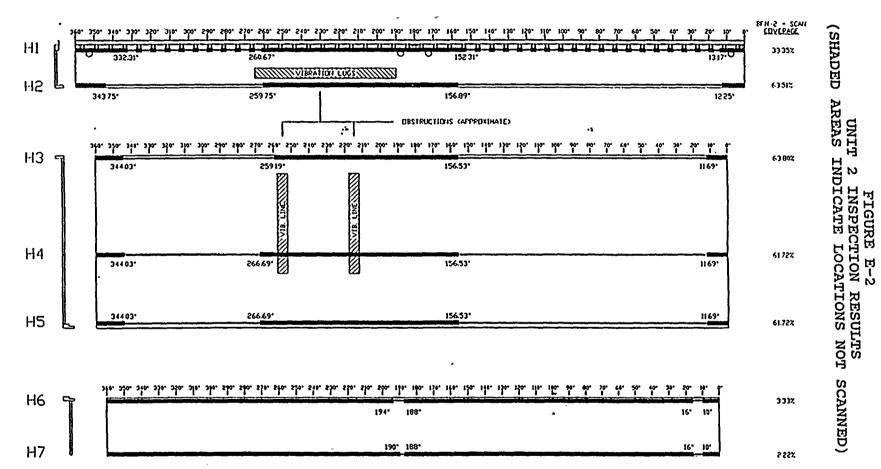
Accessibility for the inspections was limited due to various equipment or internal structures that restrict access to the welds. The proximity of various components such as guide pins, lifting lugs, core spray downcomers, shroud head locking lugs, jet pump riser braces, and jet pumps precluded further examination. Figure E-2 shows a "roll-out" of the areas inspected. The following provides a summary overview of the amount of each weld TVA examined:

	CIRCUMFERENCE	PERCENTAGE
WELD NUMBER	EXAMINED (INCHES)	<u>EXAMINED</u>
***	220 501	22 25%
H1	230.50"	33.35%
H2	438.95"	63.51%
H3	415.14"	63.80%
H4	401.60"	61.72%
H5	401.60"	61.72%
H6	21.00"	3.33%
H7	14.00"	2.22%

The amount of examination coverage for welds H1 through H5 varied from that achieved during the BFN Unit 3 shroud inspection. Specifically, coverage for welds H1 through H4 was 5 to 20 percent less while coverage for H5 was 20 percent more than that achieved on Unit 3. These variances from Unit 3 are attributed to the relative difference in location of the interferences's encountered on the Unit 2 shroud. The amount of coverage for welds H6 and H7 was 1 to 2 percent less than that achieved on Unit 3. This variance is attributed to the amount of weld buildup encountered on the H7 weld and the size of the transducer package utilized on the H6 weld.

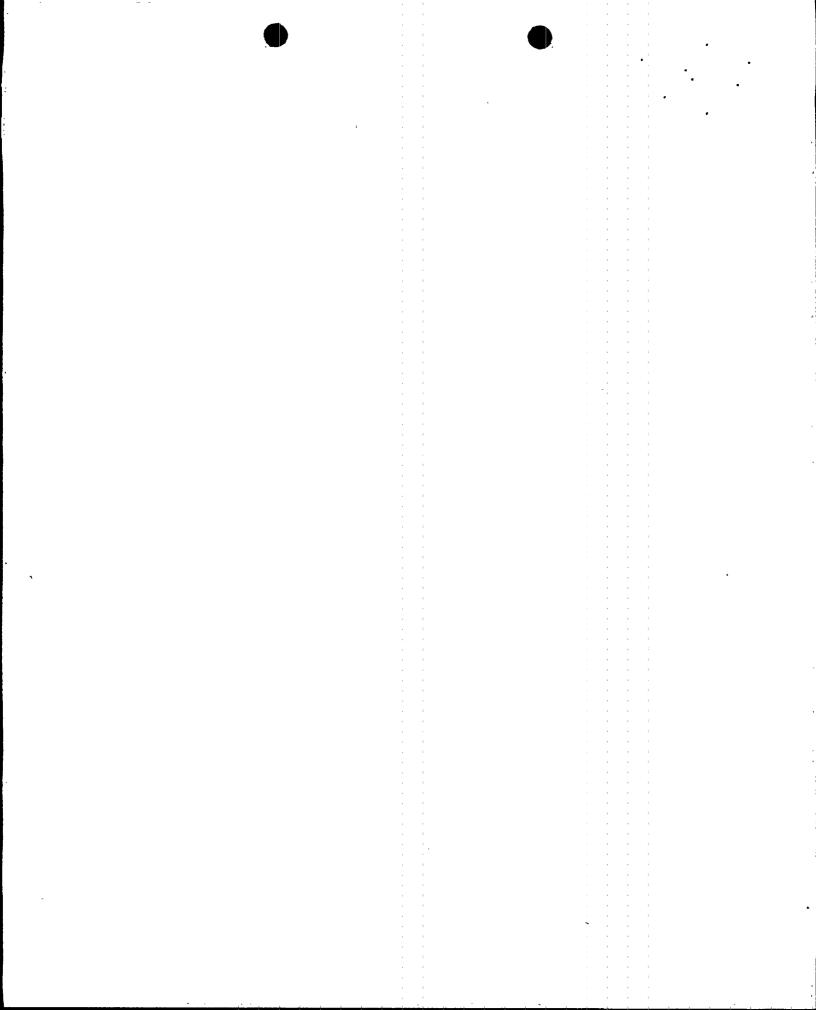


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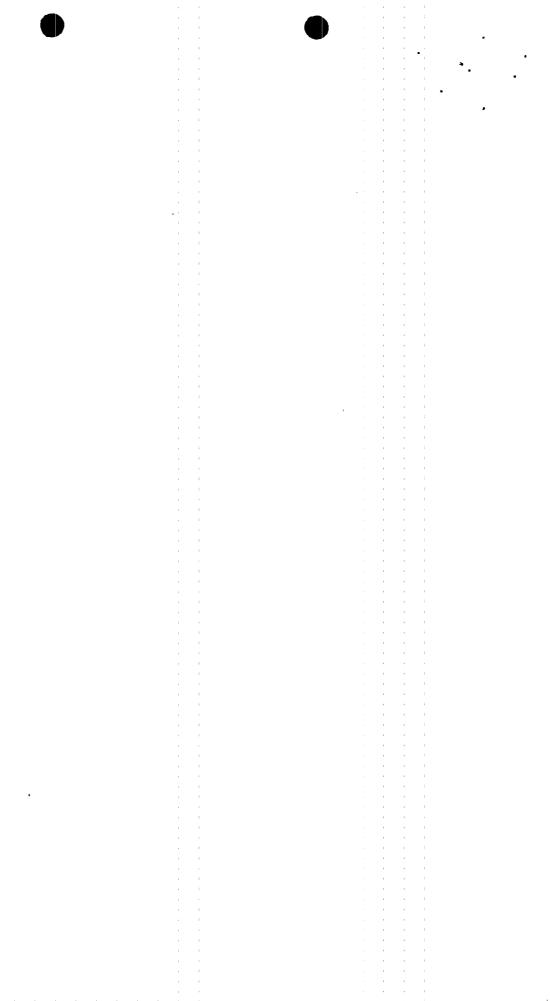
E-4



III. · INSPECTION RESULTS

The results of the Unit 2 inspection indicate that severe cracking of the core shroud welds is not occurring. During UT inspections, surface connected planar indications were found in three welds (H2, H3, and H5). The flaws were dispersed around the circumference of each weld. There were no through-wall cracks identified. A summary of the Unit 2 inspection results is provided below. The individual Examination Summary Sheets for shroud welds H1 through H7 are provided on pages E-6 through E-12.

<u>WELD</u> NUMBER	<u>INSPECTION</u> <u>TYPE</u>	RESULTS	<u>FLAW TYPE</u>
Hl	UT	No reportable indications	N/A
H2	UT	(1) indication 1.34" total length	Planar
НЗ	UT	(3) indications 9.41" total length	Planar (3)
H4	UT	No reportable indications	N/A
Н5	UT	(6) indications 9.09" total length	Planar (6)
H6	UT	No reportable indications	N/A
H7	UT	No reportable indications	N/A



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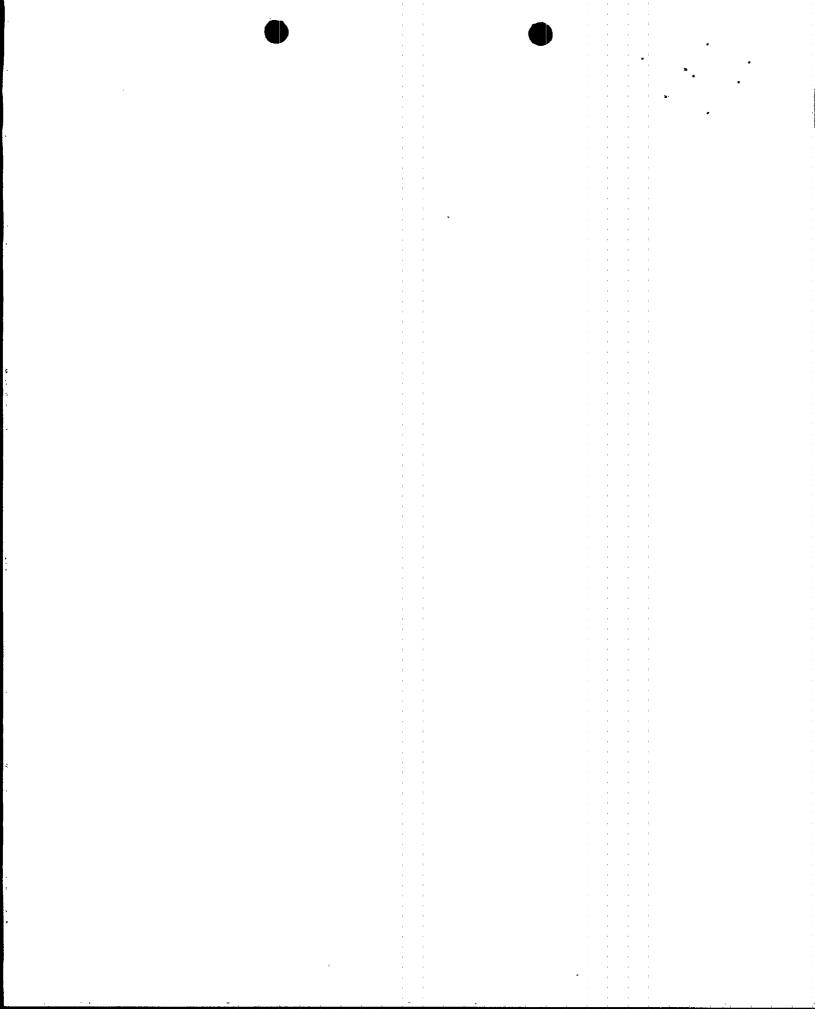
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	GE Nuclear Energy	EXAMIN	ΙΑΤΙΟ	ON SU	MMAR	Y SHEE	T	REPORT NO
	OWNS FERRY NUCLEAR	PROCEDURE	UT-BF	N-503V2		REV:_0	FRR	:
SYSTEM: SHR	OUD VESSEL					REV:_N/A	FRR	: N/A
WELD NO .:H1	(GIRTH WELD)							N/A
CONFIGURATIO	N:_SHELL TO FLANGE RING	-	_ <u>N/A_</u>			REV:_ <u>N/A</u>	FRR	
EXAMINER:								N/A
EXAMINER:M_				D MT		ा ग		
	KEAN / SWITZERLEVEL:_!!/!!	WELD TYPE:		_	UMFEREI		VED	SHROUD
DATA SHEET NO.	(S): <u>D-E94-12/13/14/15/16</u>	CAL SHEET	NO.(3	5): <u>C-E94</u>	-10/11/	2/13/14/	15	
This examination was al 73° to 77°, 81° to 85°, 88 261° to 265°, 268° to 27 336° to 340° from Vesse dimensions for all examin	search unit recorded only non-relevant ind so limited to "L" dimensions of 13° to 17°, 3° to 92°, 96° to 100°, 103° to 107°, 111° t 2°, 276° to 280°, 283° to 287°, 291° to 295 1°0° due to the proximity of lifting and vio nation scans were recorded in angular unit	21° to 25°, 28° to o 115°, 118° to 12 5°, 298° to 302°, 3 ration lugs, top gi	32°, 36 22°, 126 06° to 3 11de pin:	i* to 40*, 4 i* to 130*, 310*, 313* s, and con	3° to 47°, 133° to 13 to 317°, 3 spray do	7°, 141° to 21° to 325°, wn.comers.	145°, 328° Circu	148° to 152°, to 332°, and mferential "L"
neasurements is 1.92" p	,							
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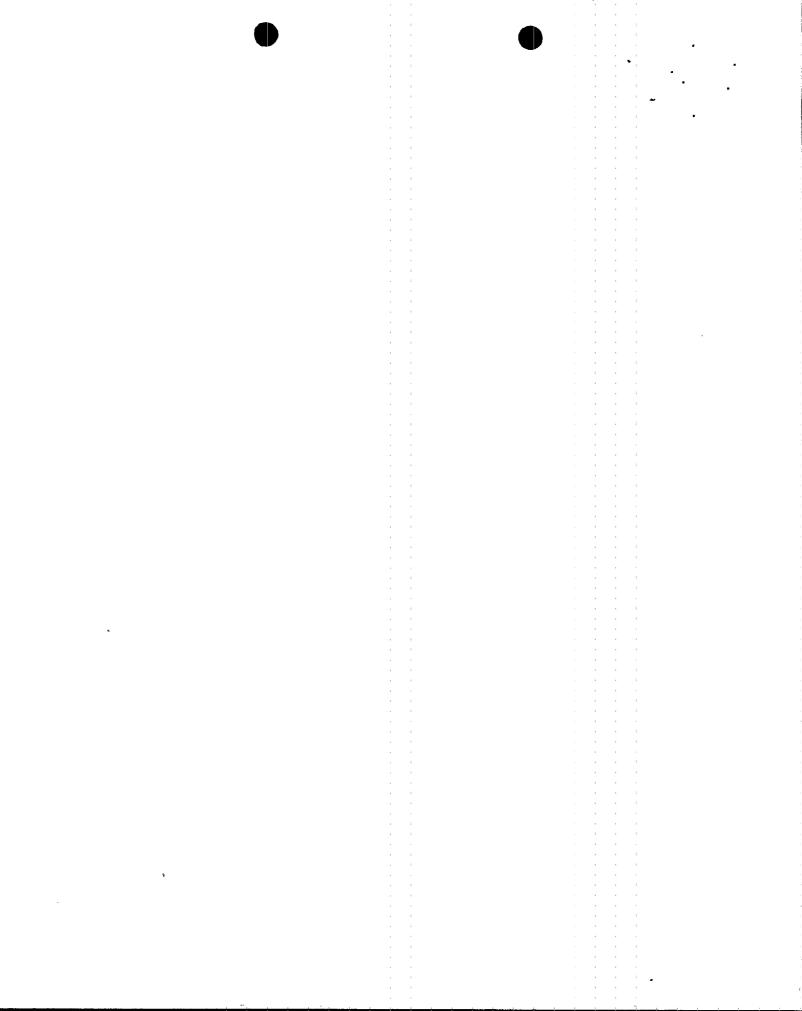
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GE REVIEWED BY LEVEL DATE	ANU REVIEW	DATE
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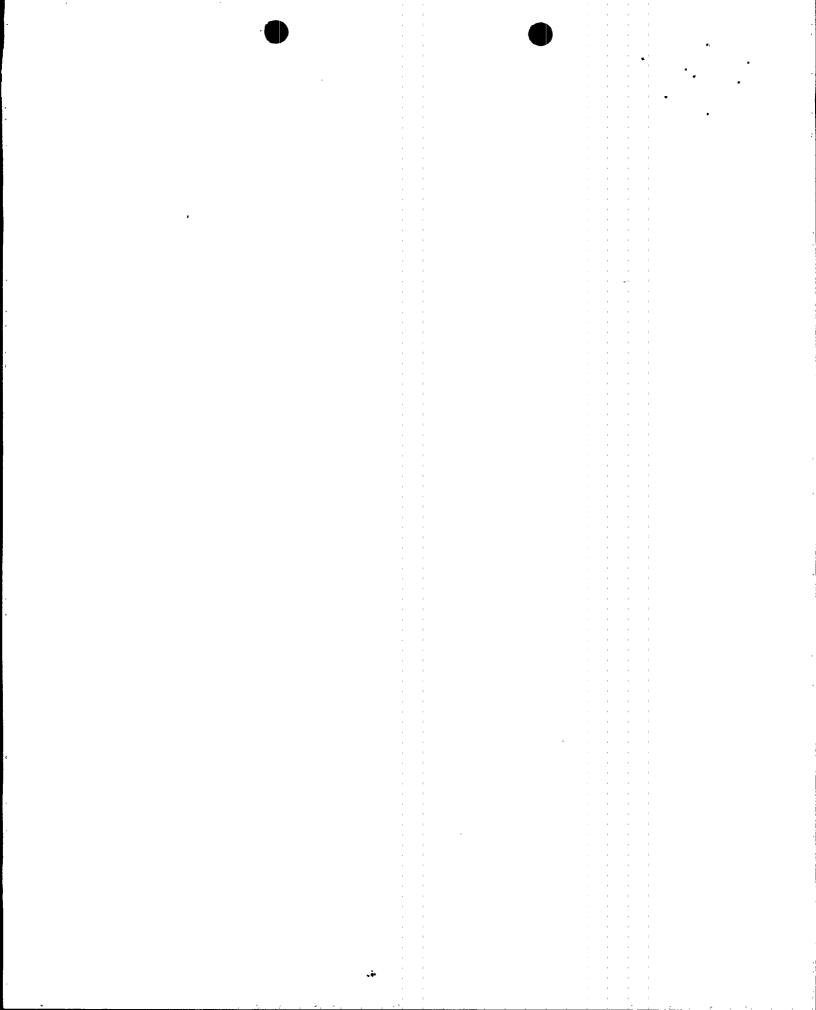


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. 88	G	E Nuclear E	nergy	EXAMI	NATIO	N SUMMA	ARY SHEET	REPORT NO.:
PROJECT	BROWNS FE		R	PROCEDURE:	UT-BEN-	-503V2	REV:_0 FR	R: <u>N/A</u> <u>N/A</u>
	SHROUD VESS	9			<u>_N/A</u>		REV: <u>_N/A</u> _FR	R: <u></u>
	ATION: FLANGE	-		 	_ <u>N/A</u>		_ REV: <u>_N/A</u> FR	R:N/A N/A N/A
	M. KRUEGER	LEVEL:	[WELD TYPE:				□∨т
	NO.(S): _D-E94-					C-E94-04 / 0	NAL OTHER	
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Indication Number	Distance From Lo	Total Length*	Remai Ligam		uwali ension**	Side of Weld	Type : Reflector	Search Unit
1	72.6* / 139.4*	0.7*7 1.34*	1.83	2".	18"	Lower	Planar	45 *
noise. ** The thi	h sizing for indicatio roughwall dimension method.						·	
ne 45° shear also eld along with acc e weld.	recorded non-relev pustic interface, out	ant indications. Ins side surface weld c	ice surface rown georr	geometry, and letry, and the on	inside surf e (1) previ	ace weld crow ously referenc	n geometry from bo ed planar flaw from	th sides of the the upper side of
ne 60°RL also rec ong with shear co	corded non-relevant component and acoust	indications, inside suc interface from t	surface ge the upper si	ometry, and inside of the weld.	de surface	weld crown g	cometry from both s	ides of the weld
e OD creeping w	rave search unit rec	orded only non-rek	evant indica	tions from both	sides of th	e weld.		
o guide pins, and	as limited to "L" din corespray downcor inversion factor for	ners. Circumferen	tial "L" dime	ensions for all ex	amination	due to the pro scans were re	ximity of lifting and corded in angular u	vibration lugs, nits in lieu of
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GE REVIEWED		0.2.3.94 -		N/A III REVIEW			PAGE:_1	OF:_26_



	GE	Nuclear Ene	rgy EXA	MINATION S	UMMAI	RY SHEET	REPORT
PROJECT:	BROWNS FER		PROCED	URE:UT-BEN-503	v2	_ REV:_01	FRR: <u>N/A</u> <u>N/A</u>
SYSTEM:_S	HROUD VESS	EL		N/A			
WELD NO .:.	H3 (GIRTH W	ELD)					N/A N/A
CONFIGURA	TION:_SHELL TO	D FLANGE RING		_N/A		REV:_N/A	FRR: <u>N/A</u>
EXAMINER:	C. MCKEAN	LEVEL:!!					N/A
EXAMINER:	T. ROCKWOOD	LEVEL:L					
EXAMINER:	W. MONEY	LEVEL:!!!	WELD T	PE.	RCUMFER	_	IER_SHROUD
DATA SHEET	NU.(S): _D_E94-0	1/02/03/04/05/0	6 CAL SH	EET NO.(S): <u></u>	94-01 / 02	/ 03	
Indication	Distance	Total	Remaining	Thruwall	Side of	Туре	Search
	-		•			••	
Number	From Lo	Length*	Ligament	Dimension**	Weld	Reflector	Unit
Number 1 2	From Lo 60.7° / 110.4° 270.0° / 488.7°	Length* 1.30* / 1.35* 1.50* / 2.72*	Ligament 1.56" 1.45"	Dimension** .44* < 50% TW .55* < 50% TW		••	
Number 1 2 3	From Lo 60.7° / 110.4° 270.0° / 488.7° 331.6° / 600.2°	Length* 1.30* / 1.35*	Ligament 1.56" 1.45" 1.22"	Dimension** .44* < 50% TW .55* < 50% TW .78* (See note)	Weld Lower Lower Lower	Reflector Planar Planar Planar	Unit 45°/60° 45°/60° 45°/60°
Number 1 2 3 • Lengt • The th sizing Note: The 45° shear also	From Lo 60.7° / 110.4° 270.0° / 488.7° 331.6° / 600.2° h sizing for indicatio roughwall dimensio method. Thruwall dimension dimension. Howev response could not recorded non-releva	Length* 1.30* / 1.35* 1.50* / 2.72* 2.40* / 4.34*	Ligament 1.56" 1.45" 1.22" s the point where vas determined w determined from surface weld cro uld be considered redirect, inside su	Dimension** .44* < 50% TW .55* < 50% TW .78* (See note) the indication signal ith the tip diffraction the tip signal respon wn geometry the full a best effort sizing o rface geometry, and	Weld Lower Lower Lower response w technique u ise which ex echo dynar estimation.	Reflector Planar Planar Planar eas obscured by using the absolut chibited the most nic pattern from	Unit 45°/60° 45°/60° 7 the baseline r to arrival time at through walk the tip signal
Number 1 2 3 • Lengt • The th sizing Note: The 45° shear also with the three (3) pro- The 60°RL also record	From Lo 60.7° / 110.4° 270.0° / 488.7° 331.6° / 600.2° h sizing for indicatio roughwall dimensio method. Thruwall dimension dimension. Howev response could not recorded non-releva aviously referenced	Length* 1.30* / 1.35* 1.50* / 2.72* 2.40* / 4.34* ons was determined at n for each indication was n on indication #3 was ver, due to the outside be achieved and sho ant indications, beam	Ligament 1.56" 1.45" 1.22" s the point where vas determined w determined from surface weld cro uld be considered redirect, inside su lower side of the shear component	Dimension** .44* < 50% TW .55* < 50% TW .78* (See note) the indication signal ith the tip diffraction the tip signal respon wn geometry the full a best effort sizing o rface geometry, and weld.	Weld Lower Lower Lower response w technique u se which es echo dynar estimation. inside surfa	Reflector Planar Planar Planar Planar as obscured by using the absolution thibited the most nic pattern from ace weld crown	Unit 45°/60° 45°/60° 7 the baseline r 7 the baseline r 7 the arrival time at through walk 9 the tip signal 9 geometry alon
Number 1 2 3 • Lengt • The th sizing Note: The 45° shear also with the three (3) pro- three (3) previously	From Lo 60.7° / 110.4° 270.0° / 488.7° 331.6° / 600.2° h sizing for indication roughwall dimension method. Thruwall dimension dimension. However response could not recorded non-relevant aviously referenced brided non-relevant in referenced planar fi	Length* 1.30* / 1.35* 1.50* / 2.72* 2.40* / 4.34* ons was determined at n for each indication was rer, due to the outside be achieved and sho ant indications, beam planar flaws from the indications along with	Ligament 1.56" 1.45" 1.22" s the point where vas determined w determined from surface weld cro uld be considered redirect, inside su lower side of the shear component de of the weld.	Dimension** .44* < 50% TW .55* < 50% TW .78* (See note) the indication signal ith the tip diffraction the tip signal respon wn geometry the full a best effort sizing of rface geometry, and weld.	Weld Lower Lower Lower response w technique u se which en echo dynar estimation. inside surfa	Reflector Planar Planar Planar Planar as obscured by using the absolution thibited the most nic pattern from ace weld crown	Unit 45°/60° 45°/60° 7 the baseline r 7 the baseline r 7 the arrival time at through walk 9 the tip signal 9 geometry alon
Number 1 2 3 • Lengt • The th sizing Note: The 45° shear also with the three (3) pro- three (3) previously The 60°RL also reco hree (3) previously The OD creeping was limensions of 13° to lowncomers. Circuit	From Lo 60.7° / 110.4° 270.0° / 488.7° 331.6° / 600.2° h sizing for indication roughwall dimension method. Thruwall dimension dimension. However response could not recorded non-relevant interferenced planar flat ave search unit record performed from the o 157° and 260° to 3 method.	Length* 1.30* / 1.35* 1.50* / 2.72* 2.40* / 4.34* ons was determined at n for each indication was rer, due to the outside be achieved and sho ant indications, beam planar flaws from the indications along with aws from the lower sh	Ligament 1.56" 1.45" 1.22" s the point where vas determined w determined from surface weld cro uld be considered redirect, inside su lower side of the shear component de of the weld. Int indications from ld due to the com ue to the proximit	Dimension** .44* < 50% TW .55* < 50% TW .78* (See note) the indication signal ith the tip diffraction the tip signal respon wn geometry the full a best effort sizing of rface geometry, and weld. and inside surface of the lower side of the ponent configuration y of lifting and vibrati	Weld Lower Lower Lower response w technique u se which es echo dynar estimation. inside surfa geometry fro e weld.	Reflector Planar Planar Planar Planar as obscured by using the absolution thibited the most nic pattern from ace weld crown or the weld crown or the weld crown	Unit 45°/60° 45°/60° 45°/60° / the baseline r / the arrival time / the tip signal geometry alon wm, as well as
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Number 1 2 3 • Lengt • The th sizing Note: The 45° shear also vith the three (3) pro- three (3) previously The OD creeping was imensions of 13° to owncomers. Circuit	From Lo 60.7° / 110.4° 270.0° / 488.7° 331.6° / 600.2° h sizing for indication roughwall dimension method. Thruwall dimension dimension. However response could not recorded non-relevant in referenced planar flave search unit record performed from the o 157° and 260° to 3 method 260° t	Length* 1.30° / 1.35° 1.50° / 2.72° 2.40° / 4.34° ons was determined at n for each indication was rer, due to the outside be achieved and sho ant indications, beam planar flaws from the indications along with aws from the lower sho orded only non-relevant a upper side of the we 344° from vessel '0' d tsions for all examinat is 1.81° per degree.	Ligament 1.56" 1.45" 1.22" s the point where vas determined w determined from surface weld cro uld be considered redirect, inside su lower side of the shear component de of the weld. Int indications from ld due to the com ue to the proximit	Dimension** .44* < 50% TW .55* < 50% TW .78* (See note) the indication signal ith the tip diffraction the tip signal respondent we geometry the full a best effort sizing of rface geometry, and wekd. and inside surface geometry, and wekd. and inside surface geometry and the lower side of the ponent configuration y of lifting and vibration the configuration y of lifting and vibration y of lifting and v	Weld Lower Lower Lower response w technique u se which es echo dynar estimation. inside surfa geometry fro e weld.	Reflector Planar Planar Planar Planar as obscured by using the absolution thibited the most nic pattern from ace weld crown or the weld crown or the weld crown	Unit 45°/60° 45°/60° 45°/60° / the baseline r / the arrival time / the tip signal geometry alon wm, as well as

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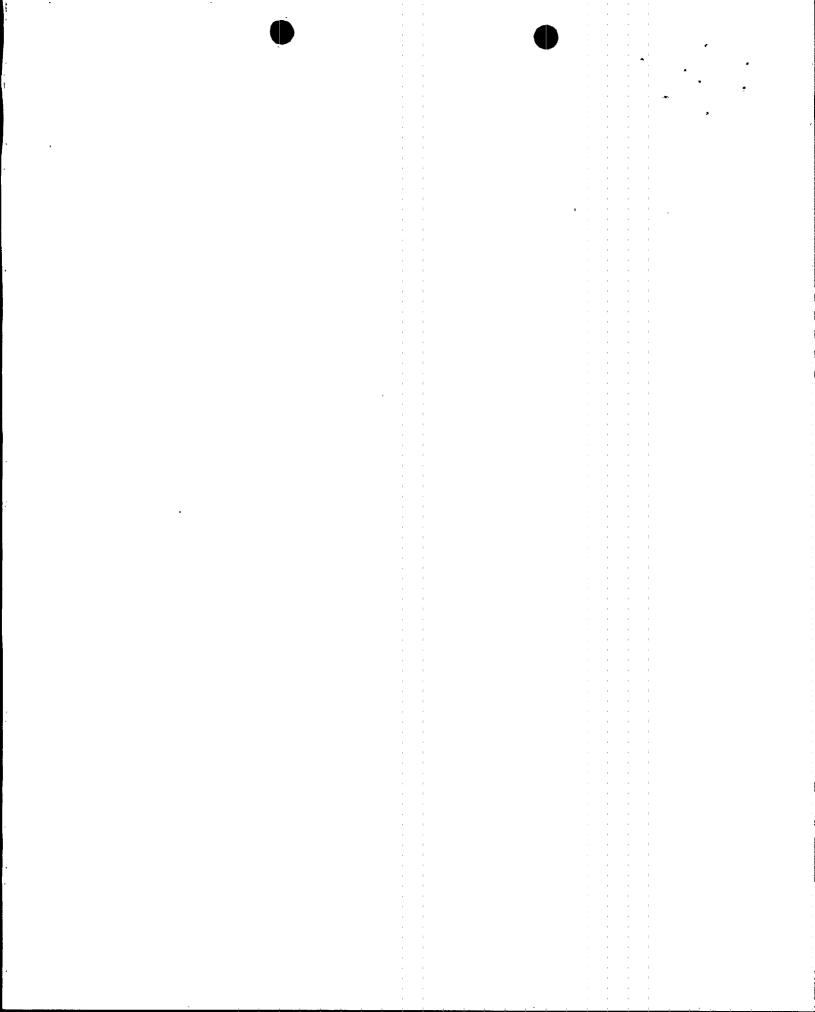


GE Nuclear Energy EXAN	REPORT NO
PROJECT: BROWNS FERRY NUCLEAR PROCEDUR	RE:UT-BEN-503V2 REV:0 FRR:N/A
SYSTEM: SHROUD VESSEL	
CONFIGURATION: SHELL TO SHELL	
EXAMINER:LEVEL:!	
EXAMINER: MCKEAN/ SWIIZER_ LEVEL:	ET NO.(S): <u>C-F94-16/17/18/19/20/21</u>
During the examination of the above referenced weld, no surface connected pla recorded by the Smart 2000 system utilizing 45° shear wave; 60° refracted long The 45° shear wave search unit did record non-relevant indications and inside s with beam redirect and outside surface weld crown geometry from the upper sid The 60° RL search unit recorded non-relevant indications, acoustic interface, an surface weld crown geometry from the upper side, and welding discontinuities fr The OD creeping wave search unit recorded only non-relevant indications from t This examination was also limited to "L" dimensions of 12° to 157° and 267° to 3 lugs, top guide pins.'and core spray downcomers. Circumferential "L" dimension of linear units. The conversion factor forcircumferential measurements is 1.81° p	nudinal wave, and OD creeping wave search units. unface weld crown geometry from both sides of the weld, along e, and welding discontinuities from the lower side of the weld. Id shear component from both sides of the weld, along with inside om the lower side of the weld. both sides of the weld. 344° from Vessel "0" due to the proximity of lifting and vibration ns for all examination scans were recorded in angular units in lie

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86)	GE	E Nuclear Ene	rgy EXA	MINATIONS	UMMA	RY SHEET	REPORT NO
PROJECT:	BROWNS FEF		PROCED	URE:	12	_ REV:_0 FR	IR: <u>N/A</u> <u>N/A</u>
SYSTEM:S	SHROUD VESS	EL		N/A			
	H5.(GIRTH W	רח ו=				REV: <u>N/A</u> FR	R:N/A N/A N/A
CONFIGUR	ATION:_FLANGE	RING TO SHELL		_ <u>`N/A</u>		REV: <u>N/A</u> FR	_N/A
EXAMINER:	M. KRUEGER	LEVEL:!					N/A
	T. ROCKWOOD	LEVEL:!!			г 🛛 рт	់ 📕 ហា	
		LEVEL;_ <u> </u>			RCUMFER	ENTIAL	
EXAMINER:	MCKEAN / SWIT	ZER_LEVEL: 1			NGITUDIN	AL 📕 OTHEI	R_SHROUD
ATA SHEET	NO.(S): _D.E94-2	2/23/24/25/26	CAL SH	EET NO.(S):	94-22/23	1 24 / 25 / 28 / 27	
	n uulizing 45° shear Irs:	te above referenced t wave, 60° refracted l Total L'ength*					
Indication Number			1.16*	.84" < 50% TW	Upper	Planar	45*/60*
Number	71.4" / 129.2"	1.10" / 1.99"			••	Planar	45*/60*
	71.4° / 129.2° 101.7° / 184.1°	1.10* / 1.99" .90* / 1.63"	1.04"	.96" (See note)			
Number 1			1.04" 1.13"	.96" (See note) .87" < 50% TW	Upper	Planar	45*/60*
Number 1 2 3 4	101.7*/ 184.1*	.90* / 1.63*		• • •	••	Planar Planar	
Number 1 2 3	101.7°/ 184.1° 103.4°/ 187.2°	.90° / 1.63" .60° / 1.09"	1.13"	.87" < 50% TW	Upper		45*/60*

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sizing method.

Note: Thruwall dimension on indication #2 was determined from the tip signal response which exhibited the most through wall dimension. However, due to the outside surface weld crown geometry the full echo dynamic pattern from the tip signal response could not be achieved and should be considered a best effort sizing estimation.

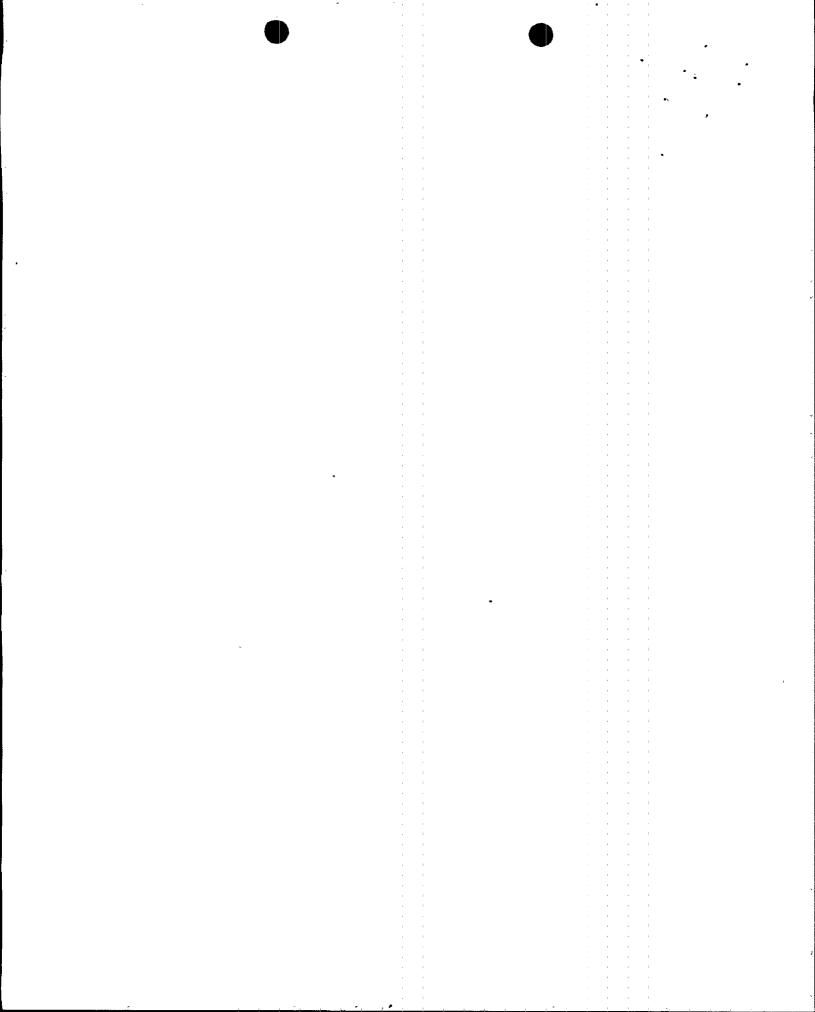
The 45° shear also recorded non-relevant indications, beam redirect, inside surface weld crown geometry, and weld discontinuities from both sides of the weld along with beam redirect, inside surface geometry, and outside surface weld crown geometry, as well as the six (6) previously referenced planar flaws from the upper side of the weld.

The 60°RL also recorded non-relevant indications and inside surface weld crown geometry from both sides of the weld, along with welding discontinuities from the lower side, as well as shear component and four (4) of the previously referenced planar flaws from the upper side of the weld.

The OD creeping wave search unit recorded non-relevant indications from both sides of the weld, along with welding discontinuities from the lower side of the weld.

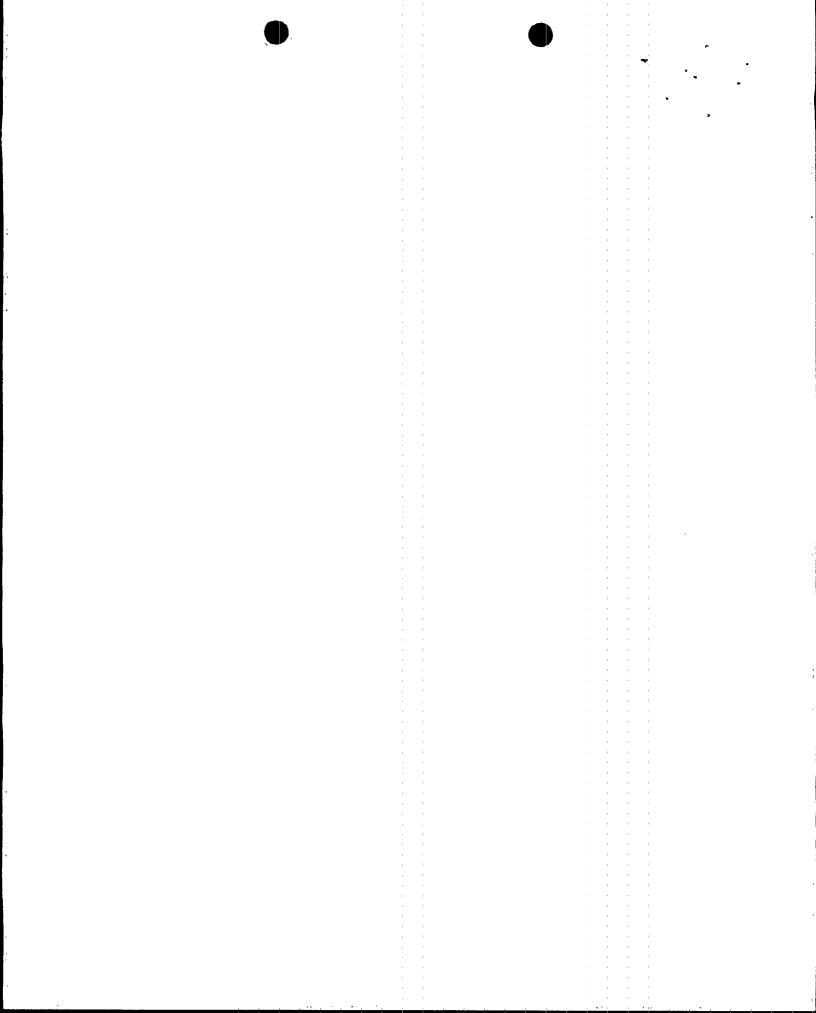
This examination was limited to "L" dimensions of 12° to 157° and 267° to 344° from vessel '0' due to the proximity of lifting and vibration lugs, top guide pins, and core spray downcomers. Circumferential "L" dimensions for all examination scans were recorded in angular units in lieu of

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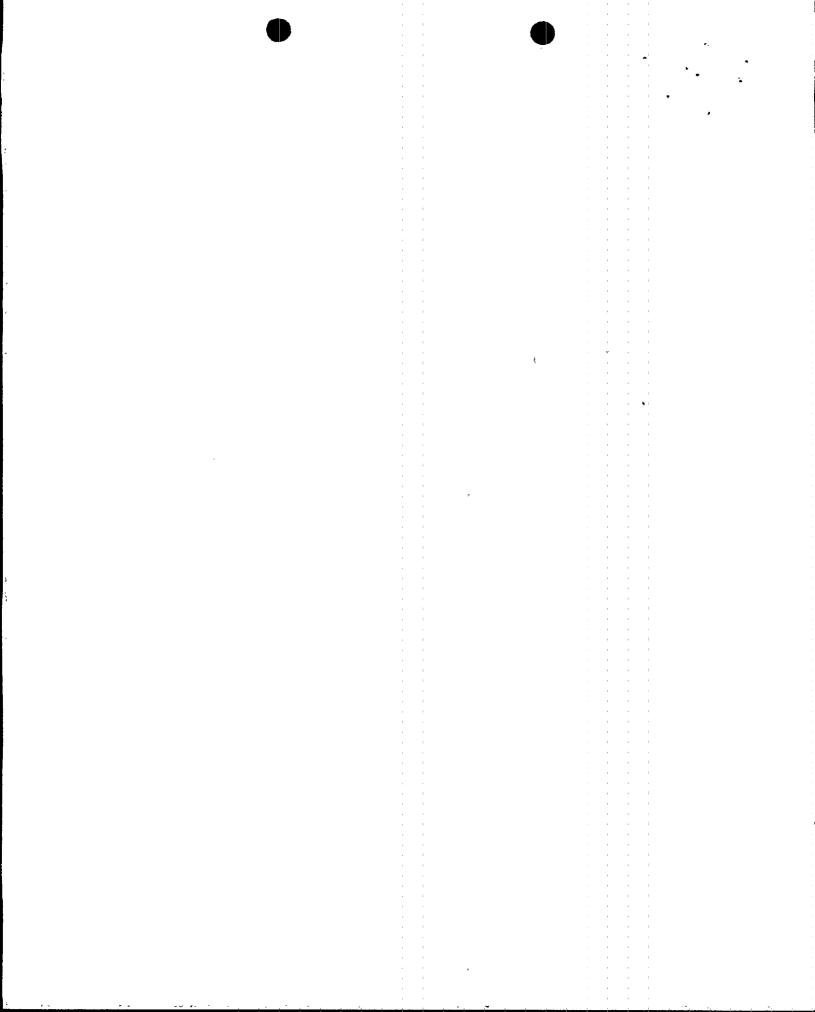
. 86	GE N	uclear Energy	EXAMINA	TION SUMMA	RY SHEET	REPORT N
PROJECT: BRO		<u>NUCLEAR</u>	PROCEDURE: U	T-BFN-503V2		R:
SYSTEM: SHROU	UD VESSEL		N	//A	REV:_N/A_FRI	
WELD NO .: H6 ((GIRTH WELD	2)				N/A
CONFIGURATION	: SHELL TO FL	ANGE RING	м	/A	REV: <u>N/A</u> FRI	R: <u>_N/A</u>
	KEAN	_ LEVEL:!				N/A
EXAMINER: M. KR	UEGER	_LEVEL:				
		LEVEL: N/A	WELD TYPE:			
ATA SHEET NO.(S			CAL SHEET N			
AIA SHEEI NU.IS	1: <u>D-F94-27</u>		CAL SHEET N	J.(S): C-F94-28/29/	130	
rring the examination of t corded by the Smart 200 e 45° shear, 60° RL, and examination was perform nensions of approximate	the above refere 0 system utilizin 0 OD creeping w ned from the up ity 10° to 16° and	g 45° shear wave, 60° ave search units did red per side of the weid due 1 188° to 194° from Ves	connected planar flav refracted longitudina cord non-relevant ind to component confi sel "0" due to the pr	I wave, and OD creepin lications from the lower guration. This examina roximity of lifting and vit	sociated with IGS og wave search un side of the weld, toon was also limit yation tugs, too of	iits. ed to "L" iide pins.
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	GE Nuclear Energy	EXAMINATION SUMMARY SHE	ET REPORT NO
	OWNS FERRY NUCLEAR	PROCEDURE: UT-BEN-503V2 REV: 0	FRR: <u>N/A</u> <u>N/A</u>
SYSTEM: SHRC	DUD VESSEL		A. FRR:
WELD NO .: H7 (GIRTH WELD)		N/A
CONFIGURATION			A FRR: <u>N/A</u>
EXAMINER:C.M		் பா பா பா	
EXAMINER: M.K			
EXAMINER: N/A	LEVEL: N/A		THER_SHROUD
DATA SHEET NO.(S):S	CAL SHEET NO.(S): <u>C-F94-31/32/33</u>	
was limited due to the pro of approximately 10° to 10 downcomers, Jet pumps :	oximity of the outside diameter backing ni 6° and 188° to 190° from Vessel "0°, due and their associated braces and restraint	b to component configuration. The examination from the ng and weld build-up area. This examination was also is to the proximity of lifting and vibration lugs, top guide p brackets. Circumferential "L" dimensions for all exami- tor for circumferential measurements is 1.75" per degra	imited to "L" dimension ins, Corespray nation scans were
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SUMMARY BY	UTILITY REVIEW	DATE	
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IV. · SAFETY ANALYSIS SUMMARY

TVA and GE performed an analysis of the core shroud cracks identified in Unit 2 to show that restart and resumption of operation for at least two cycles would be acceptable. The analysis was based on the fracture mechanics limit load based screening criteria and evaluation techniques applicable to BFN. The analysis reports used for these assessments are available on-site for review.

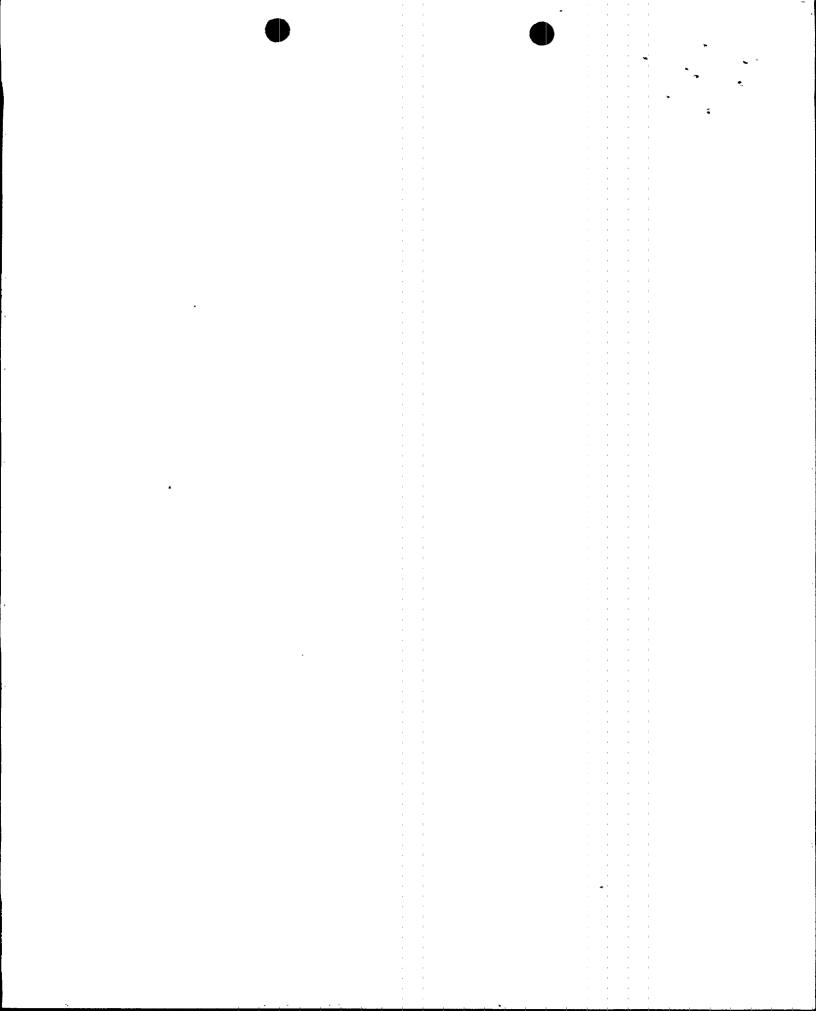
The screening criteria establishes the allowable flaw lengths for the various girth and axial welds on the core shroud. The evaluation techniques provide guidance for evaluating inspection results. The screening criteria and evaluation techniques are conservative and bound the BFN inspection results since they are based on the presumption that only visual inspections will be conducted. As such, allowable flaw lengths were established assuming that all flaws would be through-wall.

Flaw indications were observed in only three of the seven Unit 2 horizontal shroud welds inspected. The indications in welds H3 and H5 are largest with essentially equal lengths of 9.41 inches and 9.09 inches, respectively, while the indication in weld H2 is only 1.34 inches long. None of the indications were significant enough to warrant evaluation. The H5 weld is in a low fluence area (i.e., below 3.0 x 10^{20} n/cm²) so Linear Elastic Fracture Mechanics (LEFM) evaluation techniques are not needed.

TVA examined approximately 61.72% of the H5 weld. In the weld length examined, 2.3% was found to be cracked. TVA considers that any cracks in the unexamined portions of the weld would be similar to those found (e.g., 2.3% of the unexamined weld was assumed to be cracked). The deepest crack had a depth of 0.96 inches and a length of 1.63 inches. The longest continuous crack was 2.9 inches with a maximum depth of 0.74 inches.

An evaluation of the H5 weld was performed to estimate the extent that the cracking may propagate during the next two cycles of operation. ASME Section IX proximity rule (2*flaw depth + 2*flaw growth) was used in evaluating the data since flaw characteristics were determined by UT.

To account for the uncertainty in depth sizing by UT, TVA added 0.3 inches to the flaw depths. The flaw growth rate was estimated using conservative values that have been accepted by NRC (5.0 \times 10⁻⁰⁵ inches/hour of hot operation).



- A calculation was performed using the evaluation method to determine if the postulated flaw sizes would meet the acceptance criteria through two operational cycle (assumed to be 12,500 hot operating hours per fuel cycle). The results of the evaluation are shown below:

UNIT	DESCRIPTION	CYCLE 9
	Total On-Line Hours at End of Cycle	107,700
	Total Effective Flaw Length, inches	38
2	Allowable Effective Flaw Length, inches	416
	% Margin	86
	Maximum 90° Window Indications Length, inches (for information only)	17
	Allowable 90° Window Indications Length, in	104

V. CONCLUSIONS

Based on the analysis summarized above, TVA considers that it is acceptable to operate Unit 2 through the Cycle 9 operating cycle. The results of the inspection confirm that cracking in the Unit 2 core shroud welds is limited and does not pose significant near term concern for structural integrity. This conclusion is based on a significant indicated margin (approximately 90 percent margin of safety after one operating) which in turn is conservatively established.

