UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SEP 13 1993

MEMORANDUM FOR: James T. Wiggins, Acting Director
Division of Engineering

FROM: Jack R. Strosnider, Chief
Materials and Chemical Engineering Branch
Division of Engineering

SUBJECT: SUMMARY OF MEETING WITH BWR OWNERS GROUP FOR AN UPDATE ON MATERIALS RELATED ISSUES

On June 30, 1993, the staff met with members of the BWR Owners Group (BWROG) for an update of its work on BWR vessel internals and other materials issues. A list of meeting attendees and a copy of the presentation materials are attached. The BWROG's presentation is briefly summarized below:

BWR Reactor Vessel Internals:

General Electric (GE) presented an update of an on-going proactive analysis of 7 high priority reactor vessel internals and attachments to support its plans for inspection and repair. The analysis will determine the allowable flaw sizes and the crack growth for each selected component for one or more operating cycles. GE also presented sample evaluations of two irradiated components, the core top guide and shroud. The methodologies of the generic analysis of each component will be documented for use by members of the owners group. A draft report is scheduled to be completed by the end of 1993.

GE updated the staff on the intergranular stress corrosion cracking (IGSCC) found at access hole covers (AHCs) of 14 of 33 plants inspected. Cracking has occurred in the creviced Alloy 600 AHC, the shroud support ledge and Alloy 182 weld metal. The cracking found in the beltline weld region of a 304 stainless steel shroud was confirmed to be irradiation assisted stress corrosion cracking (IASCC) by the metallurgical examination of a boat sample. The program to determine the root cause of the core shroud cracking and its generic implication is still underway. The GENE SIL is being revised to recommend inspection of both high and low carbon stainless steel shrouds in the oldest plants (those accumulating 190 on-line months). The evaluation of the cracking of the core top guide at Oyster Creek is continuing. A boat sample is needed to verify the cracking mechanism. GE also reported that cracking in a J-groove weld of a control rod drive was recently found in an overseas plant. Some GE BWRs use Alloy 182 at this location.

RD-8-2
XM-1
(Pkg. 2 of 2)

DF03
1/1

Other Materials Related Issues:

During the meeting BWROG discussed the status of the following materials related issues:

(1) Relief from Inspection Requirements Based on Implementing Hydrogen Water Chemistry

The BWROG had submitted a topical report on hydrogen water chemistry (NEDC-31951P) for NRC review in April 1991. The staff reviewed this report and issued a request for additional information (RAI) in November 1991. BWROG stated that its responses to the RAI would be finalized in about a week and that Duane Arnold would be the lead plant to request relief from the requirements for augmented IGSCC inspection in Generic Letter 88-01 as a result of implementing hydrogen water chemistry.

(2) Request for Relief from the Requirements of NUREG-0619 for Examining Feedwater Nozzles

The BWROG proposes to prepare a generic request for relief from the requirements of NUREG-0619. The relief request would propose to replace the liquid penetrant test with an ultrasonic test and reduce the frequency of inspections. BWROG is doing a funding request survey to determine the feasibility of undertaking this task. The decision on whether to undertake this task will be made by July 2, 1993. The staff recommended that the owners group prepare a generic relief request accompanied by a request from a lead plant.

(3) A Model Inspection Program for BWR Reactor Pressure Vessel Welds

The BWROG is considering developing a model alternative inspection program for reactor pressure vessel welds. This program would be based on priority ranking of all BWR seam welds, attachments,and internals, the probability and consequences of failure, susceptibility to flaws, safety margins, and experience. The staff stated that if the proposed model is based on the probability and consequence of failure, a separate meeting involving the NRC Research Office and fracture mechanics experts should be held to review the risk-based approach.

(4) A New 3-party Agreement for IGSCC Inspection

The purpose of this agreement is to integrate the current 3-party (NRC/BWROG/EPRI) agreement on IGSCC inspection qualification under Generic Letter (GL) 88-01 with the Performance Demonstration Initiative (PDI) program. GL 88-01 requires qualification by a program such as that conducted by EPRI. PDI is a program initiated by the utilities to implement the qualification and training requirements of ASME

Section XI, Appendix VIII. The 3-party agreement and PDI both address these issues with respect to stainless steel piping. The new coordination plan is being developed so utilities would not have to keep two separate qualifications. BWROG provided the staff with a copy of the draft proposal of the agreement. The staff recommended that the integrated qualification program would be better served if managed by an independent third party organization. Subsequent to the meeting, the staff performed a preliminary review of the proposed agreement. The staff informed the owners group that they are not in favor of implementing such an agreement because the staff does not see the advantages or the need of such an approach at this time. The staff would prefer to see a plan from the owners group on how the industry will make the transition from the current three-party agreement to the new Appendixes 7 and 8 of Section XI.

During the meeting, the staff stated that, in view of the cracking being found in the penetrations for control rod drive mechanisms (CRDM) in PWRs, the potential exists for a similar problem in BWRs. The BWROG has committed to include the CRDM penetration welds in the reactor vessel internals and attachments program as a component with high susceptibility to cracking. The staff also shared with the owners group some overseas crack growth information.

ORIGINAL SIGNED BY:

Jack R. Strosnider, Chief
Materials and Chemical Engineering Branch
Division of Engineering

Enclosures:
(1) A List of Meeting Attendees
(2) BWROG Agenda and Presentation Materials
(3) A Draft Proposal for A New 3-Party Agreement

cc: B. D. Liaw
W. T. Russell
J. Partlow
F. Miraglia
R. Dyle, BWROG
C. L. Tully, BWROG

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* See previous concurrences.

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ENCLOSURE 1

LIST OF ATTENDEES AT JUNE 30, 1993 MEETING
WITH BWR OWNERS GROUP (BWROG) FOR AN UPDATE
OF MATERIALS RELATED ISSUES

NAME	POSITION/AFFILIATION	TELEPHONE NO.
William H. Koo	Sr. Materials Engineer NRC/NRR/DE/EMCB	(301)504-2706
Allen Hiser	Materials Engineer NRC/RES/DE/MEB	(301)492-3988
James A Davis	Materials Engineer NRC/NRR/DE/EMCB	(301)504-2713
James T. Wiggins	Director-Degsignate/NRR/DE	(301)504-2722
Robert Hermann	Sect. Chief/NRR/DE/EMCB	(301)504-2768
Martin Hum	Materials Engr./NRR/DE/EMCB	(301)504-2730
John T. Lindberg	Proj. Engr./Penna Power Light	(717)542-3875
Les England	Chairman/BWROG/GSU	(504)381-4145
Robin Dyle	SNC/BWROG Matls's Issue Comm. /chairman	(205)877-7121
Mark Richter	Sr. NDE Engr./Balto. Gas & Elec. /PDI	(401)787-5510
Ken Huffman	PDI Prog. Managr./EPRI	(704)547-6055
Marty Sime	SNC/Hatch Project	(205)877-7473
Julien Abramovici	GPU Nuclear	(201)316-7058
Har Mehta	GE	(408)925-5029
Vijay M Nilekani	PECO	(215)640-6460
Theresa Meisenheimer	Bechtel/Serch	(301)417-8818
James J. Raleigh	STS Inc.	(301)652-2500
Donald S. Brinkman	Sr. Proj. Mngr./NRR/PDI-1	(301)504-1409
Michael Kirk	Sr. Proj. Mgr.-NUMARC	(202)872-1280

AGENDA

MATERIALS ISSUES UPDATE MEETING
JUNE 30, 1993

INTRODUCTION	L. ENGLAND/R. DYLE (BWROG) B. HERMANN (NRC)
UPDATE ON INTERNALS	M. HERRERA (GE)
- ACCESS HOLE COVERS	
- SHROUD	
- TOP GUIDE	
- CRD STUB TUBES	
MISCELLANEOUS	DYLE
- NUREG-0619	
- RPV WELD EXAMS	
- NEW 3-PARTY AGREEMENT (BWROG/NRC/PDI)	
- HYDROGEN WATER CHEMISTRY INSPECTION RELIEF	
- PENDING SIL ON INSTRUMENT NOZZLE CRACKING	checking leak without removing insulation
- POST-MAINTENANCE HYDRO TESTING	
ADDITIONAL ITEMS	ALL

IMPROVED WATER CHEMISTRY INSPECTION RELIEF

- o **OBJECTIVE**:

  ESTABLISH GL 88-01 INSPECTION FREQUENCY TAKING CREDIT FOR HWC BENEFITS

- o **BACKGROUND**:

  BWROG HAS SUBMITTED TOPICAL REPORT FOR NRC REVIEW

  NRC HAS ISSUED REQUEST FOR ADDITIONAL INFORMATION

- o **STATUS**:

  BWROG RESPONSES TO NRC RFI HAVE BEEN DRAFTED AND ARE UNDERGOING FINAL REVIEW

  ONE PLANT HAS SUBMITTED RELIEF REQUEST TO NRC FOR REVIEW

- o **ACTIONS**:

  BWROG TO SUBMIT RESPONSES TO RFI

  BWROG/NRC TO ESTABLISH REVIEW SCHEDULE

NUREG-0619 FEEDWATER NOZZLE EXAMS

- o **OBJECTIVE:**

  DEVELOP FOR NRC REVIEW A GENERIC RELIEF REQUEST FROM THE FEEDWATER NOZZLE REQUIREMENTS OF NUREG-0619

- o **BACKGROUND:**

  GPC (HATCH) HAS SUBMITTED RELIEF REQUEST TO NRC

  RELIEF REQUEST WOULD ELIMINATE PT AND REDUCE CURRENT FREQUENCY OF UT

  RELIEF REQUEST BASES ON CAPABILITY OF UT TO DETECT CRITICAL FLAW SIZE

  NRC REQUESTED THAT BWROG PREPARE GENERIC RELIEF REQUEST

- o **STATUS:**

  BWROG HAS ISSUED FUNDING REQUEST IN RESPONSE

  BWROG DECISION ON WHETHER TO UNDERTAKE THIS TASK WILL BE MADE BY JULY 2

- o **ACTIONS:**

  BWROG TO COMMUNICATE DECISION TO NRC

  BWROG/NRC TO DEVELOP SCHEDULE FOR SUBMITTAL AND REVIEW

RPV WELD EXAMS

o **OBJECTIVE**: generic approach

DEVELOP A MODEL INSPECTION PROGRAM FOR BWR RPV WELDS

o **BACKGROUND**:

- NRC REQUIRES INSPECTIONS OF "ESSENTIALLY 100%" OF VESSEL SHELL WELDS

- OTHER AREAS SUCH AS ATTACHMENT WELDS, MAY HAVE HIGHER PRIORITY FOR INSPECTION

o **STATUS**:

BWROG CONSIDERING DEVELOPING A MODEL ALTERNATIVE INSPECTION PROGRAM BASED ON:

- PRIORITY RANKING OF ALL BWR SEAM WELDS, ATTACHMENTS AND INTERNALS
- PROBABILITY AND CONSEQUENCE OF FAILURE
- SUSCEPTIBILITY TO FLAWS
- INHERENT SAFETY MARGINS
- INDUSTRY FAILURE EXPERIENCE

o **ACTIONS**:

OBTAIN FEEDBACK FROM NRC ON WHETHER THEY WOULD CONSIDER REVIEWING THE BWROG MODEL PROGRAM

RPV WELD EXAMS

- o **PROPOSED MODEL ALTERNATIVE INSPECTION PROGRAM:**

  - INSPECTION PRIORITY RANKING

  - TECHNICAL BASES FOR INSPECTION SCOPE AND FREQUENCY

  - GENERIC COST/BENEFIT ANALYSIS FOR CURRENT REQUIREMENTS VS. ALTERNATIVE PROGRAM

  - SPREADSHEET FORMAT LISTING ALL BWR SEAM WELDS, ATTACHMENTS AND INTERNALS TO ADDRESS PRIORITY RANKING, EXAMINATION METHOD AND EXAMINATION FREQUENCY

  - BWROG II&R COMMITTEE RANKING OF INTERNALS INSPECTION AND REPAIR PRIORITIES TO BE INCORPORATED IN PROGRAM

NEW 3-PARTY AGREEMENT

- o **OBJECTIVE**:

  INTEGRATE CURRENT 3-PARTY AGREEMENT (NRC/BWROG/EPRI) ON IGSCC WITH PDI

- o **BACKGROUND**:

  GL 88-01 STAFF POSITION REQUIRES QUALIFICATION BY A PROGRAM SUCH AS THAT CONDUCTED AT EPRI

  3-PARTY AGREEMENT AND PDI BOTH ADDRESS STAINLESS STEEL PIPING

  NEW COORDINATION PLAN BEING DEVELOPED SO UTILITIES WOULD NOT HAVE TO MAINTAIN TWO SEPARATE QUALIFICATIONS

- o **STATUS**:

  BWROG HAS APPROVED PROPOSED PDI INTEGRATION PLAN

- o **ACTIONS**:

  NRC TO CONSIDER NEED FOR EITHER NEW INTEGRATION PLAN OR GL 88-01 REVISION

GE Nuclear Energy

BWR Vessel Internals Update

June 30, 1993

Marcos L. Herrera
GE - San Jose

Objective

- Update on BWROG internals inspection and repair proactive analysis
- BWR vessel internals update
  - Access hole cover
  - Shroud
  - Top guide
- Future plans

BWROG COMMITTEE ACTIVITIES

INTERNALS INSPECTION & REPAIR

0 PROACTIVE ANALYSES

- DOCUMENT GENERIC ANALYSIS METHODOLOGIES (AND BOUNDING ANALYSES WHERE POSSIBLE) FOR HIGH PRIORITY INTERNALS AND ATTACHMENTS:

  CORE SPRAY INTERNAL PIPING
  CORE SPRAY T-BOX
  TOP GUIDE
  SHROUD
  SHROUD SUPPORT
  SHROUD SUPPORT ATTACHMENT
  CORE DELTA-P/SLC PENETRATION
  ACCESS HOLE COVER (DONE)

- ANALYSES ARE STILL IN PROGRESS, WITH DRAFT RESULTS SCHEDULED FOR END OF YEAR

Proactive Analysis

- Determination of allowable flaw sizes prior to inspection
- May provide justification for continued operation
- Allows for contingency (repair / replacement/ analysis) option preparation
- Reduces likelihood that small indications disrupt or extend outage

Proactive Analysis Approach

- Critical flaw size
- Allowable flaw size
- Crack growth for one cycle or more
- Flaw acceptance for continued operation

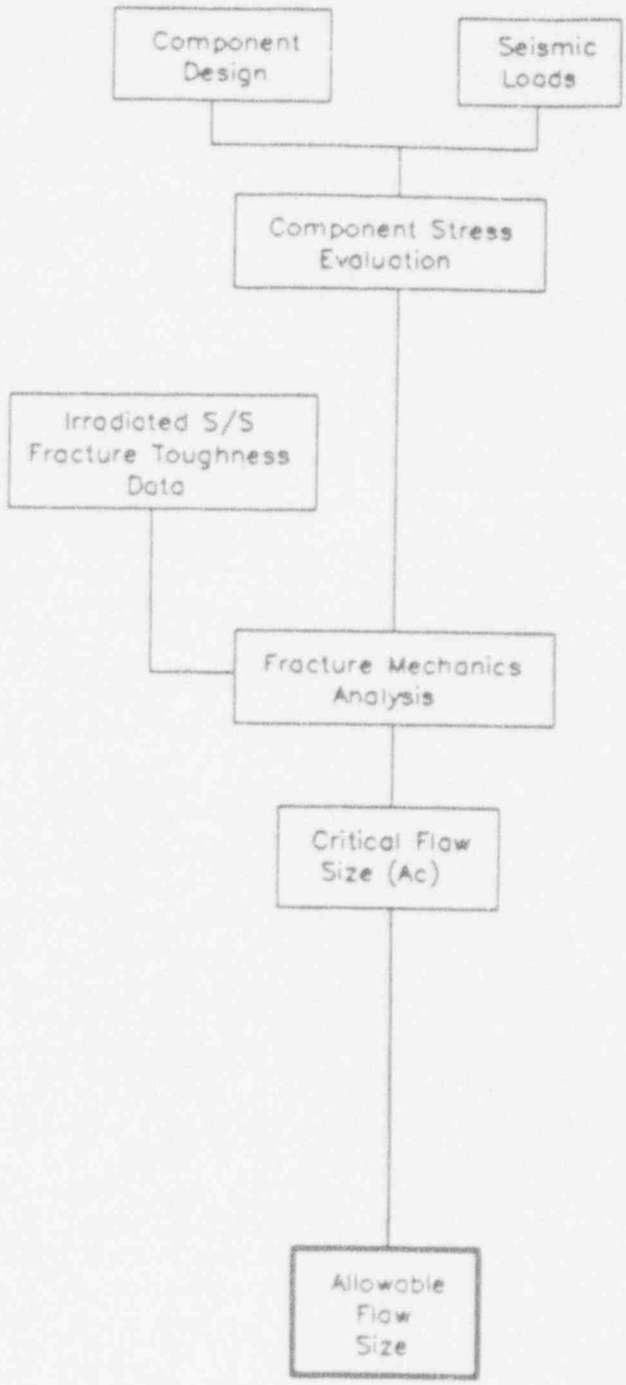
Methodology for Prediction of Allowable Flaw Size in Irradiated Stainless Steel BWR Internals

Applied to highly irradiated stainless steel BWR internals

- *Top guide*
- *Core shroud*

Essential Steps

- *Load determination*
- *Finite element modelling*
- *Stress analysis*
- *Stress intensity factor distribution determination*
- *Fracture toughness properties*
- *Critical flaw size calculation*
- *Allowable flaw size calculation*



Procedure For Evaluation of Allowable Flaw Size

Irradiated Stainless Steel Internals

- Core top guide and core shroud
- Selection of fracture toughness based on fluence
- Fracture toughness decreases with fluence
- Fracture toughness (KIC) decrease shows "saturation" behavior at high fluences
    - KIC of 50 Ksi$\sqrt{in}$ bounds
    - Data obtained from specimen irradiated up to $6 \times 10^{21} n/cm^2$

Top Guide Evaluation

- BWR/2 used as example

- Finite element modeling used to evaluate in-plane membrane and out-of-plane bending stress.

- Limiting conditions evaluated - Limiting seismic

- Two Models used to estimate stress in beams.

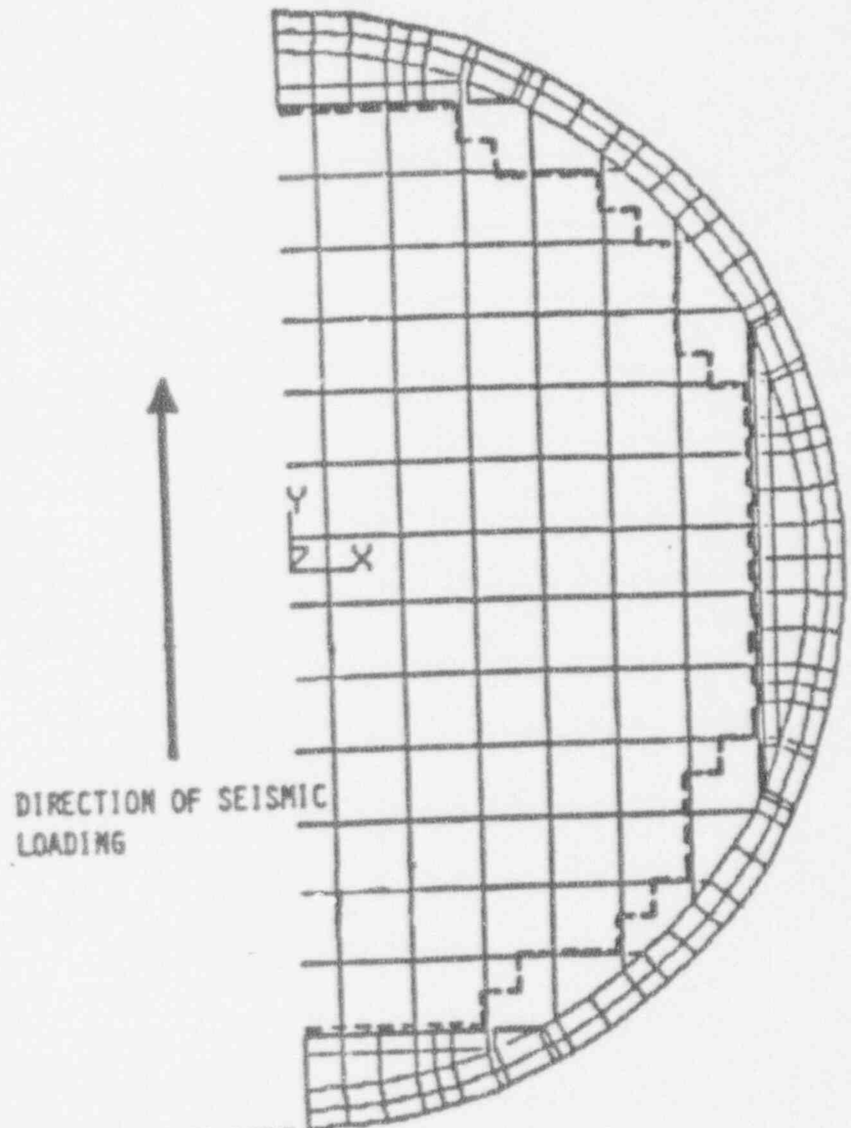
  - Full model for in-plane stress

  - Box model for out-of-plane bending stress

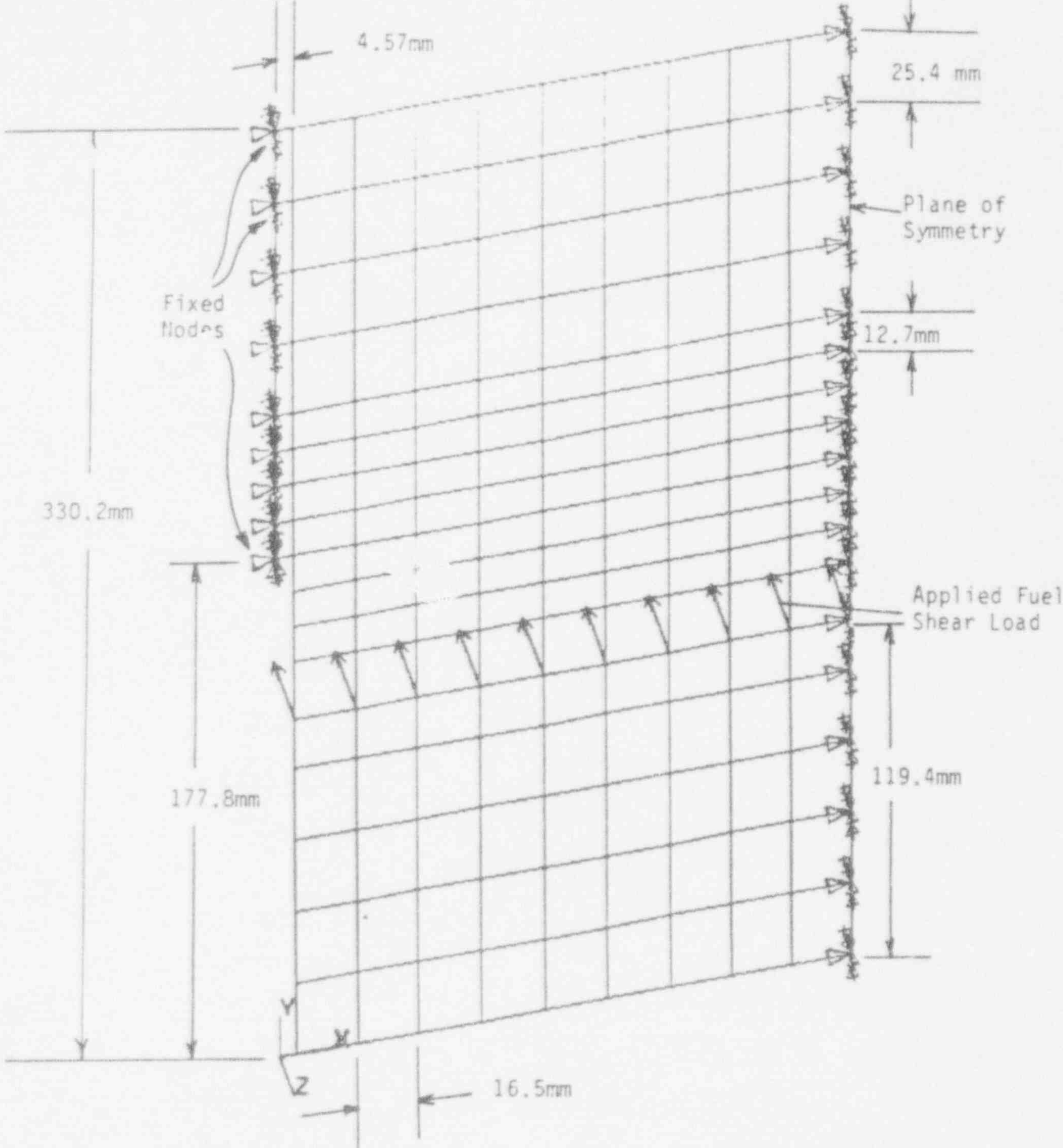
Top Guide Evaluation

- Applied Loads
    - Weight
    - Pressure drop across top guide
    - Fuel impact due to seismic event

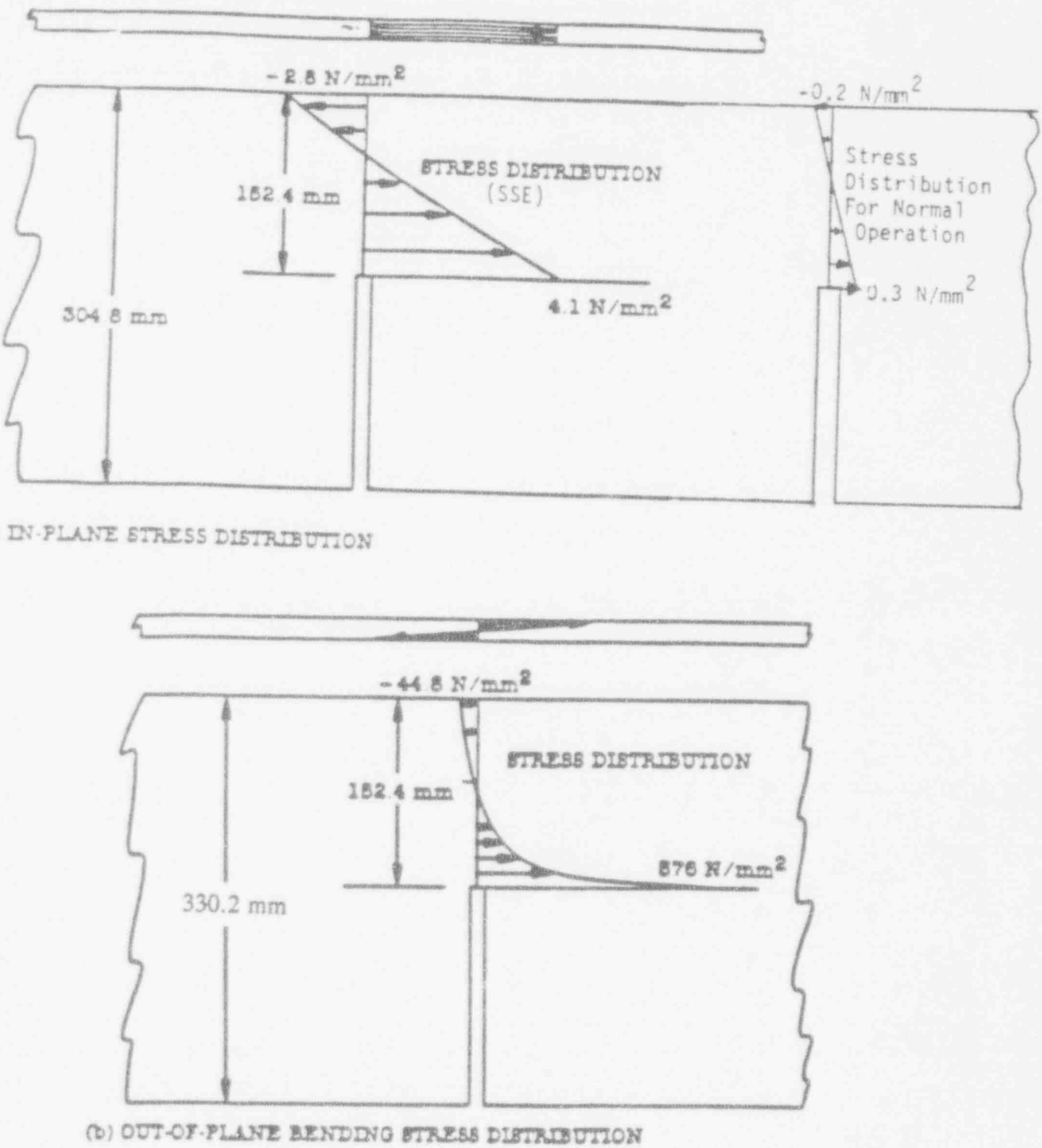
- Fuel impact load
    - Consider flexibility between fuel and top guide upper beams



TOP GUIDE MODEL



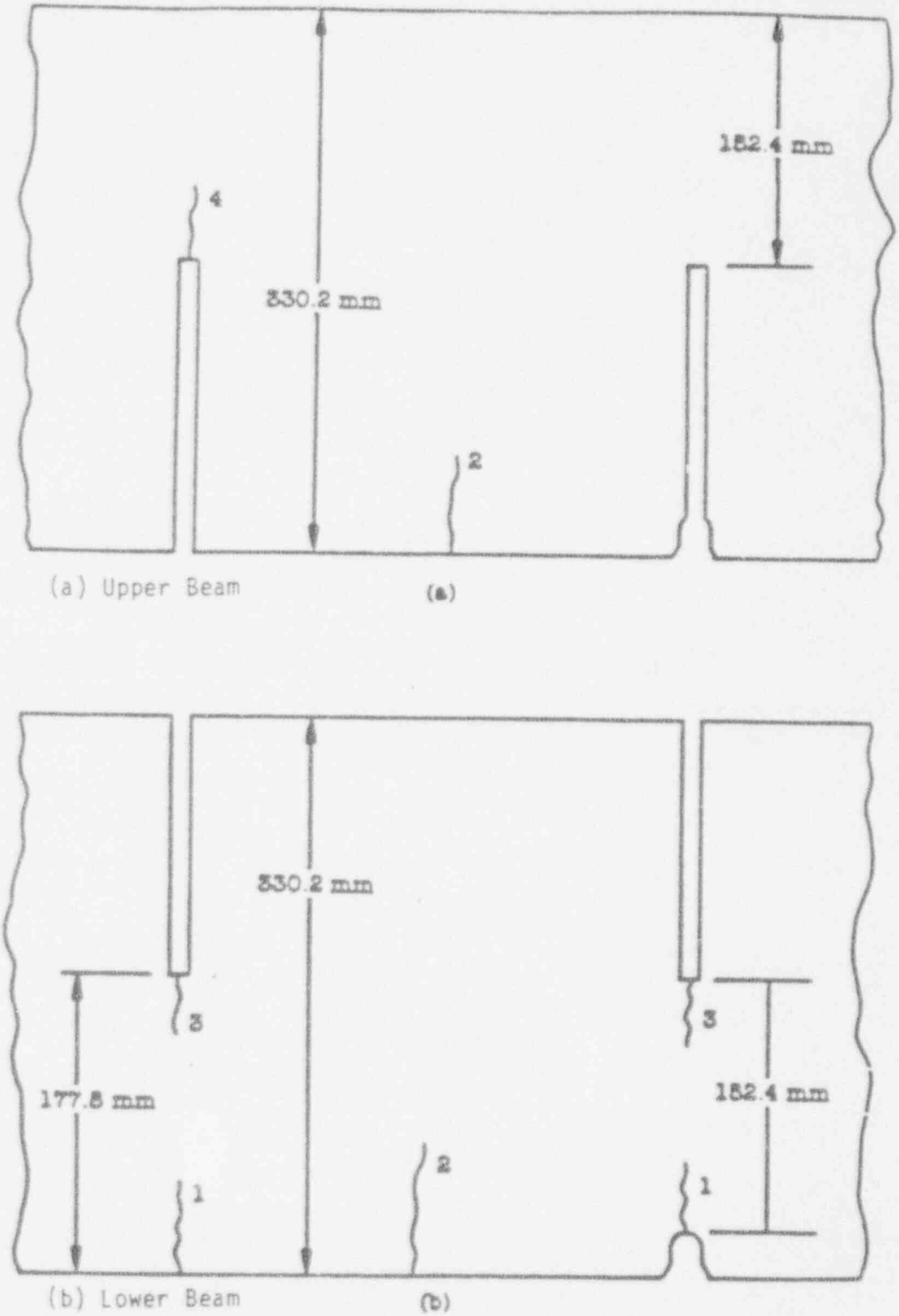
Detailed modeling of upper beam segment.



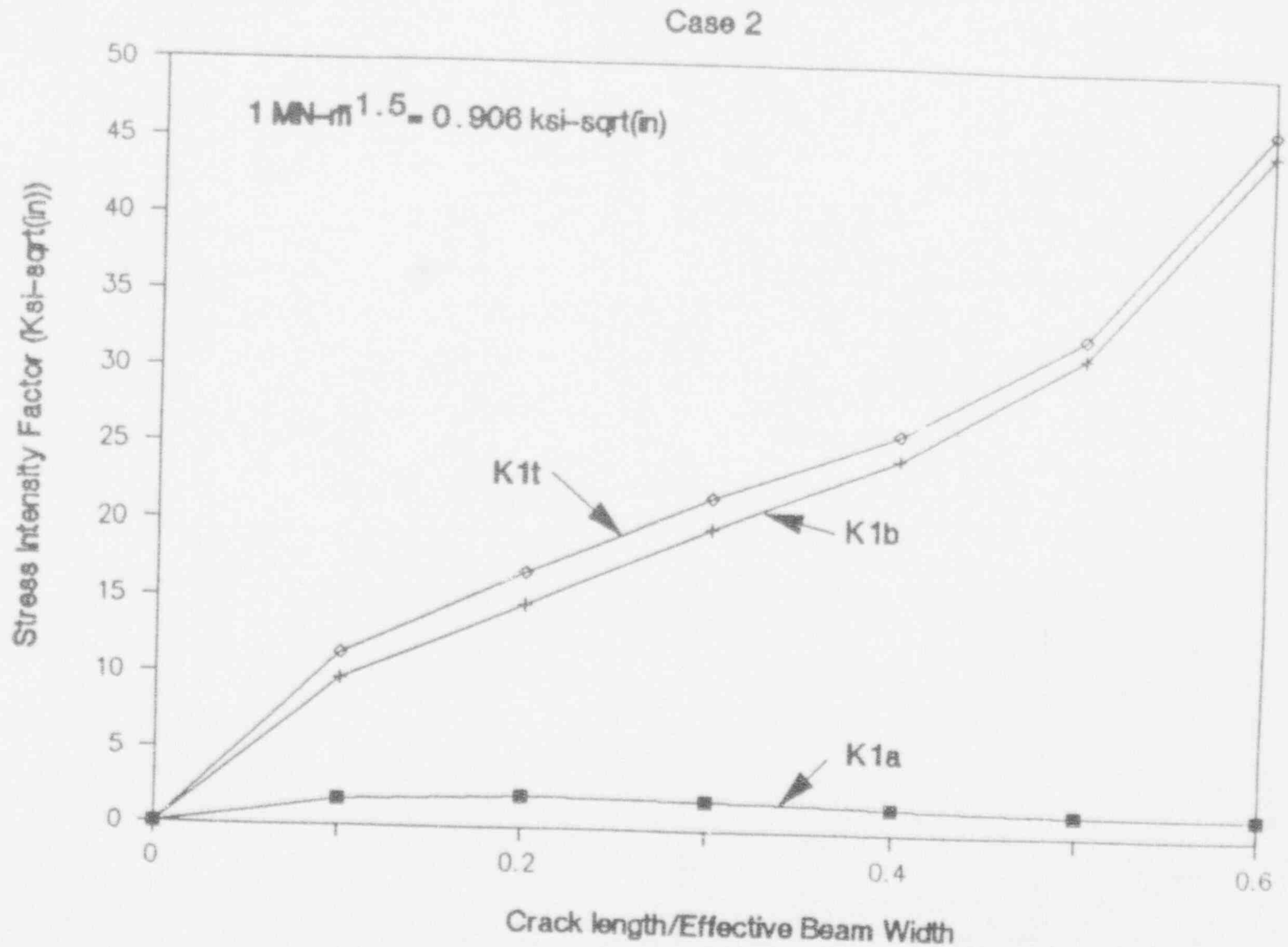
Maximum stress distributions for postulated crack location 4.

Top Guide Evaluation

- Crack locations postulated at several limiting locations
- Stress intensity factor determined from total stress
  - Bending stress (Box Model)
  - Membrane stress (Full Model)
- Stress intensity factors determined using solution for edge cracked plate
- Critical flaw size defined when applied K equals fracture toughness
- Allowable flaw size determined from critical flaw size and application of safety factor



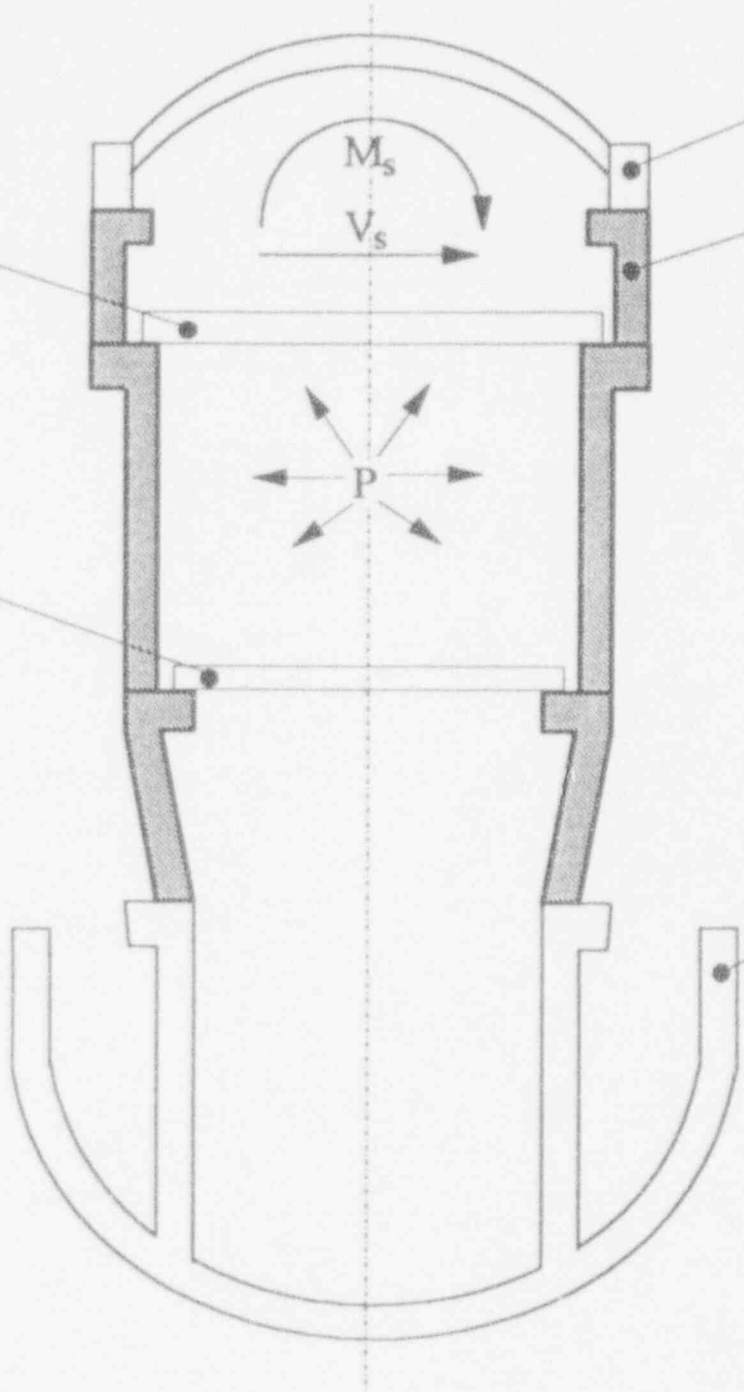
Identification of postulated crack locations for critical flaw size calculations. (a) Upper beam; (b) Lower beam.


Case 2
1 MN-m^1.5 = 0.906 ksi-sqrt(in)
Stress Intensity Factor (Ksi-sqrt(in))
Crack length/Effective Beam Width
K1t
K1b
K1a
0
5
10
15
20
25
30
35
40
45
50
0
0.2
0.4
0.6

Shroud Example

- Evaluation performed using limiting seismic event
- Applied loads due to overturning moment, shear and internal pressure.
- Weld residual stress considered in crack growth evaluation.
- Throughwall crack in shroud does not impair intended function.

Shroud Schematic



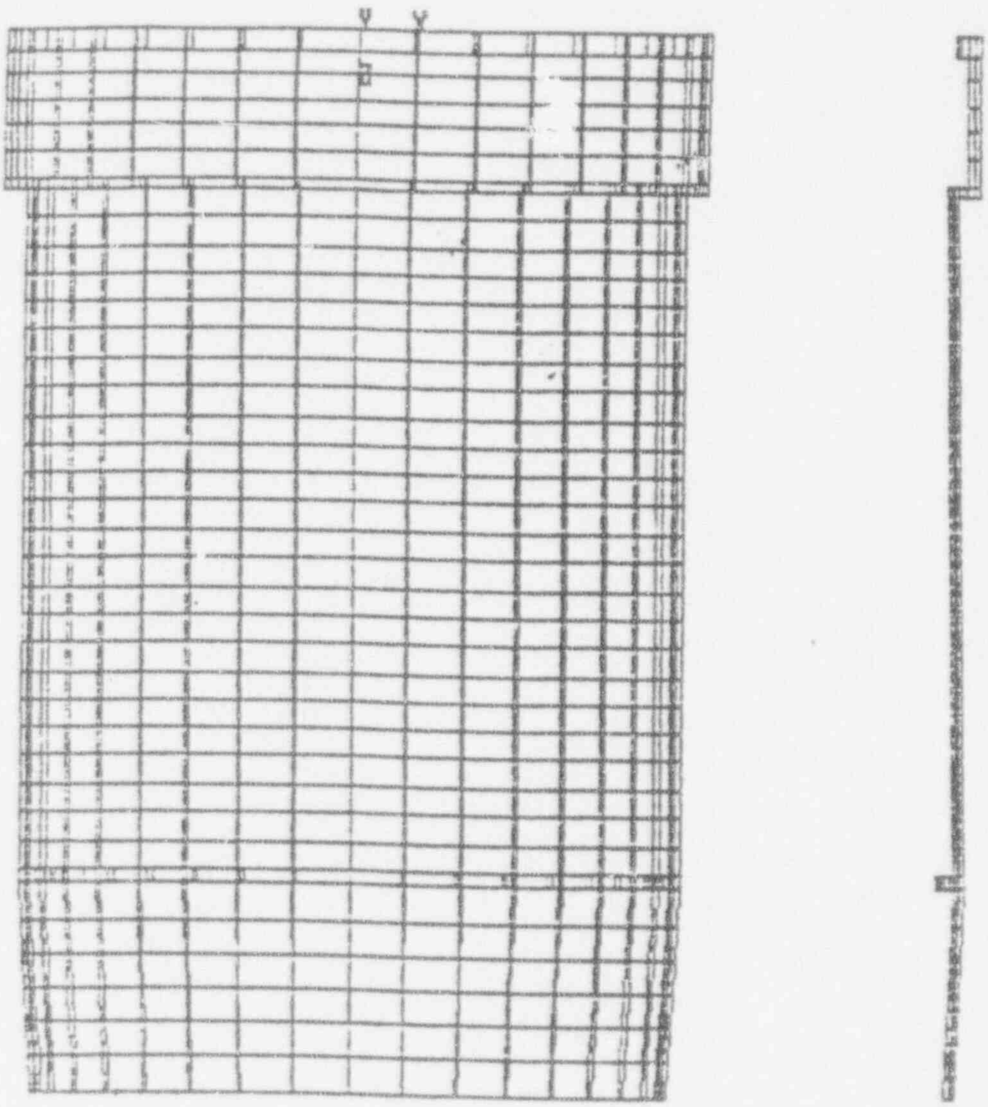
Loads

Ms = 1.28e6 lbf-ft (1.74e6 N-m)

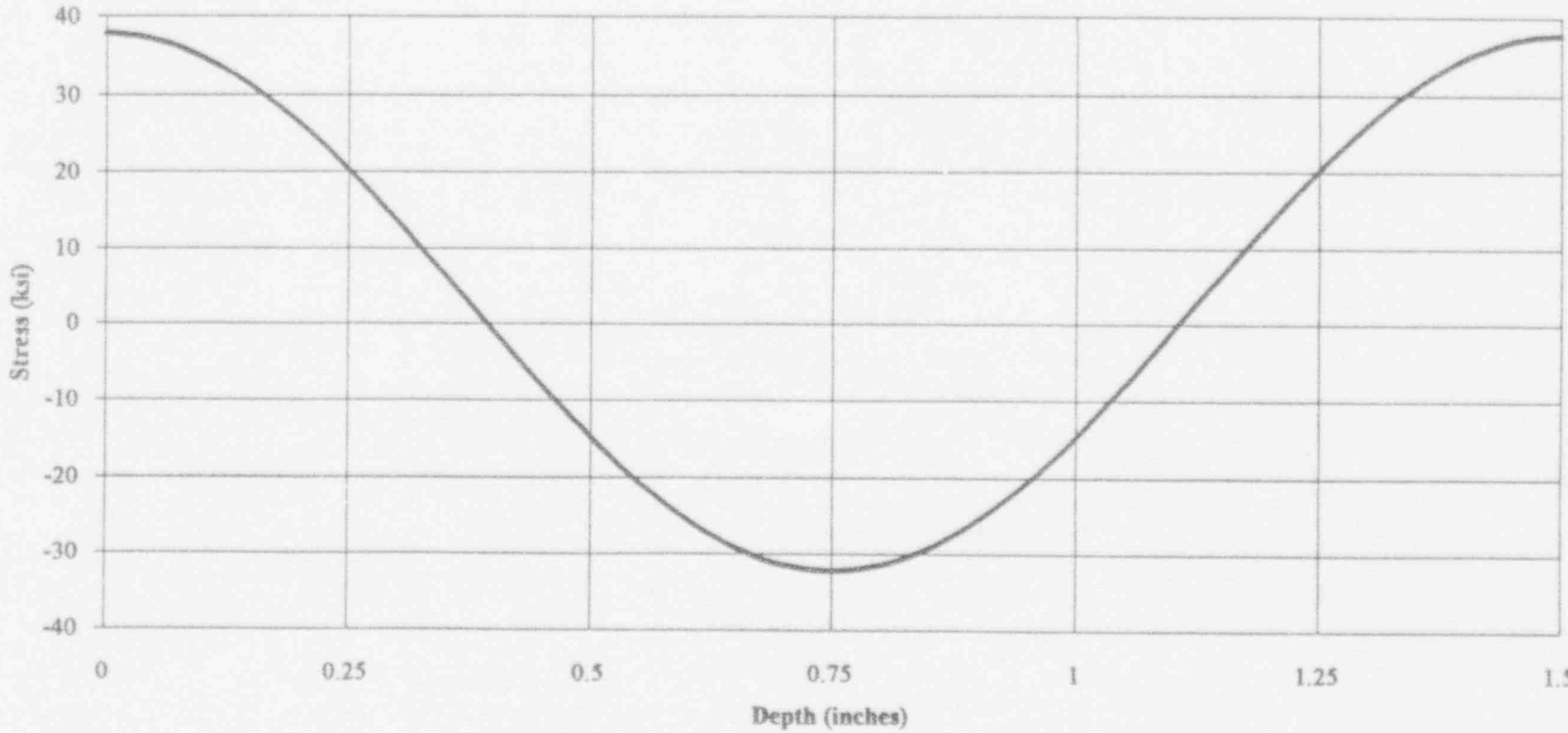
Vs = 117,000 lbf (520,000 N)

P = 47.18 psid (0.33 MPa), Internal

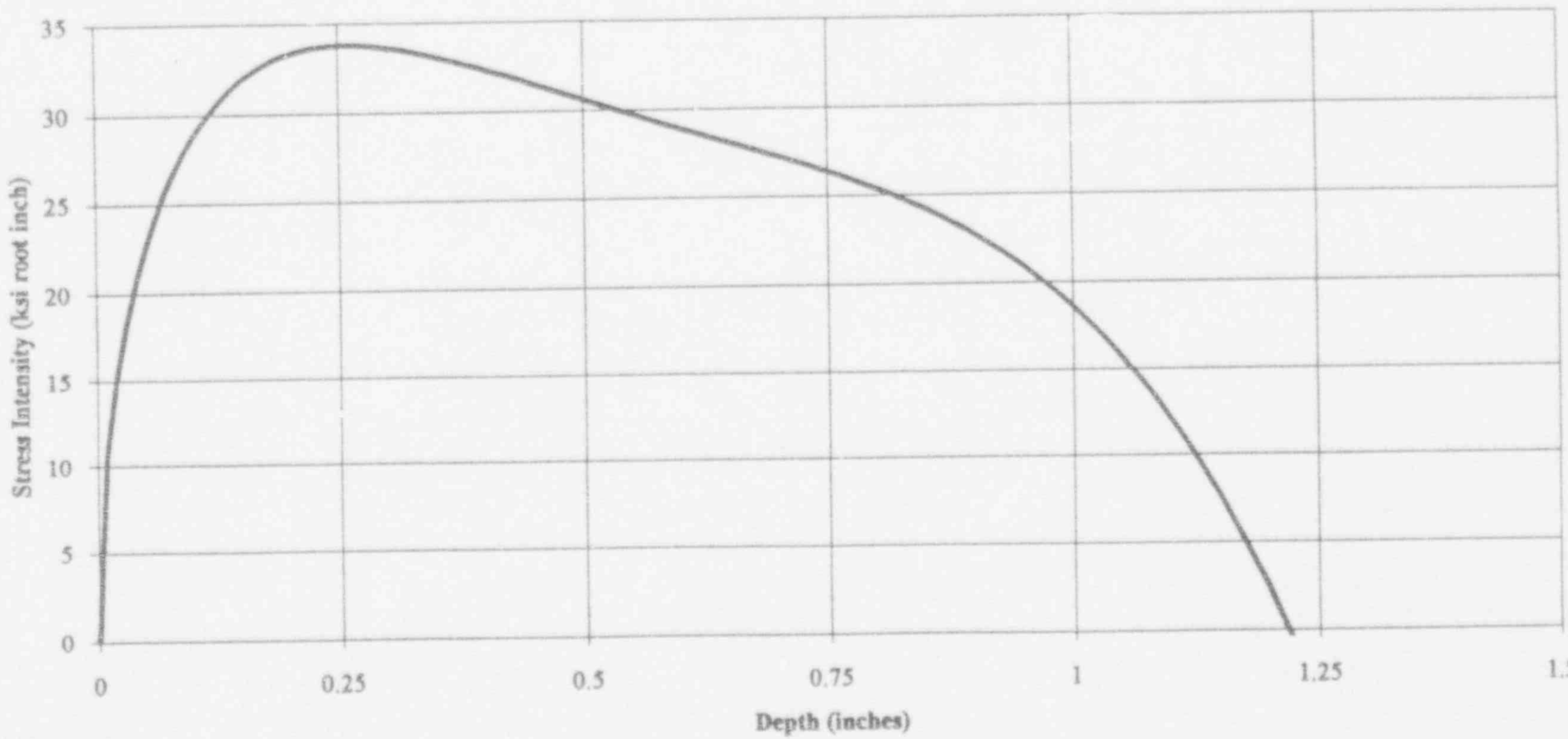
ANSYS Finite Element Model of Shroud



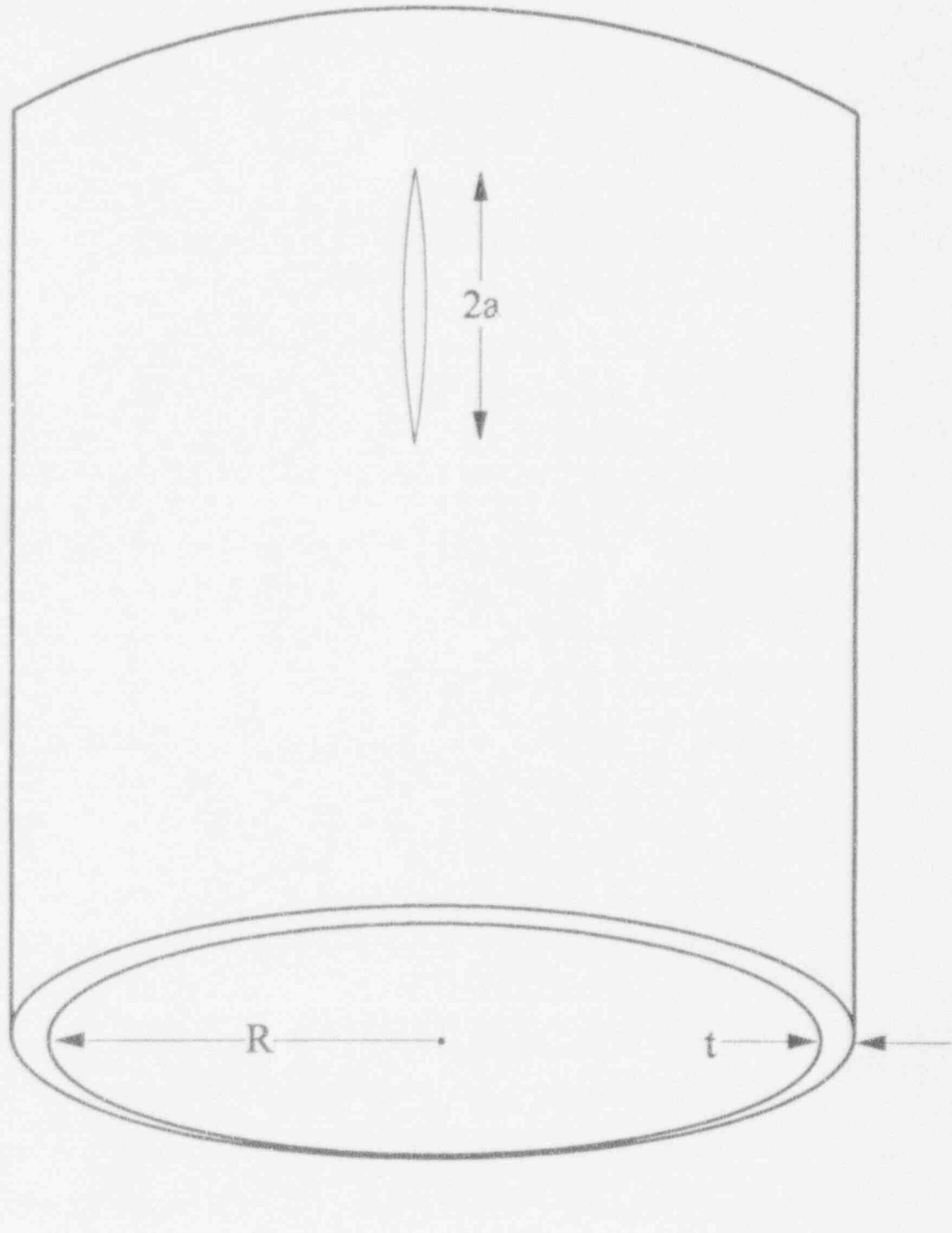
Total Through Wall Stress Distribution



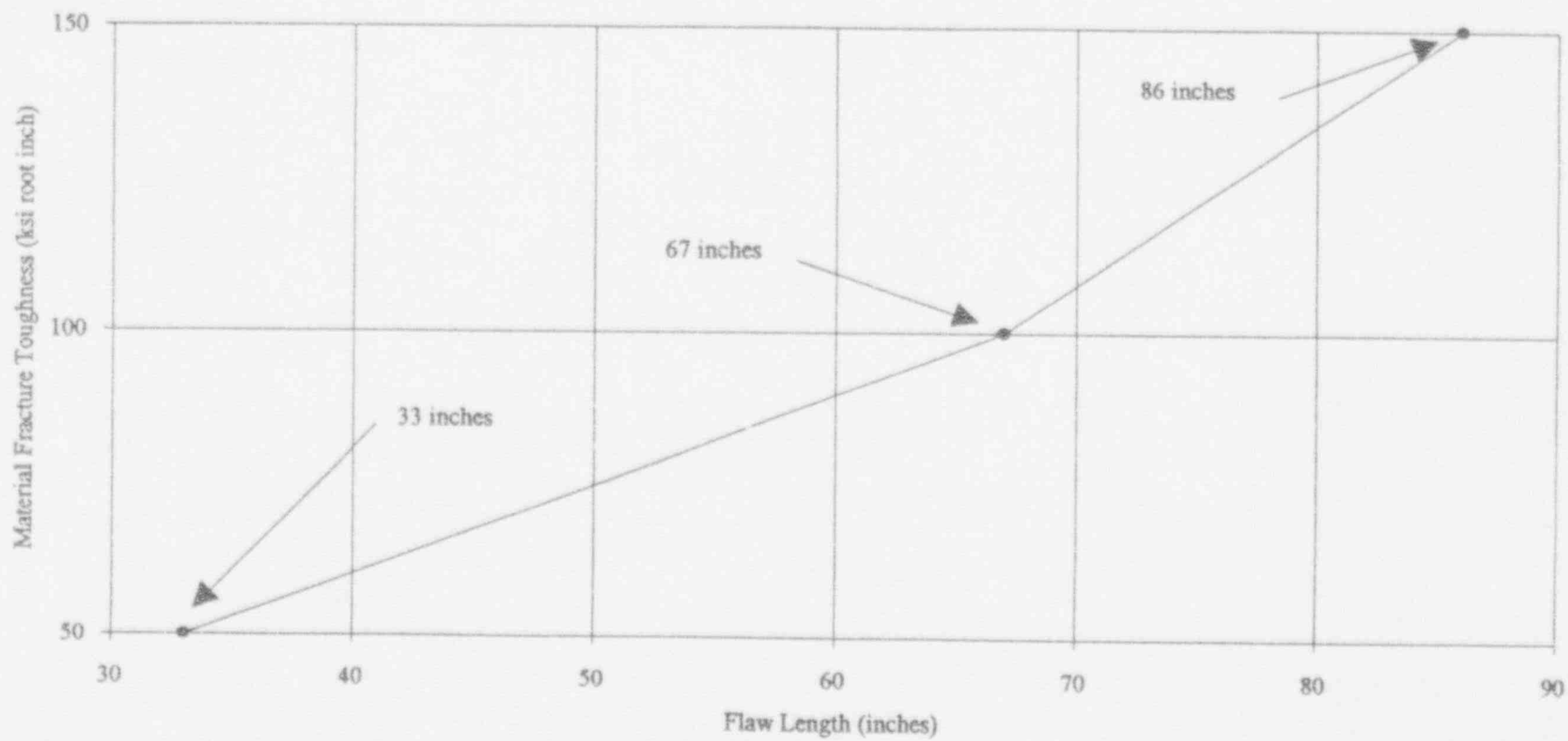
Stress Intensity Factor for an Axial Crack



Schematic of Axial Through Wall Crack in Shroud Wall

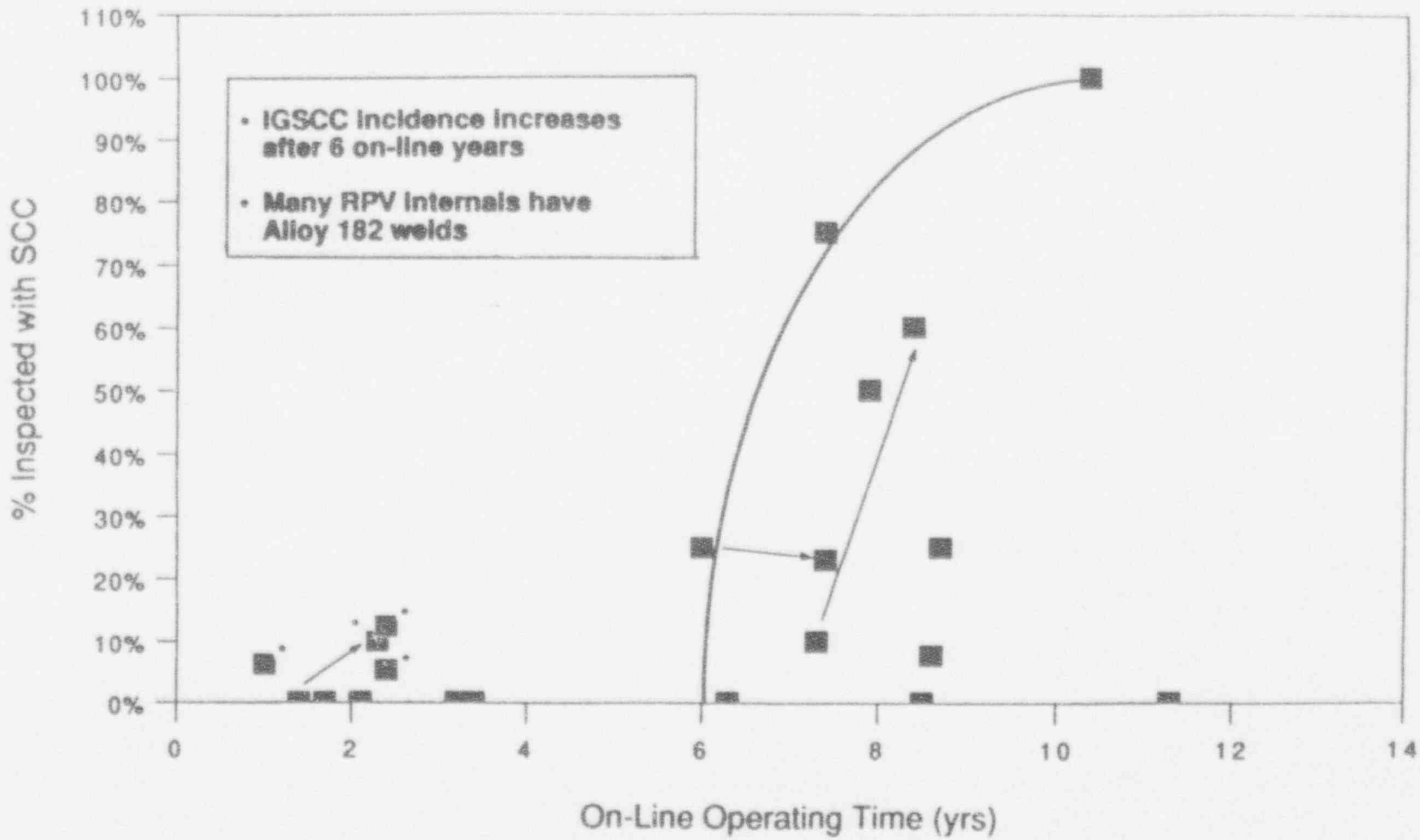


Critical Axial Flaw Length in Hatch Shroud



ALLOY 182 FIELD EXPERIENCE

NOZZLE WELD INSPECTION RESULTS

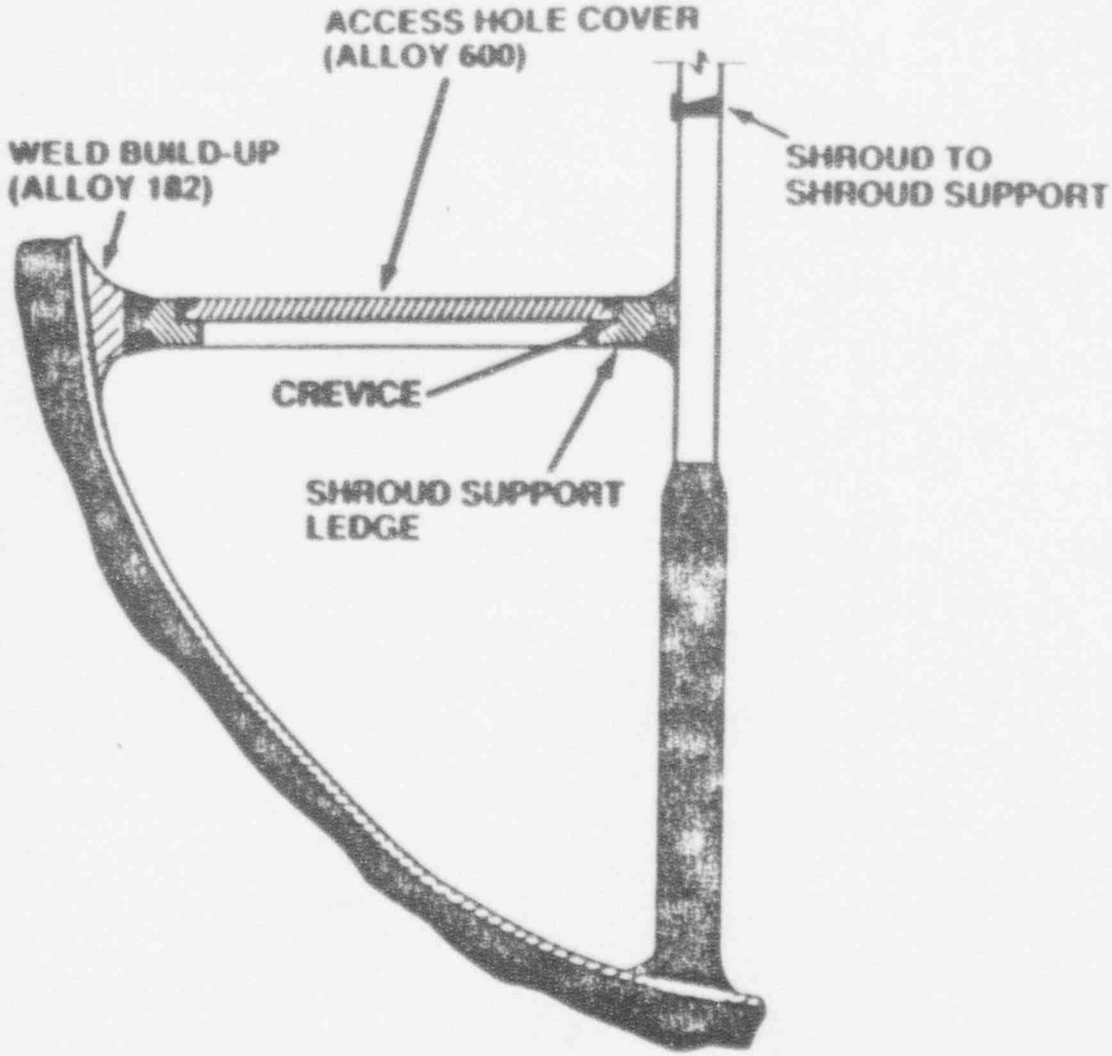


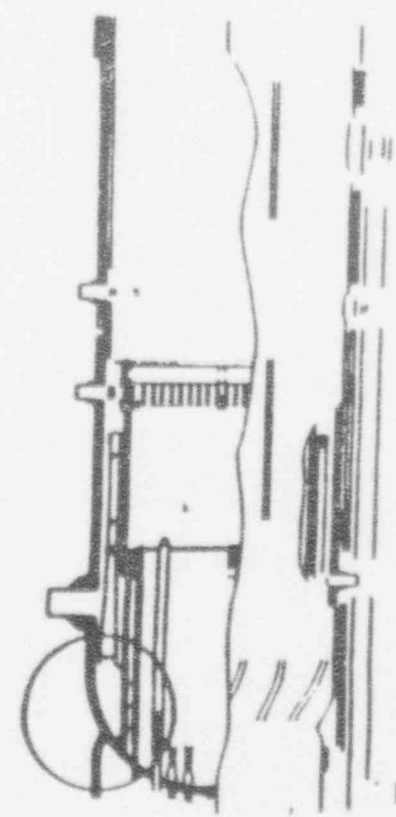
* Appear to have initiated from pre-existing fabrication defects.

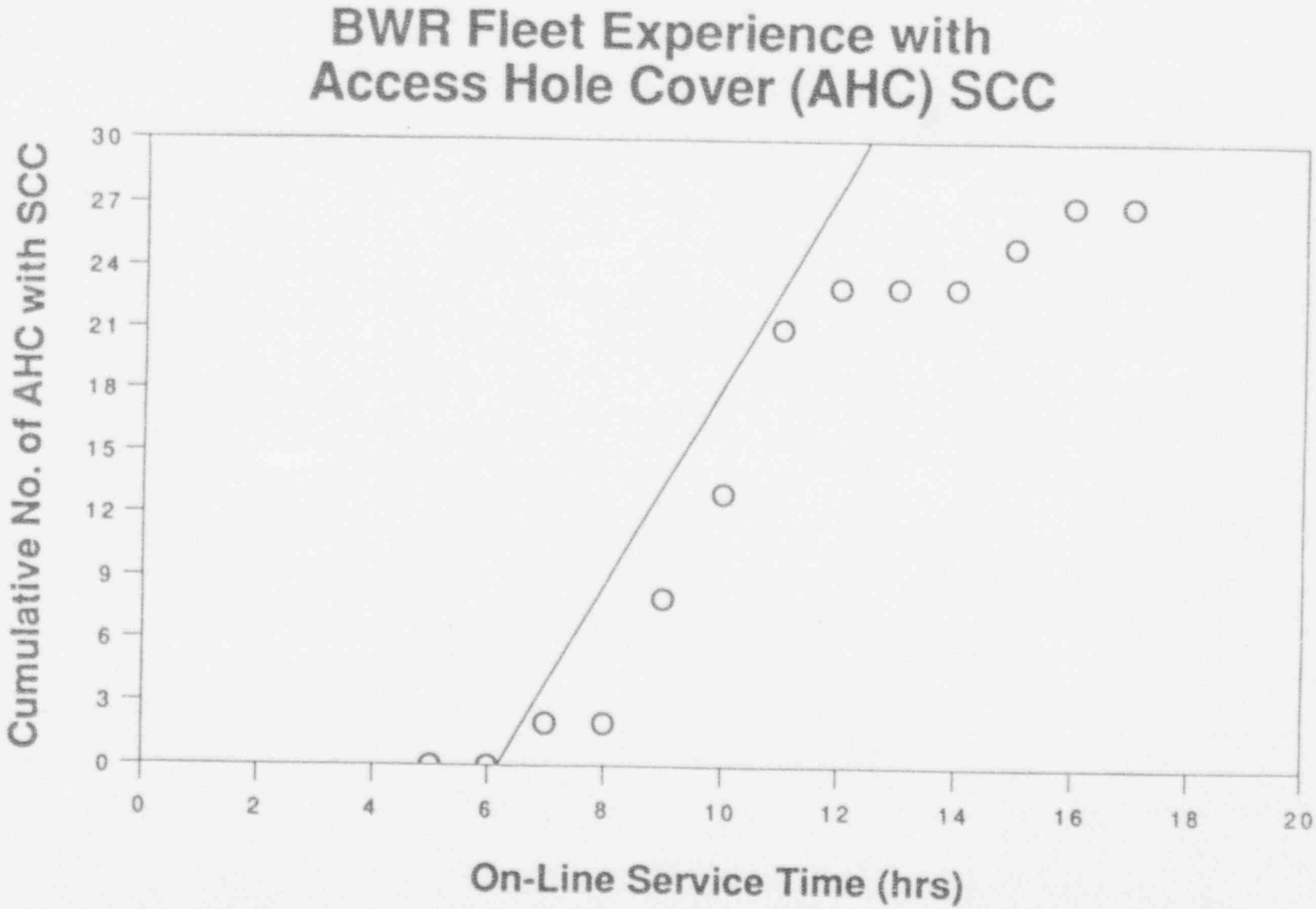
Access Hole Cover (AHC) IGSCC

- AHC IGSCC discovered at 14 plant of 33 plants inspected
  - Through-thickness cracking observed at several plants in both thin and thick covers
  - Most plants experienced cracking following 8.5 to 12 on-line service years
- Cracking (circumferential and radial) has occurred in creviced Alloy 600 access hole cover, shroud support ledge and in Alloy 182 weld material
- No apparent coolant conductivity dependence
  - Presence of Alloy 182 weld metal appears to dominate response

REACTOR INTERNALS







* Chart reflects service time at inspection. SCC likely initiated earlier.
Fewer older plants were included in inspected population.

KSR 5/21/93

Access Hole Cover Update - Alloy 182 Crack Growth Rate

- Recent overseas test data shows significantly higher growth rates for low conductivity water (0.1 μS/cm).
  - Maximum rates approximately 10^{-4} in/hr with significant data scatter
  - 1.2 inches over 18 month cycle (12,000 hours) - well in excess of field observation
  - Inconsistency with field suggests key differences between actual service and test.
- Plant field experience and on-line CAV's data consistent with $2x10^{-5}$ in/hr growth rates
  - 0.24 inch over 18 month cycles
- Crack growth rate of $2x10^{-5}$ in/hr continues to be reasonable for average crack growth determination

Access Hole Cover Update - Alloy 182 Crack Growth Rate

- Inconsistency of new data and field experience may be explained by:
  - Load controlled versus displacement controlled test specimens
  - Key role of plasticity
  - Crack branching at higher K values
  - Possible added impurities in new data

- Weld residual stress governs crack growth in access hole cover weld regions
  - Displacement controlled data more appropriate

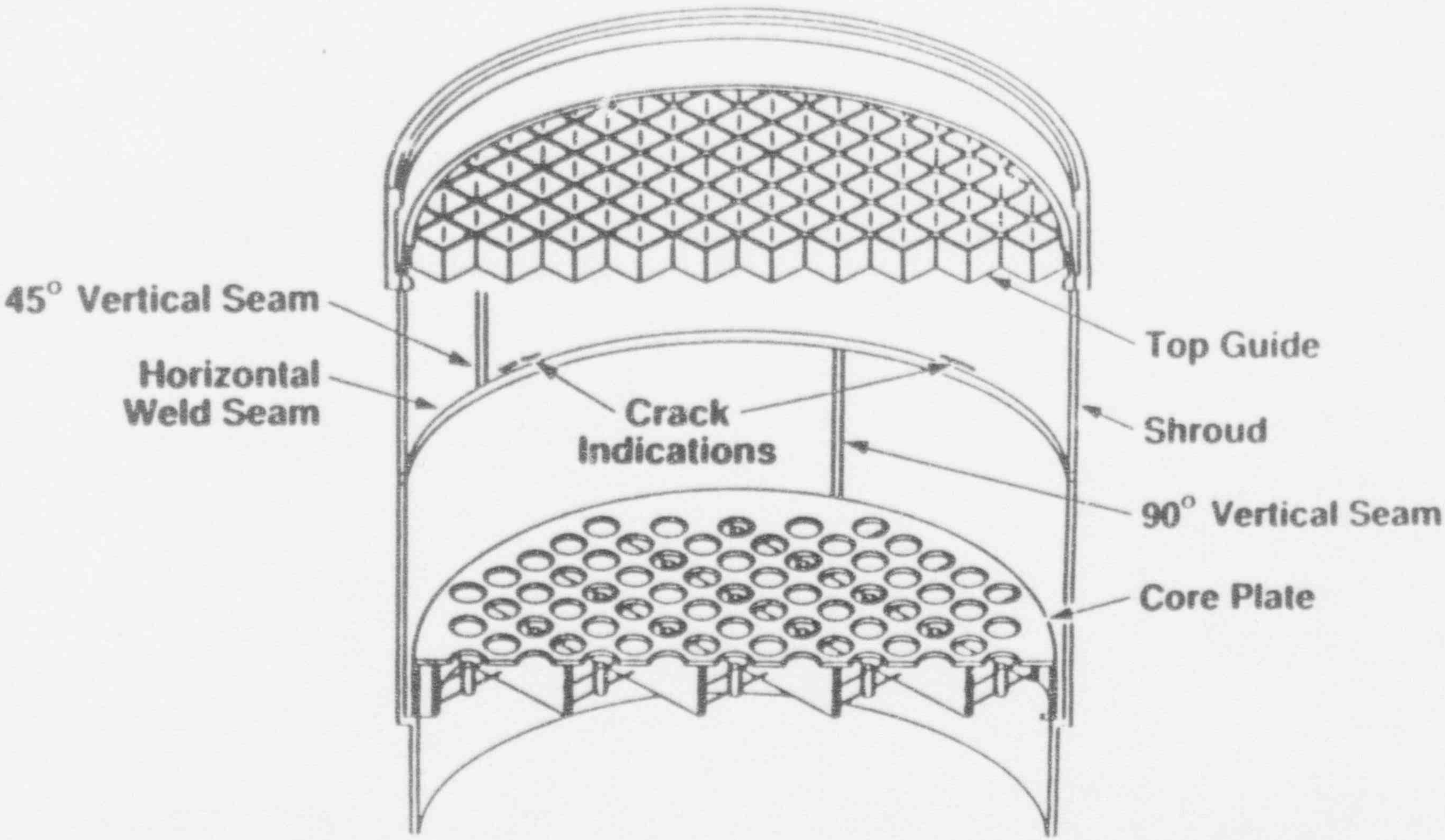
Access Hole Cover Update

- Current GE SIL recommends:
  - Inspection for radial cracking at next outage if not yet done
  - Inspect for circumferential cracks:
    - (i) once every three years, or
    - (ii) every outage if on 2 year cycle.
  - Some revision expected to address:
    - + non-creviced Alloy 182 welds
    - + more recent crack growth data
    - + consideration for extended operating cycles

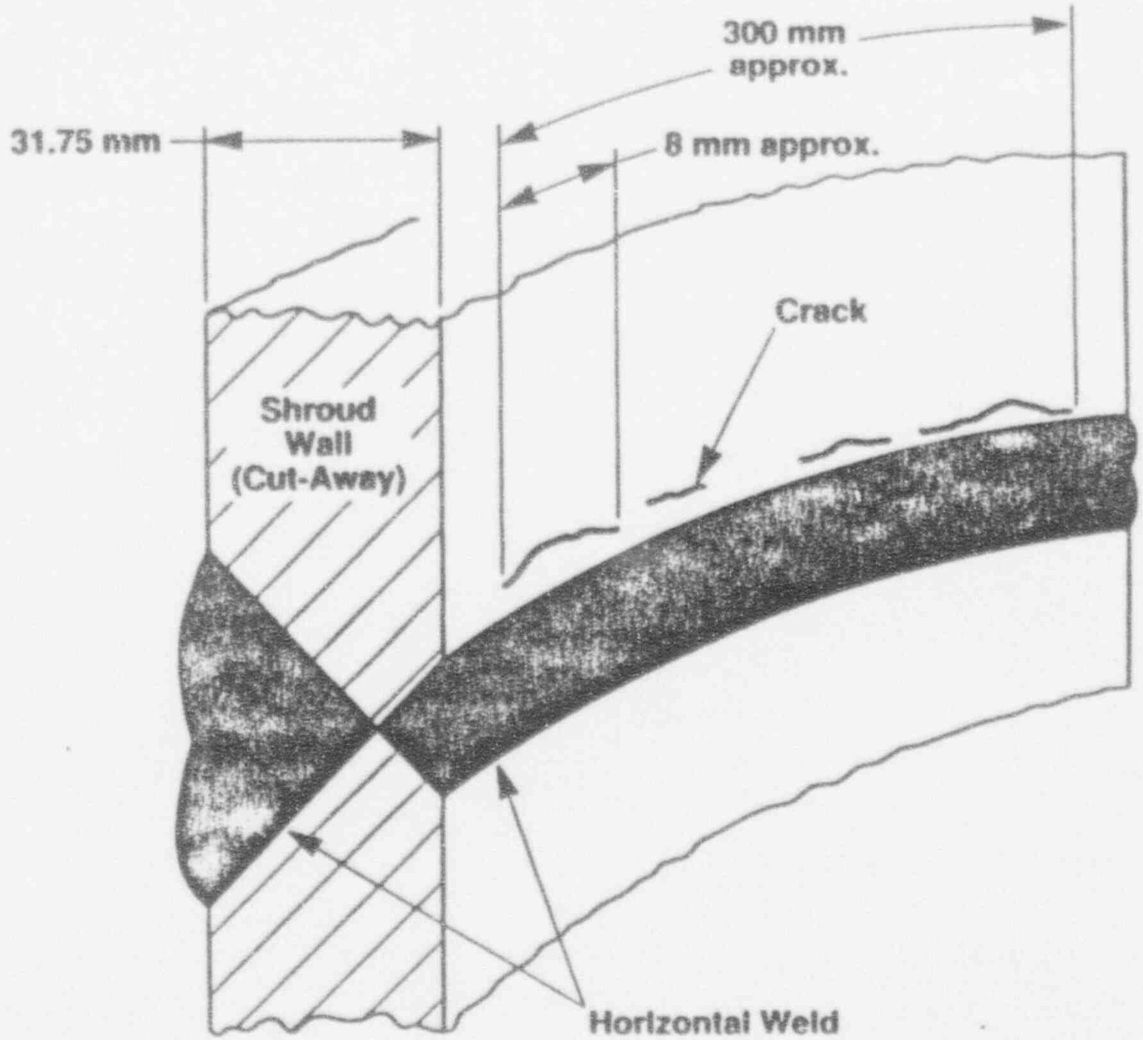
Core Shroud SCC Update

- First incident occurred in beltline weld region of a 304 SS shroud
  - Found in 1990 after ~190 on-line months
- Initial indications discovered during in-vessel visual inspection
  - Circumferential indications on inside surface (~.2 in. deep)
  - One area of axial indications on outside surface
- Enhanced UT in 1992 showed cracks as deep as ~0.6 in.
  - Circumferential crack increase seen
- Completed Metallography confirmed IASCC mechanism
  - Fluence ~$8x10^{20}$ nvt > threshold
    - Grain boundary impurity segregation/distribution typical of IASCC
    - No apparent weld sensitization present
    - Crack growth appears driven by oxide wedging stress
  - IASCC now confirmed to apply to Type 304L shrouds

Shroud Configuration



45° Area of Shroud



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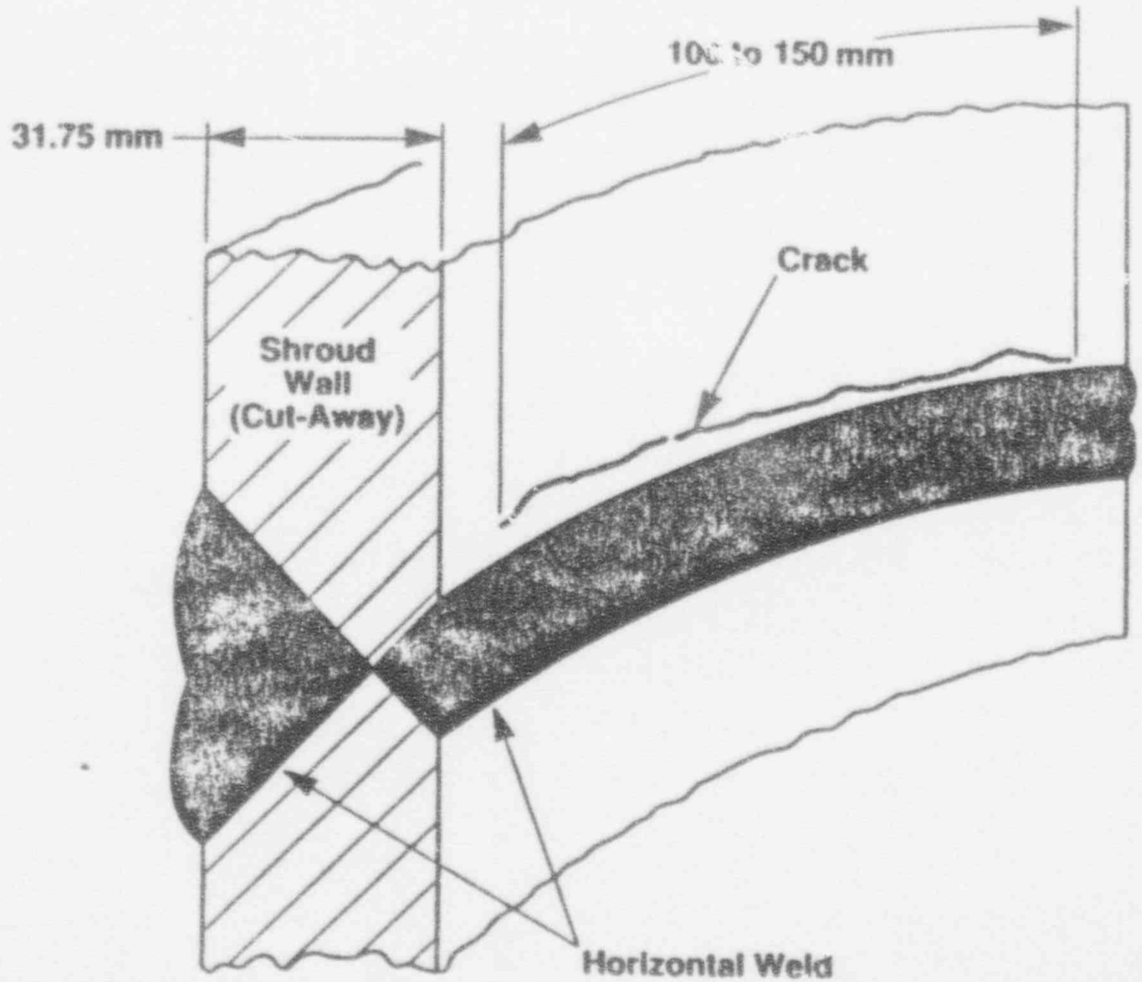
100° Area of Shroud



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BWR CORE SHROUD CRACKING STATUS

- Crack growth analysis performed
    - Continued operation approved and plant operating

- GENE SIL being revised to recommend inspection of both high and low carbon stainless steel shrouds in oldest plants (after ≈ 190 on-line months)

- Development of automated UT equipment planned by GE

- Program to better understand cause of cracking and generic implications still underway

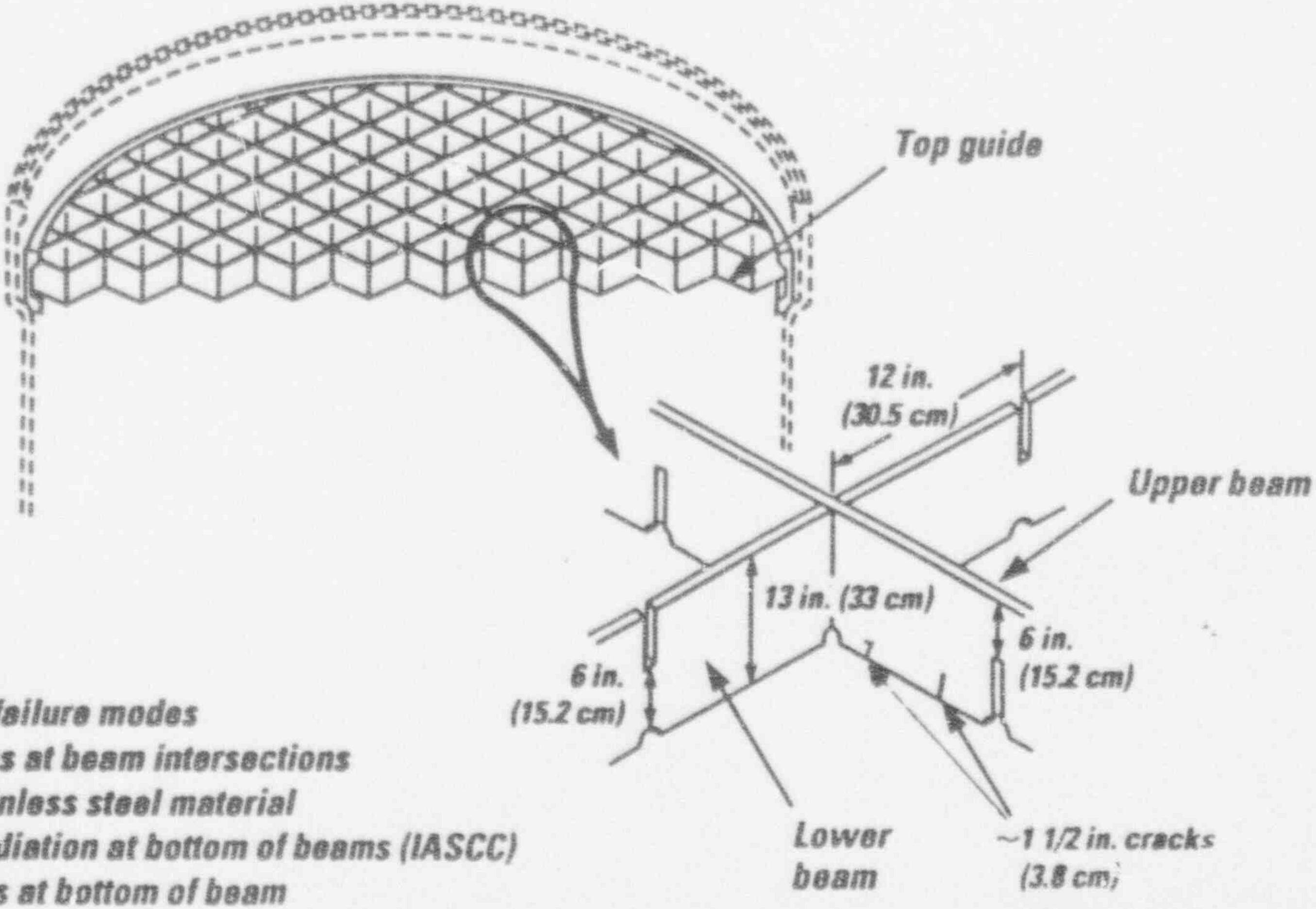
- High toughness based on actual sample J-R Curve

Core Top Guide SCC Update

- First crack indication observed visually in1991
- Two additional cracks found during IVVI in 1992
- Cracks (3/4 to 1-5/8 in. deep) initiated in uncreviced, high neutron fluence regions at bottom of grid beams
  - Crevices at beam intersections not examined by UT
- Preliminary fluence estimate is ~$3.5x10^{21}$ n/cm^{21}
  - IASCC is most likely cause
- GE initial analysis showed adequate structural margin
  - Sufficient margin still expected for next fuel cycle
- Boat sample required to verify mechanism and predict actual life

Proactive IVVI/UT inspection recommended (SIL 554)
Verify margins and minimize potential repair costs

Typical Core Top Guide Configuration



Potential failure modes
- *Crevices at beam intersections*
- *304 stainless steel material*
- *High radiation at bottom of beams (IASCC)*
- *Notches at bottom of beam*

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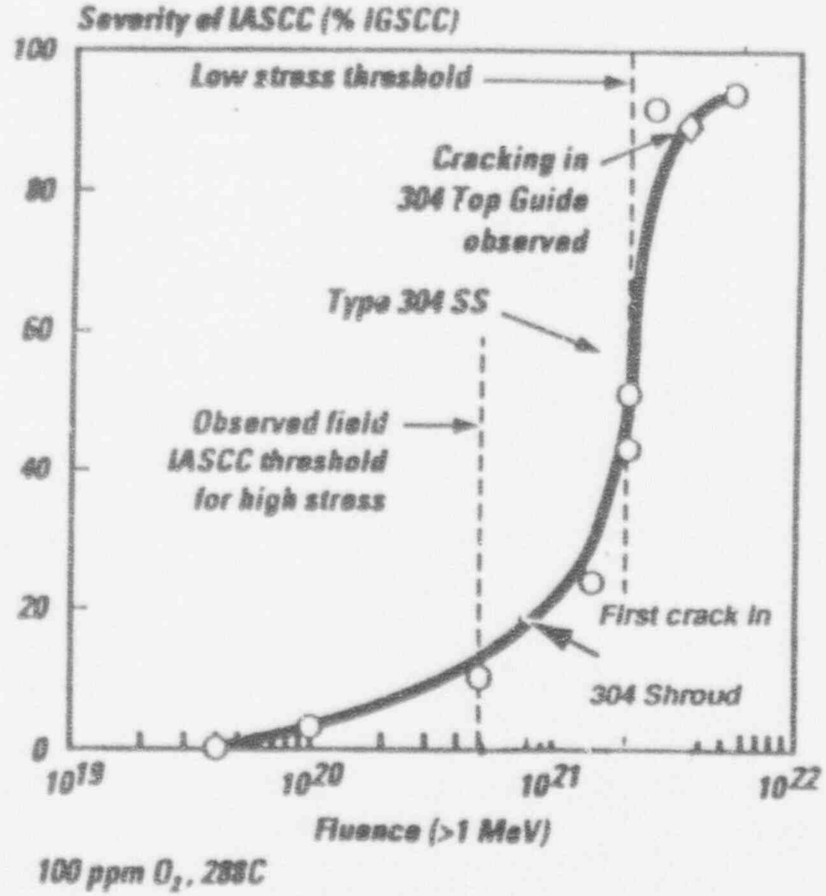
SCC Test Results on Irradiated Annealed Type 304 Stainless Steel



Field Experience Consistent with Laboratory Results

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Top Guide SCC Update

- Discussions on-going concerning alternatives regarding cracked top guide.

- Confirm crack mechanism

- Establish material properties

    - Fracture toughness
    - Yield strength, etc

- Confirm structural integrity

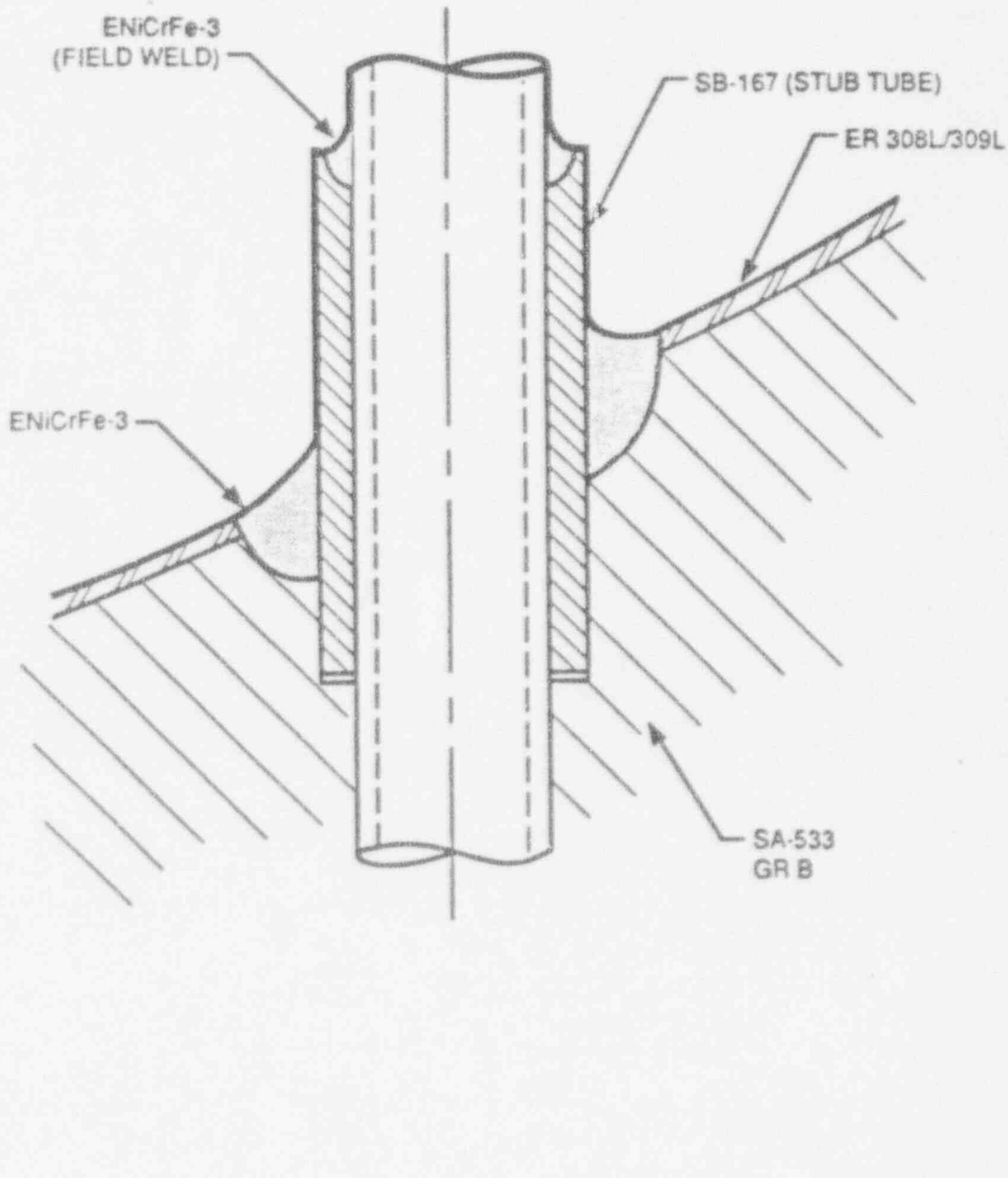
CRD J-Groove Weld Crack

- Recent observation of cracking in J-groove weld in overseas plant

- Some GE BWR's use Alloy 182 at this location.

- Cracking in stub tubes occurred in two plants
  - Cracking in furnace sensitized stainless steel stub tubes - not weld
  - Furnace sensitized stub tube unique to these plants.

- Visual inspections have been performed with no cracking seen.



ENiCrFe-3
(FIELD WELD)
SB-167 (STUB TUBE)
ER 308L/309L
ENiCrFe-3
SA-533
GR B

Future Plans

- Complete evaluation of remaining high priority internal components
- Issue draft document by end of 1993
- Evaluate Oyster Creek Top guide crack further

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PROPOSAL FOR INTEGRATION

OF THE

NRC/EPRI/BWROG COORDINATION PLAN

WITH THE APPENDIX VIII

PERFORMANCE DEMONSTRATION INITIATIVE (PDI) PROGRAM

I. Background:

The purpose of this plan (referred to as the "Integration Plan") is to integrate the NRC/EPRI/BWROG Coordination Plan with the Appendix VIII Performance Demonstration Initiative (PDI) program. The PDI is a group of participating utilities responsible for implementing ASME Section XI, Appendix VIII. This plan allows BWR owner's ultrasonic testing personnel to simultaneously comply with the requirements of: NRC Generic Letter 88-01; NUREG 0313; ASME Section XI, Appendix VIII; and generic provisions of 10 CFR 50 regulations. This plan replaces the NRC/EPRI/BWROG Coordination Plan.

In the implementation of this plan several underlying assumptions are made, including the following:

0 The BWROG, PDI, and EPRI recognizes NRC's regulatory responsibilities.

0 NRC recognizes BWROG, PDI, and EPRI continuing efforts to improve the quality of ultrasonic (UT) examinations performed on BWR stainless steel piping systems. This should result in significant improvements in UT technology used in the detection and sizing of intergranular stress corrosion cracking in BWR stainless steel piping.

0 The principal benefit for integration of the "Coordination Plan" with the PDI program is to minimize potentially duplicative qualification requirements, while continuing to address the inspection needs for BWR stainless steel piping subject to IGSCC.

0 Under the Integration Plan, all parties recognize that each BWR owner is responsible for compliance with: the training and qualification requirements of NRC Generic Letter 88-01 and NUREG 0313; the UT personnel training and qualification requirements of ASME Section XI Appendix VII; and the performance demonstration requirements of ASME Section XI, Appendix VIII.

0 The owner fulfills the above responsibilities via implementation of the "written practice" required per ASME Section XI, IWA-2300. Alternately, the owner may review and adopt the written program of an inspection service organization.

0 This Integration Plan is applicable <u>only</u> to the qualification of personnel performing IGSCC flaw detection and sizing on BWR stainless steel piping systems.

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II. Integration Plan Responsibilities

This section defines the responsibilities of the various parties to assure effective implementation of the Integration Plan.

A. Owners' responsibilities include:

1. Development of a "written practice" which addresses the qualification and training requirements from ASME Section XI, Appendices VII and VIII; NRC Generic Letter 88-01; and NUREG 0313. This "practice" shall detail the owner's plan for the qualification of UT personnel performing IGSCC flaw detection and sizing. This plan should be comparable to the existing "Coordination Plan" requirements.
2. Implementation of the above written practice. If the written practice allows several training and qualification options, then each option must be clearly defined and implemented. Alternately, the owner may review and adopt the written program of an inspection service organization.
   Note: The owner has the option to use training, qualification, and performance demonstration services from qualified sources other than the EPRI NDE Center.

B. The BWROG responsibilities include:

1. Overseeing Integration Plan activities through BWR owners' membership in PDI.

2. Interface with BWR owners and regulatory authorities on issues pertaining to BWR piping integrity and plant safety.

C. The PDI responsibilities include:

1. Providing a performance demonstration function for qualifying ultrasonic examination procedures, equipment and personnel. By an agreement between the PDI Steering Committee and EPRI, the PDI Program is administered by the EPRI NDE Center in Charlotte, N.C.

2. Controlling and overseeing the PDI Program.

3. By mutual agreement with the BWROG, provide performance demonstration functions specifically addressing the IGSCC inspection requirements for BWR owners and their inspection service organization.

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D. EPRI's responsibilities include:

1. By agreement with the PDI, the EPRI NDE Center will administer performance demonstration tests to candidate IGSCC UT inspectors/operators. These tests will be performed in accordance with Appendix VIII and PDI test protocol.

2. Providing ultrasonic inspection training and qualification programs at its NDE Center in Charlotte, NC. Specifically, these programs address UT Operator Training for the Detection of IGSCC; and UT Operator Training for Planar Flaw Sizing.

3. The EPRI NDE Center will administer the training programs for IGSCC flaw detection and sizing on a periodic or as-needed basis. The NDE Center will provide training literature, instructional lectures, facilities and test sample sets prerequisite to effective implementation of the program. Training materials will be made available to owners and their inspection service organizations to facilitate training in their respective facilities.

E. NRC's responsibilities include:

1. Review of selected activities and documents pertaining to the Integration Plan.

III. Elements of the Integration Plan

This section details the program attributes and requirements for the Integration Plan.

A. Owners Written Practice - The "owner's written practice" required per ASME Section XI, IWA-2300 shall also address specific training and qualification requirements for IGSCC flaw detection and sizing.

1. Alternately, the written practice may allow the owner to review and adopt the written program of an inspection service organization.

2. The owner should develop the written practice requirements specific to the owner's IGSCC examination personnel needs. For example, the qualification and training requirements for an owner utilizing only in-house UT personnel may vary significantly from an owner using an inspection service organization.

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3. The written practice should specify the requirements for qualification and training. Qualification should be based on any combination of the following elements:
   a. Training/Retraining
   b. Testing/Retesting
   c. Documented continued satisfactory performance.
   d. Appendix VII requalification.
   e. UT procedure requalification.

B. Training

1. The owner or inspection service organization fulfill their training requirements by any of the following:
   a. Completing the IGSCC training programs available through the EPRI NDE Center.
   b. Completing "in-house" IGSCC training conducted to formal, documented training plans comparable to existing IGSCC qualification training.
   c. Use of an NDE training service organization approved by the owner or inspection service organization. Such training shall be performed to formal, documented training plans comparable to existing IGSCC qualification training.

C. Qualification/Performance Demonstrations

1. Qualification is ultimately achieved by satisfactorily completing performance demonstration testing.

2. Qualification tests may be completed in conjunction with piping examination performance demonstrations OR as an individual IGSCC qualification.

3. The performance demonstration tests should be performed in conjunction with Appendix VIII qualification testing through the PDI program. EPRI NDE Center will administer the performance demonstration tests in accordance with the PDI test protocol.

4. Performance demonstrations may be conducted "in-house" or through the use of an outside agency/qualification service organization. This qualification method must be clearly specified in the written practice. It is recommended that the "PDI Qualification Guidelines for ASME Section XI Appendix VIII Performance Demonstrations" be used for guidance to establish such requirements.

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D. Documentation

1. The owner's written practice will specify the requirements for training and qualification records.

2. As a minimum, the documentation shall include:
   a. Qualification Records required per ASME Section XI, Article VII-5000.
   b. Record of Qualification required per ASME Section XI, Article VIII-5000.

E. Implementation

1. This Coordination Plan will become effective six months after the last date of signature below, and will remain in force until the plan is terminated by any of the undersigned organizations upon thirty (30) days written notice to the other organization.

2. Changes or modifications in this Integration Plan as may be requested by any of the parties must be approved by the other parties.

Prepared by: John T. Lindberg Date: 12/16/92

Approved by: Jack Spanner, Jr. Date: 12/16/92
PDI Chairman

Cynthia Date: 3/24/93
BWROG Representative

__________ Date: ________
Electric Power Research Institute

__________ Date: ________
U.S. Nuclear Regulatory Commission