



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

April 14, 1993

Docket No. 50-390

APPLICANT: Tennessee Valley Authority (TVA)

FACILITY: Watts Bar Nuclear Plant, Unit 1

SUBJECT: MEETING SUMMARY - MARCH 25, 1993, MEETING TO DISCUSS USE OF ASME CODE CASE N-480 AND ACCUMULATOR CLADDING CRACKS (TAC M63650)

REFERENCE: Meeting notice by P. S. Tam, March 10, 1993

On March 25, 1993, NRC and TVA representatives met at the NRC headquarters office to discuss TVA's use of ASME Code Case N-480 and TVA's proposed fixes of the accumulator cladding cracks described in Inspection Report 50-390, 391/93-02 (dated February 3, 1993). Enclosure 1 is the list of meeting participants. Enclosure 2 is the set of slides used by TVA in the discussion.

First, the issue regarding use of ASME Code Case N-480 surfaced during the staff's inspection of TVA's implementation of the Microbiologically Induced Corrosion (MIC) Special Program (see upcoming Inspection Report 50-390/93-09). The staff has stated, in Watts Bar SSER 10, Appendix Q, its position that the Code Case applies to operating plants only. TVA stated that it will not use the Code Case before Watts Bar is licensed to operate, and that the Code Case has not been used to date in the Watts Bar MIC Special Program. TVA has submitted a letter, dated March 24, 1993, to NRC documenting this commitment. The staff indicated that TVA's actions fully resolve the staff's concern on this issue.

Second, the issue regarding accumulator cladding cracks was reported in detail in Inspection Report 50-390/93-02. A small diameter sample nozzle in the bottom head of the accumulator has been replaced because of incorrect welding material in the nozzle-to-vessel weld. Afterwards, TVA discovered crack indications on the roll-bond stainless steel clad surface adjacent to the repair. In attempting to repair the clad, TVA found that each time a repair (by welding and grinding) was made, additional significant cracking was identified in the clad adjacent to the repair. TVA stated that its engineering evaluation led it to conclude that (1) the flaws are entirely in the clad, (2) base metal (carbon steel) thickness in the thinnest region meets ASME Section III requirements, and (3) fracture mechanics evaluation shows that the cracks do not lead to unacceptable conditions. Hence TVA concludes that no further repairs need be attempted, since the accumulator meets all

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pertinent ASME Code Section III requirements. However, TVA plans to submit a request for relief from ASME Section XI requirements (regarding leaving the flaws in the cladding). The staff agreed that this is a reasonable approach and will evaluate the request.

Original signed by

Peter S. Tam, Senior Project Manager  
Project Directorate II-4  
Division of Reactor Projects - I/II  
Office of Nuclear Reactor Regulation

Enclosures:

- 1. Participant list
- 2. TVA's slides

cc w/enclosures:

See next page

Distribution

Enclosure 1

- T. Murley/F. Miraglia
- J. Partlow
- S. Varga
- G. Lainas
- F. Hebdon
- V. Nerses
- M. Sanders
- E. Jordan
- ACRS (10)
- W. Kleinsorge, RII
- L. Plisco, EDO
- Enclosures 1 and 2
- Docket File
- NRC PDR & LPDR
- WBN Reading
- E. Merschoff, RII
- P. Tam

cc: Licensee & Service List

OFFICE	PDII-4/LA	EMCB	EMCB/SC	PDII-4/PM	PDII-4/D
NAME	MSanders	JDavis	RHermann	PTam:as	FHebdon
DATE	4/10/93	4/9/93	4/9/93	4/6/93	4/14/93

DOCUMENT NAME: N480MTG

ENCLOSURE 1

LIST OF PARTICIPANTS

MARCH 25, 1993

WATTS BAR NUCLEAR PLANT

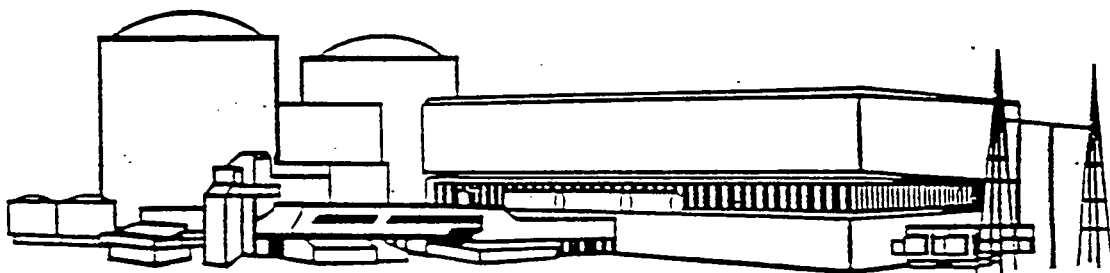
MEETING TO DISCUSS USE OF ASME CODE N-480 AND ACCUMULATOR CRACK FIXES

<u>Name</u>	<u>Organization</u>
Warren Bamford	Westinghouse Energy Systems
Robert Briggs	TVA/Watts Bar
James Davis	NRC/NRR/Material and Chemical Engineering Branch
Tom Dean	TVA/Watts Bar Site Licensing
Walter Elliott	TVA/Watts Bar Engineering
Robert Hermann	NRC/NRR/Material and Chemical Engineering Branch
Geoff Hornseth	NRC/NRR/Material and Chemical Engineering Branch
Roger Huston	TVA Rockville Office
William Kleinsorge	NRC/Region II
V. Nerses (part-time)	NRC/NRR/Project Directorate II-4
George Pannell	TVA Watts Bar Site Licensing
Larry Rinaca	TVA Corporate Engineering
Peter Tam	NRC/NRR/Project Directorate II-4

MEETING WITH NRC STAFF  
ROCKVILLE, MD  
MARCH 25, 1993

**MICROBIOLOGICALLY INDUCED CORROSION  
ASME CODE CASE N-480**

**SAFETY INJECTION ACCUMULATOR TANK  
INDICATIONS IN THE CLADDING**



**WATTS BAR NUCLEAR PLANT**

**TVA**

## PURPOSE

- **PROVIDE THE NRC STAFF WITH INFORMATION REGARDING THE REFERENCE TO ASME CODE CASE N-480 IN THE MICROBIOLOGICALLY INDUCED CORROSION PROGRAM REPORT FOR WATTS BAR NUCLEAR PLANT.**
- **DISCUSS THE APPROACH BEING TAKEN BY TVA TO QUALIFY THE ACCUMULATOR TANK WITH LINEAR INDICATIONS IN THE CLADDING.**

# AGENDA

## TOPICS

- **MICROBIOLOGICALLY INDUCED CORROSION  
PROGRAM REPORT**

**BACKGROUND**

**ASME CODE CASE N-480**

**SUBMITTAL**

- **SAFETY INJECTION ACCUMULATOR TANK  
INDICATIONS**

**BACKGROUND**

**INTEGRITY EVALUATION**

**LICENSING APPROACH**

**SUMMARY**

# MICROBIOLOGICALLY INDUCED CORROSION

PROGRAM REPORT SUBMITTED FEBRUARY 26, 1991

- SECTION III, "STRUCTURAL INTEGRITY IMPLICATION/EVALUATION"

POTENTIAL USE OF ASME CODE CASE N-480

ISOLATED TO CARBON STEEL

- SUBMITTAL — *TVA letter dated 3/24/93*

ISSUED TO WITHDRAW USE OF CODE CASE N-480 UNTIL AFTER WBN IS LICENSED

THE SUBJECT CODE CASE HAS NOT BEEN USED TO-DATE IN WBN MIC PROGRAM

- CONCLUSION

TVA CONSIDERS THIS ISSUE TO BE RESOLVED. BASED ON THE ABOVE SUBMITTAL, TVA REQUEST THE URI FROM INSPECTION 390/93-09 TO BE CLOSED.

# ACCUMULATOR TANK

- **PURPOSE**

**CONTAINS BORATED WATER TO BE INJECTED TO MEET INITIAL CORE COOLING REQUIREMENTS IN CASE OF AN INTERMEDIATE OR LARGE BREAK IN THE RCS**

**THREE TANKS ARE NEEDED TO MEET INITIAL CORE COOLING REQUIREMENTS**

- **FABRICATION**

**SA-516 GRADE 70 WITH SA-240 TYPE 304 ROLL BONDED CLADDING**

- **OPERATING PRESSURE/TEMPERATURE**

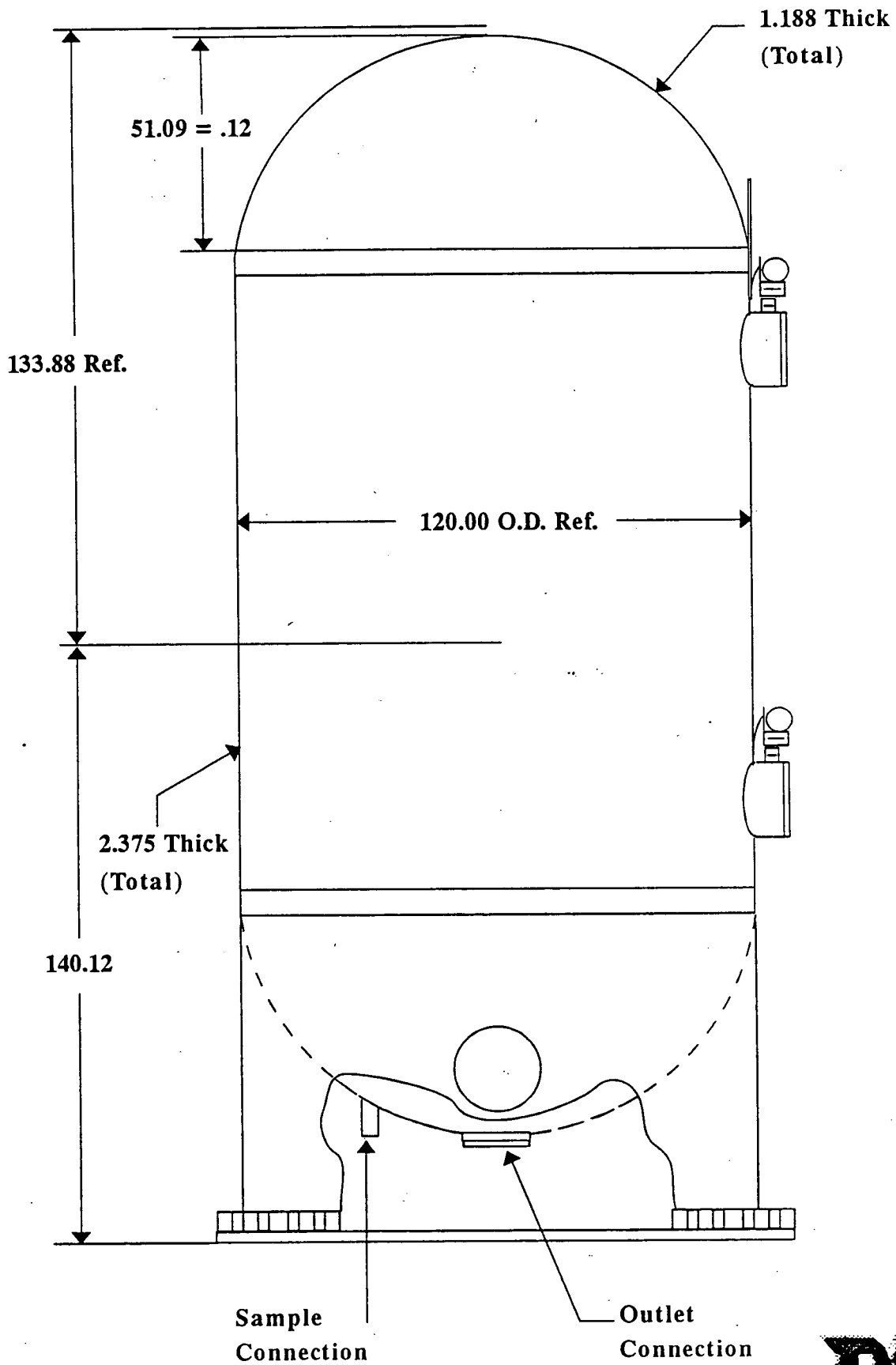
**626 - 660 PSI**

**60 - 150 DEGREES F**

**TVA**



# Accumulator Tank



## **HISTORY**

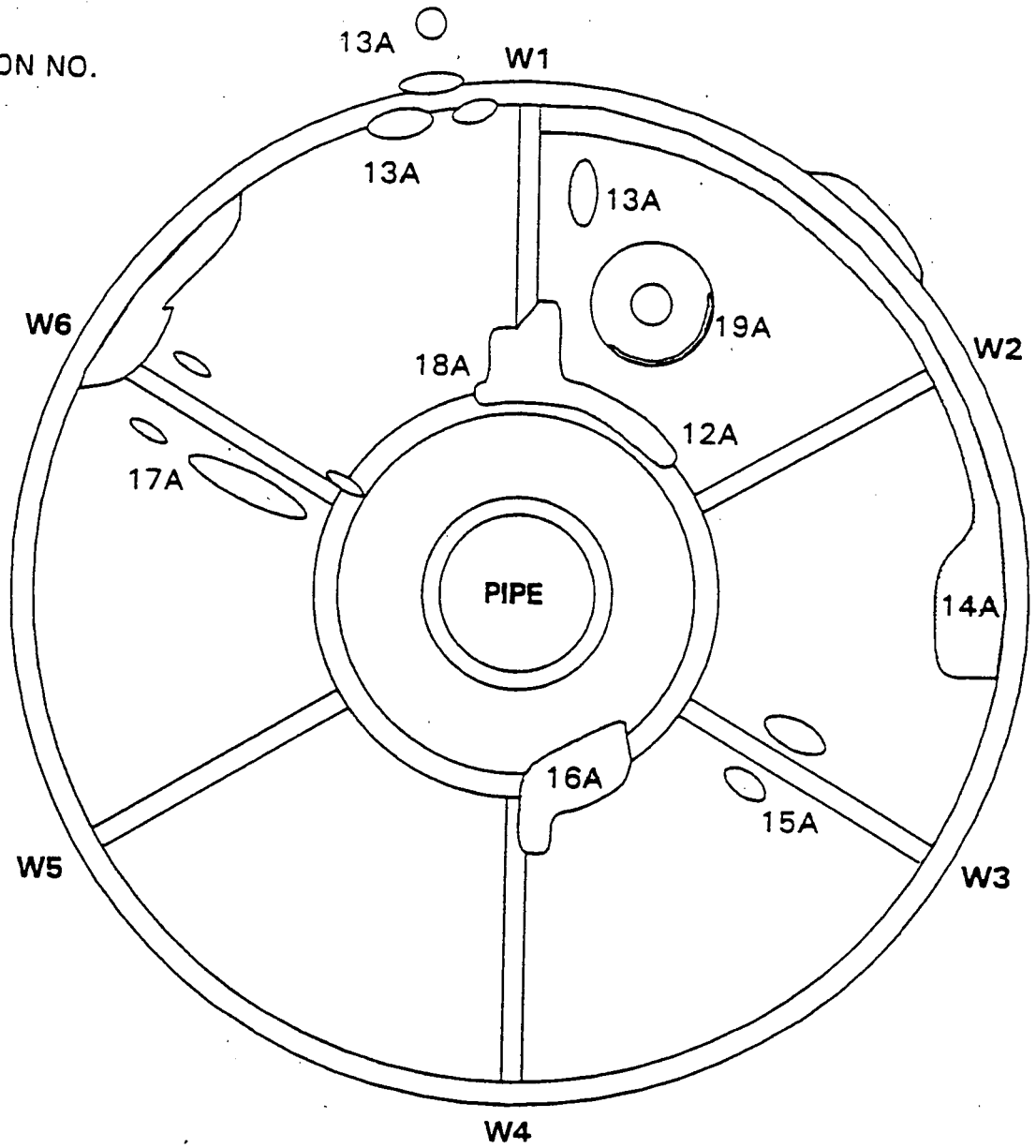
- **SAMPLE LINE REINSTALLATION**
- **DYE PENETRANT RESULTS  
EXTENT OF CONDITION**
- **WELD REPAIRS  
ASME SECTION III  
  
REPAIR AREAS**
- **ADDITIONAL INDICATIONS IDENTIFIED  
CONTACTED WESTINGHOUSE  
  
VENDER SUPPLIED CODE STAMPED  
COMPONENT  
  
FRACTURE MECHANICS EVALUATION**
- **APPROACH DISCUSSED WITH NRC  
  
INSPECTION REPORTS  
390/92-38, NOVEMBER 2 THRU 20, 1992  
390/93-02, JANUARY 11 THRU 15, 1993  
IFI 390/93-02-01**

# **INTEGRITY EVALUATION**

- **DUCTILE FAILURE**
- **FRACTURE MECHANICS**

WELD EXCAVATION NO.

- 12A
- 13A
- 14A
- 15A
- 16A
- 17A
- 18A
- 19A



Map of Indications Remaining in Unit 1 Tank Number 3  
Bottom Head

**TVA**

## **DUCTILE FAILURE: PRIMARY STRESS LIMITS**

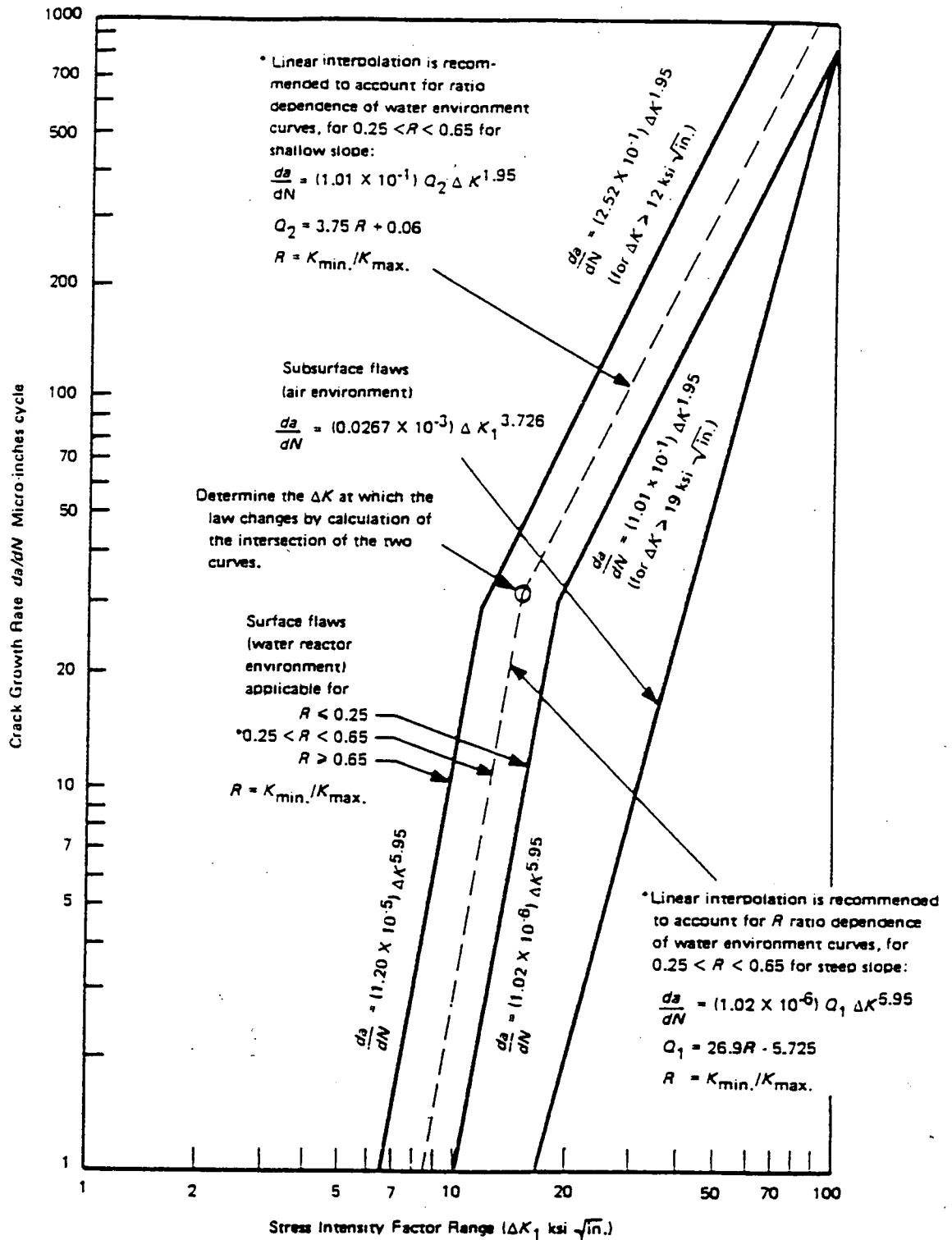
- **WHAT FLAW DEPTH WILL EXCEED DESIGN MARGINS OF SECTION III, NB 3000**
- **FLAW DEPTH = 1.7 INCHES WILL EXCEED DESIGN MARGINS OF SECTION III, NB 3000 IN THE CYLINDRICAL SHELL REGION**
- **FLAW DEPTH = 0.8 INCHES WILL EXCEED DESIGN MARGINS OF NB 3000 IN THE HEAD REGION**
- **THESE ANALYTICAL FLAW DEPTHS GREATLY EXCEED THE ACTUAL INDICATION DEPTHS AND ARE LARGE ENOUGH THAT THE FRACTURE MECHANICS RESULTS WILL BE GOVERNING**

# **FRACTURE MECHANICS ANALYSIS**

- **LOADS**
- **FATIGUE CRACK GROWTH**
- **FRACTURE TOUGHNESS**

**CHARPY RESULTS**

**REFERENCE TOUGHNESS**



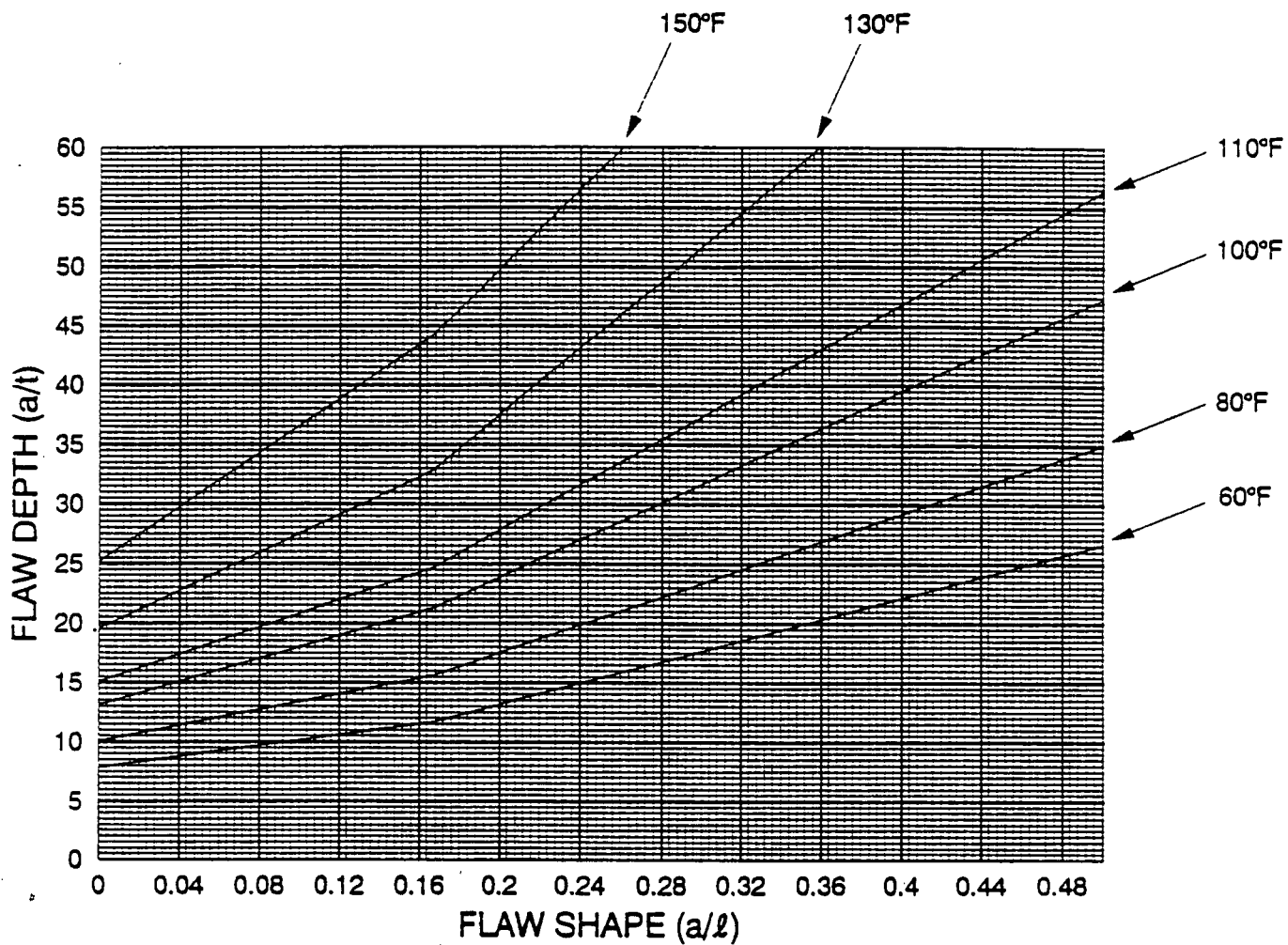
Reference Fatigue Crack Growth Curves for Carbon and Low Alloy Ferritic Steels



## FATIGUE CRACK GROWTH RESULTS FOR SURFACE FLAWS

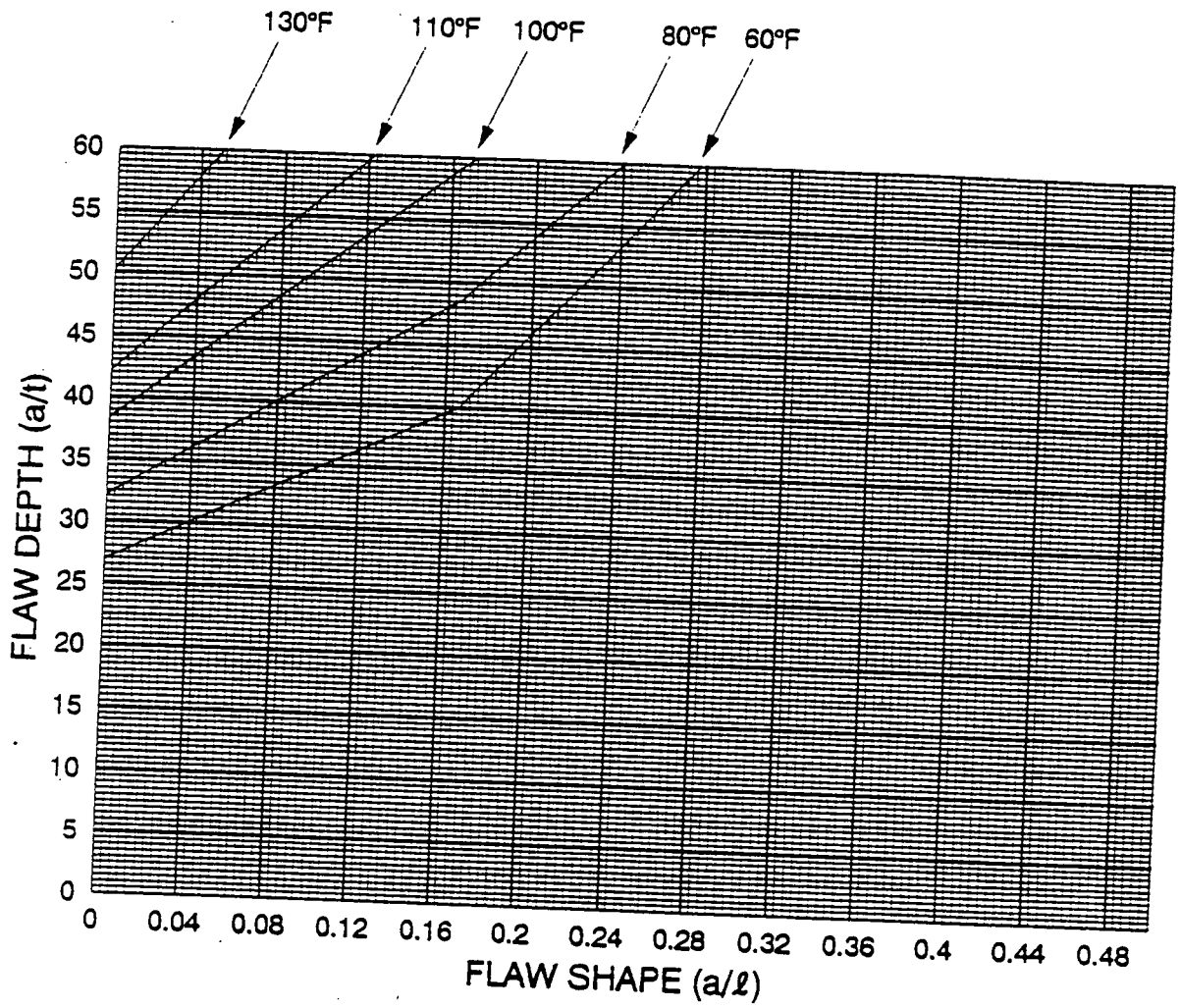
INITIAL CRACK DEPTH (IN.)	CRACK DEPTH (IN.) AFTER YEAR			
	10	20	30	40
0.2	.20005	.20011	.20016	.20022
0.3	.30020	.30050	.30072	.30079
0.4	.40052	.40114	.40166	.40228





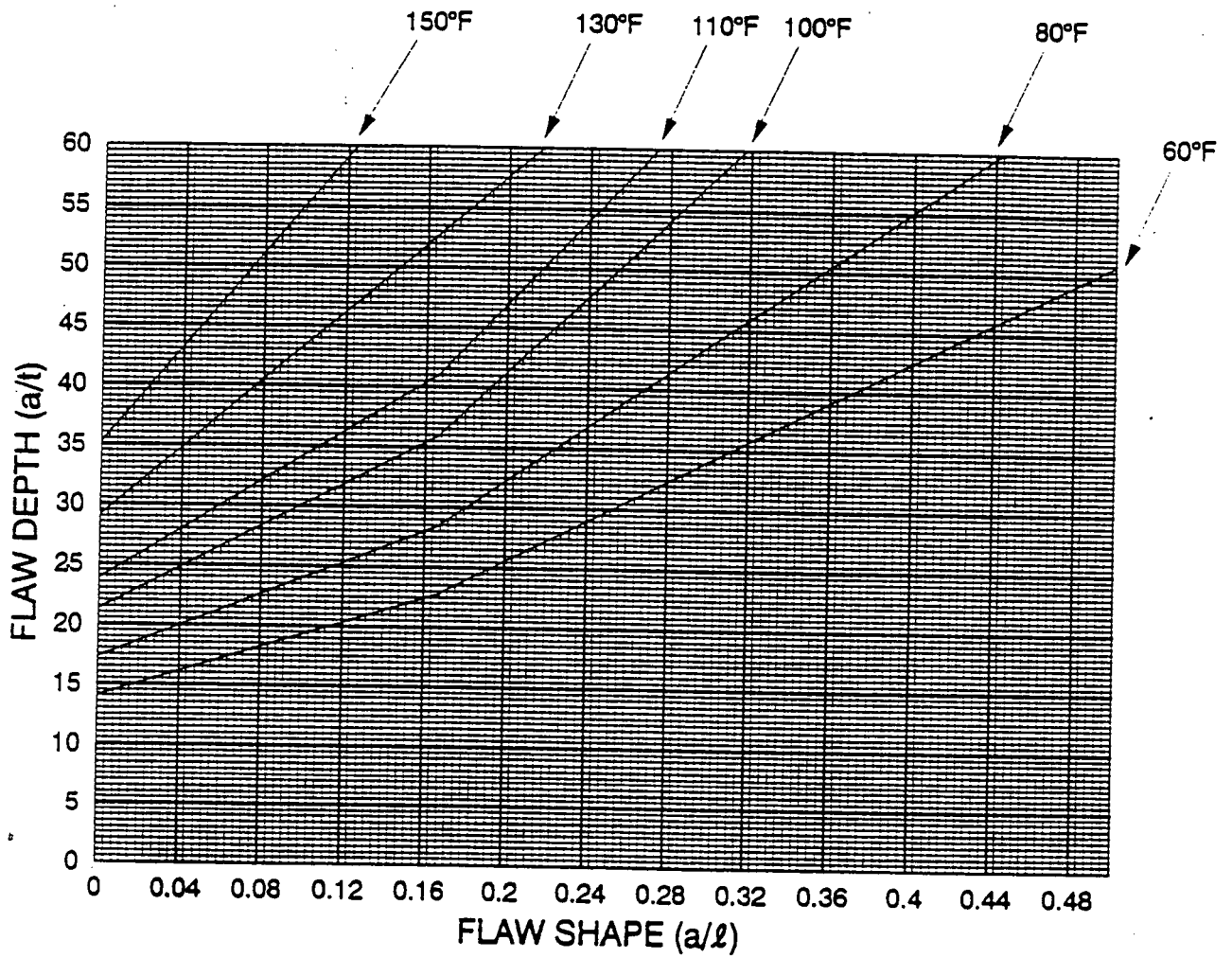
Results for Largest Allowable Flaw Depth: Accumulator Tank Cylindrical Shell Region — Longitudinal Flaws





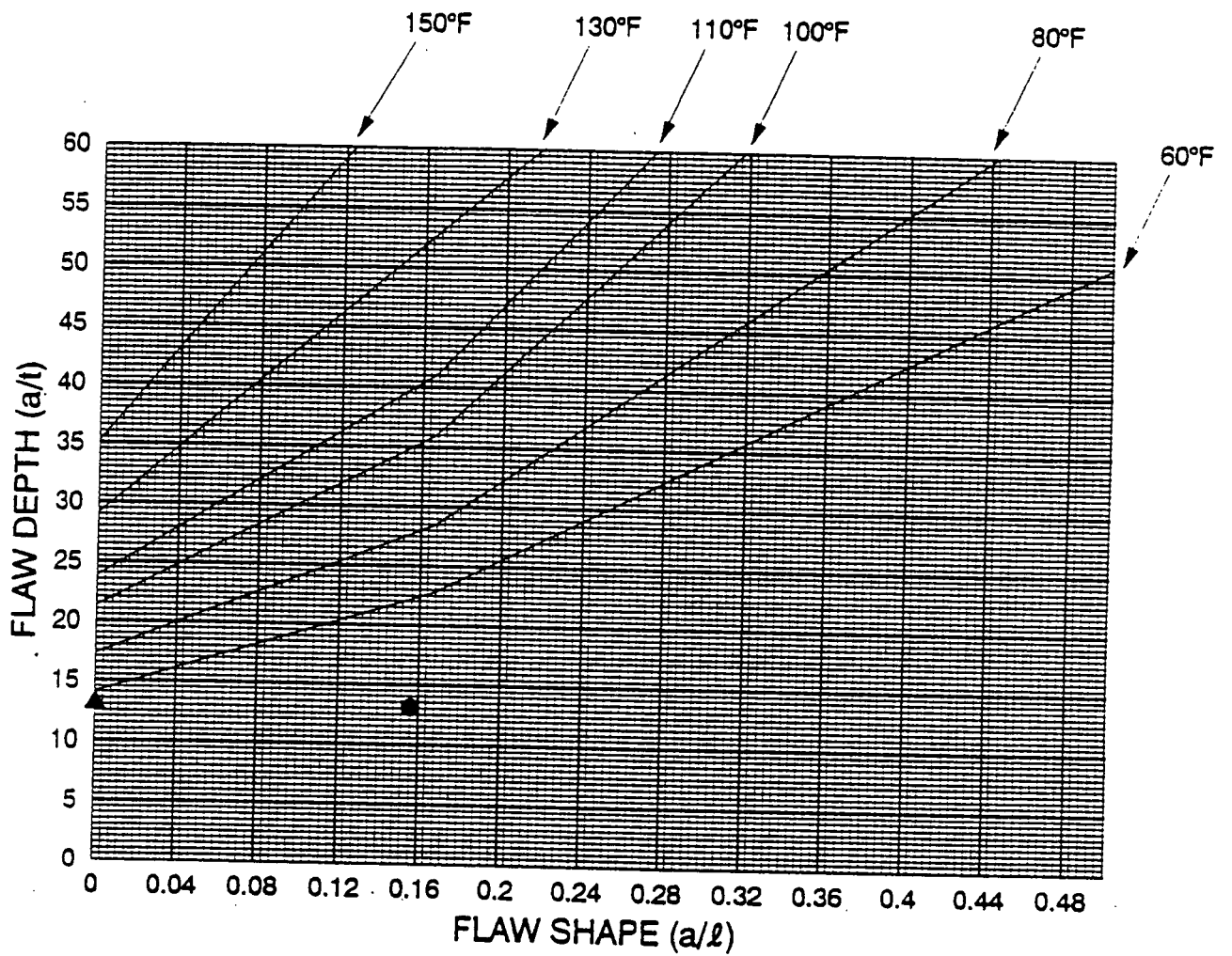
Results for Largest Allowable Flaw Depth: Accumulator  
 Tank Cylindrical Shell Region — Circumferential Flaws





Results for Largest Allowable Flaw Depth: Accumulator Tank Hemispherical Head Region — Circumferential and Longitudinal Flaws





Flaw Evaluation Results for An Existing Indication in the Head Region



## **OTHER CONCERNS**

### **CORROSION OF EXPOSED CARBON STEEL**

- **WATER CHEMISTRY**

**BORON IS 2000 PPM (NOMINAL)**

**2100 PPM (TECH. SPEC. UPPER LIMIT)**

- **WATER IS NORMALLY THE SAME AS PRIMARY WATER**

**NITROGEN BLANKET**

- **EXAMPLES OF SERVICE WITH NO DETRIMENTAL EFFECTS**

### **CODE COMPLIANCE OF THINNED AREAS**

- **"LOCAL" STRESS LIMITS VS "GLOBAL" LIMITS**

- **RESULTS**

## REQUIRED MINIMUM THICKNESS FOR LOCAL REGIONS

REGION	MINIMUM THICKNESS		DESIGN THICKNESS* (BASE METAL ONLY)
	$\sqrt{RT}$ REGION** (1.5 S LIMIT)	LARGER LOCAL REGION (1.1 S LIMIT)	
CYLINDER SHELL	1.58 IN.	2.16 IN.	2.06 IN.
HEMISPHERICAL HEAD	0.78 IN.	1.06 IN.	1.03 IN.

\* This thickness is the original design tank minimum thickness for the carbon steel, to which was added to minimum thickness of 0.156 inches for the roll bonded stainless steel.

\*\* RT = 8.5" for head, 12" for cylindrical shell

## **RESULTS OF THICKNESS INVESTIGATION**

- **THE CARBON STEEL THICKNESS IN THE GROUND AREAS WAS MEASURED BY UT**

**MINIMUM MEASURED 1.07 IN. HEAD REGION**

**NO GRINDING WAS PERFORMED ON THE SHELL**

- **CARBON STEEL MEETS ASME SECTION III STRESS LIMITS WITHOUT THE STAINLESS STEEL**
- **THE STAINLESS STEEL CAN BE CONSIDERED CLADDING, WHOSE PRIMARY PURPOSE IS CORROSION PROTECTION**

## **TECHNICAL SUMMARY**

- **FLAWS ARE ENTIRELY IN THE CLAD. THE CLAD THICKNESS WAS ORIGINALLY USED TO SATISFY DESIGN THICKNESS REQUIREMENTS**
- **BASE METAL THICKNESS IN THINNEST REGION MEETS ASME SECTION III**
- **FRACTURE MECHANICS EVALUATION SHOWS ACCEPTANCE**
- **INDICATIONS ARE TECHNICALLY ACCEPTABLE WITHOUT FURTHER REPAIR**
- **SERVICE EXPERIENCE SHOWS NO DETRIMENTAL EFFECTS FROM OVER TEN YEARS OF SERVICE**



## **SUMMARY AND CONCLUSIONS**

- **ENGINEERING EVALUATION IS COMPLETE**
- **INDICATIONS ARE ACCEPTABLE WITHOUT FURTHER REPAIR**
- **SERVICE EXPERIENCE SHOWS NO DETRIMENTAL EFFECTS FROM OVER TEN YEARS OF SERVICE**
- **RECOMMENDATION IS TO PROCEED WITH SUBMITTAL TO NRC**

# LICENSING APPROACH

- THE INTEGRITY EVALUATION DISCUSSED SAFETY CONCERNS
- ASME CODE REQUIREMENTS

MET ASME SECTION III REQUIREMENTS FOR ORIGINAL FABRICATION

MEETS STRUCTURAL REQUIREMENTS OF ASME SECTION III

MEETS ASME SECTION XI REQUIREMENTS FOR FRACTURE MECHANICS EVALUATION

PRESERVICE CODE REQUIREMENTS

- 10 CFR 50.55a(a)(3)

PROPOSED ALTERNATIVE TO SECTION XI REQUIREMENTS

HARDSHIP WITHOUT A COMPENSATING INCREASE IN THE LEVEL OF QUALITY AND SAFETY

POTENTIAL DAMAGE TO THE TANK

STRESS RELIEF/HYDROTEST

COST/SCHEDULE

THE COST OF REPAIR IS NOT COMMENSURATE WITH SAFETY GAINS

- SUMMARY

REQUEST NRC COMMENT ON THE TECHNICAL AND LICENSING APPROACH TO THIS ISSUE

**TVA**