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

April 25, 1997

LICENSEE: Niagara Mohawk Power Corporation

FACILITY: Nine Mile Point Nuclear Station, Unit No. 1

SUBJECT: SUMMARY OF MEETINGS WITH LICENSEE AND PUBLIC ON APRIL 14, 1997, REGARDING CORE SHROUD (TAC NO. M98170)

On April 14, 1997, the NRC staff participated in a meeting with Niagara Mohawk Power Corporation (licensee and NMPC) regarding the Unit 1 core shroud. The meeting, held from 5:00 to 7:30 p.m., was followed by an NRC meeting with the public from about 7:45 p.m. to 10:30 p.m. on the same subject. The meetings were located at the Joint News Center, 10 Airport Road in Fulton, New York.

The agenda and a list of NRC attendees are given in Enclosure 1. Participants for NMPC included Messrs. R. Sylvia, R. Abbott, M. McCormick, C. Terry, and N. Rademacher. Contractor personnel included Dr. R. Smith of Altran Corporation, Dr. M. Manahan, Sr. of MPM Technologies, and Dr. S. Ranganath of General Electric Nuclear Energy. Both meetings were well attended by state and local officials, members of the public, and local media.

The purpose of the meeting with NMPC was to review the letter to the NRC dated April 8, 1997. To introduce the technical discussions, Mr. Hermann and Ms. Kavanagh of NRC provided background discussions, including related generic activities by the Boiling Water Reactor Vessel Internals Project (BWRVIP), descriptions and functions of the core shroud, an explanation of intergranular stress corrosion cracking, and a review of relevant NMP1 and industry operating experience. Enclosure 2 presents the viewgraph slides and handouts used by Mr. Hermann and Ms. Kavanagh.

In the April letter and meeting, NMPC discussed recent inspection findings of cracking in the heat affected zones of some vertical and horizontal shroud welds, and anomalies associated with the installation and design of the shroud tie rod assemblies. The licensee discussed root cause and corrective actions, reviewed design documentation and analyses regarding the acceptability of the as-found vertical weld cracking for a period of at least 10,600 operating hours, proposed a weld re-inspection schedule, and described actions taken to restore the tie rod assemblies to the as-designed condition. The licensee's corrective actions for the tie rod assemblies include a modification of the lower wedge retainer clip design, for which the licensee has requested NRC approval under 10 CFR 50.55a prior to restart. Details of the licensee's presentations are given in the April 8 letter and are not repeated here. Enclosure 3 presents the viewgraph slides and handouts used by NMPC and its contractors.

CONTACT: D. Hood, NRR
301-415-3049

Enclosure 1

9704300187 109/1.

The meeting with the public included introductions of local officials and members of various organizations by Ms. Barbara Brown, Legislator of Oswego County. Numerous questions and expressions of concern for shroud integrity were received and discussed by the NRC staff. Ms. C. Scott of Volney, New York, expressed a preference that the shroud should be replaced before restart and provided the NRC a signed petition to this end. Mr. P. Guenther stated his belief that cracks associated with vertical welds had extended into the base metal of the shroud and felt that this condition represented an unreviewed safety question. Dr. J. Johnsrud of Pennsylvania State College asked questions regarding aging, operational history, managerial attitudes and regulatory policy. Some individuals expressed concerns for the present financial health of NMPC and concerns for the impact that a major accident could have on the local economy. Some employees and union members indicated their confidence in the licensee's analyses and their support for continued operation with shortened inspection intervals as proposed by the licensee. Asked about the restart plans, Mr. Sylvia replied that although the refueling efforts would probably be completed by the end of April, the unit will not be restarted until the NRC has completed its review and approved the modified shroud repair. Several people expressed appreciation for the meeting and requested that more meetings on issues of local concern be held in the future.

The meeting was video recorded and copies of the three VCR cassette tapes are available for a fee from the NRC Public Document Room, the Gelman Building, 2120 L Street, NW., Washington, DC 20555 (phone 800-397-4209, fax 202-634-3343, e-mail pdr@nrc.gov).

Darl Hood

Darl S. Hood, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-220

Enclosures: 1. Agenda and NRC attendees
2. NRC Slides by Mr. Hermann and Ms. Kavanagh
3. NMPC and contractor slides

cc w/encls: See next page

Niagara Mohawk Power Corporation

Nine Mile Point Nuclear Station
Unit No. 1

cc:

Mr. B. Ralph Sylvia
Executive Vice President
Generation Business Group
and Chief Nuclear Officer
Niagara Mohawk Power Corporation
Nuclear Learning Center
450 Lake Road
Oswego, NY 13126

Mr. Richard B. Abbott
Vice President and General Manager - Nuclear
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
P.O. Box 63
Lycoming, NY 13093

Mr. Martin J. McCormick, Jr.
Vice President
Nuclear Safety Assessment
and Support
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
P.O. Box 63
Lycoming, NY 13093

Mr. Kim A. Dahlberg
General Manager - Projects
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
P.O. Box 63
Lycoming, NY 13093

Mr. Norman L. Rademacher
Plant Manager, Unit 1
Nine Mile Point Nuclear Station
P.O. Box 63
Lycoming, NY 13093

Ms. Denise J. Wolniak
Manager Licensing
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
P.O. Box 63
Lycoming, NY 13093

Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 126
Lycoming, NY 13093

Charles Donaldson, Esquire
Assistant Attorney General
New York Department of Law
120 Broadway
New York, NY 10271

Mr. Paul D. Eddy
State of New York
Department of Public Service
Power Division, System Operations
3 Empire State Plaza
Albany, NY 12223

Mr. F. William Valentino, President
New York State Energy, Research,
and Development Authority
Corporate Plaza West
286 Washington Avenue Extension
Albany, NY 12203-6399

Mark J. Wetterhahn, Esquire
Winston & Strawn
1400 L Street, NW
Washington, DC 20005-3502

Supervisor
Town of Scriba
Route 8, Box 382
Oswego, NY 13126

Gary D. Wilson, Esquire
Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, NY 13202

AGENDA

April 14, 1997
Meeting on Nine Mile Point Nuclear Station Unit 1 Core Shroud

I. NRC SESSION WITH NIAGARA MOHAWK POWER CORPORATION (NMPC)

5:00	NRC Opening Remarks Purpose Introduction of Participants	Darl Hood
5:05	Background on Core Shroud Issue	Kerri Kavanagh Robert Hermann
5:15	NMPC Review of April 8, 1997, Letter to NRC and Supplemental Information Introduction Core Shroud Stabilizer Assemblies (Tie Rods) Core Shroud Weld Inspections and Evaluations Conclusions	Martin McCormick et al.
6:30	NRC Questions/Comments	
6:50	Break	

II. NRC SESSION WITH PUBLIC ON CORE SHROUD

7:00	NRC Opening Statements	Darl Hood
7:10	Questions/Comments from Audience	
9:30	NRC Closing Remarks	Singh Bajwa Richard Wessman

ENCLOSURE 1

NRC ATTENDEES

Office of Nuclear Reactor Regulation, Rockville, MD:

Richard H. Wessman	Chief, Mechanical Engineering Branch Division of Engineering
Singh S. Bajwa	Acting Director Project Directorate I-1
Darl S. Hood	Senior Project Manager Project Directorate I-1
Robert A. Hermann	Senior Level Advisor-Materials Science Materials and Chemical Engineering Branch Division of Engineering
Kerri A. Kavanagh	Reactor Systems Engineer Reactor Systems Branch Division of Systems Safety and Analysis
William H. Koo	Senior Materials Engineer Materials and Chemical Engineering Branch Division of Engineering
Jai Raj N. Rajan	Mechanical Engineer Mechanical Engineering Branch Division of Engineering

Region I, King of Prussia, PA:

Lawrence T. Doerflein	Chief, Project Branch 1 Division of Reactor Projects
Barry S. Norris	Senior Resident Inspector Nine Mile Point Nuclear Station
Diane P. Screnci	Senior Public Affairs Officer Public Affairs Staff

MEETING ON CORE SHROUD CRACKING AT NINE MILE POINT UNIT 1

April 14, 1997

Robert A. Hermann, Senior Level Advisor
Division of Engineering
Office of Nuclear Reactor Regulation

ENCLOSURE 2

BACKGROUND

- Core Shroud Cracking
  - → first detected in U.S. plants in 1993
  - → GL 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors," issued July 25, 1994
  - → all responses evaluated and SERs issued

- CATEGORY C (22 Plants)
  - → All Category C plants' core shrouds inspected per GL 94-03 (or initiated preemptive repairs)[1]
  - → 13 plants installed core shroud repairs (11 tie-rods and 2 clamps)

- CATEGORY B (6 Plants)
  - → All Category B plants core shrouds inspected per GL-94-03, met ASME structural integrity criteria for at least one operating cycle
  - → No repairs

- CATEGORY A (8 Plants)
  - → Limited VT inspection performed at 2 plants

---

[1] except Browns Ferry 1, which has been in an extended shutdown

STATUS OF BWRVIP REPORT REVIEWS

- BWRVIP-03, Reactor Pressure Vessel and Internals Examination Guidelines
- BWRVIP-05, BWR Vessel Shell Weld Inspection Recommendations
- BWRVIP-06, Safety Assessment of Reactor Internals
- BWRVIP-07, Guidelines for Reinspection of BWR Core Shrouds
- BWRVIP-14, Evaluation of Crack Growth in BWR Stainless RPV Internals
- BWRVIP-17, Roll/Expansion of Control Rod Drive and In-Core Instrument Penetrations in BWR Vessels

STATUS OF BWRVIP REPORT REVIEWS (con't.)

- BWRVIP-18, Core Spray Internals Inspection and Flaw Evaluation Guidelines
- BWRVIP-19, Internal Core Spray Piping and Sparger Repair Design Criteria
- BWRVIP-25, Core Plate Inspection and Flaw Evaluation Guideline
- BWRVIP-26, Top Guide Inspection and Flaw Evaluation Guideline
- BWRVIP-28, Assessment of BWR Jet Pump Riser Elbow to Thermal Sleeve Weld Cracking

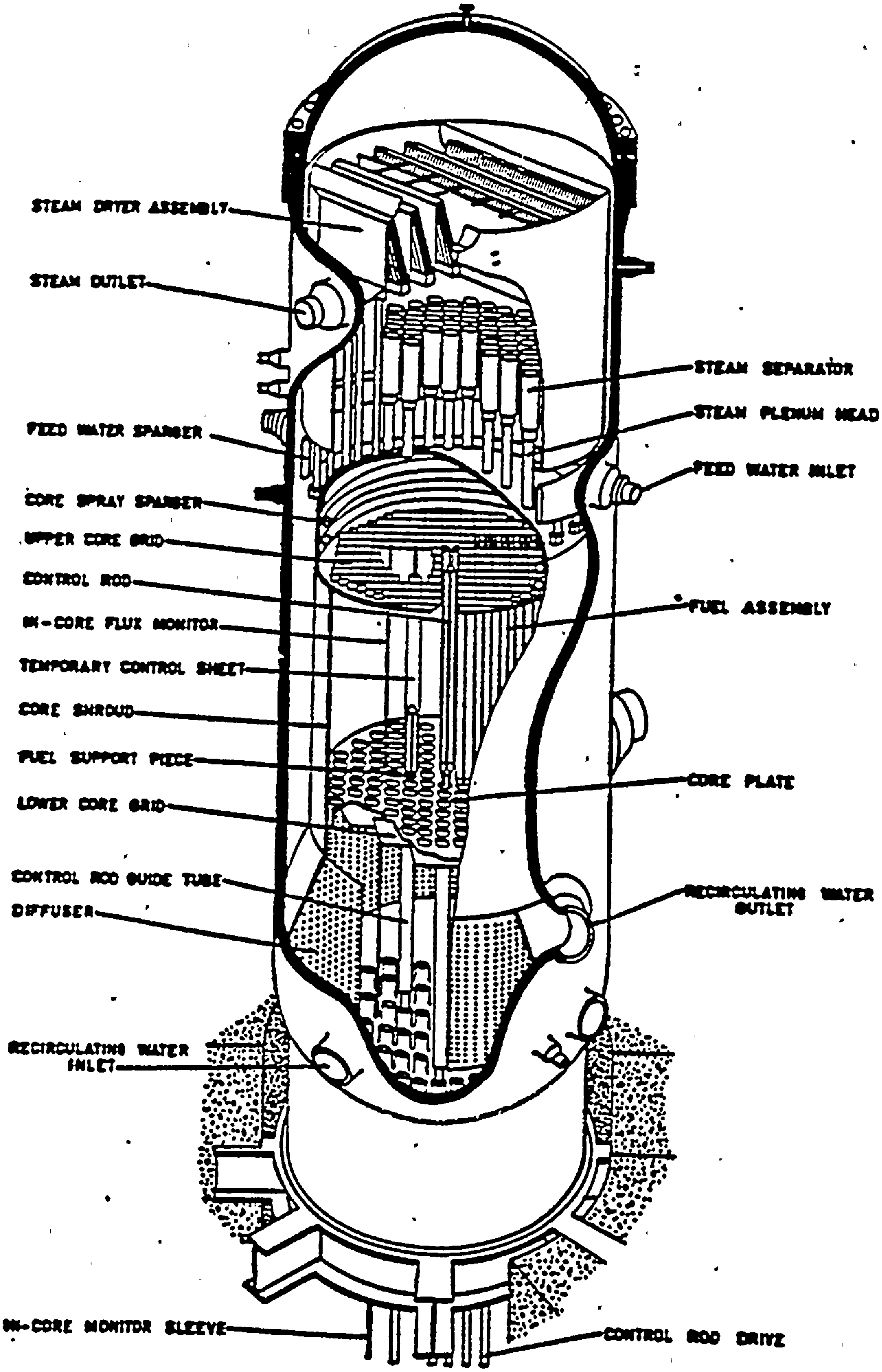


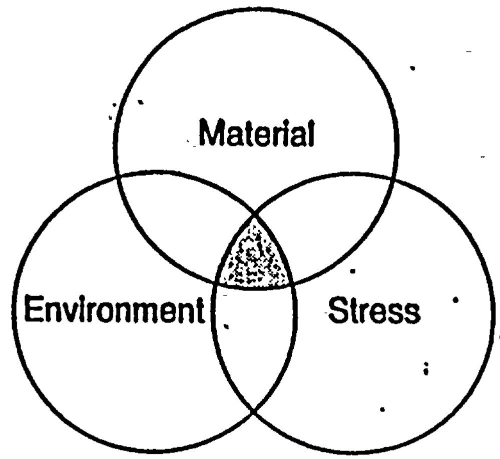
Figure 9.2-1. Typical BWR/2 Nuclear Boiler

INTERGRANULAR STRESS CORROSION CRACKING (IGSCC) MECHANISM

- **Material**
  - Higher Carbon Content More Susceptible
  - Rolled More Susceptible than Forged

- **Environment**
  - Susceptibility Increases with Greater Oxygen/ Contaminants in the Reactor Coolant
  - Irradiation Increases Susceptibility

- **Stress**
  - Higher Stress Levels Increase Susceptibility



REACTOR VESSEL ISOMETRIC

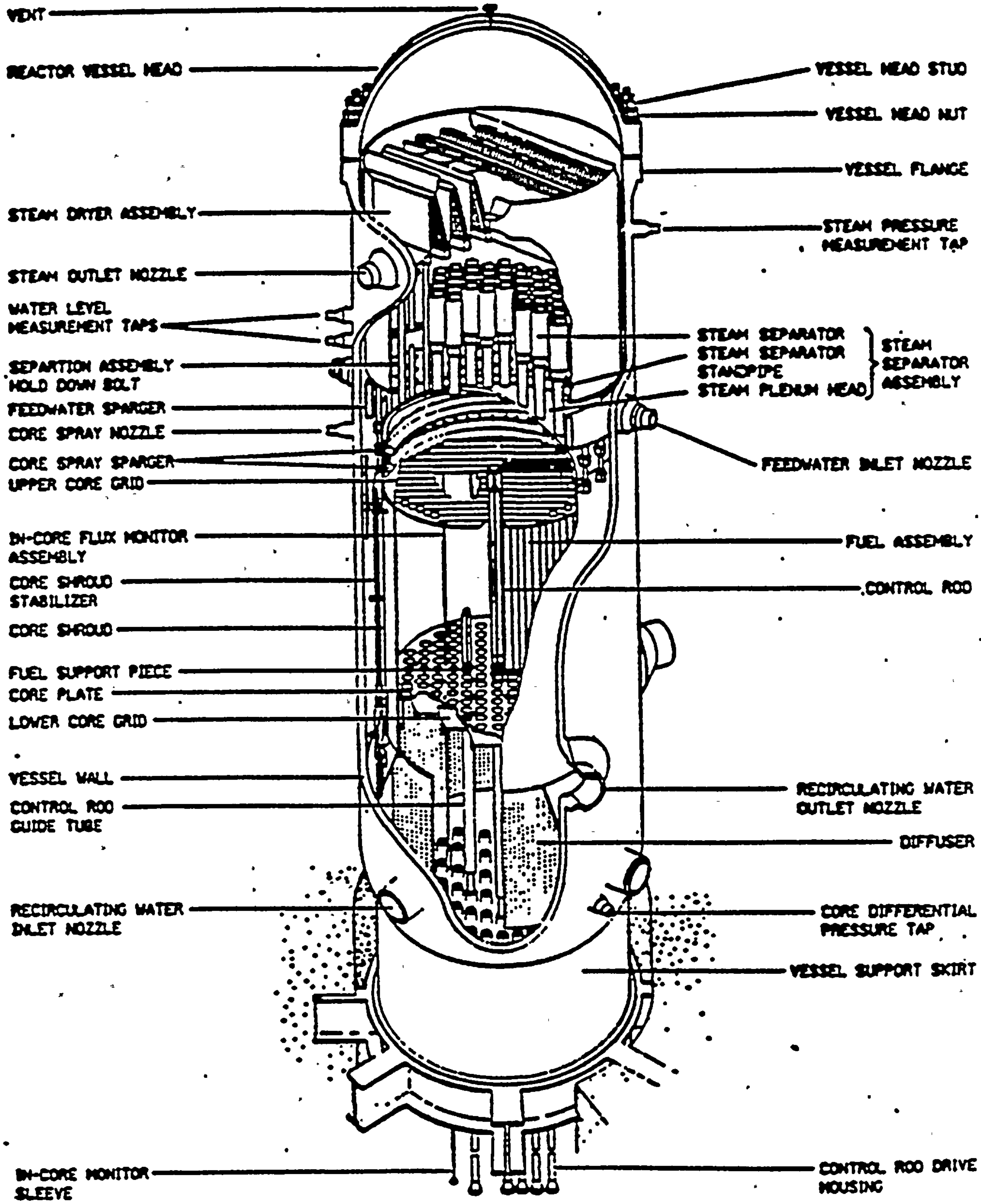


FIGURE IV-9

URCE: IV.9.dgn (eadd)

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT NUCLEAR STATION UNIT 1

NRC/NMPC
Core Shroud Issues Meeting

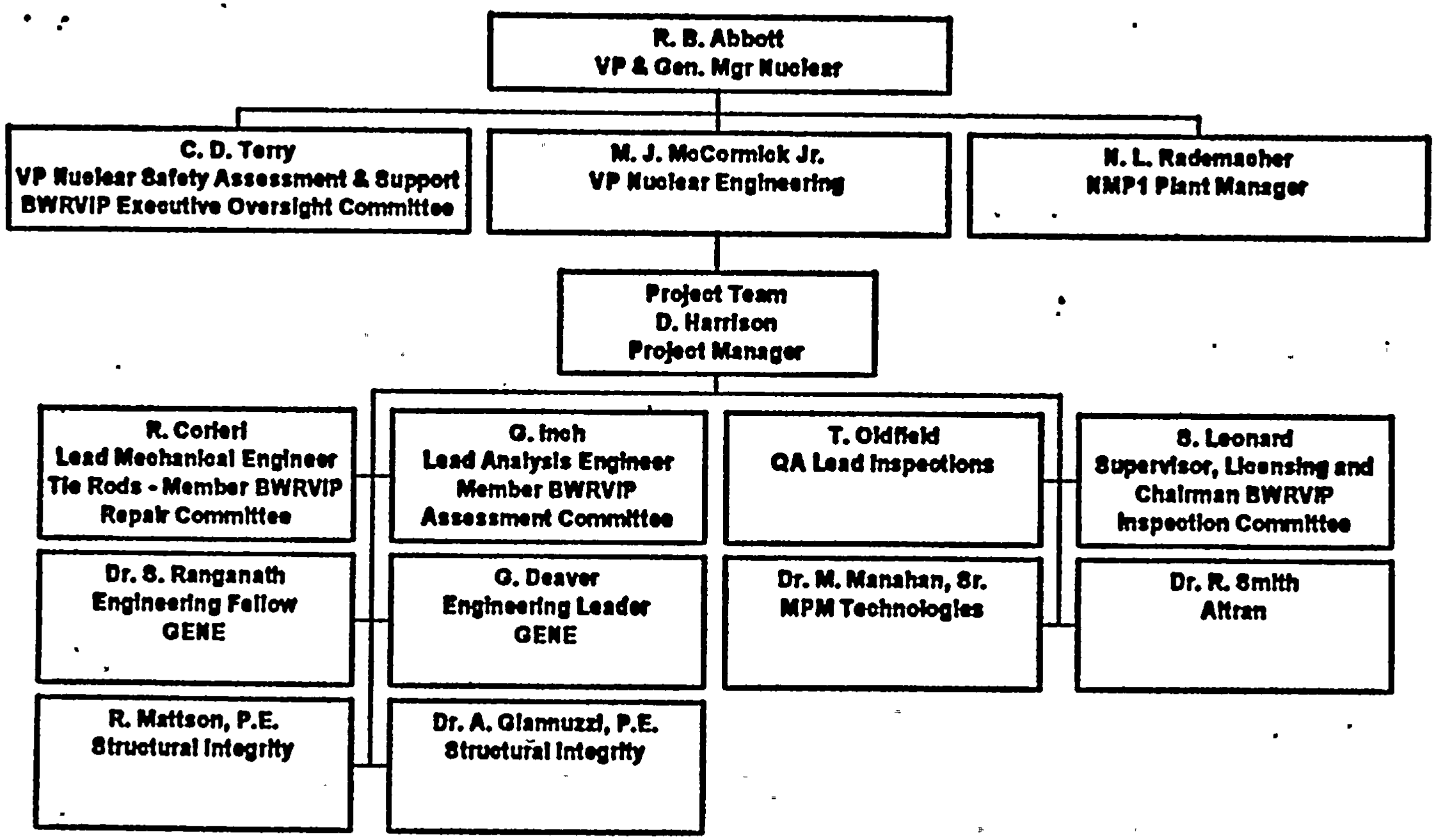
April 14, 1997

ENCLOSURE 3

Agenda

NRC Welcome	B. R. Sylvia
NRC Summary for the Public	NRC
Introductions	M. McCormick
Purpose	M. McCormick
Summary of Results	M. McCormick
Core Shroud Stabilizer (Tie Rod Findings)	R. Corieri/G. Deaver
Core Shroud Vertical Weld Assessment	G. Inch/ Dr. R. Smith Dr. M. Manahan/Dr. S. Ranganath
Summary	M. McCormick
Closing Remarks	R. B. Abbott

Introduction
Senior Management Team Oversight



Meeting Purpose

The purpose of the meeting is to:

- Discuss the details of recent inspections of the core shroud and stabilized assemblies (tie rods).
- Discuss the analyses supporting the 10CFR50.55a submittal for proposed tie rod retainer clip modification.
- Discuss analyses which demonstrate that the shroud and tie rods were operable and safe during the previous cycle.

Shroud Repair Background

- The BWRVIP developed industry standardized shroud repair criteria which was approved by the NRC. The NMP1 repair was designed to meet standardized criteria.
- NMPC evaluated the industry experience related to core shroud horizontal weld cracking and concluded that the NMP1 core shroud could be susceptible to similar cracking.
- NMP1 took a pro-active approach with this issue and decided to install a shroud repair during the Spring 1995 refuel outage.

Summary of Results

- The Unit 1 Core Shroud Stabilizers have been restored to the as-designed condition.
- Redesigned lower spring wedge retainer clips have been installed to improve tie rod operation.
- Steady state and transient thermal expansion has been analyzed and proper function of the tie rods and their components is assured.

Summary of Results

- A baseline inspection of the shroud vertical welds has been completed.
- The as-found condition has been analyzed, taking no credit for the integrity of the horizontal welds and applying conservative crack growth rates, and demonstrates the continued structural integrity of the shroud.

Recommended Re-inspection Schedule

- NMPC requests operation for at least 10,600 hours (14 1/2 months) before re-inspection.
- A safety evaluation, based on conservatism with regard to analytical parameters, concludes no unreviewed safety questions with regard to tie rod repairs and vertical weld integrity.

Core Shroud Stabilizers

R. Corieri
NMPC Engineering

Shroud Repair Description

- Shroud repair designed to structurally replace the shroud circumferential welds.
- Four tie rod assemblies are placed around the shroud (azimuths 90°, 166°, 270°, 350°).
- Vertical restraint is provided by an alternate load path between the top of shroud and shroud support cone.
- Horizontal restraint of the shroud is provided through the use of linear springs and limit stops.

Spring 1997 Shroud Repair Inspection Plan

- Prior to the 1997 refueling outage, NMPC submitted its shroud repair inspection plan to the NRC for approval.
- The plan was in accordance with the BWRVIP-07 guidance.
- Visual inspection of all four stabilizer assemblies to:
  - Verify the general mechanical and structural condition.

As-Found Condition

- Tie Rod Assemblies
  - The tie rod assemblies were found to be in place and functional at the time of the inspection with some anomalies.
- Tie Rod Nuts
  - All nut locking devices were intact.
  - A torque check on the 270 degree tie rod nut identified a lack of the original installation mechanical preload.
  - The torque check determined that an axial clearance in the tie rod assembly on the order of 0.08″ existed.
- Lower Spring Wedge and Latch
  - 90°: latch fractured and lower wedge re-positioned down on wedge guide
  - 166°: latch and lower spring wedge normal
  - 270°: latch potentially damaged and lower spring wedge normal
  - 350°: latch damaged and lower spring wedge ≈ 1/8″ below normal position

Additional Inspections

- Based on the as-found conditions, additional inspections were determined to be required.
- A comprehensive procedure was developed to interogate the condition of each of the tie rod assemblies.
- Remote operated underwater tooling and inspection equipment was designed and fabricated to implement the procedure.
- The procedure was also intended to obtain data to validate the root cause theories associated with the degraded latches and the lack of preload in the 270° tie rod.
- As a result it was determined that the tie rod assemblies at the 90, 166 and 350 degree azimuths also had some amount of axial clearance which ranged from 0.054" to 0.151".

Root Cause

- The evaluation of the as-found condition shows that both the latch failure and the loss of tie rod preload were related.
- The design of the lower spring contact implicitly assumed that the lower spring contact would slide along the Reactor Pressure Vessel (RPV) wall.
- There were two conditions causing differential movement that were not expected:
  - The lower support assemblies were able to shift up the shroud cone toward the shroud due to original installation clearances between the toggle bolts and the cone holes. The impact of the clearances was not recognized.
  - Differential motion could also be caused by the deflection of the C-spring under tie rod load for heat up. This could also cause stresses in the latch, although somewhat less than in the previous case.

Consequence of Tie Rod Anomalies During the Past Operating Cycle

- No plant operational anomalies noted during the past cycle.
- All plant operating design cases evaluated.
  - All stresses are within ASME Code limits.
  - Bypass leakage does not affect plant operation or safety functions.
  - Core cooling operability unaffected.
  - Safe shutdown capability unaffected.
- Flow induced vibration did not occur.
- As found shroud horizontal weld conditions were safe without tie rod repair in place.
- Conclusion: no safety concern; no adverse affect on tie rod repair hardware.

Corrective Actions

- Removed clearance between the lower support toggle bolts and the shroud side of the cone holes.
- Re-torqued the tie rods to their original design installation torque.
- Installed new modified latches which are more tolerant of differential vertical displacement.

Latch Design Objective

Jerry

G. Deaver

GENE

Latch Design Objective

- Support lower wedge dead weight loads
- Accommodate potential vertical displacements between lower wedge and lower spring
- Prevent release of the lower wedge and loss of lower spring contact

Potential Sliding Cases

- Only sliding at vessel wall/lower wedge interface.
- Only sliding at lower wedge/lower spring interface.
- Combination of the above.

Lower Wedge/Lower Spring Sliding Scenario

Event	Surface Assumed to Slide	Latch Displacement (inches)
Initial heatup and hydrotest	Spring Interface	0.042
Remainder of heatup to full power operation	Spring Interface	0.090
Loss of Feedwater Heating	Spring Interface	0.132

Combined Sliding Scenario

Event	Surface Assumed to Slide	Latch Displacement (inches)
Initial heatup and hydrotest	Spring Interface	0.042
Remainder of heatup to full power operation	Spring Interface	0.090
Cooldown to Ambient (70°F)	Vessel Interface	0.115*
Heatup to Full Power Operation	Spring Interface	0.182
Loss of Feedwater Heating	Spring Interface	0.224

* Maximum displacement is limited by the amount of travel down the 5 degree angle of the spring.

Stress Analysis Results

Sliding Condition	Plant Operating Condition	Displacement	Calculated Stress ÷ Allowable Stress
Sliding only at lower wedge/lower spring interface	Normal Operation	.090"*	33%
	LOFWH Operation	.132"	43%
Sliding at both interfaces	Normal Operation	.182"	60%
	LOFWH Operation	.224"	73%

* The stress results reported are for a 0.100" displacement, which is conservative.

Stress Corrosion Evaluation

- Stress Rule Index Methodology utilized.
- For probable sliding case, stress corrosion will not occur for remaining life of plant.
- For worst case sliding, stress corrosion will not occur in the next operating cycle.

Comparison of Latch Designs

- The improved latch design stresses are 8 to 12 times lower than the original design
  - membrane + bending
    ratio = 8.6
  - membrane + bending + peak
    ratio = 12.8
- No permanent deformation in new latch design even under worst case conditions

Core Shroud Vertical Weld Inspection and Evaluation

G. B. Inch
NMPC Engineering

Expanded Shroud Inspection Goals

- Baseline shroud vertical and horizontal welds.
- Obtain comparison between vertical and horizontal IGSCC cracking patterns
  - Horizontal cracking at the H4 location consistent with other BWR-2 cracking and NMP1 H4 analysis predictions.
- Obtain H8 UT re-inspection data
  - Re-inspection of H8 confirms no significant IGSCC cracking which could impact core shroud support function.
    - » Structural capability assured based on inspection
  - Sample inspection of H9 with EVT shows no indications.

Expanded Shroud Inspection Goals

- Determine actual core shroud structural margin present in horizontal welds.
- The tie rod installation assumed horizontal welds not present.
  - Inspection shows significant margin.
- Based on structural capability of H4 and H5 establish the margins associated with vertical weld cracking

Additional Assessment Initiatives

- Obtain comprehensive material condition assessment using all available inspection tools (enhanced visual examination/ultrasonic volumetric examination).
- Assessment of the shroud vertical cracking performed by several independent IGSCC experts to compare cracking to other industry shroud cracking.
- Advanced computer modeling of the fabrication process to better define the most probable residual stress state which could explain OD dominant cracking.
- Obtain metallurgical sampling of vertical welds (two boat samples).

Additional Assessment Initiatives *(continued)*

- More refined analysis of the vertical weld cracking is expected to increase the inspection interval to one operating cycle.
- Re-inspection of vertical weld cracking most probably will show deeper cracking is arrested.
- The industry has never seen through wall cracking.

Basis for Vertical Weld Analysis Loads

- Welding residual stresses and the welding process fitup related induced stress in the weld create built in stresses which drive IGSCC cracking.
- Pressure stress dominates fracture.
- The pressure stresses are defined by reactor internal pressure difference calculations.

Root Cause of Cracking

- Vertical weld cracking is IGSCC.
- Potential for irradiation enhanced material sensitization in the HAZ, which, coupled with enhanced stress relaxation, can affect crack growth.
- All findings show that IGSCC consistent with basis for BWRVIP established and NRC approved methods for analyzing core shroud cracking and establishing re-inspection requirements.
- Conclusion is that the BWRVIP core shroud inspection and evaluation guidance applies to the NMP1 vertical weld cracking.

Thermal Hydraulics Assessment

- Potential vertical weld through-wall cracking could result in (negligible) diverted core flow.
- Anticipated transients (potentially increased carryunder has favorable effect on thermal limits).
- LOCA
  - Potential leakage has no impact on core spray flow.
  - Core cooling is assured through core spray.

Vertical Weld V9 and V10 Crack Growth Margins

- Uncertainty associated with variables like stress intensity, neutron fluence are basis for bounding crack growth rates of 5e-5 inches/hour.
- Detailed crack growth analyses which account for all the above variables define V9 and V10 crack site specific growth rates which demonstrate that 5e-5 inches/hour is conservative.

Evaluation of Cracking in Vertical Welds

Dr. R. Smith
Altran

Purpose

- Careful examination of cracking patterns and other information.
- Develop a plausible explanation of what happened.

Cracking Patterns Provide Evidence of the Reasons for Cracking

Observations @ V9 and V10

- Cracking characteristics typical for shroud
- Cracking predominantly on OD
- Cracking remains axial predominantly in the weld HAZ
- Cracking density favors one plate
- Cracking deeper at top/more shallow towards bottom

Considerations

- Parameters for IGSCC are well known
- Welding and fabrication practices alter residual stresses

Residual Stress Sources

- Welding
- Surface metal working
- Fabrication and fitup

Welding Residual Stresses

- Extensively studied
- Predicted by FEM
- Confirmed by measurements

Through-Wall Stress Pattern

- Depends on heat input and weld sequence
- High OD stress predicted for low heat input welds
- Fitup shaping adjustments (diameter squeeze)
- Combination produces a stress pattern that is consistent with the cracking observations

Time Dependent Irradiation Effects

- Increase electrochemical potential (ECP)
- Enhances material susceptibility
- Reduces residual stresses by a creep mechanism

Core Flux Pattern Suggests a Possible Reason for Crack Depth Differences Top to Bottom

Conclusion

- Shroud fabrication practices provide a plausible explanation of vertical weld cracking observations
- Time dependent irradiation effects can help explain crack depth profiles top to bottom

Analysis of Shroud Weld V9 and Weld V10 Cracking

Dr. M. P. Manahan, Sr.
MPM Technologies, Inc.

Introduction

The analyses have focused on:

- Contributing to the determination of the root cause of cracking at V9 and V10 from a stress field, crack growth, and cracking mechanism perspective
- Explaining why cracking along V9 and V10 is predominantly OD (this behavior would not be expected from examination of double V-groove weld stress fields)
- Providing a realistic estimate of the allowable future operating time based on a conservative, but accurate model

Qualitative Characterization of V9 and V10 Cracking

- The cracking is almost exclusively on the OD side of the weld within the HAZ
- Most of the cracks run longer in the axial direction and are connected to a short horizontal crack segment
- The axial cracks (driven by hoop stress) are deepest near the H4 weld where the fast neutron flux is highest
- Both the left and right sides of V10 are cracked
- The left side of V9 is cracked with little cracking on the right side
- The depth of cracking correlates with fast (E > 1 MeV) neutron fluence

Conclusion: The evidence suggests that the cracking mechanism is irradiation enhanced - intergranular stress corrosion cracking (IE-IGSCC).

Cause of Predominant OD Cracking at V9/V10

A retrospective analysis of the cracking observed has been performed to obtain an in-depth understanding of the fabrication processes which contributed to the observed cracking behavior. The approach involved the following:

- welding simulations (WELD 3)
- shop load simulations (ALT 3D)
- weld repair simulations (ALT 3D)

Conclusion: It can be demonstrated that a combination of low heat input and a diametral squeeze (dead weight and/or jacking) produce a stress field which would explain the cracking behavior.

Structural Margin Assessment of V9 for Continued Operation

<u>Model Description</u>

- Credit was not taken for crack arrest
- LEFM, EPFM, and limit load calculations were performed
- Crack growth rates were calculated using GE fluence dependent model
- Initial crack depths which bound the measured depths were used
- Variation of fluence through the wall was modeled using plant-specific fluxes
- K vs. a data were calculated using finite element methods for a representative stress field
- Cracks initiate under axial stress, grow 0.3 to 0.5 inches deep, and then grow under hoop stress
- Cases with, and without, credit for integrity of the H4 and H5 welds were analyzed

Structural Margin Assessment of V9 for Continued Operation

Conclusions

- The bounding 5×10^{-5} in/hr crack growth rate is conservative
- The analyses show that safe operation can be ensured for at least an additional 2 years of hot operation

Structural Evaluation of the Shroud Vertical Weld Indications

Dr. S. Ranganath
GENE

Impact of Vertical Weld Cracking on the Tie Rod Function

- Tie rod repair design basis does not require vertical welds to be crack free
  - Any flaws should be within the allowable size
  - No credit for horizontal welds
- Structural analysis of NMP1 vertical weld indications based on separate stand-alone cylindrical model
  - Acceptability demonstrated assuming horizontal welds to be fully cracked
  - No adverse effect on the tie rod repair function

Vertical Weld Cracking does not lead to Violation of Tie Rod Repair Design Basis

Effect of Tie Rod Loading on the Vertical Weld Cracking

- Analysis performed to determined whether tie rod loading can cause stresses which could cause crack growth in the vertical welds
  - 3D finite element modeling
- Results confirm that the stresses due to tie rod loading are negligibly small

Tie Rod Repair has no Impact on Vertical Weld Cracking

Structural Evaluation

- Two types of evaluations performed; with common features:
  - Fracture and Limit Load considered
  - ASME Code safety factors included
- Screening Criteria Approach
  - Assumes through wall cracking
  - Analysis for 16,000 hours
- Detailed Analysis using UT Depth Data
  - Credit for uncracked ligaments
  - Maximum period of operation based on allowable K

Crack Growth Rate Assessment

- Several predictive models evaluated
  - BWRVIP correlation
  - GE PLEDGE model
  - SKI crack growth model
  - NRC crack growth rates
- NRC accepted growth rate of 5×10^{-5} in/hr is bounding
  - Irradiation effects are bounded by the NRC curve
  - BWR shroud field cracking data confirms that actual growth rates are lower; 2×10^{-5} in/hr bounds data
  - NMP1 water chemistry during the last cycle has been excellent (less than 0.1 micro-siemen/cm)

NMP1 Crack Growth Rates Expected to be Much Less than the Bounding Crack Growth Rate used in the Analysis

Screening Criteria Analysis Technical Approach

- Cracks assumed through wall in all uninspected regions
- Where indications found (UT/VT), through wall flaw assumed
- LEFM and Limit Load analysis
- ASME Code safety factors
  - 3.0 Normal and upset; 1.5 Emergency and faulted
- Uncertainty factors for UT and VT included
- Evaluations performed for 16,000 hours
  - Crack growth rate of 5×10^{-5} in/hr
  - Indications acceptable if final length less than allowable value

All Welds except V4, V9 and V10 shown acceptable by the Screening Criteria Analysis

Detailed Evaluation of V9, V10, and V4 Welds

- Detailed evaluations for the V9, V10, and V4 indications
  - Credit for remaining ligament after crack growth of 5×10^{-5} in/hr and inspection uncertainty factors
  - LEFM and limit load analysis with ASME code safety factors
  - Covers normal/upset and accident conditions
  - Acceptable period for continued operation determined
- Analysis shows that continued operation is justified for at least 10,600 hours

Structural Analysis Conclusions

- Tie rod repair design basis maintained even with the observed vertical weld cracking
  - No credit taken for horizontal weld integrity
- Structural margin demonstrated for continued operation for at least 10,600 hours
  - ASME Code safety factors maintained
  - Bounding crack growth rates used
  - Conservative flaw sizing assumed

Required Structural Margins Maintained

[illegible] [illegible]

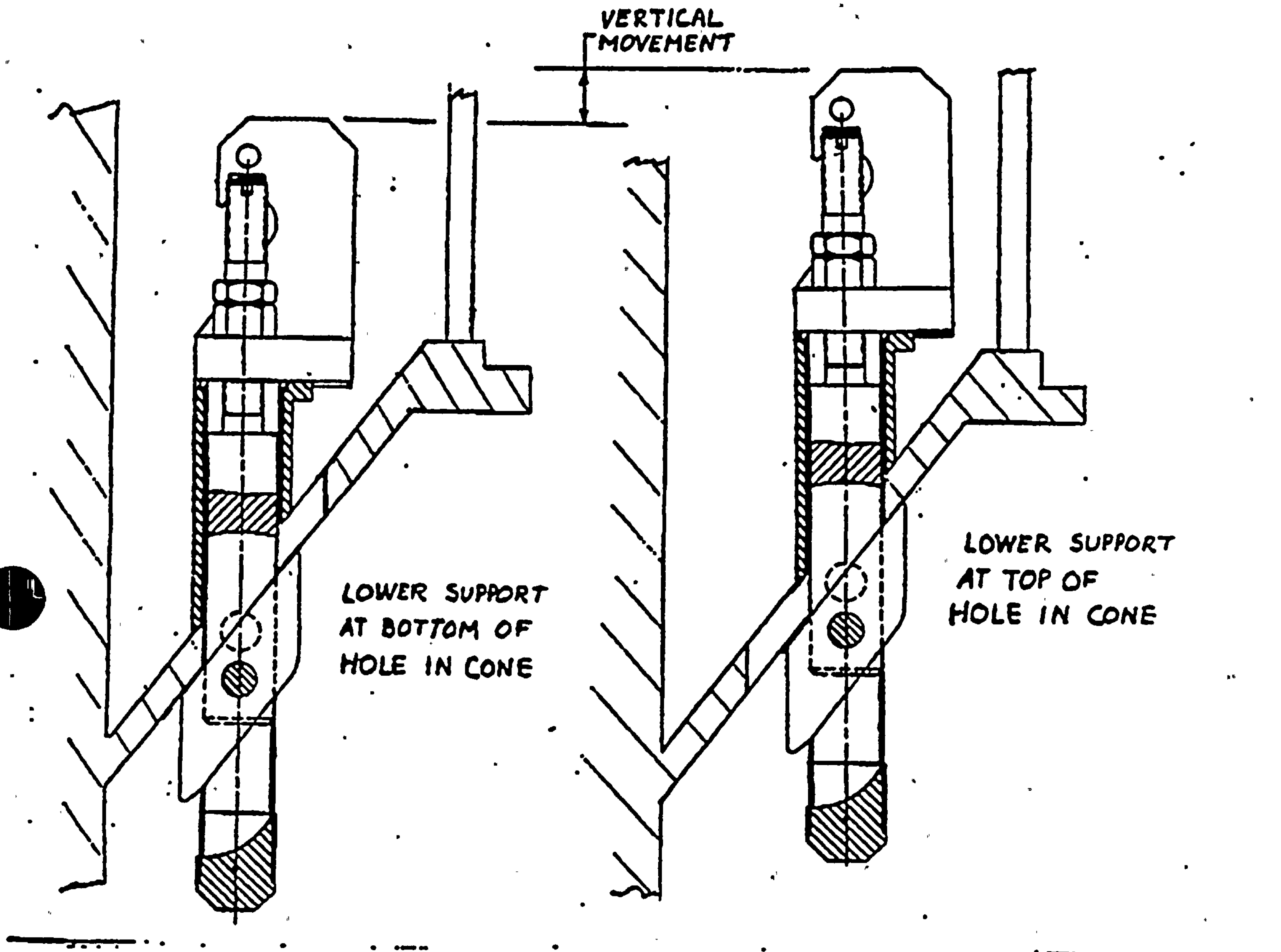
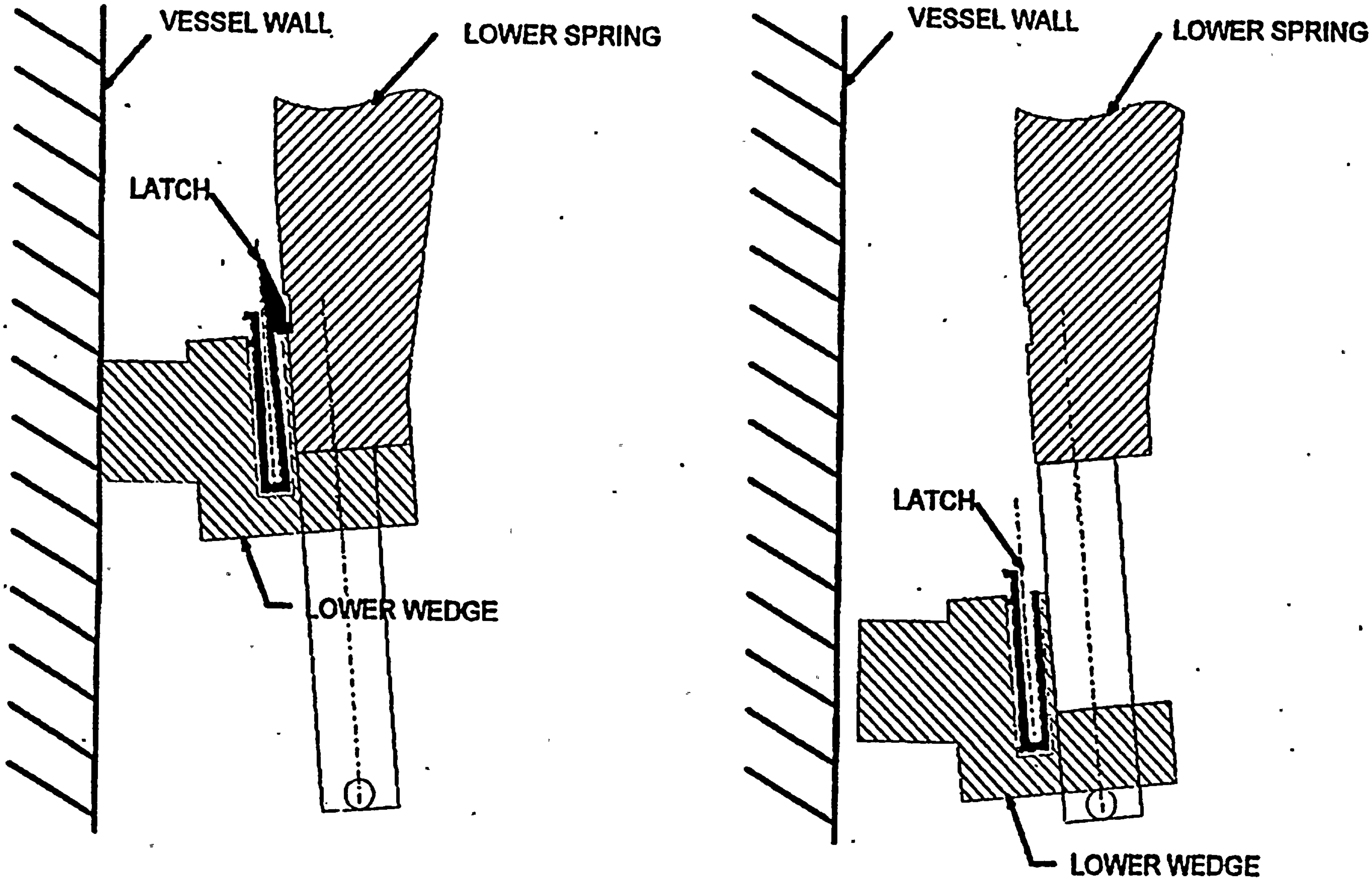
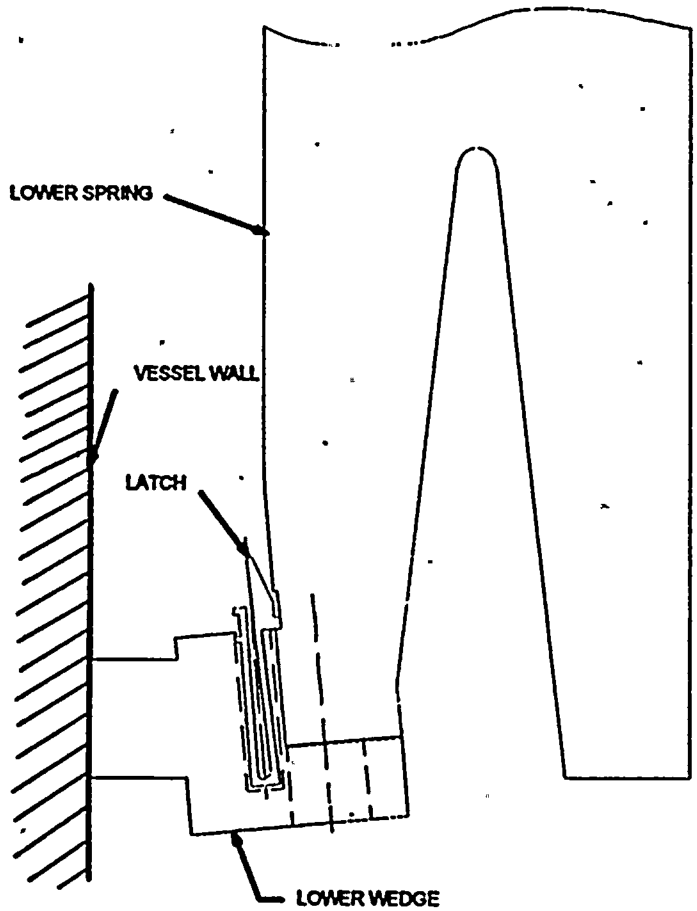


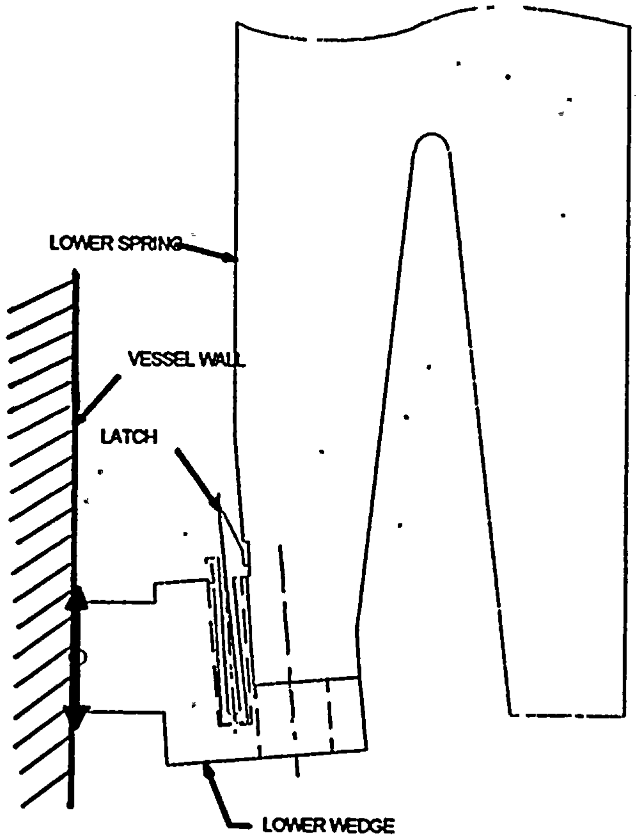
Figure 3

Toggle Bolt Movement in Shroud Support Cone

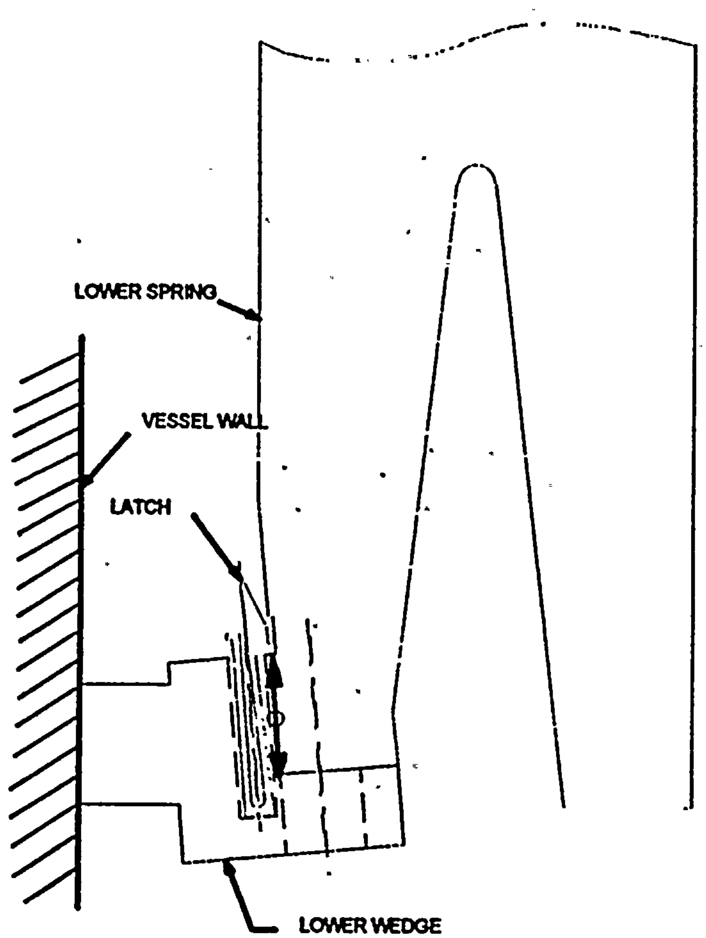

VESSEL WALL
LOWER SPRING
LATCH
LOWER WEDGE
VESSEL WALL
LOWER SPRING
LATCH
LOWER WEDGE



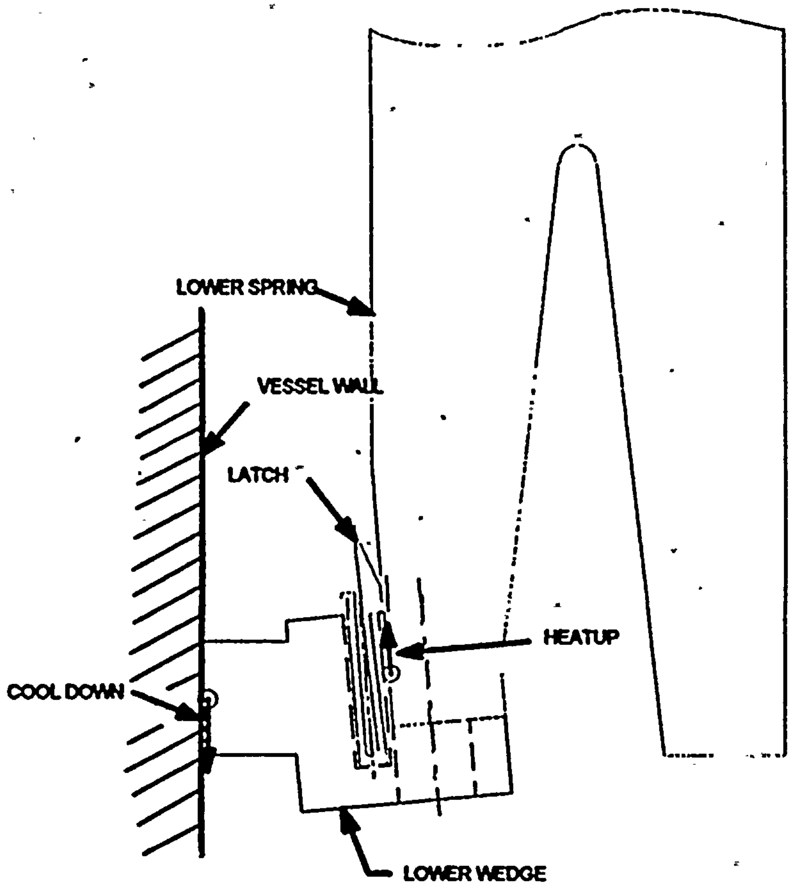
ORIGINAL LATCH



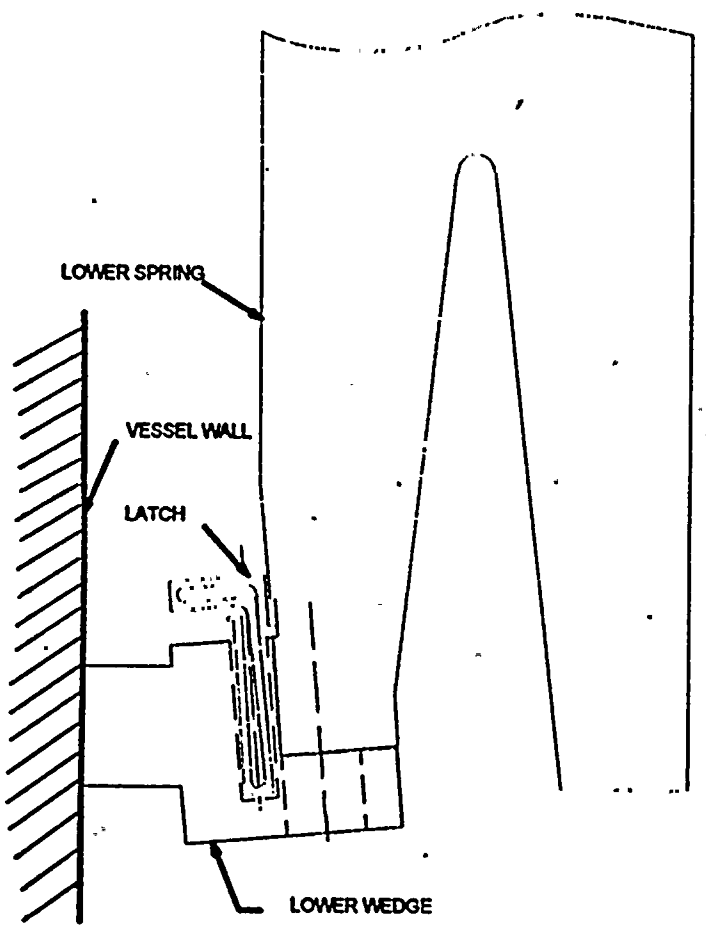
VESSEL SLIDING CASE



LOWER WEDGE/LOWER SPRING SLIDING CASE



COMBINED SLIDING CASE
(WORST CASE DIRECTION)



NEW LATCH

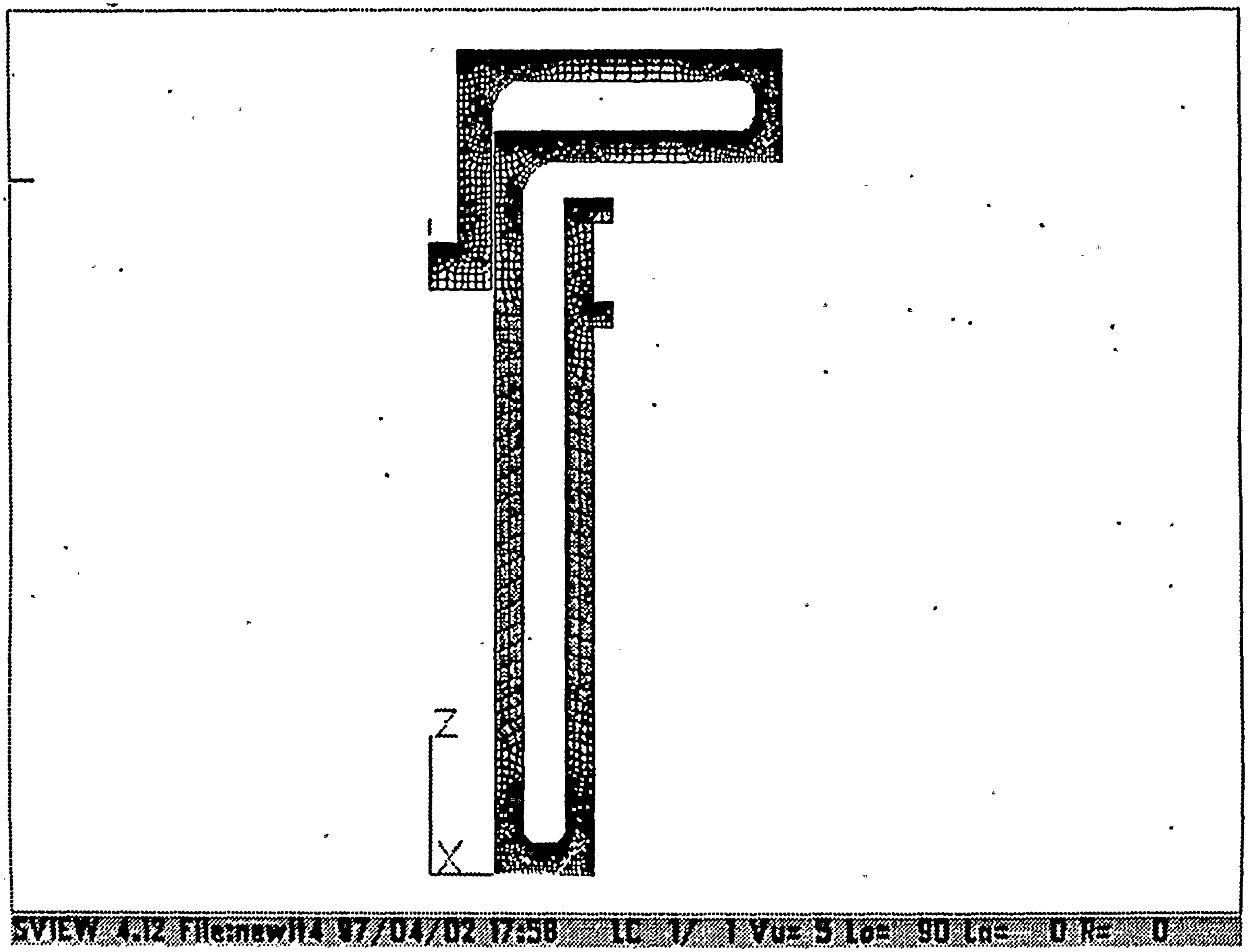
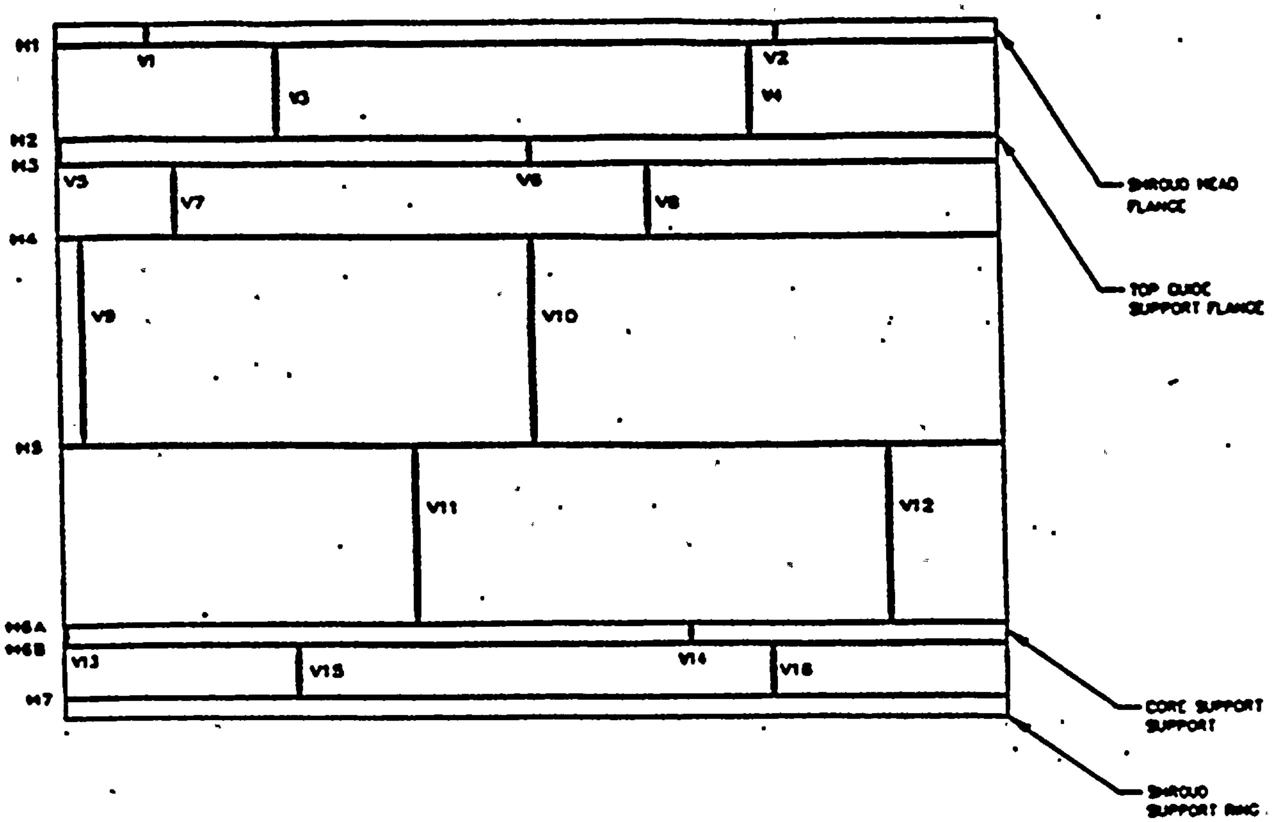

Z
X
SVIEW 4.12 File:new114 97/04/02 17:58 LC 1/ 1 Vu= 5 Lo= 90 La= 0 R= 0

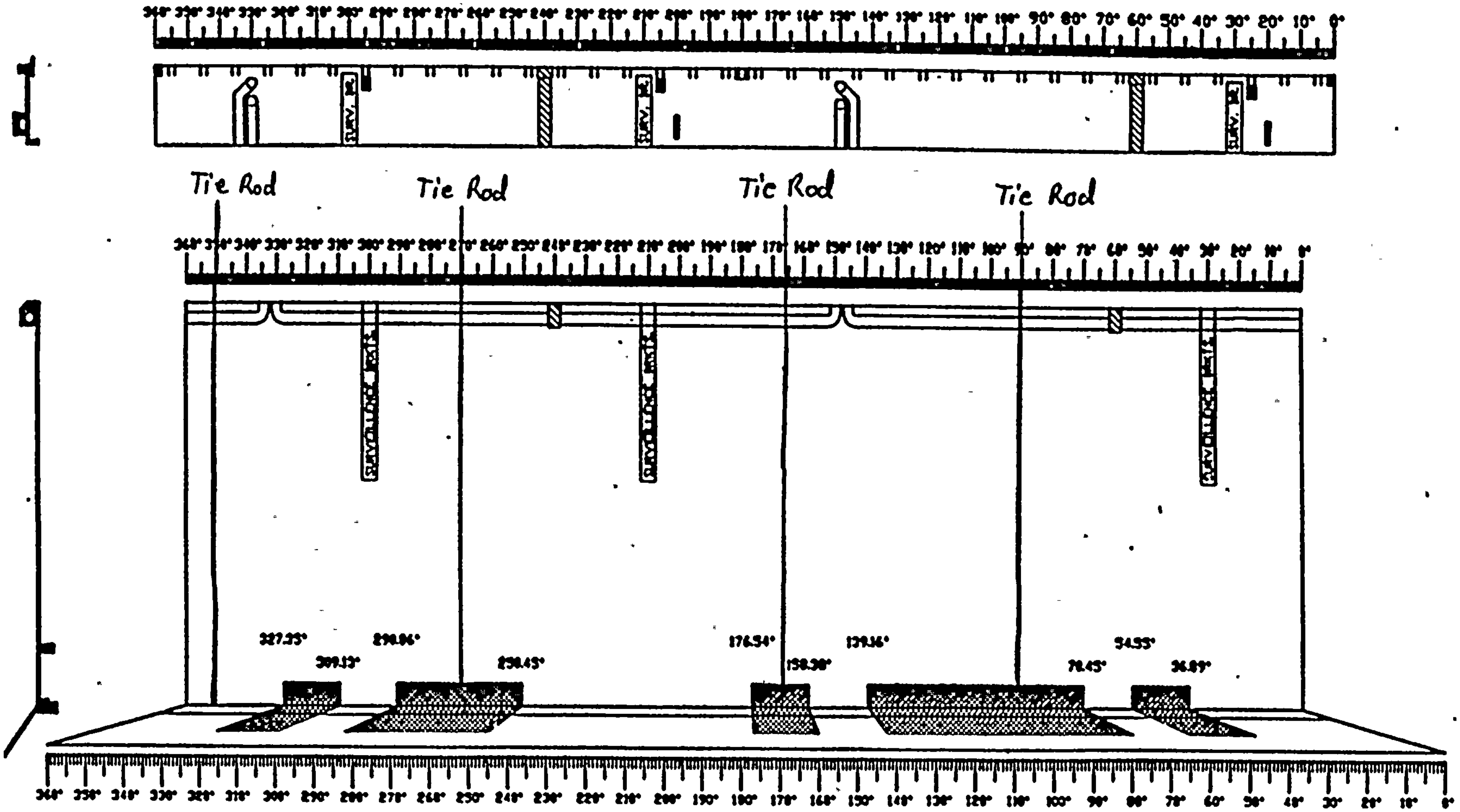
FIGURE 1: SHROUD WELD MAP



NINE MILE UNIT 1 - SHROUD ROLLOUT

ACTUAL H8 CIRCUMFERENCIAL SCAN TOTAL: 45.32%

(BASED ON WHERE ANY TRANSDUCER PASSED AREA)

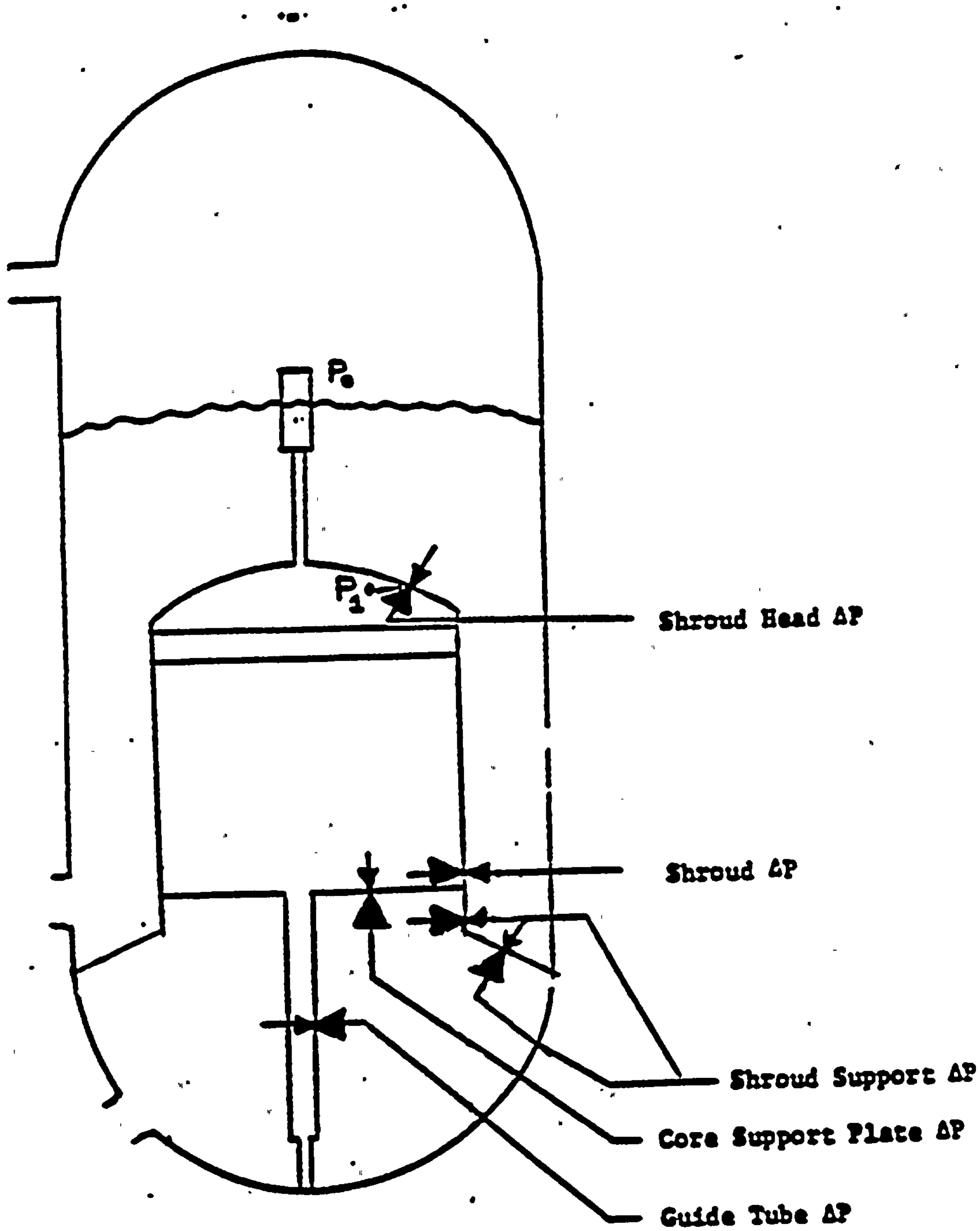


SKETCH RELEASE RECORD

REV	DATE	PREPARED	REVIEWED	INT.	APPROVED	INT.	PURPOSE
0	2/17/95	JIM COLLINS	XXXXX		XXXXX		SHROUD ROLLOUT
1	2/20/95	JIM COLLINS					SHROUD ROLLOUT
2	2/25/95	JIM COLLINS					SHROUD ROLLOUT - FINAL COVERAGE OBTAINED

NOTE: THIS SKETCH IS FOR ISI PROGRAM USE ONLY AND SHALL NOT BE USED FOR FABRICATION/INSTALLATION.

GE DWG NO.	PROJECT	TITLE	SKETCH NO.
	NMP1	SHROUD UT INSPECTION	NMP-01-ROLL



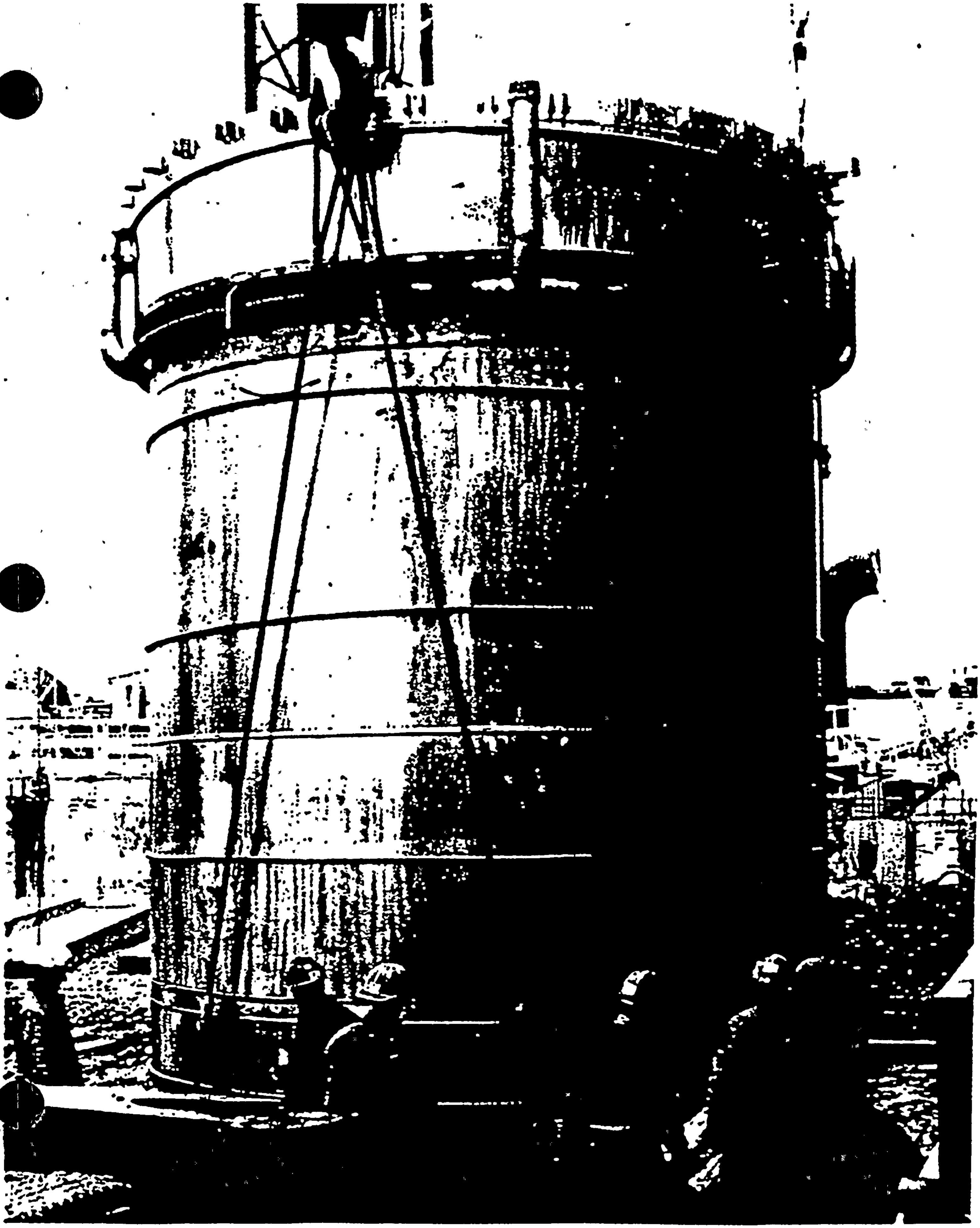
P_o
P_1
Shroud Head ΔP
Shroud ΔP
Shroud Support ΔP
Core Support Plate ΔP
Guide Tube ΔP

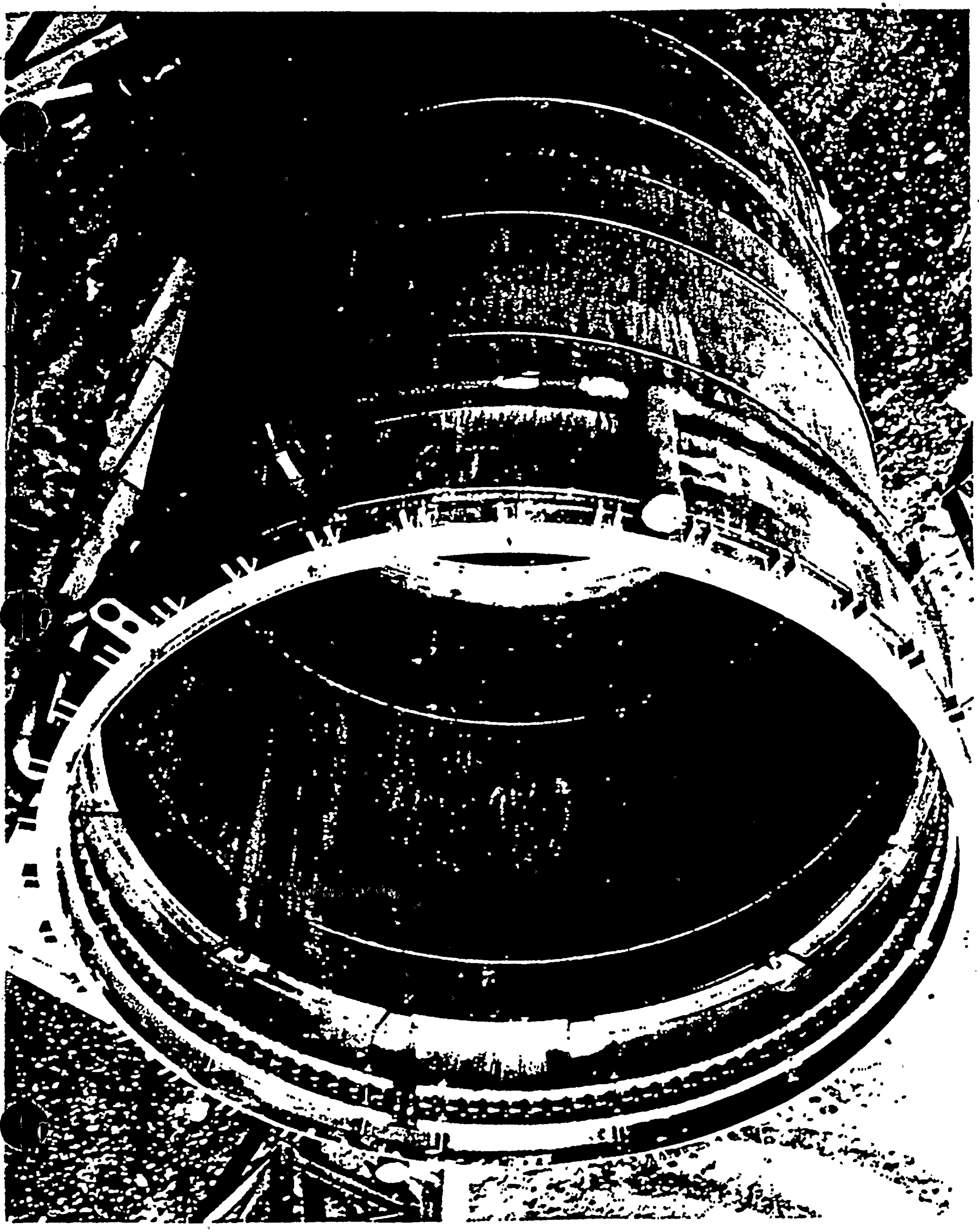
Reactor Internals Pressure Differentials

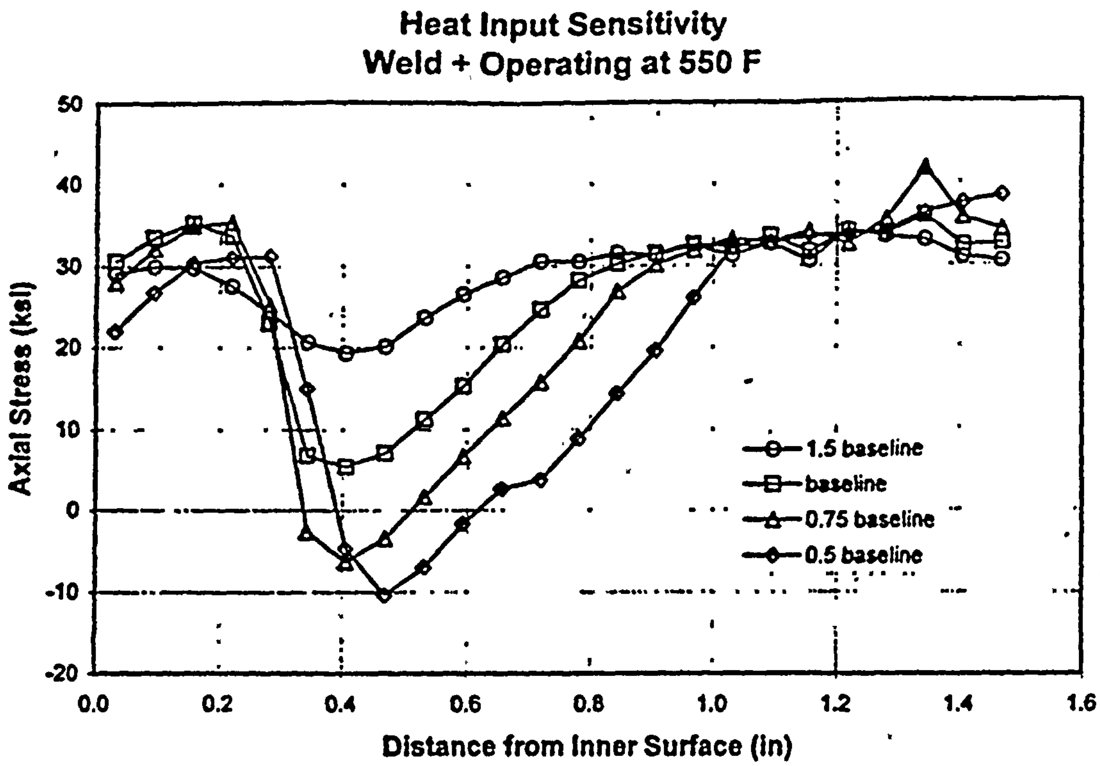
Event	H1 to H-2 Delta P	H-3 to H-6a Delta P	Below core Plate Delta P
Normal and Upset	8.9 psi.	8.9 psi	23.6 psi
Faulted	22 psi	22 psi	63.0 psi

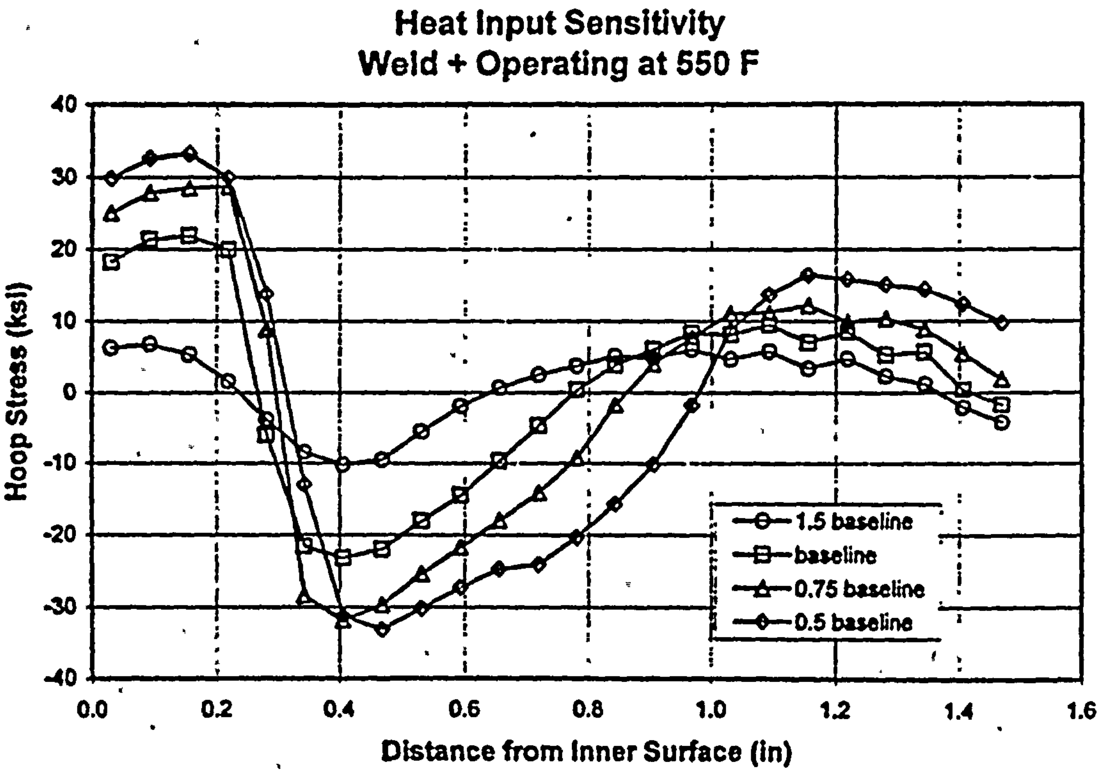
Leakage Flows at Rated Conditions

	Flow (gpm)	% Core Flow
Vertical Weld Cracks V-9 and V-10	200	0.11
Horizontal Weld Repair	1510	0.54









Axial and Hoop Stresses at Operating Temperature for the V9/V10 Welds as a Function of Heat Input During Welding

Surface Stress Summary for Several Weld Heat Input Cases Showing the Effect of Diametral Squeeze on the Stresses

HAZ Surface Stress Summary (Baseline Weld Heat)

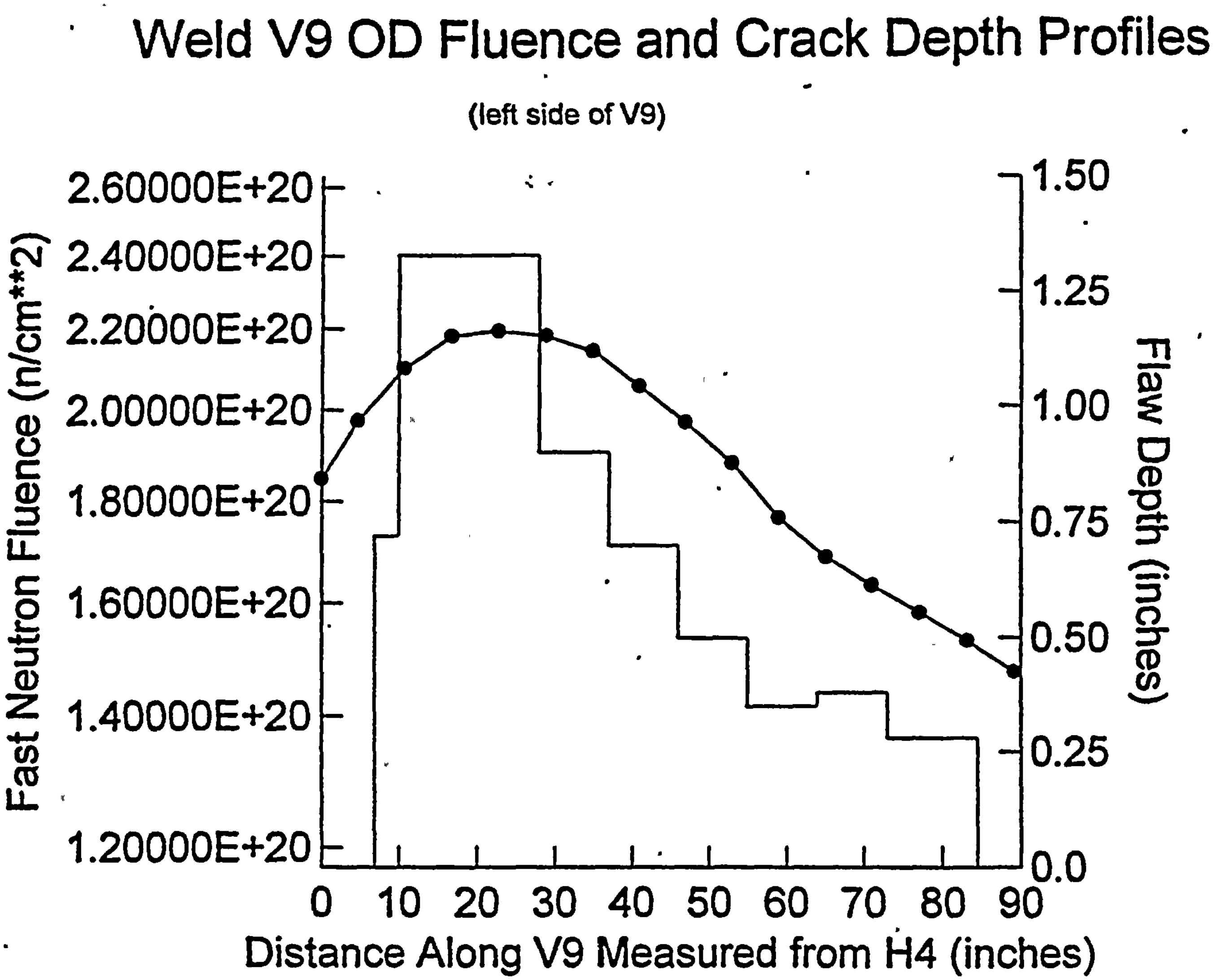
	Hoop Stress (ksi)		Axial Stress (ksi)	
	ID	OD	ID	OD
as welded	19.8	-3.7	39.9	42.6
welded + operating	16.6	-2.8	29.1	32.7
weld + 4" squeeze + op	9.0	-1.9	19.5	25.5

HAZ Surface Stress Summary (0.75 Baseline Heat Weld)

	Hoop Stress (ksi)		Axial Stress (ksi)	
	ID	OD	ID	OD
as welded	29.4	0.2	37.1	43.8
welded + operating	23.6	0.0	26.0	33.6
weld + 2" squeeze + op	17.2	0.7	20.2	26.4
weld + 4" squeeze + op	8.4	-0.4	13.4	26.0
weld + 6" squeeze + op	-2.6	0.7	8.1	14.0

HAZ Surface Stress Summary (0.5 Baseline Heat Weld)

	Hoop Stress (ksi)		Axial Stress (ksi)	
	ID	OD	ID	OD
as welded	38.8	11.0	27.7	50.3
welded + operating	28.4	8.5	19.6	38.8
weld + 2" squeeze + op	15.3	7.1	13.8	31.7
weld + 4" squeeze + op	6.2	5.4	10.4	28.7
weld + 6" squeeze + op	-5.0	5.2	7.0	19.4



Correlation Between Fast Neutron Fluence and Crack Depth at NMP-1 Vertical Weld V9

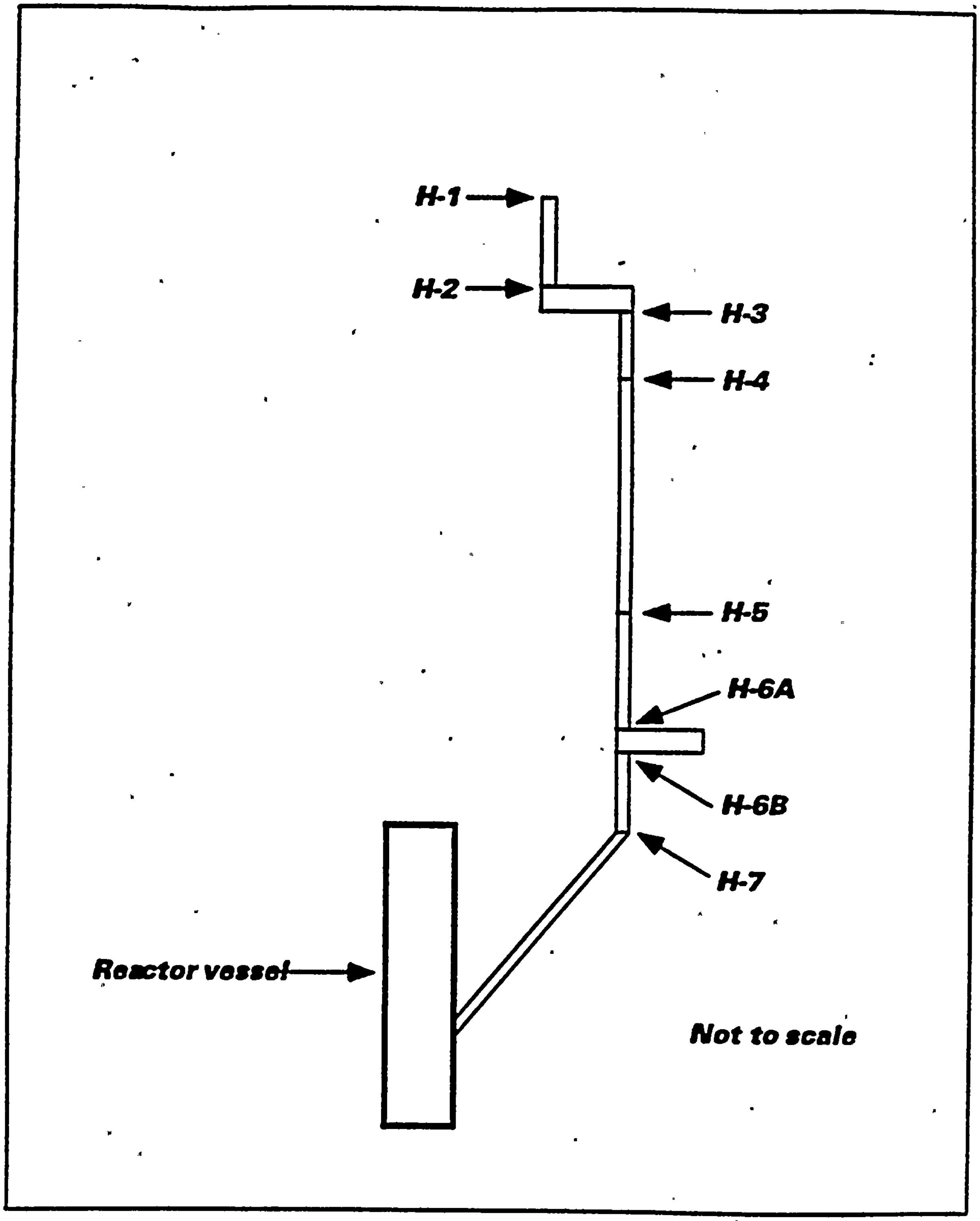


Figure 1-1 NMP1 Shroud Weld Locations, Cross Sectional View

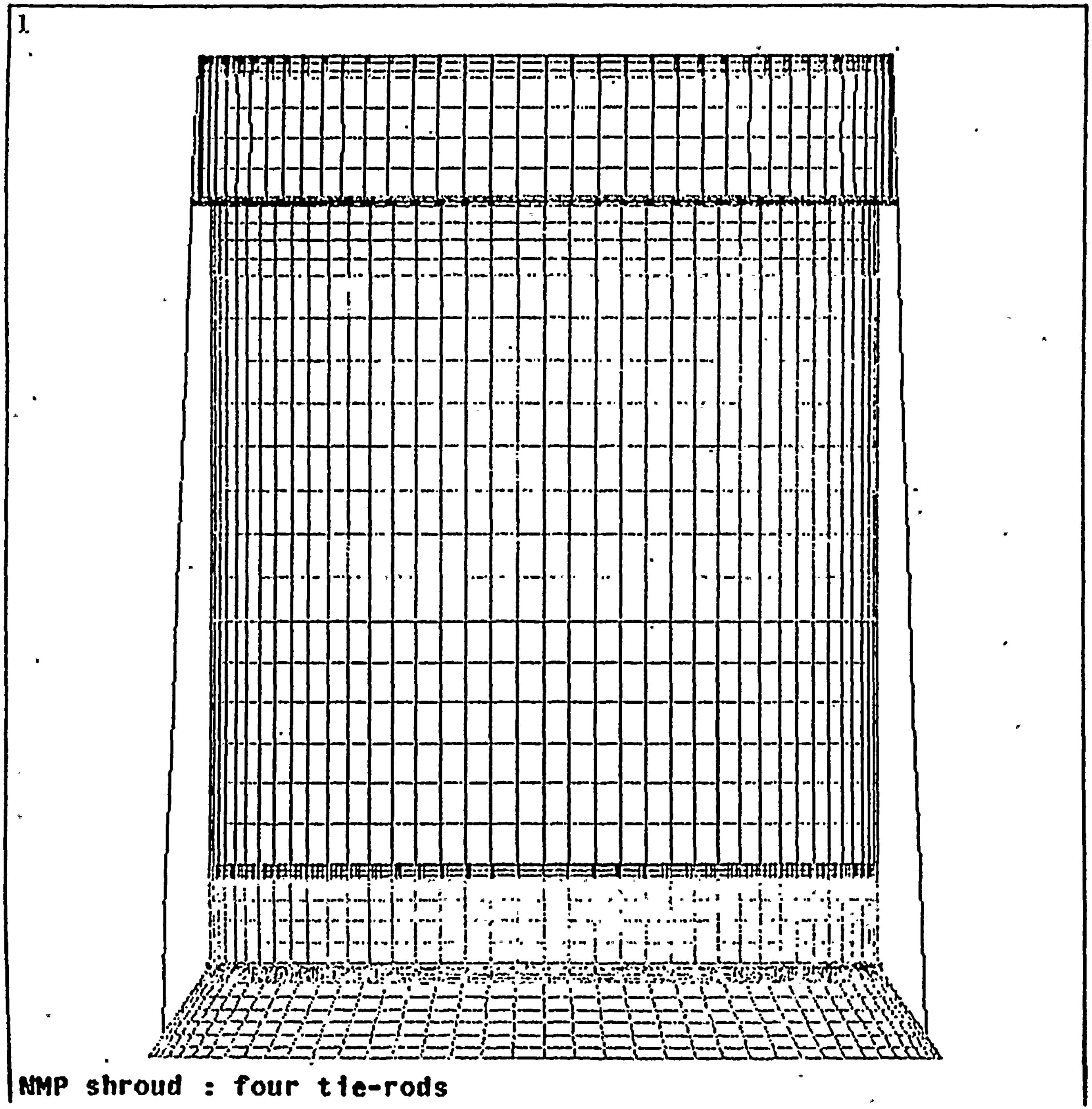
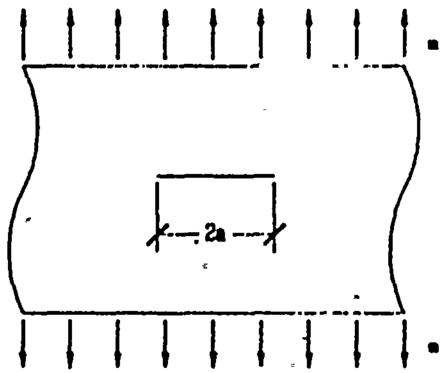


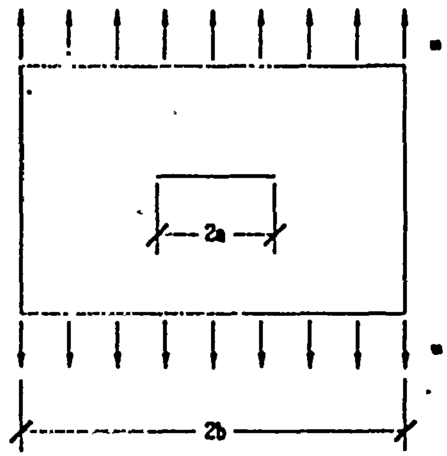
Figure 2. Analysis Model
(Four tie-rods)

LEFM Model

Infinite and Finite Plate with Through Thickness Cracking

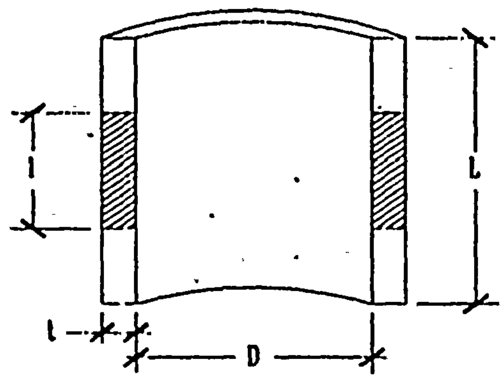


Infinite Plate



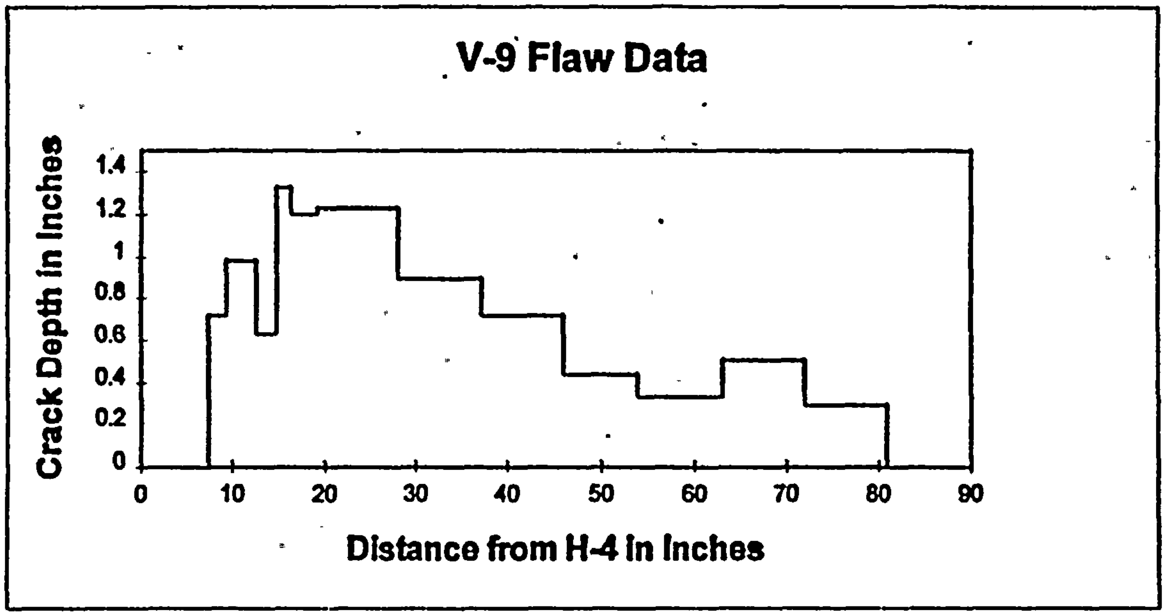
Finite Plate

Limit Load Model

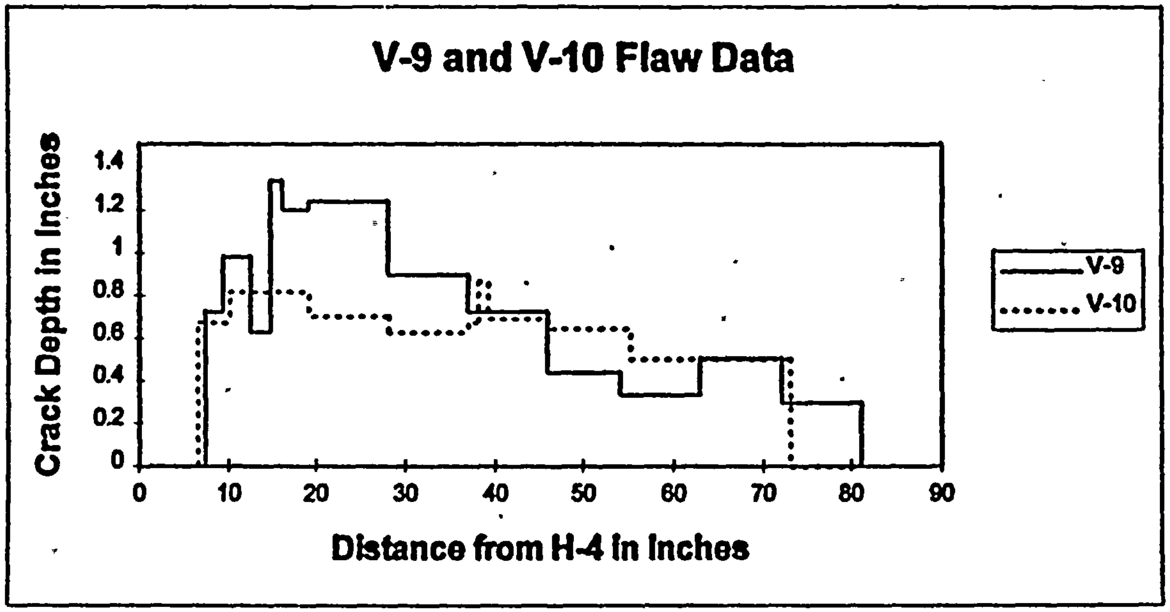


Partial Shell Section

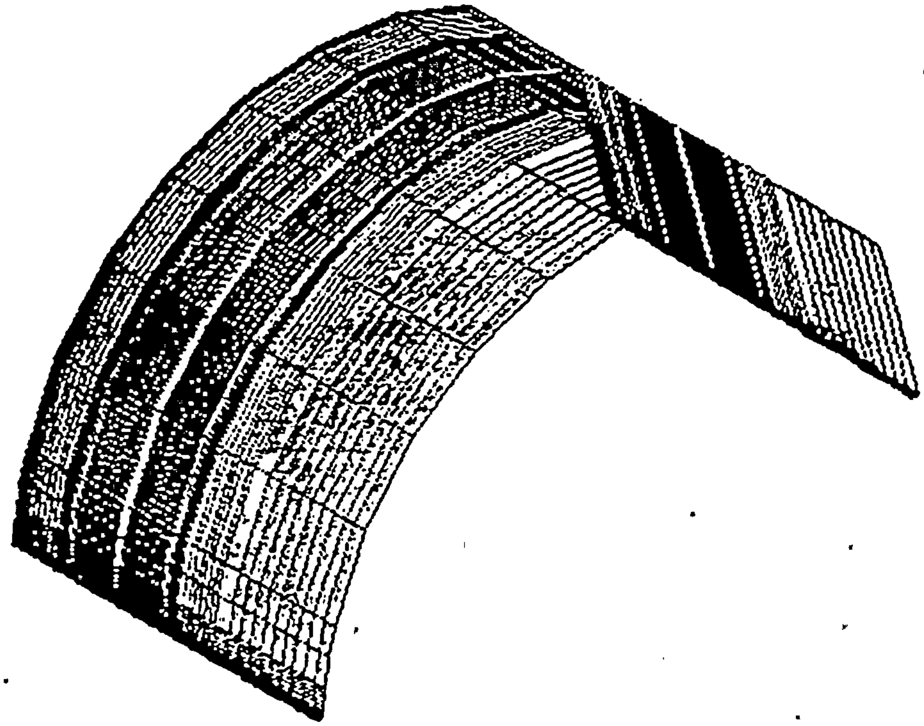
Weld V-9 UT Data

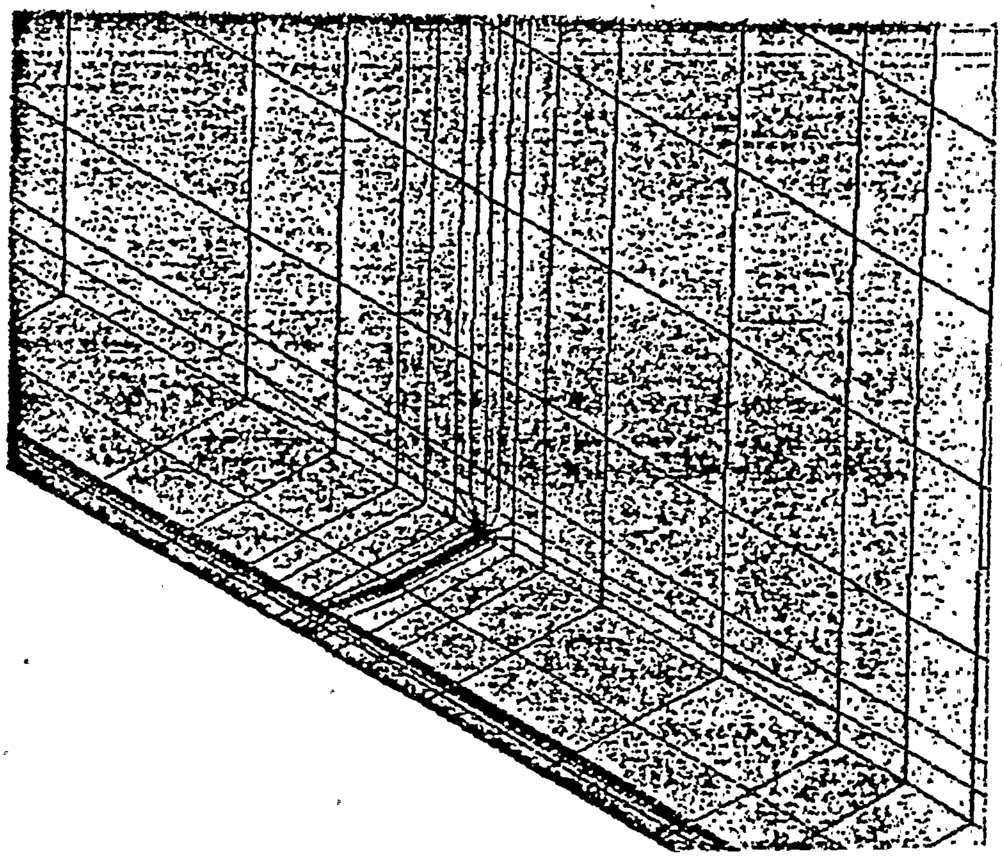


V-9 and V-10 Flaw Data Comparison

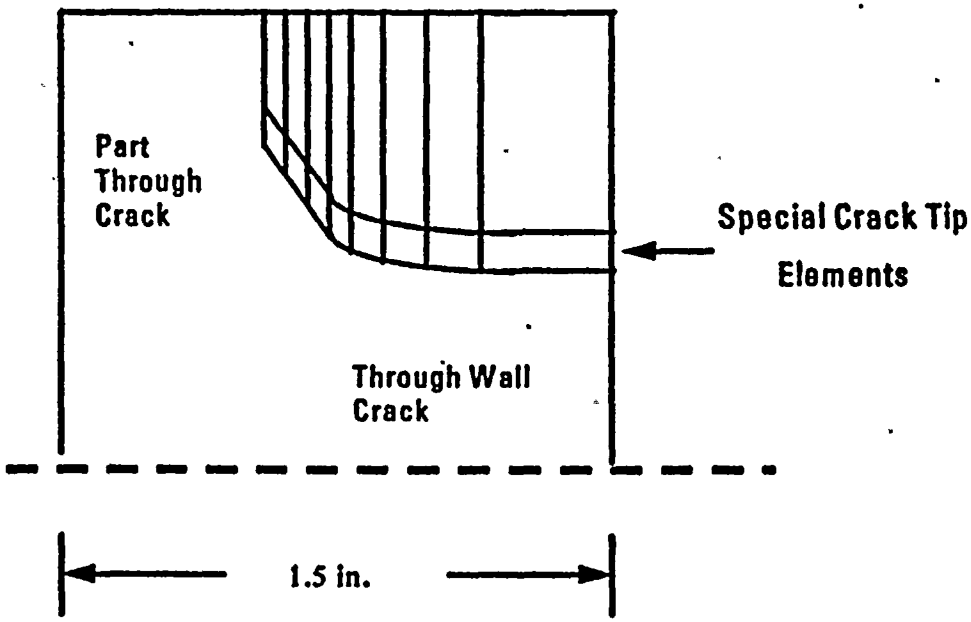


Finite Element Model of the Shroud

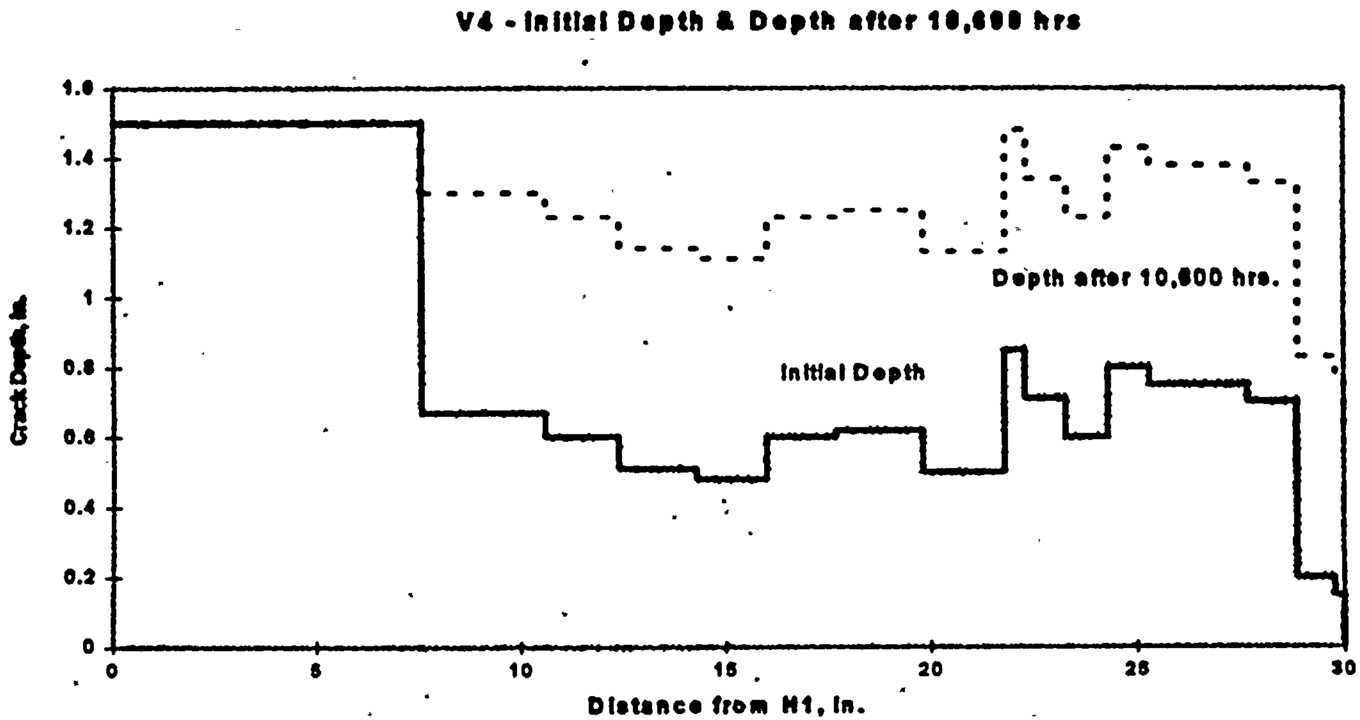




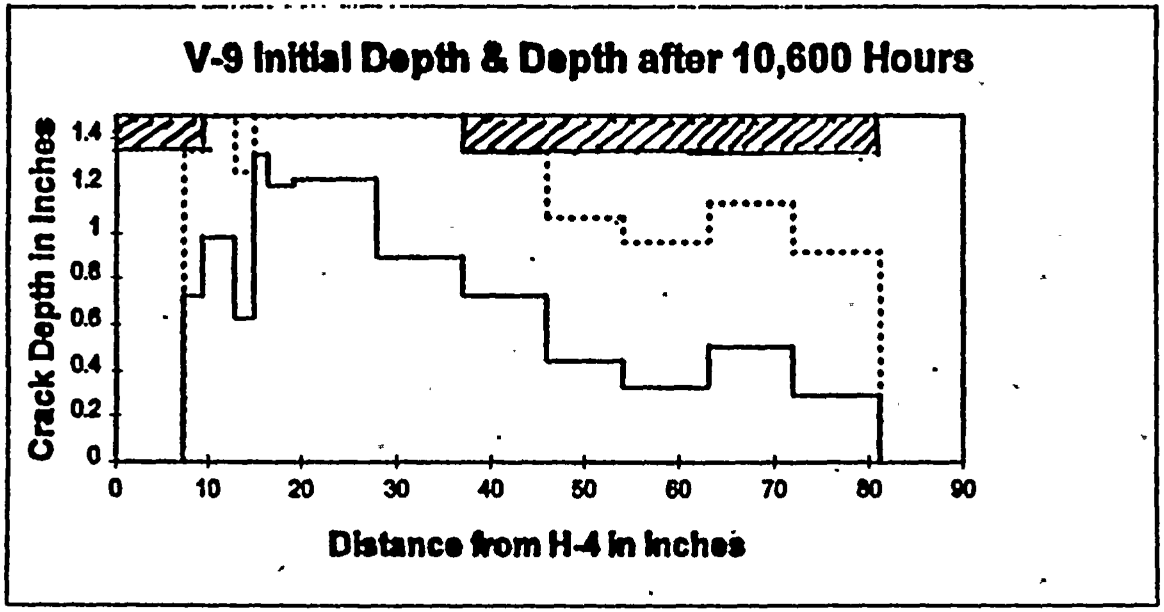
Details of the Crack Tip Element



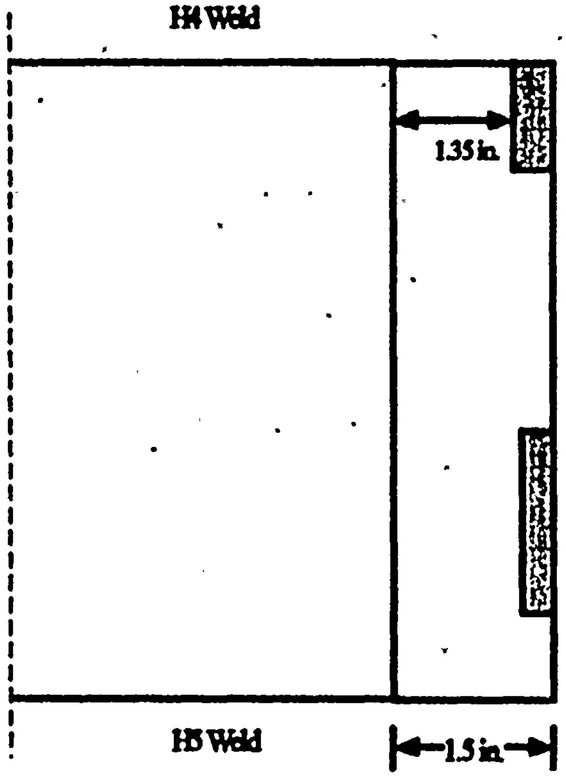
V-4 Depth and Depth after 10,600 hours

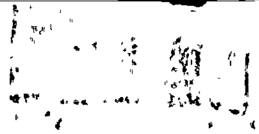


V-9 Depth and Depth after 10,600 hours



Idealized Compound Crack for V-9





ENCLOSURE

Figures, tables, and Appendix C from General Electric Nuclear Energy Document GE-NE-B13-01869-043, Revision 0.

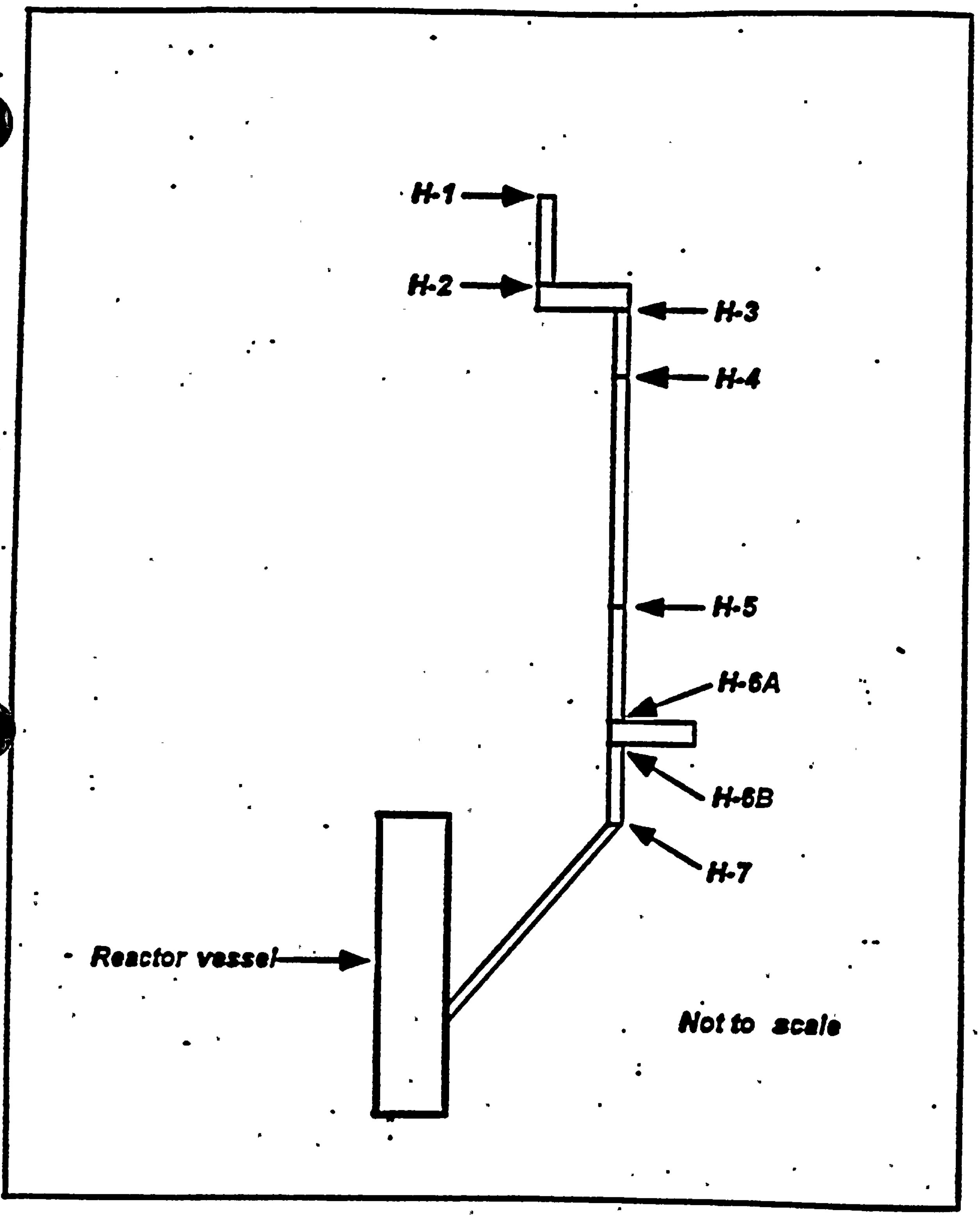


Figure 1-1 NMP1 Shroud Weld Locations, Cross Sectional View

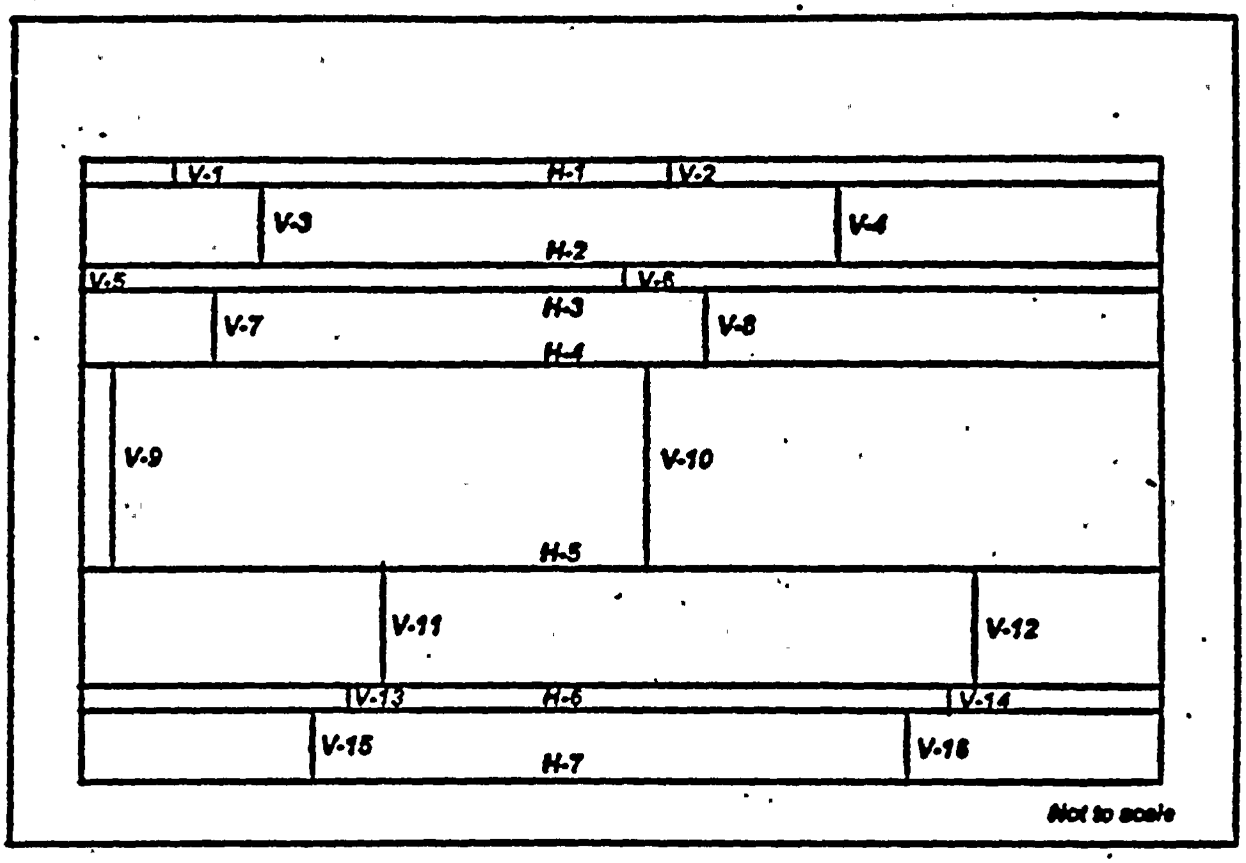


Figure 1-2 NMP1 Shroud Weld Locations

Table 2-2
Summary of Recent Shroud Vertical Weld Inspections (RFO 14)

Weld	Weld Length (in)	Inspection Coverage*	Shroud ID/OD	Exam Type	Flaw Length
V-3	31.25	15" Left 15" Right	OD	UT	1.5" ID, Right HAZ 0.8" OD, Right HAZ
V-4	31.25	22" Left 11" Right	OD	UT	22"ID Left HAZ, 1.5"ID Right HAZ
V-5 ring		Not located	NA	NA	NA
V-6 ring		Not located	NA	NA	NA
V-7	18.5	9" Left 11" Right	OD	UT	No Indications
V-8	18.5	5.5" Left 9.5" Right	OD	UT	No Indications
V-9 shell	90.12	100%	ID and OD	EVT-1	Indications on over 90% OD right HAZ Minor cracking on OD left side and on ID both sides
		80"	OD	UT	Numerous indications on OD, Left HAZ Two minor flaws on ID, Right HAZ
V-10	90.12	100%	ID and OD	EVT-1	Cracking on OD, Right HAZ Cracking on ID, Left and Right HAZ
		84"	OD	UT	Flaws detected on > 80% on OD, Right HAZ Flaws detected on > 10% on OD, Left HAZ
V-11	63.5	100% OD 50% ID	ID and OD	EVT-1	No Indications
V-12	63.5	100% OD 50% ID	ID and OD	EVT-1	6" OD, Right HAZ
V-15	22.13	11" Left 11" Right	OD	UT	6" ID, Left HAZ 2.2" ID, Right HAZ
V-16	22.13	100%	OD	EVT-1	.75" OD, Left HAZ
		10.5" Left 20" Right	OD	UT	5" ID Left HAZ 4" ID Right HAZ 3" ID Left HAZ from right side exam

* The inspected regions indicated on each side of the weld are not necessarily coincident, hence the integrated inspection coverage may be less than indicated, but has been taken into account in determining the uncracked ligament length.

Appendix C
Shroud Inspection Summary

The following is a weld by weld summary detailing the scope of inspections and results of the shroud examinations performed to date.

Weld V-3

Performed ultrasonic examination of approximately 15 inches of each side of the weld from the shroud OD surface. Approximately 1.5" of flaw was detected on the ID surface and 0.8" of flaw on the OD surface.

Weld V-4

Performed ultrasonic examination of approximately 11" of the left HAZ and 22" of the right HAZ. ID flaws were detected over the entire examined length of the left HAZ and 1.5" of flaw was detected on the ID of the right HAZ.

Weld V-7

Performed ultrasonic examination of approximately 9" of the left HAZ and 11" of the right HAZ. No flaws were detected during the examination..

Weld V-8

Performed ultrasonic examination of approximately 5.5" of the left HAZ and 9.5" of the right HAZ. No flaws were detected during the examination.

Weld V-9

Performed ultrasonic examination from the shroud OD surface for approximately the entire length of both the left and right HAZs as well as EVT from both the ID and the OD. Visual cracking was detected over greater than 90% of the right HAZ on the OD and minimal cracking was detected on the ID in both the left an right HAZs. Minor cracking was also detected on the OD in the left HAZ. The cracks detected visually on the shroud ID surface were found to be predominantly transverse to the weld whereas the cracking detected visually on the shroud OD surface was mostly parallel to the weld with components that branched transverse to the weld. Ultrasonic examinations of essentially the entire length of the weld was performed from the shroud OD surface and detected numerous flaws over the length of the left HAZ emanating from the shroud OD surface. Two small flaws on the ID surface were detected in the right HAZ.

Weld V-10

Performed ultrasonic examination from the shroud OD surface for approximately the entire length of both the left and right HAZs as well as EVT from both the ID and the OD. Flaws were detected on greater than 80% of the right HAZ on the OD surface and greater than 50% of the left HAZ revealed flaws on the OD surface. The EVT examination revealed cracking in the left and right

HAZs on the OD surface for most of the length of the weld and on the ID in both the left and right HAZs. The cracks detected visually on the shroud ID surface were found to be predominantly transverse to the weld whereas the cracking detected visually on the shroud OD surface was mostly parallel to the weld with components that branched transverse to the weld.

Weld V-11

EVT examinations were performed on the accessible weld length from both the ID and the OD of both the left and right HAZs. No cracking was detected during the examination.

Weld V-12

EVT examinations were performed on the accessible weld length from both the ID and the OD of both the left and right HAZs. One 6" crack was detected on the length OD surface in the right HAZ. No other cracking was detected.

Weld V-15

Ultrasonic examination was performed from the shroud OD surface on approximately 11 inches of both the left and right HAZs. One 6" flaw was detected in the left HAZ on the ID surface and several ID flaws totaling 2.2" in total length was detected on the ID in the right HAZ. No flaw detected in either HAZ was greater than 10% through wall.

Weld V-16

Ultrasonic examination was perfotmed from the shroud OD surface of approximately 10.5" of left HAZ. Two flaws were detected on the ID surface. One flaw was 5" in length, 10% through wall. The other ID flaw in the left HAZ was detected from the scan on the right HAZ and was 3" long and 30% through wall. Approximately 22 inches of the right HAZ was examine from the shroud OD surface. One flaw was detected on the ID which measured 4" in length and 21% through wall. An EVT examination of both HAZs from the shroud OD surface revealed one crack in the left HAZ.

Recent Inspection Results for Shroud Horizontal Welds

In addition to the shroud vertical weld inspections, the horizontal welds H-2, H-4, H-5, H-6a, H-6b, and H-7 were also inspected for analytical purposes, to evaluate the overall integrity of the shroud using assumptions of worst case cracking of the vertical welds.

Weld H-2

Ultrasonic examination was performed from the shroud OD surface of approximately 24 inches of the upper HAZ adjacent to weld V-4. Approximately 7 inches of intermittent flaws were detected on the OD surface, with the deepest area having a through wall depth of .22 inches.

Weld H-4

Ultrasonic examination from the shroud OD surface was performed on approximately 60% of the lower HAZ. ID and/or OD flaws were detected intermittently throughout the examination area. Some ID flaws were detected in the upper HAZ. Approximately 32 inches of the upper HAZ was ultrasonically examined. 3 inches of shallow OD flaws were detected in the upper HAZ and one 6 inch long ID flaw was detected with the maximum through wall depth of .23 inches. . An EVT examination of the OD was performed of over 70% of the upper and lower HAZs. Cracks were detected in both the upper and lower HAZs.

Weld H-5

Ultrasonic examination from the shroud OD surface was performed on approximately 30% of the upper and lower HAZs. OD and ID flaws were detected in the upper HAZ only. No flaws were detected in the lower HAZ. EVT of approximately 60% of the shroud OD surface revealed cracks intermittently in both the upper and lower HAZs. Most of the flaws detected visually on the OD surface were oriented perpendicular to the weld. No flaws were detected in the upper HAZ at the intersections of welds V9 or V10.

Weld H-6A

Ultrasonic examination was performed on both the upper and lower HAZs of approximately 30% of the circumference from the shroud OD surface. Flaws were detected on the OD surface of the lower HAZ only. No flaws were detected in the upper HAZ or on the ID of either HAZ.

Weld H-6B

Ultrasonic examination was performed on both the upper and lower HAZs of approximately 30% of the circumference from the shroud OD surface. Flaws were detected on the OD surface of the upper HAZ only. No flaws were detected in the lower HAZ or on the ID of either HAZ.

Weld H-7

Ultrasonic examination was performed for the shroud OD surface on the upper HAZ on approximately 30% of the circumference. No flaws were detected during the examination.

Weld H-8

Ultrasonic examination was performed for the shroud OD surface on the lower HAZ on approximately 30% of the circumference. A flaw which was identified by UT during a prior

outage was located as well as one additional flaw in the same area. This flaw was ultrasonically sized to be of lesser through wall depth than in RFO13. A review of the previous data indicates that the previous sizing performed was very conservative. An EVT was performed on approximately 30% of the circumference from the shroud OD surface. Of the five small cracks visually detected during RFO13 only 1 was visible during this inspection. The inspection in the area of the other four was hampered by the placement of a Tie Rod support which prevented a good EVT inspection. Cracks were visually detected in three new locations in the upper HAZ. The largest of these cracks (9"-12") is located predominantly in the ring segment Upper HAZ and runs into the weld toe and back into the ring segment.

Weld H-9

An EVT examination was performed in one area 26 inches long. No indications were noted during the examination.

Table 5-2
Allowable Flaw Sizes for the Nine Mile Point Unit 1
Shroud Vertical Welds

(1) Weld ID	(2) Weld Length, in	(3) Allowable Through wall crack length, in. LEFM	 Limit Load	(4) Minimum required ligament, in.	(5) Min. Ligament including crack growth (two years) and Inspection Uncertainty, in. (Note 1)	(6) Available Equivalent Uncracked Ligament Length, in.
V-3, V-4	31.25	-	29.97	1.28	3.63	7.3 (V-3) Note 2 (V-4)
V-7, V-8	18.50	18.3	17.78	0.72	3.07	9.0 (V-7) 5.6 (V-8)
V-9, V-10	90.12	75.40	86.61	14.72	17.07	Note 2 (V-9) Note 2 (V-10)
V-11, V-12	63.50	58.20	61.03	5.30	9.30 Note 3	31.75 (V-11) 25.75 (V-12)
V-15, V-16	22.13	-	19.53	2.46	4.81	Note 4 (V-15) 5.5 (V-16)

Notes

1. Based on crack growth of 1.6 in. and UT inspection uncertainty of 2 x 0.375 inch at each crack tip for length sizing.
2. Meets requirements based on further evaluation reported in Subsection 5.3.
3. The minimum ligament for EVT inspection is larger to account for greater uncertainty in the visual inspection. The uncertainty factor applied is equal to 2 x 1.2 in.
4. The equivalent length after subtracting crack growth and inspection uncertainty is 2.89 in. which is greater than the required ligament of 2.46 in. and thus acceptable.

Rec'd DRP2 5/5/97

Bagwa/Hood

ACTION

EDO Principal Correspondence Control

FROM: DUE: 05/16/97 EDO CONTROL: G970319
DOC DT: 04/20/97
FINAL REPLY:

Michael J. Bragman
State of New York (Albany)

TO:

Chairman Jackson

FOR SIGNATURE OF : ** GRN ** CRC NO: 97-0407

Office Director

DESC:

CRACKED SHROUD AT NIAGARA MOHAWK'S NINE MILE ONE NUCLEAR REACTOR (Michael Slee/Sandra J. Weston)

ROUTING:

Callan
Jordan
Thompson
Norry
Blaha
Burns
Miller, RI

DATE: 05/02/97

ASSIGNED TO: NRR

CONTACT: Collins

SPECIAL INSTRUCTIONS OR REMARKS:

NRR RECEIVED: MAY 2, 1997
NRR ACTION: DRPE:VARGA

NRR ROUTING: COLLINS
MIRAGLIA
ZIMMERMAN
MARTIN
SLOSSON
TRAVERS
BOHRER

ACTION

DUE TO NRR DIRECTOR'S OFFICE

BY May 13, '97

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

PAPER NUMBER: CRC-97-0407 LOGGING DATE: Apr 30 97

ACTION OFFICE: EDO

AUTHOR: MICHAEL J. BRAGMAN
AFFILIATION: NEW YORK

ADDRESSEE: CHAIRMAN JACKSON

LETTER DATE: Apr 20 97 FILE CODE: IDR-5 NINE MILE POINT

SUBJECT: NIAGARA MOHAWK'S NINE MILE ONE NUCLEAR REACTOR

ACTION: Direct Reply

DISTRIBUTION: CHAIRMAN

SPECIAL HANDLING: SECY TO ACK

CONSTITUENT:

NOTES:

DATE DUE: May 16 97

SIGNATURE: DATE SIGNED:
AFFILIATION:

EDO -- G970318

MICHAEL J. BRAGMAN
MAJORITY LEADER

THE ASSEMBLY
STATE OF NEW YORK
ALBANY

District Office
305 South Main Street
North Syracuse, New York 13212
(315) 452-1044

Room 926
Legislative Office Building
Albany, New York 12248
(518) 455-4567

Room 436
Capitol Building
Albany, New York 12224
(518) 455-4225

April 20, 1997

Shirley A. Jackson
Chairwoman
United States Nuclear
Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852-2738

Dear Shirley:

I have enclosed copies of two recent letters that I have received from Michael Slee, 21 Lower Road, Constantia, New York 13044 and Sandra J. Weston, ESDW AC for Environmental Concerns, Inc., 819 West Third Street South, Fulton, New York 13069-3200. These letters, relative to concerns regarding the cracked shroud at Niagara Mohawk's Nine Mile One nuclear reactor, are self-explanatory.

Would you please review this matter and provide me with your comments and recommendations. Subsequent to receiving your response, I will be able to determine what further action on my part is necessary and appropriate.

Thank you for your anticipated cooperation.

Best wishes,

Very truly yours,

Michael J. Bragman
Majority Leader

MJB/kev

Enclosures

cc: Michael Slee
Sandra J. Weston

ESDWAG for Environmental Concerns, Inc.

FAX Transmission

From:	Sandra J. Weston	Date:	April 9, 1997
To:	Honorable Michael Bragman	Time:	4:10 PM
Company:	Assembly Majority Leader	FAX #:	(315) 452-0872

Message:

Residents of Oswego County are very concerned about the Cracked Core Shroud at Nine Mile Point Unit 1. It is our belief that the reactor should not be restarted without total replacement of the core shroud.

We are not only concerned about the health and safety of county residents but a valuable and irreplaceable natural resource, Lake Ontario, which adds an economic factor to consider.

We would like to suggest that experts not affiliated with Niagara Mohawk, nor company employees, inspect and evaluate the plant.

VOICE: (315) 592-9731 FAX: (315) 592-9731 EMail: SWeston724@aol.com

919 West [illegible] Street [illegible] Fulton, New York 13069-3220

On April 17 1997, the NRC will make a decision on allowing
Niagara Mowhawk Power Authority to re start the reactor at
Nine Mile One in the town of Scriba NY.
Niagara Mowhawk maintains, that cracks in a shroud around
the reactor, will not get any worse for at least [2] years,
and wants to re start it with out making any kind of repairs.
The Nuclear Information and Resource Group, maintain,
that the shroud must be replaced be fore the reactor is restarted.
As a resident of Oswego County ware the reactor is located,
I find it very distressing that the main meeting with Ni Mo
is to be held in Maryland? Why there?
Why don't they want it held locally, so the residents can voice,
their opinions and concerns?
Its clear that they are trying to do a restart on a dangerous
unit and at the same time, white wash it in the eyes of the
public.
They are looking at the dollar side of this, instead of the
impact of what may happen if this animal blows and poisons
New York State and who knows ware else.
I ask you to please take a stand with us in insisting that
the repairs be done safely and properly. This is your state also
Thank You
sincerely

Michael Slee

Michael Slee
21 Lower Road
Constantia, NY 13044