APR 0 8 1992

Official Copy

Docket Nos. 50-327, 50-328
License Nos. DPR-77, DPR-79

Tennessee Valley Authority
ATTN: Dr. Mark O. Medford, Vice President
Nuclear Assurance, Licensing and Fuels
3B Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Gentlemen:

SUBJECT: MEETING SUMMARY - SEQUOYAH ICE CONDENSER AND FEEDWATER PIPE CRACKING

This refers to the meeting conducted at our request in the Region II office on April 3, 1992. The purpose of the meeting was for you to present the status of your corrective actions for: 1) the ice condenser door jamming, which was the subject of our Confirmation of Action Letter (CAL) dated March 23, 1992 and 2) feedwater pipe cracking problems. A summary of the meeting, a list of attendees and a copy of your handouts are enclosed.

It is our opinion that this meeting was beneficial to us in aiding our understanding of the issues and your corrective actions associated with them.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and its enclosures will be placed in the NRC Public Document Room.

Should you have any questions concerning this matter, please contact us.

Sincerely,

/s/ P. Kellogg

Bruce A. Wilson, Chief
Reactor Projects Branch 4
Division of Reactor Projects

Enclosures: (See page 2)

IE01

Enclosures:
1. Meeting Summary
2. List of Attendees
3. License Handouts

cc w/encls:
Mr. John B. Waters, Director
Tennessee Valley Authority
ET 12A
400 West Summit Hill Drive
Knoxville, TN 37902

TVA Representative
Tennessee Valley Authority
Rockville Office
11921 Rockville Pike
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Rockville, MD 20852

General Counsel
Tennessee Valley Authority
ET 11H
400 West Summit Hill Drive
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Mr. J. R. Bynum, Vice President
Nuclear Operations
Tennessee Valley Authority
5B Lookout Place
101 Market Street
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Ms. Marci Cooper, Site
Licensing Manager
Sequoyah Nuclear Plant
Tennessee Valley Authority
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Mr. Jack Wilson, Vice President
Sequoyah Nuclear Plant
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Mr. M. J. Burzynski, Manager
Nuclear Licensing and
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Tennessee Valley Authority
5B Lookout Place
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Mr. Michael H. Mobley, Director
Division of Radiological Health
T.E.R.R.A. Building 6th Floor
150 9th Avenue North
Nashville, TN 37219-5404

County Judge
Hamilton County Courthouse
Chattanooga, TN 37402

State of Tennessee

bcc w/encls: (See page 3)

APR 0 8 1992

Tennessee Valley Authority 3

bcc w/encls:
S. D. Ebneter, RII
L. A. Reyes, RII
J. R. Johnson, RII
G. C. Lainas, NRR
F. J. Hebdon, NRR
P. J Kellogg, RII
D. E. LaBarge, NRR
NRC Document Control Desk
J. Wechselberger, EDO
NRC Senior Resident Inspector
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2600 Igou Ferry
Soddy-Daisy, TN 37379

RII/DRP RII/DRP

PKellogg JJohnson
4/7/92 4/7/92

ENCLOSURE 1

MEETING SUMMARY

Ice Condenser Doors

The licensee presented the causes and corrective actions concerning the up lifting of the wear pads in the ice condenser bays which impeded the opening of the ice condenser doors by jamming a flashing piece up under the doors. This issue was first identified on Unit 2 and was subsequently found on Unit 1. The causes of the heaving of the wear pads were determined by the licensee to be 1) the absence of sealing around the edges of the wear pads, and 2) poor maintenance practices asscciated with the removal of ice following a defrost operation. The licensee installed a monitoring system in each bay with a remote readout outside containment to monitor the wear pads during operation to alert them of any further upward movement of the wear pads. An action criteria was established of 7/8ths of an inch upward movement where the licensee would take action to evaluate the operability of the doors. The licensee agreed during the meeting to keep the resident inspectors informed of any significant movement in the wear pads, and would perform an evaluation of that movement.

Feedwater Pipe Cracking

The licensee presented the causes and corrective actions for the feedwater pipe cracking identified during the Unit shutdown for ice condenser repairs. The licensee is replacing all eight feedwater nozzles and transition pieces (four per unit). The cause of the cracking was identified as thermal fatigue. The licensee's In Service Inspection (ISI) Program incorrectly identified the indications on previous inspections as previously identified geometry. The licensee explained their increased sampling program that was introduced to ensure that other indications were not incorrectly dispositioned as geometry. The licensee agreed to notify the NRC if additional indications of cracks were identified during this sampling program. Additionally, the licensee agreed to notify the NRC that all the applicable actions of NRC Bulletin 79-13 were reviewed and accomplished as necessary.

ENCLOSURE 2

LIST OF ATTENDEES

NRC

S. D. Ebneter, Regional Administrator, Region II, (RII)
L. A. Reyes, Director, Division of Reactor Projects (DRP), RII
B. A. Wilson, Chief, DRP Branch 4, RII
E. W. Merschoff, Deputy Director, Division of Reactor Safety (DRS), RII
G. C. Lainas, Associate Director, RII Reactors, Office of Nuclear Reactor Regulation (NRR)
F. J. Hebdon, Director, Project Directorate II-4, NRR
J. Zeiler, Resident Inspector, RII
G. A. Belisle, Chief, DRP Section 3A, RII
J. J. Blake, Chief, Materials and Process Section, DRS, RII
J. L. Coley, Reactor Inspector, RII
W. E. Holland, Senior Resident Inspector, RII
J. F. Wechselberger, Regional Coordinator, Office of Executive Director for Operations
P. J. Kellogg, Chief, DRP Section 4A, RII
W. Koo, Materials Engineer, NRR
D. Naujack, Metallurgist, NRR
H. Ashar, Senior Civil Engineer, NRR
J. J. Lenahan, Civil Engineer/Inspector, RII
C. Hsu, Mechanical Engineer, NRR

TVA

J. R. Bynum, Vice President, Nuclear Operations
M. O. Medford, Vice President, Nuclear Assurance, Licensing and Fuels
N. C. Kazanus, Vice President Completion Assurance
J. L. Wilson, Vice President, Sequoyah
R. J. Beeken, Plant Manager
M. Cooper, Site Licensing Manager
T. Flippo, Site Quality Manager
P. G. Trudel, Engineering Manager
H. R. Rogers, Technical Support Manager
D. L. Lundy, Site Engineering
L. A. Budlong, Nuclear Engineer, Stone and Webster Engineering Company (SWEC)
D. F. Cortehaus, Outage Support Manager
G. V. Rad, Senior Materials Engineer, Westinghouse (W)
P. V. Guthrie, Jr., Corporate Engineering Manager
C. Scrabis, Engineer, W
A. Y. Wong, Chief Engineer, SWEC
R. Bryan, Manager, NSSS and Analysis
M. L. Turnbow, Inspection Services Manager
S. M. Walker, Piping Inspection Manager, EPRI NDE Center

ENCLOSURE 3

TVA/NRC MANAGEMENT MEETING

APRIL 3, 1992

ICE CONDENSER FLOOR ISSUE

ICE CONDENSER FLOOR ISSUE

AGENDA

I. SEQUENCE OF EVENTS LEADING TO DISCOVERY

II. ICE CONDENSER FLOOR DESIGN

III. AS FOUND CONDITIONS

IV. INVESTIGATION ACTIONS

V. CAUSE OF CONDITION

VI. ACTIONS TAKEN AND PLANNED

VII. CONCLUSIONS

I. SEQUENCE OF EVENTS LEADING TO DISCOVERY

March 13	Unit 2 Enters Cycle 5 Refueling Outage
March 15	Maintenance Foremen Identify Difficulty in Opening Some Doors
March 16 1400 EST	Tech Support Performs Walkdown
March 17 1330 EST	Tech Support and Nuclear Engineering Perform Inspection; Floor Cracking Identified and Inspected; Frost Upheaval of Wear Slab Noted; PER Initiated
	Plant Management Notified Following Evaluation of Unit 2 Ice Condenser Condition
1745 EST	NRC Notified of Unit 2 Ice Condenser Condition
	Planning Initiated for Unit 1 Ice Condenser Inspection

I. SEQUENCE OF EVENTS LEADING TO DISCOVERY (cont'd)

March 18	Detailed Inspection Plan Developed; Including Unit 2 Mock-Up Walk-Thru
2000 EST	Tech Support and Nuclear Engineering Perform 'At Power' Inspection of Unit 1 Ice Condenser; Similar Conditions Noted; 11 of 48 Doors Declared Inoperable
2048 EST	LCO 3.6.5.3 Entered
2143 EST	NRC Notified of Unit 1 Ice Condenser Problem
2210 EST	Unit 1 Shutdown Initiated as Prudent Action
2245 EST	NRC Notified of Unit 1 Shutdown
March 19 0247 EST	Unit 1 Entered Hot Standby

II. ICE CONDENSER FLOOR DESIGN

- Floor Assembly Detail

  - Structural Slab
  - Foam Concrete
  - Vapor Barrier
  - Grout Layer
  - Steel Plate With Glycol Piping
  - Wear Slab
  - Floor Drain

III. AS FOUND CONDITIONS

- 27 of 48 Doors Difficult to Open on Unit 2
- 11 of 48 Doors Difficult to Open on Unit 1
- Wear Slab Raised Small Amounts up to 2-3 Inches
- Wear Slab Cracking Noted Near Points of Rigid Restraint
- Turning Vanes in Contact With Wear Slab in Some Bays
- Drains Separated From Wear Slab in Some Bays

IV. INVESTIGATION ACTIONS

- Perform Structural Walkdowns and Inspections
- Perform Mapping of Wear Slab Configuration
- Perform Structural Evaluation - TVA and Independent
- Consult Westinghouse Ice Condenser Specialist
- Review of Initial Design and Construction
- Review of Maintenance Practices
- Monitoring for Immediate Changes

V. CAUSE OF CONDITION

Direct Cause: Intrusion of Water Beneath Wear Slab Resulting in Frost Upheaval Over Time

Root:

- Construction
  - Lack of Sealant at Some Joints
  - Vapor Barrier Extends Thru Sealant at Some Joints

- Field Design Changes
  - Omission of Expansion Joint
  - Deletion of Flashing at Crane Wall

Contributor:

- Maintenance Activities
  - Cleaning
  - Defrosting

V. CAUSE OF CONDITION (cont'd)

Comparison of Other Ice Condenser Plants

Design

- Common
  - Expansion Joint Seal Detail
  - Wear Slab Coating
  - Door Flashing

- Different
  - Drain Detail (Fiberglass vs Steel)
  - Crane Wall Flashing (Only Cook)

Construction

- No Known Difference

V. CAUSE OF CONDITION (cont'd)

Maintenance

- Common
  - Sequoyah And Cook Floor Defrost
- Different
  - Catawba And McGuire Do Not Floor Defrost
  - Sequoyah Has More Frequent And Longer Defrosts
  - Other Plants Actively Pursue Removing Water Accumulation

VI. ACTIONS TAKEN AND PLANNED

Unit 1 Actions

- Temporary Alterations to Door Flashing and Seal
  - Lower Section of Sheetmetal Flashing Removed
  - Insulation Bags Replaced With Strip Insulation
- Tech Spec 'Pull-Test' Performed on Doors
- On Line Monitoring Plan Established
  - Displacement Transducers Installed in Each Bay
  - Ice Condenser Camera Available for Visual Inspection
  - Lower Plenum Entry Plan Available as Backup Method
- Operational Guidance Established
- Structural Evaluation Completed - Functionality Maintained

VI. ACTIONS TAKEN AND PLANNED (cont'd)

Structural Evaluation Details

- Detailed Walkdowns and Inspections Conducted, Including Boroscope
- No Apparent Cracking or Areas of Obvious Distress on Structural Slab
- Turning Vanes Inspected for Contact With Wear Slab, Bolting Deformation, and Wear Slab Cracking at Points of Contact
- Minimal Additional Downward Loading Impact on Structural Slab
- Minimal Additional Dead Weight Impact From Water/Ice Beneath Wear Slab
- Wear Slab Position Will be Maintained During Seismic Event
- No Indications of Corrosion at Steel Containment Vessel Interface

VI. ACTIONS TAKEN AND PLANNED (cont'd)

Unit 2 Actions

- Unit 2 Design Changes
  - Door Seals
  - Drains
  - Floor Seals
- Complete Structural Evaluation
- Changes to Outage Maintenance Practices
  - Minimize Water Generation
  - Minimize Water Exposure
  - Enhanced Surveillance Scheduling
- On Line Monitoring Plan Established

VI. ACTIONS TAKEN AND PLANNED (cont'd)

Longer Term Actions For Both Units

- Continued Monitoring
- Evaluate Effectiveness of Corrective Actions
- Submit TS Change

VII. CONCLUSIONS

- Condition Identified by Licensee Inspections
- Prudent Operational Decisions
- Condition Effects Evaluated and Bounded for Unit 1
  Acceptability and Monitoring Plan Established
- Design Changes and Repairs to be Implemented for Unit 2
- Independent Specialist Reviews
- Longer Term Evaluation of Effectiveness of Corrective Actions

OPENING TORQUE (in/lbs)	UNIFORM FORCE (lbs/ft^2)	POINT FORCE (lbs)*
675 (Tech Spec)	1.25	17
1620	3	41
2160	4	55
2700	5	68
10800	20	270

*40 inch moment arm

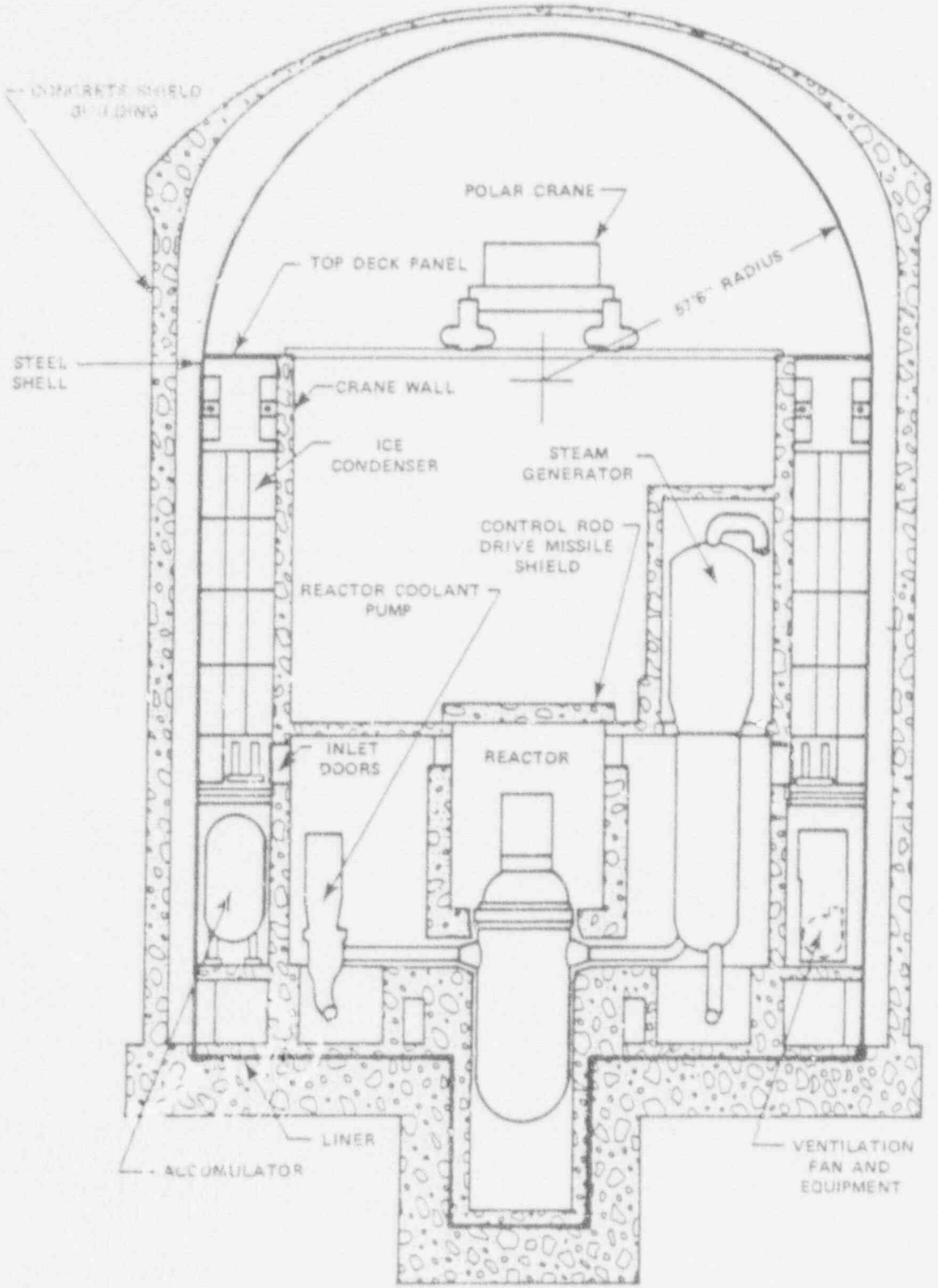

CONCRETE SHIELD BUILDING
POLAR CRANE
TOP DECK PANEL
57'6" RADIUS
STEEL SHELL
CRANE WALL
ICE CONDENSER
STEAM GENERATOR
CONTROL ROD DRIVE MISSILE SHIELD
REACTOR COOLANT PUMP
INLET DOORS
REACTOR
LINER
ACCUMULATOR
VENTILATION FAN AND EQUIPMENT

Figure 1

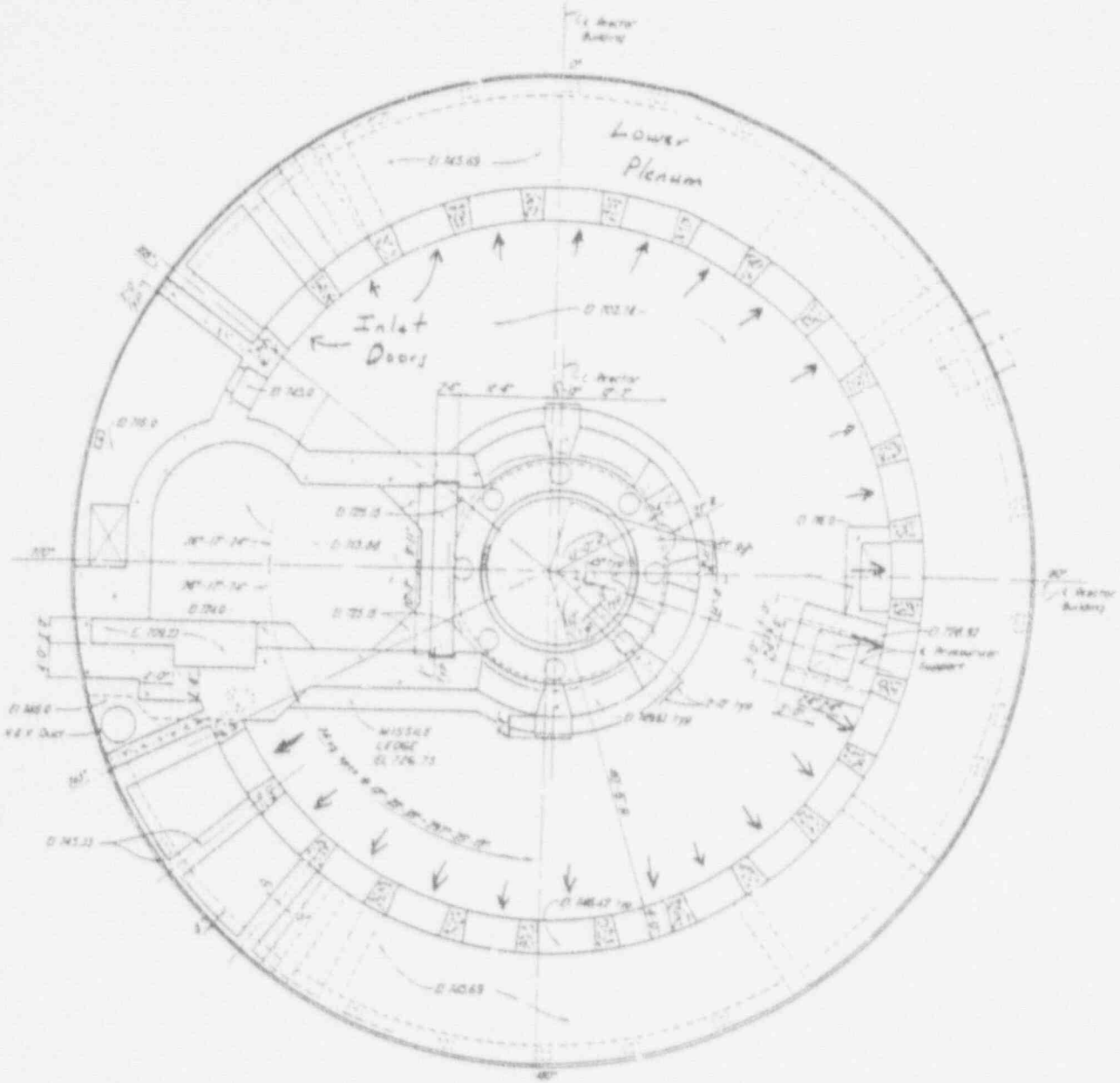


Figure 2

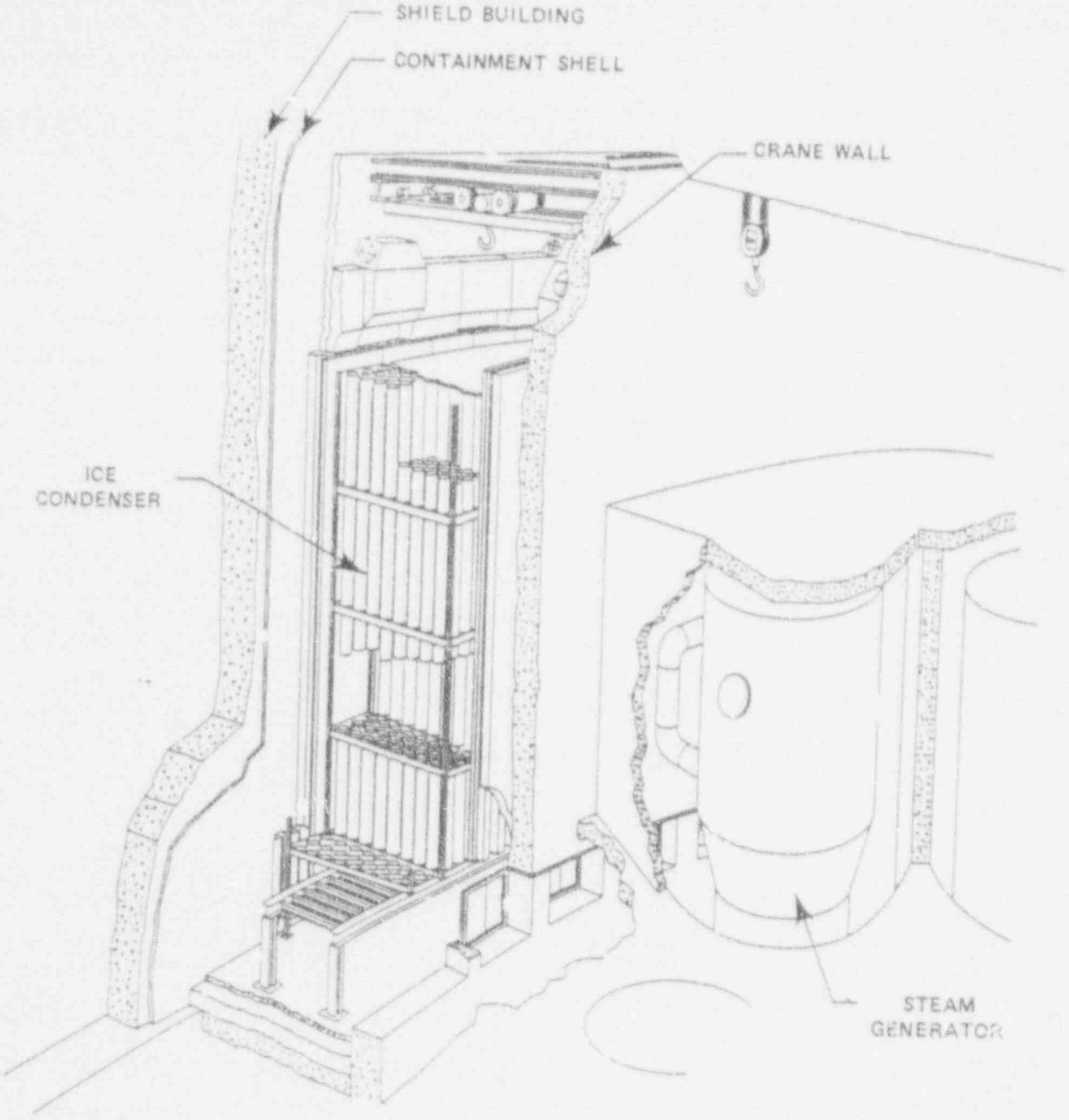
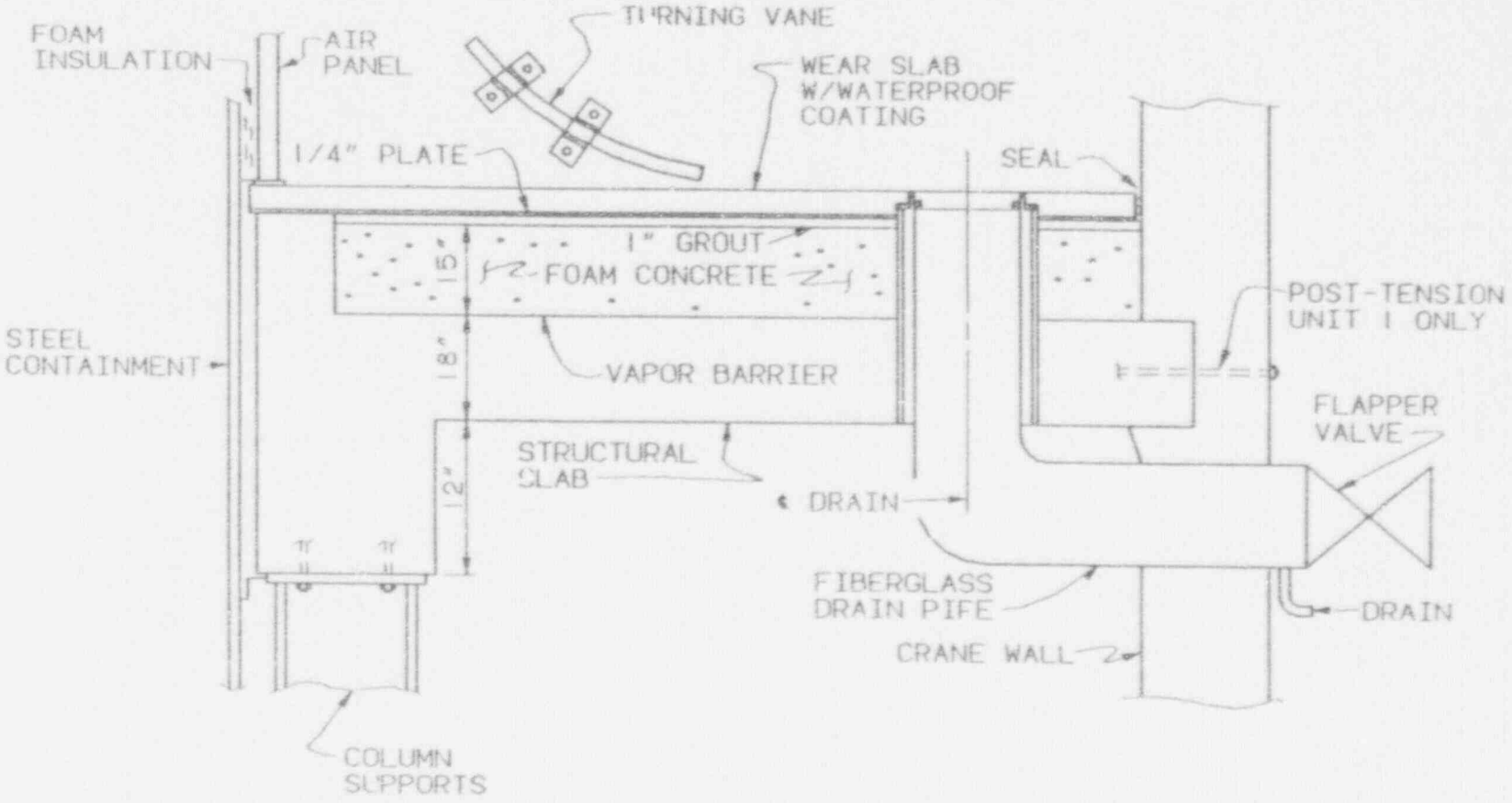
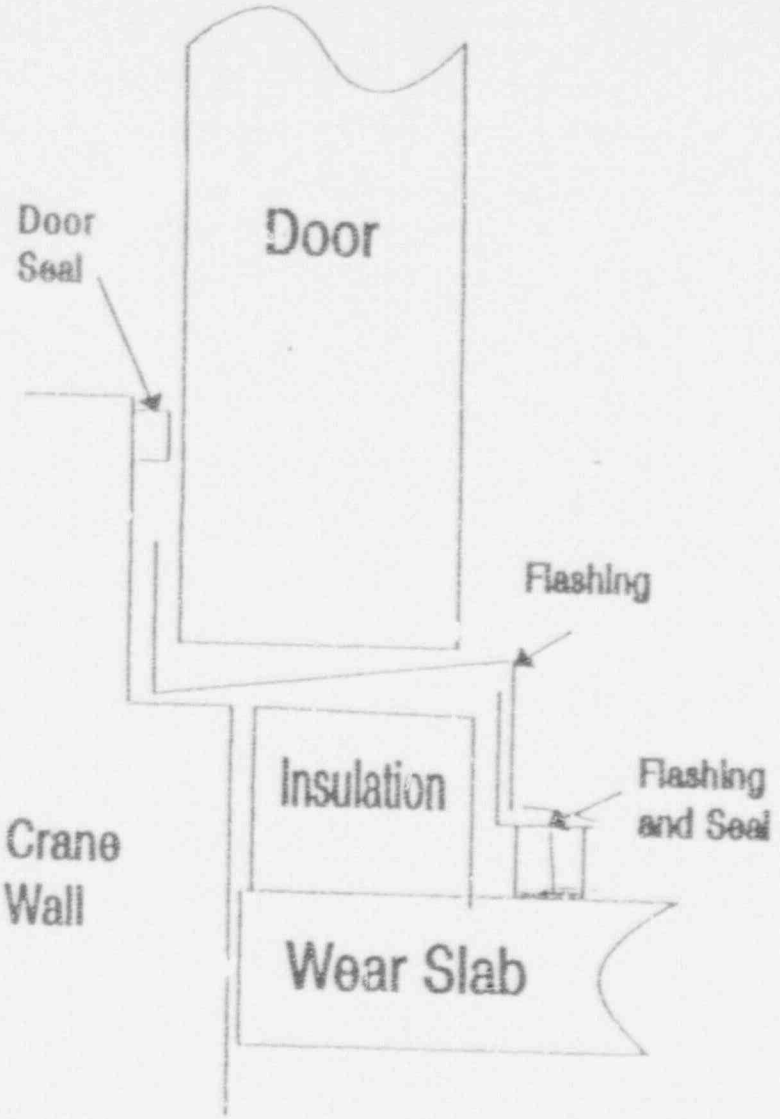

SHIELD BUILDING
CONTAINMENT SHELL
CRANE WALL
ICE
CONDENSER
STEAM
GENERATOR

Figure 3



ICE CONDENSER
FLOOR SLAB

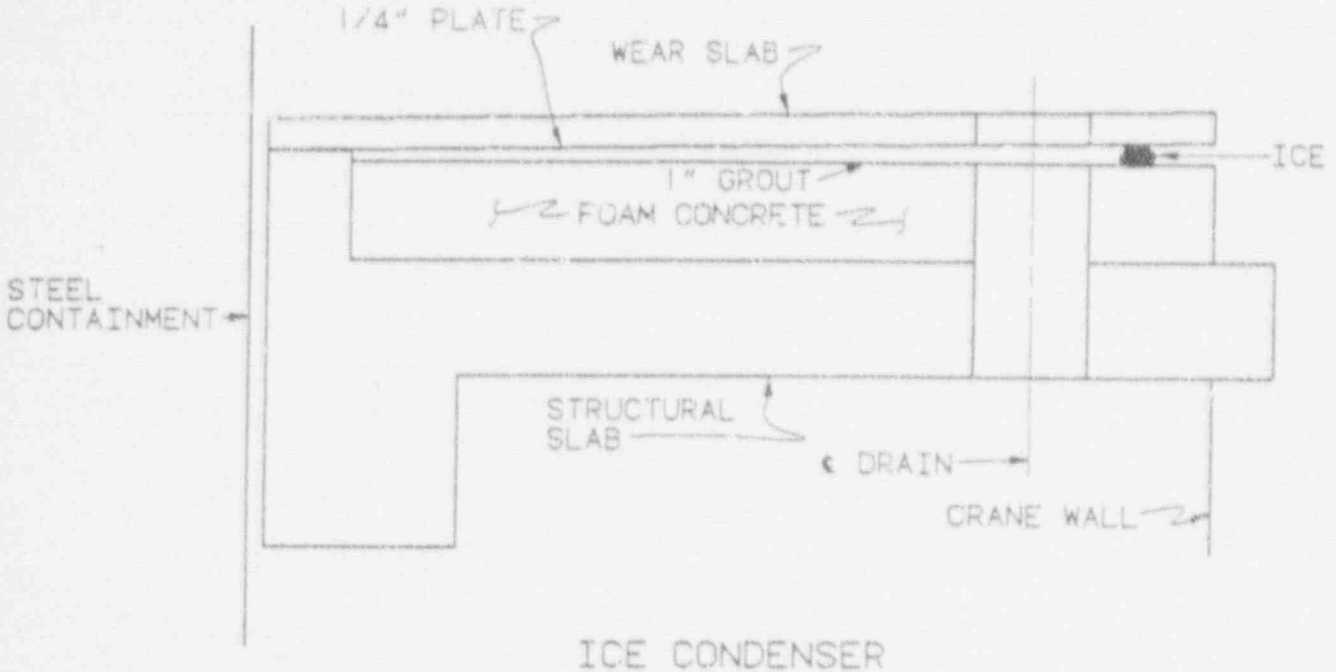
Figure 4



Ice Condenser Lower Inlet Door

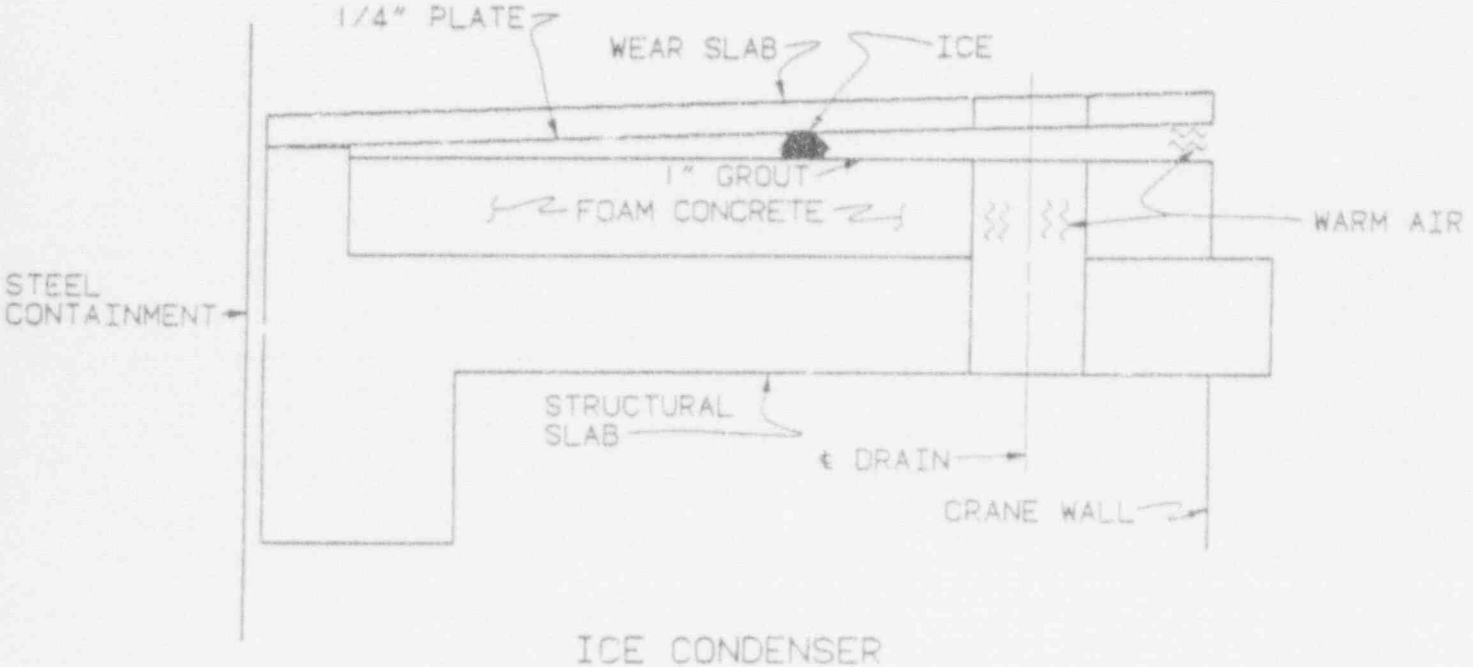
Figure 5

STAGE 1
INITIAL



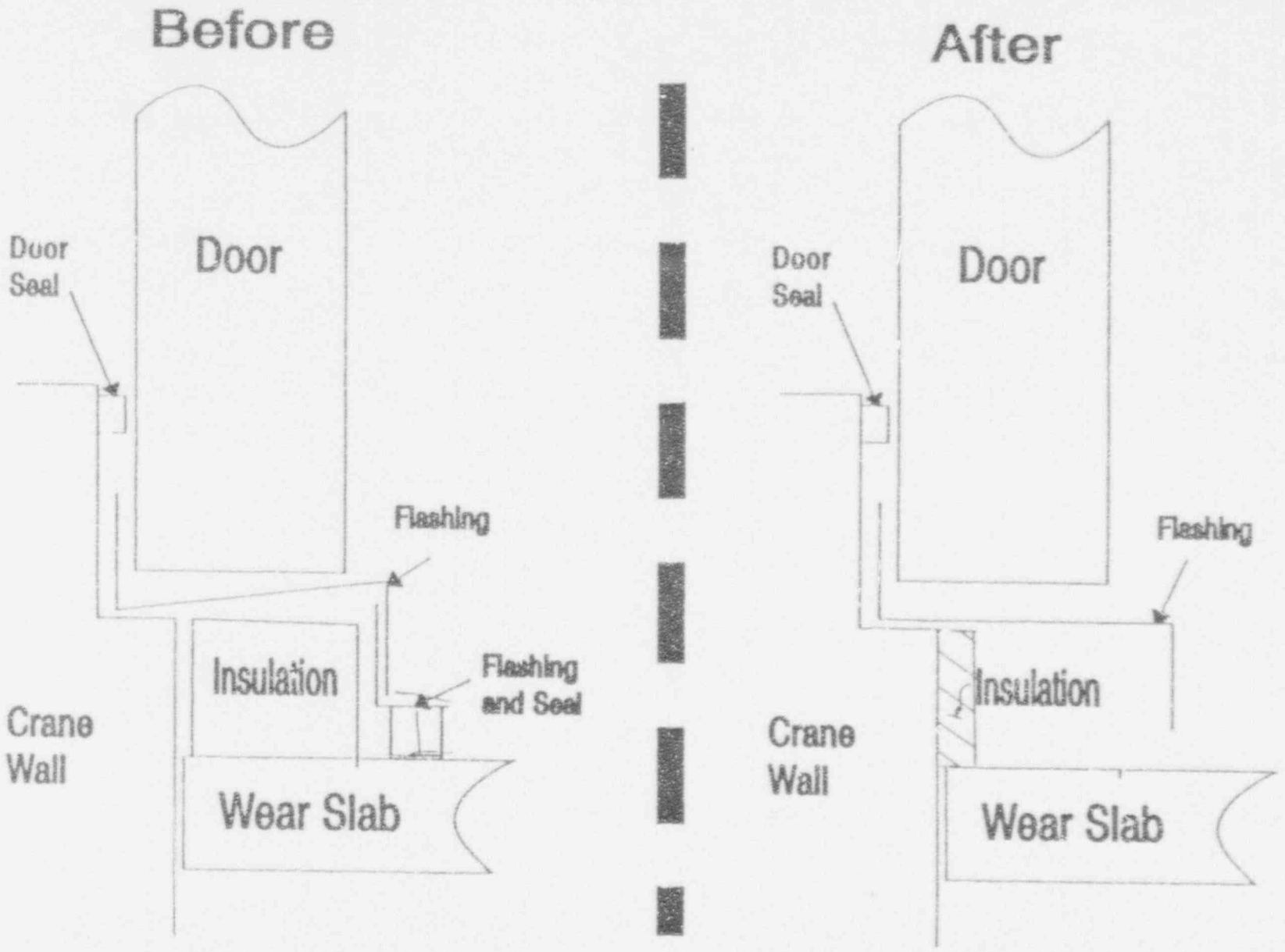
ICE CONDENSER
FLOOR SLAB

STAGE 2
CURRENT



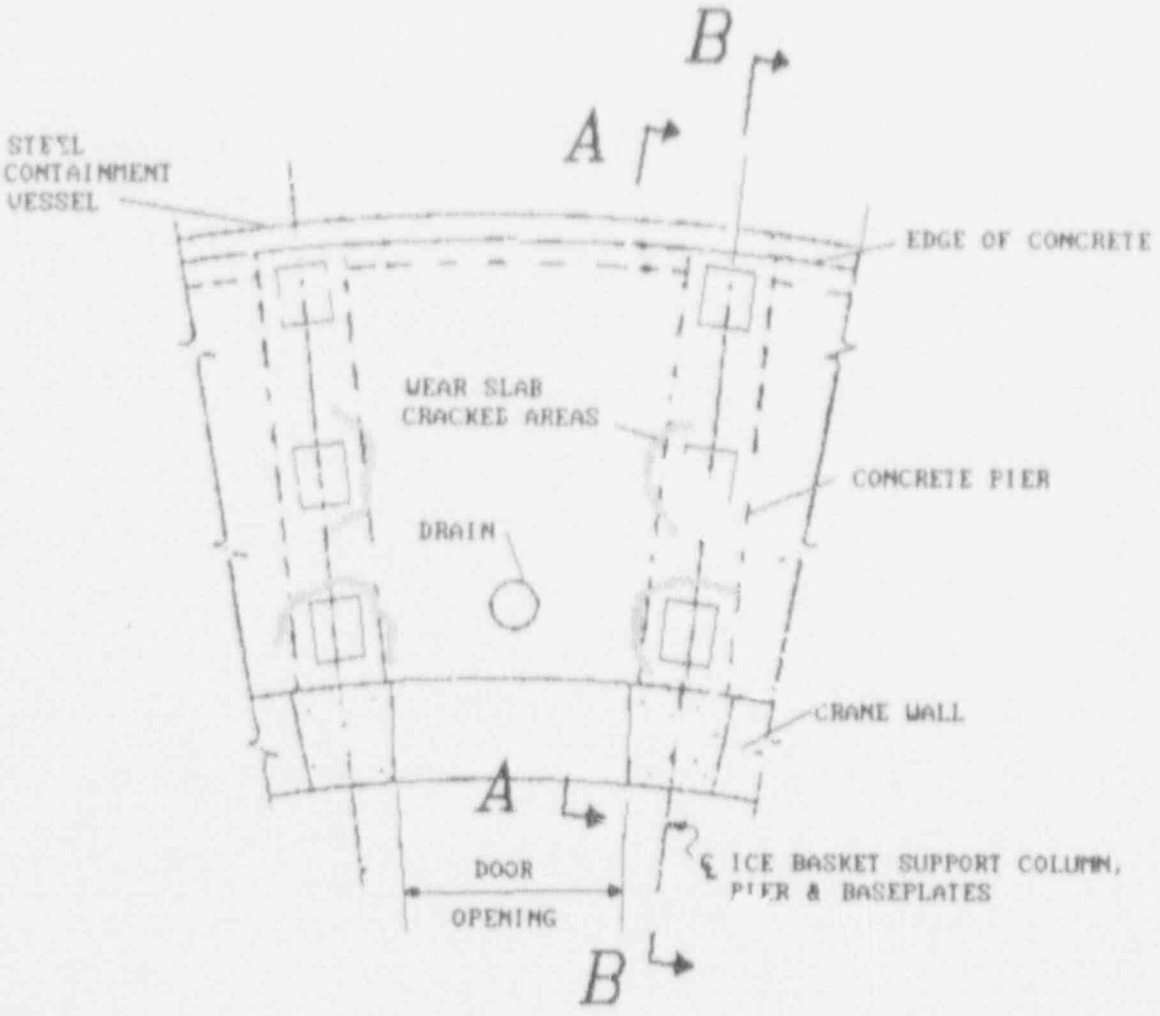
ICE CONDENSER
FLOOR SLAB

Figure 6



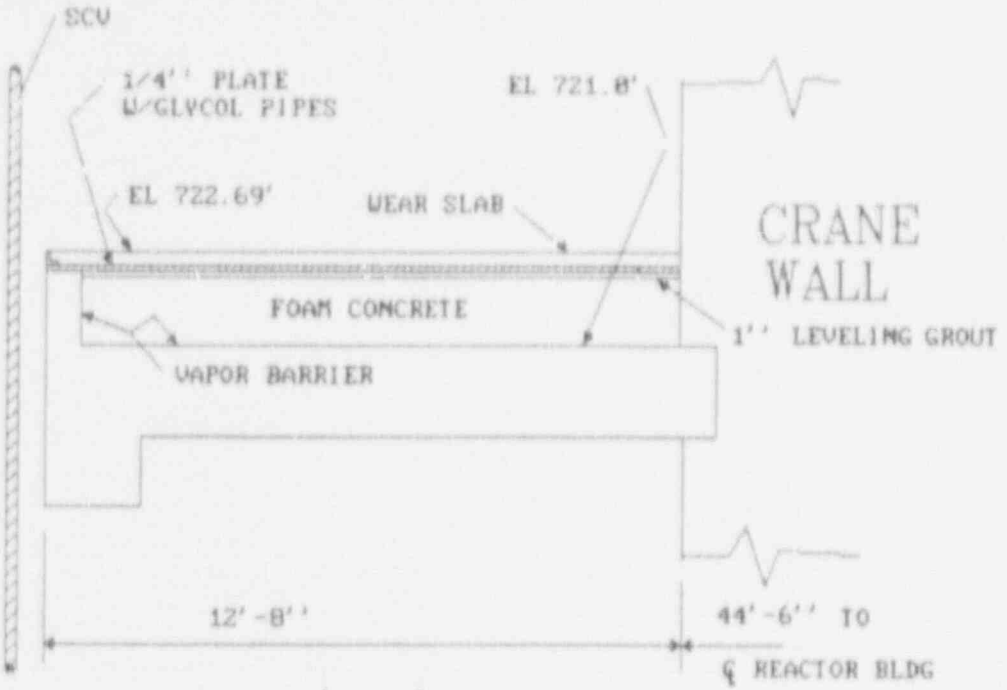
Ice Condenser Lower Inlet Door

Figure 7



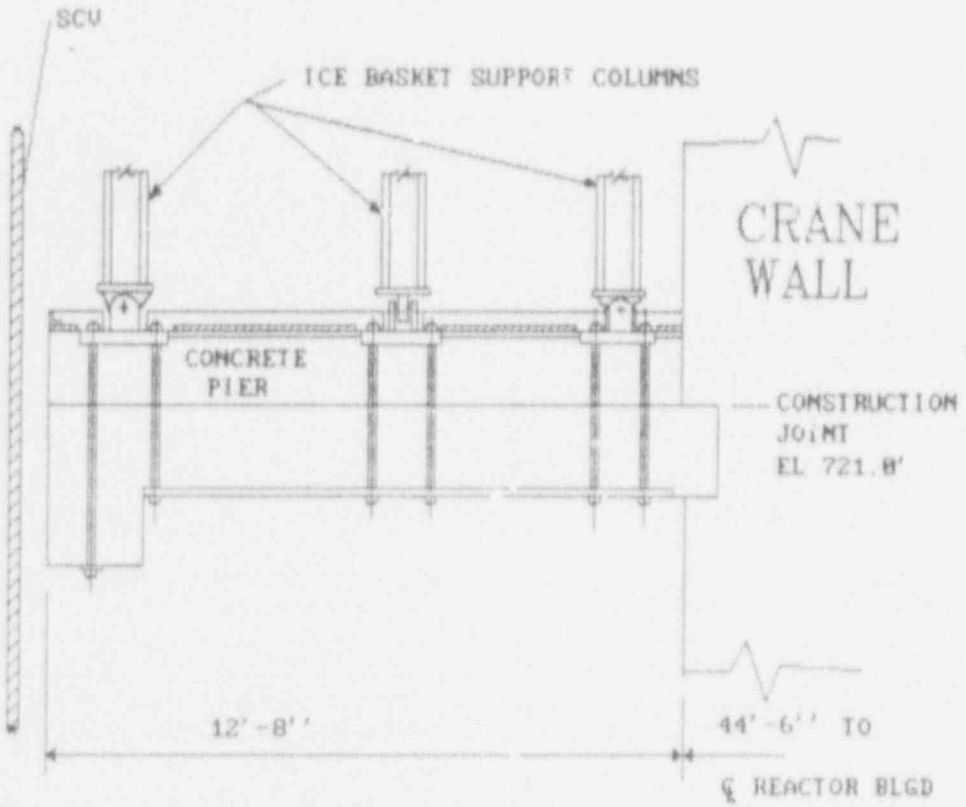
ICE BAY
FLOOR SEGMENT

Figure 8



A--A

FOAM CONCRETE FILL SECTION



B-B

CONCRETE PIER/BASEPLATE SECTION

Figure 9

TVA/NRC MANAGEMENT MEETING

APRIL 3, 1992

CRACKING OF FEEDWATER PIPING

AGENDA

I.	OVERVIEW	JOE BYNUM
II.	IDENTIFICATION OF LEAK	ROB BEECKEN
III.	MATERIAL INVESTIGATION RESULTS	DAVID GOETCHEUS
IV.	HISTORY OF SQN'S IEB 79-13 PROGRAM	DAVID GOETCHEUS
V.	FEEDWATER INSPECTION HISTORY	NICK KAZANAS
VI.	FEEDWATER INSPECTION EVALUATION	NICK KAZANAS
VII.	EVALUATION OF EXTENT OF CONDITION	DAVID GOETCHEUS
VIII.	SUMMARY OF CAUSES	NICK KAZANAS
IX.	CORRECTIVE ACTIONS	NICK KAZANAS
X.	CONCLUSIONS	JACK WILSON

I. OVERVIEW

- Cracks Caused By Thermal Fatigue - Replacing Section on Both Units
- SQN Relied on UT To Recommend Replacement Before A Crack Propagated Through Wall
- Implementation Weaknesses Combined with Specific Geometry Resulted in Not Identifying Cracks
- Causal Factors Evaluated
- Limit Of Conditions Being Verified
- Program Improvements Being Implemented

II. IDENTIFICATION OF LEAK

- Observation of Leak - March 19, 1992
  - Ice Condenser Personnel
  - Containment Leak Inspection
  - Pocket Sump Indications
- Cooldown to Mode 5
- Determine Leak Location
- Initiate Incident Investigation
- RT The U1 Transition Pieces To Determine Extent Of Immediate Problem

HALF-PIPE FLOW

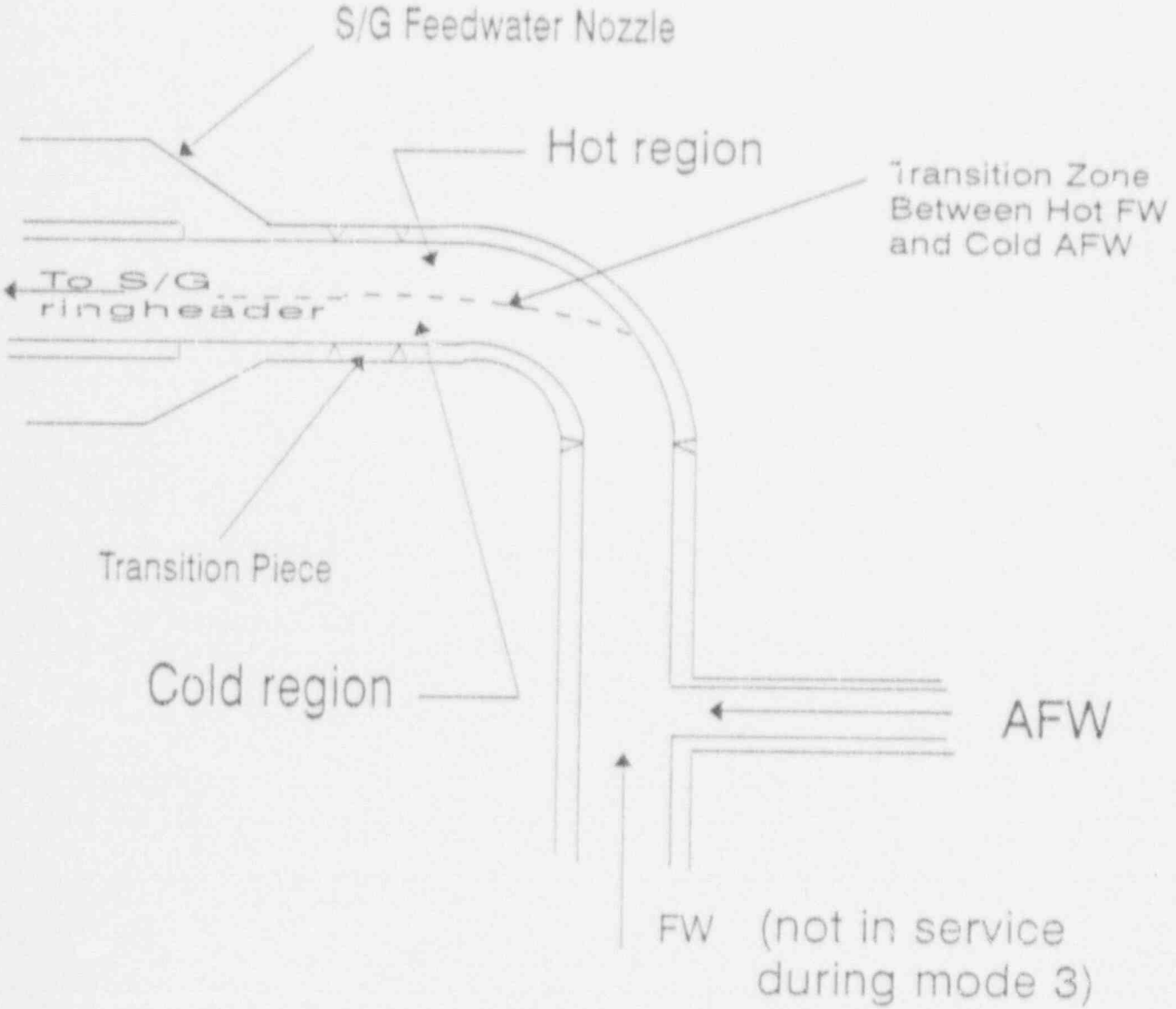


FIGURE 1

RADIOGRAPH INSPECTION RESULTS OF STEAM GENERATOR FEEDWATER NOZZLE

MARCH 1992

UNIT	SG	CRACKING IN TRANSITION TO ELBOW WELD	CRACKING IN NOZZLE TO TRANSITION WELD	APPROX. LOCATION	LENGTH	COMMENTS
1	1	N	N	-	N/A	Intermittent machine marks confirmed on Construction Radiographs
	2	N	N	N/A	N/A	N/A
	3	N	Y	270°	6.7"	Nozzle weld FDF-131, transition side of root.
	4	N	Y	90° & 270°	1. 90° 5.3" 2. 270° 4.9" 3. 270° 5.5"	1. Noz. Weld FDF-022 transition side of root 2. Noz. Weld FDF-022, multiple circumferential cracks Transition side of root 3. Noz. Weld FDF-022 nozzle side of root
2	1	N	Y	Essent.Top Dead Center (0°)	5.1"	Noz. Weld FDF-011 Transition side of root
	2	N	N	N/A	N/A	N/A
	3	N	Y	90° & 270°	1. 90° 0.4" 1. 90° 2.4" 2. 270° 6.7"	1. Noz. Weld FDF-131 Transition side of root 2. Noz. Weld FDF-131 Transition side of root
	4	N	Y	90°	1.6"	Noz. Weld FDF-022 Transition side of root

NOTE: Radiograph Inspections performed in 3/92 were performed using high sensitivity "M "grade film and greater source to film distance.

III. MATERIAL INVESTIGATION RESULTS
METALLURGICAL EXAMINATION OF LOOP 3 CUTOUT

- Through Wall Crack
  - Initiated At Weld Root Interface On ID (Nozzle To Transition Piece Weld)
  - 10 Inches In Length Along Inside Diameter - 2 Inch OD
  - Radial Circumferential Fatigue
- Secondary Cracks
  - Located In Transition Piece And Elbow Counterbore
  - Numerous Cracks Of $\leq$ 10% Of Wall Thickness
- Counterbore Region
  - Essentially Free Of Corrosion Pitting
  - No Observed Erosion/Corrosion
- PT Of Loop 3 Nozzle And Vertical Pipe Run
  - No Cracks Identified
  - Other Loops To Follow

III. MATERIAL INVESTIGATION RESULTS (Cont'd)

METALLURGICAL EXAMINATION OF LOOP 3 CUTOUT

- Findings Consistent With Known Failure Mechanism
  - Thermally Induced Fatigue Failure Caused By AFW Operation
  - Radially Propagating Circumferential Cracks
  - Presence Of Corrosion Products Indicates Crack Has Existed For Significant Time Period

- Independent Review Of Findings

III. MATERIAL INVESTIGATION RESULTS (Cont'd)
BOUNDING OF FEEDWATER CONDITION

- Surface Exams of Nozzle And Vertical Pipe
- UT Or RT Of AFW/FW Connections
- No Indications Found On Vertical Pipe
- Surface Defects Found On Two Nozzles
- No Indications Found On AFW/FW Connections To Date

IV. HISTORY OF SQN IEB 79-13 PROGRAM

- ISI Performed To Bulletin - 1982
- Augmented Inspections Initiated -1983
- Evaluation Of AFW Operating Time In 1988 - Expanded Augmented Inspections
- Operating Procedure Review To Minimize Impact Of AFW
  - Westinghouse Recommendations
  - AFW Pressure Pulsations - Less Than Optimal
  - AFW Recirc Line Modification - Optimize Operational Conditions During Steady State Mode 3 Conditions (Implement During Cycle 5 Outages)
- Primary Reliance On Inspection

V. FEEDWATER INSPECTION HISTORY

- Construction RT Completed In 1979
- 79-13 RT Performed First RFO In 1982
- Augmented Exams Initiated, UT - 1 Loop/RFO
- Expanded Scope Of Augmented UT Exams In 1988 To Include 4 Loops/RFO
- Indications Recorded At Sites Of Cracks - Misinterpreted As Geometry

VI. FEEDWATER INSPECTION EVALUATION

- Technique Limitations
  - Focus On Code Requirements And IGSCC Methodology
  - Techniques Available To Further Interrogate Weld Not Fully Utilized
  - Specific Configuration And UT Techniques Not Maximized

- Process Weaknesses
  - NDE Limitations With Respect To This Failure Mechanism Not Communicated - Limited Experience Base
  - Over Emphasis On Past Data Interpretations
  - Over Reliance On Qualifications Of Personnel
  - Inconsistent Understanding Of Level III Responsibilities

- Inspector Qualifications
  - EPRI Qualified in IGSCC UT Techniques
  - No Industry Qualification Method Available For Identification of Thermal Fatigue

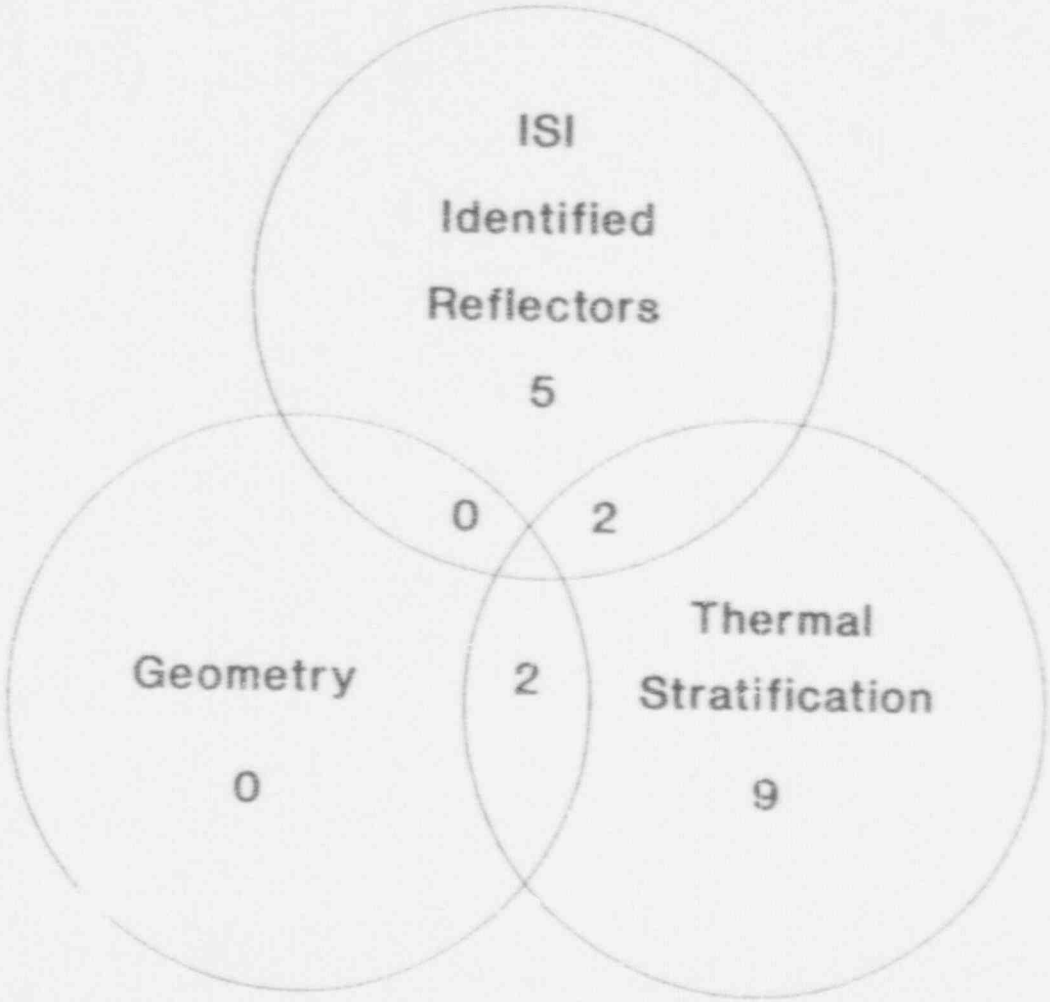
- Independent EPRI NDE Assessment

VII. EVALUATION OF EXTENT OF CONDITION

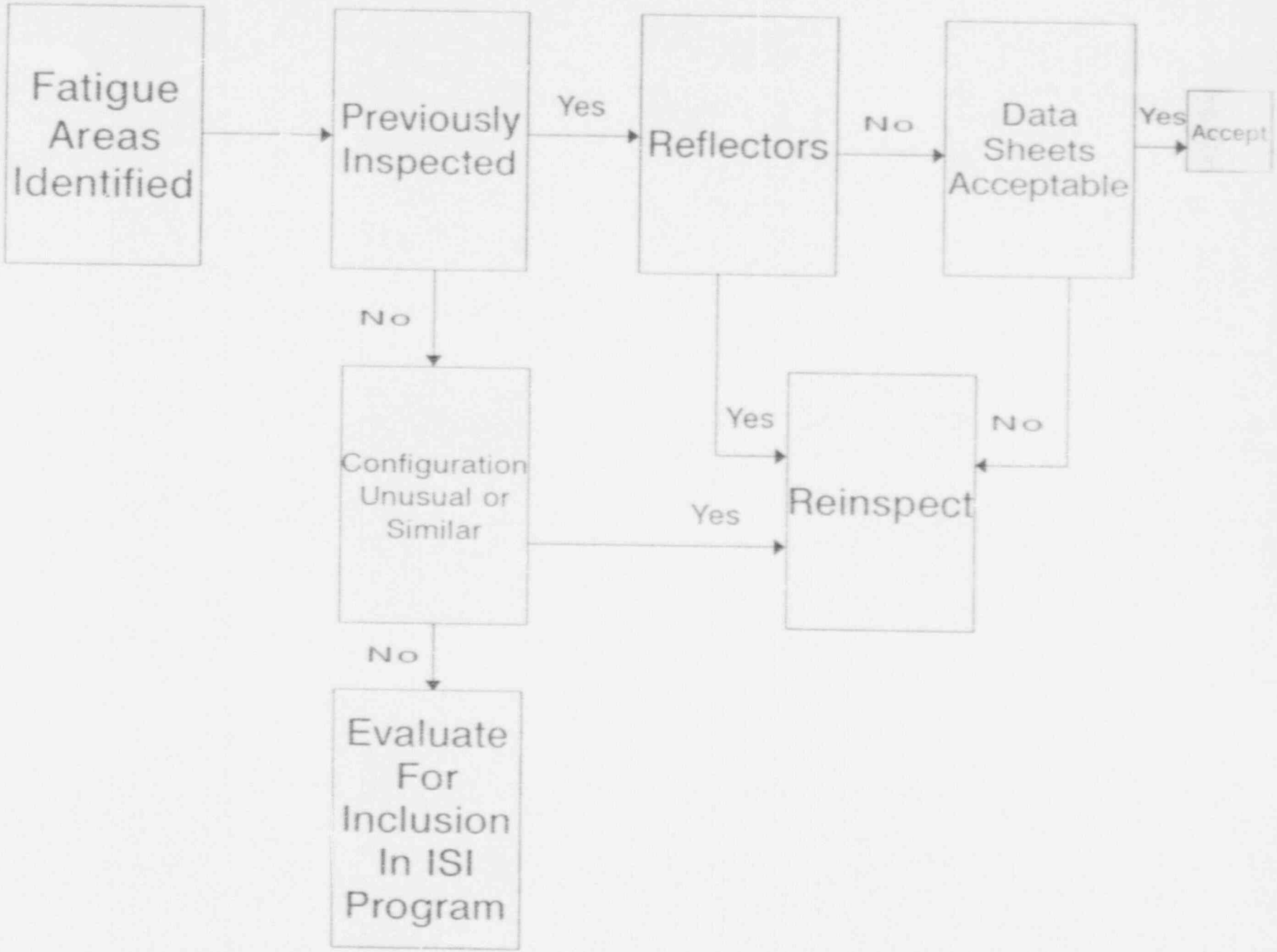
AREAS CONSIDERED IN EVALUATION

- Failure Mechanism - Thermal Stratification
- Inspection Process/ Technique - Geometry
- Disposition of Indications - Reflectors

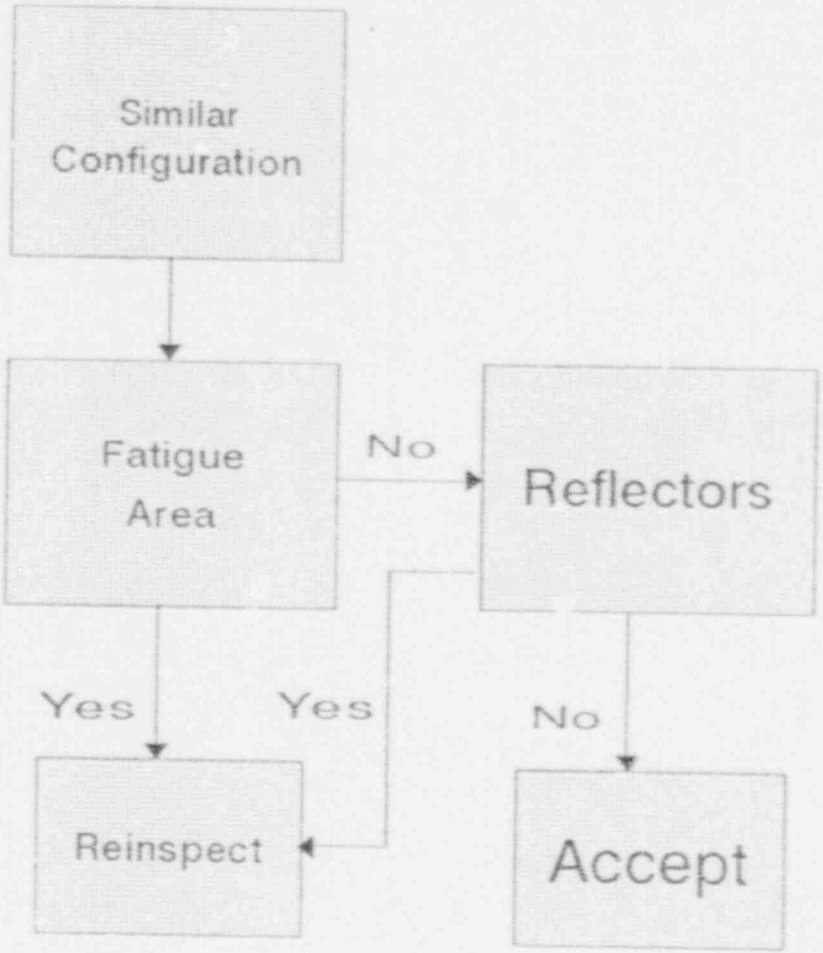
VII. EVALUATION OF EXTENT OF CONDITION EVALUATION METHOD



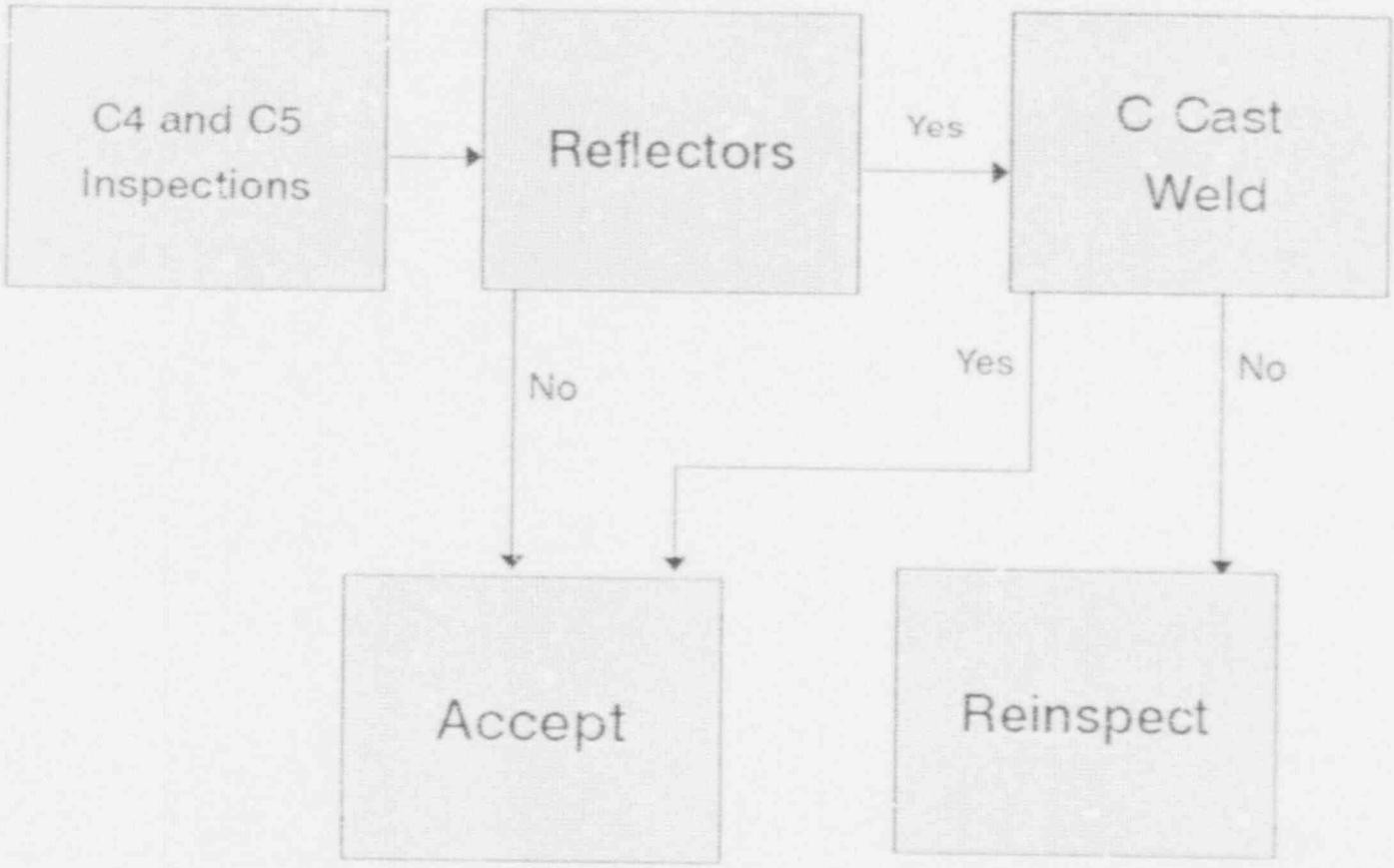
VII. EVALUATION OF EXTENT OF CONDITION FAILURE MECHANISM



VII. EVALUATION OF EXTENT OF CONDITION INSPECTION PROCESS/TECHNIQUE



VII. EVALUATION OF EXTENT OF CONDITION
DISPOSTION OF INDICATIONS



VIII. SUMMARY OF CAUSES

- Cracking:
  - Thermal Fatigue - Consistent With Industry Experience

- Failure to Identify Cracking:
  - Technique Limitations For Specific Geometry
  - Specific And Pertinent Information Not Provided To Inspectors
    - Characteristics Of Expected Crack
    - Fatigue Cycle Lifetime

IX. CORRECTIVE ACTIONS

UNIT 1 And UNIT 2 RESTART

- Replacement of Transition Piece To Elbow
- RT And Baseline UT Of Replaced Pieces
- Procedural Requirements Upgraded
- Enhanced Training Provided Using Feedwater Hardware
- Review Of The Event With ISI Personnel
- Develop Plan To Verify Scope Of Condition
- Implement Additional Confirmatory Inspections

IX. CORRECTIVE ACTIONS

LONG-TERM

- Establish Long-Term ISI Methodology
- Institute "Hands On" Training Using Field Removed Elbows
- Evaluate Long-Term Actions To Minimize Failure Mechanism
- Evaluate Life Cycle And Implement Replacement Program
- Evaluate And Upgrade ISI/NDE/Fatigue Monitoring Interfaces

X. CONCLUSIONS

- Feedwater Cracking Consistent With Industry Experience
- SQN ISI/NDE Implementation Was Insufficient To Detect Flaws
- Limit Of Condition Verified By Inspections
- ISI/NDE Process And Techniques Being Improved
- Lessons Learned Being Communicated To Industry