

NOTICE OF VIOLATION

Georgia Power Company
Hatch Nuclear Plant

Docket Nos. 50-321 and 50-366
License Nos. DPR-57 and NPF-7
EA 95-167

During an NRC inspection conducted on July 5 through August 15, 1995, a violation of NRC requirements was identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600 (60 FR 34381; June 30, 1995), the violation is listed below:

10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions", as implemented by the Georgia Power Company, Hatch Quality Assurance Program, Revision 44, Section 16.1, requires, in part, that measures be established to assure that conditions adverse to quality, such as failures, malfunctions, and defective material and equipment, are promptly identified and corrected.

Contrary to the above, the licensee failed to promptly correct conditions adverse to quality, namely, the degradation of safety-related Low Pressure Coolant Injection (LPCI) and Core Spray Injection (CSI) valves. These failures are evidenced by the following examples:

1. The licensee failed to provide prompt corrective action for LPCI inboard injection valve failures in that:
 - Following a May 19, 1995, failure, the licensee determined the valves should be manually unseated to reduce the opening motor load during surveillance tests; however, this corrective action was not adequately implemented until after additional failures occurred on June 18, 1995, and July 2, 1995.
 - Following failures of valve 2E11F015B actuator motor on May 19, 1995, and June 18, 1995, the licensee failed to promptly inspect the other LPCI inboard injection valves to determine if they were experiencing similar problems. After valve 1E11F015B failed its surveillance test on July 2, 1995, the "A" valves were inspected and degradation was noted.
2. Due to leakage of system check valves, the potential existed for the leakage of reactor coolant into the LPCI and CSI inboard injection valve bonnets. Industry information indicated pressure locking of such valves caused by leakage into the valve's bonnet could occur during accident conditions, resulting in the valve being unable to stroke such that the system can perform its safety-related function. The licensee did not consider the potential for pressure locking of the LPCI and CSI inboard injection valves in their original pressure locking evaluations.

This is a Severity Level IV violation (Supplement I).

Enclosure 1

Pursuant to the provisions of 10 CFR 2.201, Georgia Power Company is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 with a copy to the Regional Administrator, Region II, and a copy to the NRC Resident Inspector at the facility that is the subject of this Notice, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

Because your response will be placed in the NRC Public Document Room (PDR), to the extent possible, it should not include any personal privacy, proprietary, or safeguards information so that it can be placed in the PDR without redaction. However, if you find it necessary to include such information, you should clearly indicate the specific information that you desire not to be placed in the PDR, and provide the legal basis to support your request for withholding the information from the public.

Dated at Atlanta, Georgia
this 27th day of September, 1995

LIST OF ATTENDEES

NRC

S. Ebnetter, Regional Administrator, Region II (RII)
H. Berkow, Director, Project Directorate II-2, Office of Nuclear Reactor Regulation (NRR)
A. Gibson, Director, Division of Reactor Safety (DRS), RII
K. Jabbour, Project Manager, NRR
T. Chan, Division of Engineering, Mechanical Engineering Branch (EMEB), NRR
C. Casto, Chief, Engineering Branch, DRS, RII
R. Crlenjak, Chief, Reactor Projects Branch 3 (RPS3), Division of Reactor Projects (DRP), RII
B. Uryc, Director, Enforcement and Investigation Coordination Staff (EICS), RII
C. Evans, Regional Counsel, RII
M. Shymlock, Acting Section Chief, Test Program Section, DRS, RII
T. Scarbrough, Engineering, NRR
E. Girard, Reactor Engineer, DRS, RII
A. Boland, Senior Enforcement Specialist, RII
*M. Satorius, Office of Enforcement

*Attended by telephone conference

Licensee

W. Hairston III, Executive Vice President, Georgia Power Company
J. Beckham, Jr., Vice President, Hatch Nuclear Plant
H. Sumner, General Manager, Hatch Nuclear Plant
J. Heidt, Nuclear Engineering and Licensing Manager
S. Bethay, Engineering Manager
D. Crowe, Manager of Nuclear Licensing
J. Hammonds, Nuclear Safety and Compliance Supervisor
W. Warren, Hatch Maintenance Support
J. Branum, Nuclear Licensing Project Engineer

LPCI INJECTION VALVE ISSUES

GPC PRESENTATION

TO NRC STAFF

September 13, 1995

Enclosure 3

AGENDA

1. Introduction- J. T. Beckham
2. Failures During Testing- H. L. Sumner
 - Discussion of Issues
 - Safety Assessment
 - Corrective Actions
3. Pressure Locking Issues - J. D. Heidt
 - Discussion of Issues
 - Safety Assessment
 - Corrective Actions

SUMMARY OF VALVE FAILURE ISSUES

- **Two separate and distinct failure mechanisms involved:**
 - Motor failure**
 - Shaft cracking**
- **We believe our actions were timely and appropriate based on available information.**

MOTOR ISSUES

CORRESPONDENCE

SCS letter of 6/8/94, LPCI valve operator capability:

- **Adequate capability for safety function.**
- **Lack of margin under test conditions.**
- **Successful past testing.**
- **100 valve cycles allowable.**
- **Revise procedures before 100 cycles.**

NOTE:

1. **Solution not obvious; manual operation, cold shutdown, design.**
2. **NRC later agreed "no safety concern", IER 95-02, page 3.**

MOTOR ISSUES (con'd)

CORRESPONDENCE (continued)

Actions in response to 6/8/94 letter:

- **Initiated efforts to change IST program.**
- **Frequency of testing to be changed from “quarterly” to “cold shutdown”.**
- **No “impracticality” basis identified (IWV-3412).**
- **Scheduled for submittal to NRC in Sept. '95 as part of 10 year IST program update.**

MOTOR ISSUES (con'd)

5/19/95: 2E11-F015B failed to open during testing due to motor failure.

Short Term Corrective Actions:

- **Replaced motor to restore operability.**
- **SOR for root cause analysis.**
- **GPC motor expert called in to inspect failed motor.**
- **Conservatively assumed high d/p only cause.**
- **Processed IST program deviation request, invoked "impracticality" basis.**

MOTOR ISSUES (con'd)

5/19/95 Event continued:

Root Cause Analysis Results:

- **Motor stall caused high current to short windings.**
- **Rotor degradation due to locked rotor occurrences in '86.**
- **High torque due to high d/p, valve speed.**
- **Time in service: ~ 9 years.**

Long Term Corrective Actions:

- **Employ improved motor diagnostics.**

MOTOR ISSUES (con'd)

6/18/95: 2E11-F015B failed to open during FT after relay replacement.

Note: Stroking of valve was required to prove operability, with or without IST program change.

Short Term Corrective Actions:

- **Replaced motor to restore operability.**
- **SOR for root cause analysis.**
- **Revised procedures to allow manual opening.**
- **Motor inspected by GPC motor expert.**

MOTOR ISSUES (con'd)

6/18/95 Event continued:

Root Cause Analysis Results:

- **Motor stall caused high current to short windings.**
- **Misinterpreted cause of high amps after 5/19 installation.**
- **Bushing friction reduced motor capability.**
- **High torque due to d/p, valve speed.**

Long Term Corrective Actions:

- **Revised Maint procedure to check motor bushing clearance.**

SHAFT CRACKING ISSUES

7/2/95: 1E11-F015B failed to open during testing due to broken motor shaft. Procedure to unseat valve was used; may not have been effective.

Short Term Corrective Actions:

- Replaced motor to restore operability.
- Initiated Event Review Team.
- Performed NDT on other LPCI injection valve motor shafts.
- Performed metallurgical analysis of two shafts and two keys.
- Replaced two additional motors.

SHAFT CRACKING

TESTING/ANALYSIS RESULTS

<u>VALVE</u>	<u>INSPECTION/ANALYSIS RESULTS</u>
1E11-F015A	Motor pinion key was sheared. No cracks in shaft. Key was made of 1018 steel.
1E11-F015B	Motor shaft was broken at the keyway. Shaft had cracks emanating from <u>both edges</u> of the keyway as a result of fatigue. Final failure was result of torsional overload. Shaft material was 1144 carbon steel. Key material was 4140.
2E11-F015A	Shaft was cracked. Key was half way out of keyway, had a small crack, and was 4140.
2E11-F015B	Shaft from motor which failed on 5/19/95 was cracked. Had been in service ~9 years with a 4140 key, 1144 shaft .

SHAFT CRACKING ISSUES (con'd)

7/2/95 Event continued:

Root Cause Analysis Results:

Shaft cracking and failure are probably result of multiple factors:

- Key & shaft material
- Hammer blow effect
- High motor rpm
- High thrust due to d/p and speed
- Time in service
- Non-radiused keyway corners

SHAFT CRACKING ISSUES (con'd)

7/2/95 Event continued:

Long Term Corrective Actions:

- **Inspect other motor shafts for cracking during upcoming refueling outages.**
- **Continue to pursue solutions to motor shaft cracking with industry experts.**
- **If warranted, advise BWROG and others of potential generic nature of shaft cracking issue.**

CONCLUSIONS

1. **None of the failures were the result of high differential pressure alone.**
2. **Motor failures were the result of several causes unique to the 2E11-F015B valve which did not lead to inspection of other valves.**
3. **Shaft cracking and failure were result of multiple causes and represent a failure mechanism previously unseen and unexpected by GPC.**
4. **Pretest manual operation may have prevented (and masked) motor problems but not shaft cracking.**

SAFETY ASSESSMENT

- 1. All valves (except possibly 1E11-F015B) were capable of performing safety function until failure occurred during testing.**
 - Required opening force is greater under test conditions than accident conditions even considering system pressure in the bonnet.**
 - Valves have operated successfully for many years under test conditions and shutdown cooling entry conditions.**

SAFETY ASSESSMENT (continued)

2. **1E11-F015B** may not have opened for safety function after successful 4/95 test due to extensive motor shaft cracking. Other RHR loop was operable.
 - **Manually operating the valve before the 7/2/95 test may have contributed to failure at that time.**
3. **All four LPCI injection valves are operable now.**
 - **New motors installed on each valve.**
 - **Shaft cracking occurs over time.**
 - **U-2 valves modified: slower with more thrust.**

TIMELINESS ISSUES

From Inspection Report 95-17

“...the licensee determined that procedural changes should be instituted to preclude further failures. These changes were not adequately implemented until after the third MOV failure.”

GPC believes actions were appropriate and timely based on information available at the time.

TIMELINESS ISSUES (CONTINUED)

- **After the 6/8/94 SCS letter, past valve performance indicated it was acceptable to incorporate surveillance frequency changes in the Fall 1995 IST Program update. (GPC initially believed prior NRC approval was required.)**
- **The NRC Staff reviewed the GPC approach to the 6/8/94 SCS letter and identified no concerns. (NRC IR 95-02, 5/5/95, section 2.1, page 3)**

TIMELINESS ISSUES (continued)

- **After the 5/19/95 motor failure, GPC planned to revise the surv. procedures prior to the next scheduled valve operation (Unit 1 in July).**
- **Shortly after the 5/19/95 motor failure, actions were initiated to revise the surveillance frequency to once per cold shutdown to alleviate high differential pressure conditions during testing.**
- **Surveillance procedure was revised prior to the 7/2/95 test.**

TIMELINESS ISSUES (continued)

From Inspection Report 95-17

“The licensee failed to inspect similar LPCI MOVs for degradation caused by exceeding the motor ratings until after the third failure had occurred.”

GPC believes actions were appropriate and timely based on the information available at the time and the relative timing of the valve motor failures.

TIMELINESS ISSUES (continued)

- **The 5/19 and 6/18 failures were motor related and on the same valve. They had no relationship to the shaft cracking which was subsequently identified.**
- **The 6/18 failure was “maintenance related” in that it was a consequence of the repairs done following the 5/19 failure.**

TIMELINESS ISSUES (CONTINUED)

- **The nature of the first two failures (motor related) did not alone present sufficient reasons to immediately inspect other MOVs.**
- **The third failure was the result of a broken shaft. The degradation which contributed to the failure (i.e., keyway cracking, key/shaft material) was reasonably expected to be found in the other MOVs. Thus, inspections were performed promptly and completed within 7 days of the failure.**

SUMMARY OF PRESSURE LOCKING ISSUES

- **Pressure locking issue is not new.**
- **Early PL evaluations considered design dp on the valve.**
- **Erroneously believed check valve leakage had not been considered.**
- **Valves were originally tested under “pressure locking” conditions.**
- **Pressure locking may not be an issue where process dp is less than design.**

PRESSURE LOCKING ISSUES

PREVIOUS EVALUATIONS

- **INPO issued SOER 84-7 on Pressure Locking and Thermal Binding (PL/TB)**
 - **Evaluation of the SOER revealed no vulnerabilities.**

PRESSURE LOCKING ISSUES

- **PL issue revisited several times.**
INPO SER 8-88
NRC IN 92-26
AEOD/S92-07
NUREG 1275
- **Conclusions consistent - no PL vulnerabilities except 2P41-F115A/B due to temperature changes.**

PRESSURE LOCKING ISSUES

RECENT DEVELOPMENTS

- Issue of pressure locking arose during phone calls with NRC in July 1995.
- GPC erroneously concluded that original PL evaluation did not include check valve leakage.
- Analytical evaluation concluded 2E11-F015B inoperable, 2E11-F015A marginal.
- Valves were modified to provide more opening capability.

PRESSURE LOCKING ISSUES

- **Subsequent evaluations determined both valves operable based on test conditions being more severe than accident conditions.**
- **Original evaluations revisited.**
- **Determined that process fluid in the valve bonnet had been considered, but not well documented.**

PRESSURE LOCKING ISSUES

- Original evaluation performed to determine the pressure locking susceptibility of MOVs correctly dismissed process fluid induced bonnet pressurization based on vendor input in cases where process pressure was less than design differential pressure.
- The documentation of this evaluation was inadequate with regard to consideration of downstream check valve leakage.

PRESSURE LOCKING ISSUES

- **Recent information from valve vendors) confirmed that process fluid induced bonnet pressurization causing locking is not possible if bonnet pressure is less than design specified differential pressure.**
- **Originally specified differential pressure for the 1/2E11-F015A/B is 1350 psid.**

PRESSURE LOCKING ISSUES

- **Powell valves were actually successfully tested for opening under defacto pressure locking conditions (each side pressurized to 2200psi then vented, valve cycled).**
- **Based on actual valve performance, calculations which show marginal motor/operator capability under test conditions are conservative.**

CONCLUSION

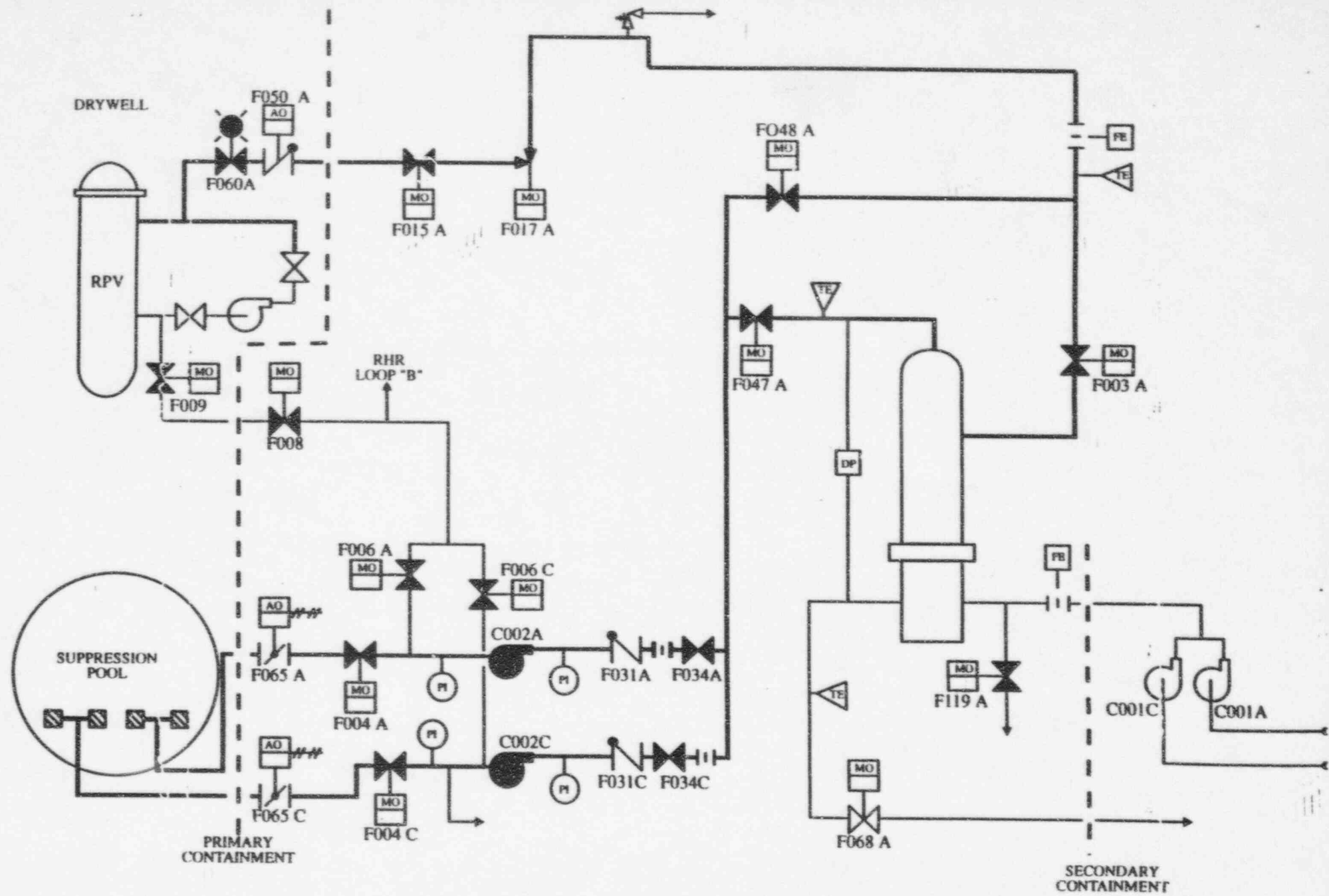
- **Process fluid induced pressure locking may not be a real problem.**

SAFETY ASSESSMENT

- 1. All valves (except possibly 1E11-F015B) were capable of performing safety function until failure actually occurred during testing.**
 - Required opening force is greater under test conditions than accident conditions.**
 - Valves have operated successfully for many years under test conditions.**

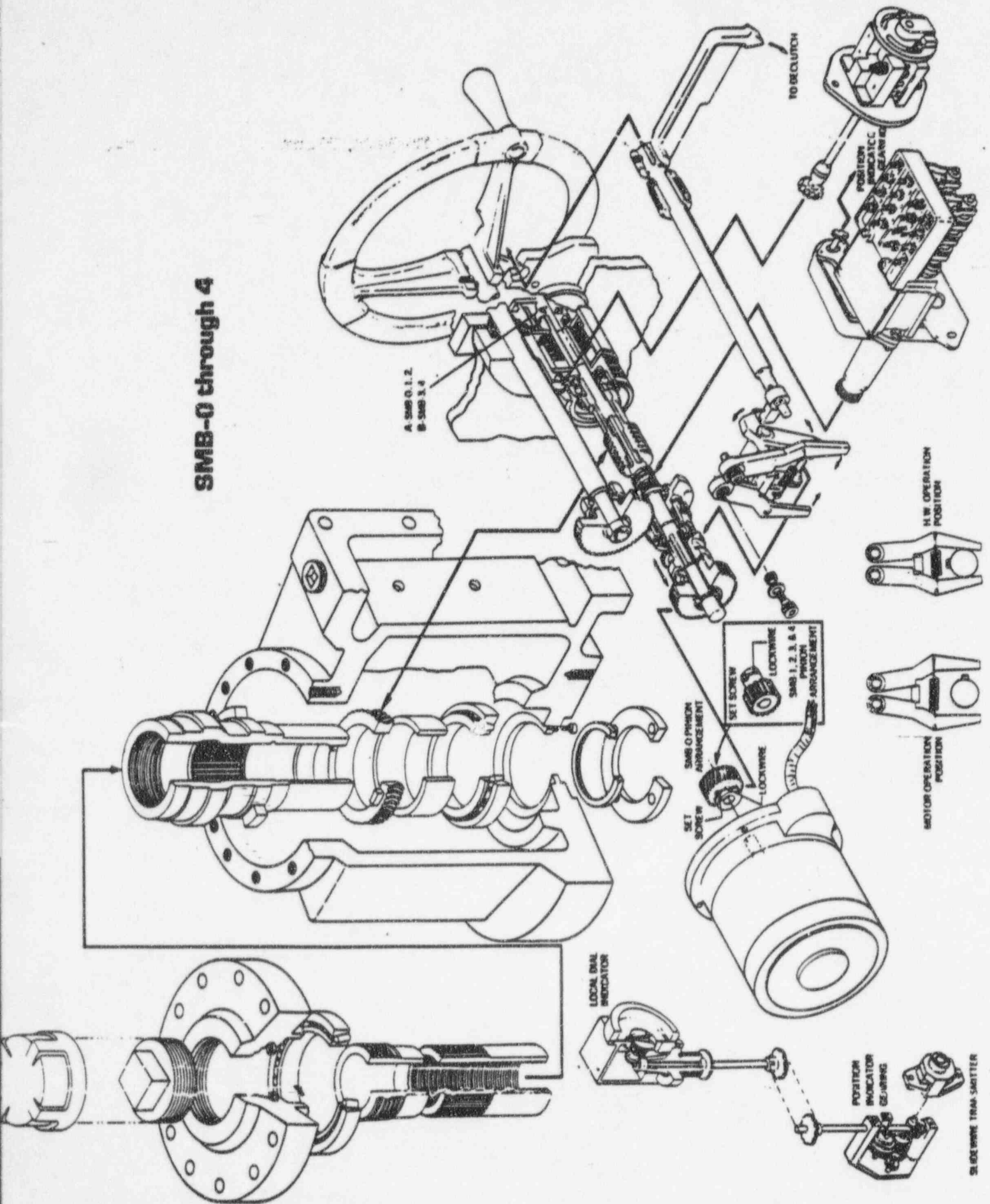
CORRECTIVE ACTIONS

- 1. Continue investigation into the validity of process fluid induced pressure locking phenomenon.**
- 2. Motor operated valves with active safety functions to open potentially susceptible to pressure locking have been evaluated.**
- 3. LPCI, Core Spray, and Plant Service Water valves will be modified to alleviate pressure locking concerns. (Fall '95 Unit 2, Spring '96 Unit 1).**



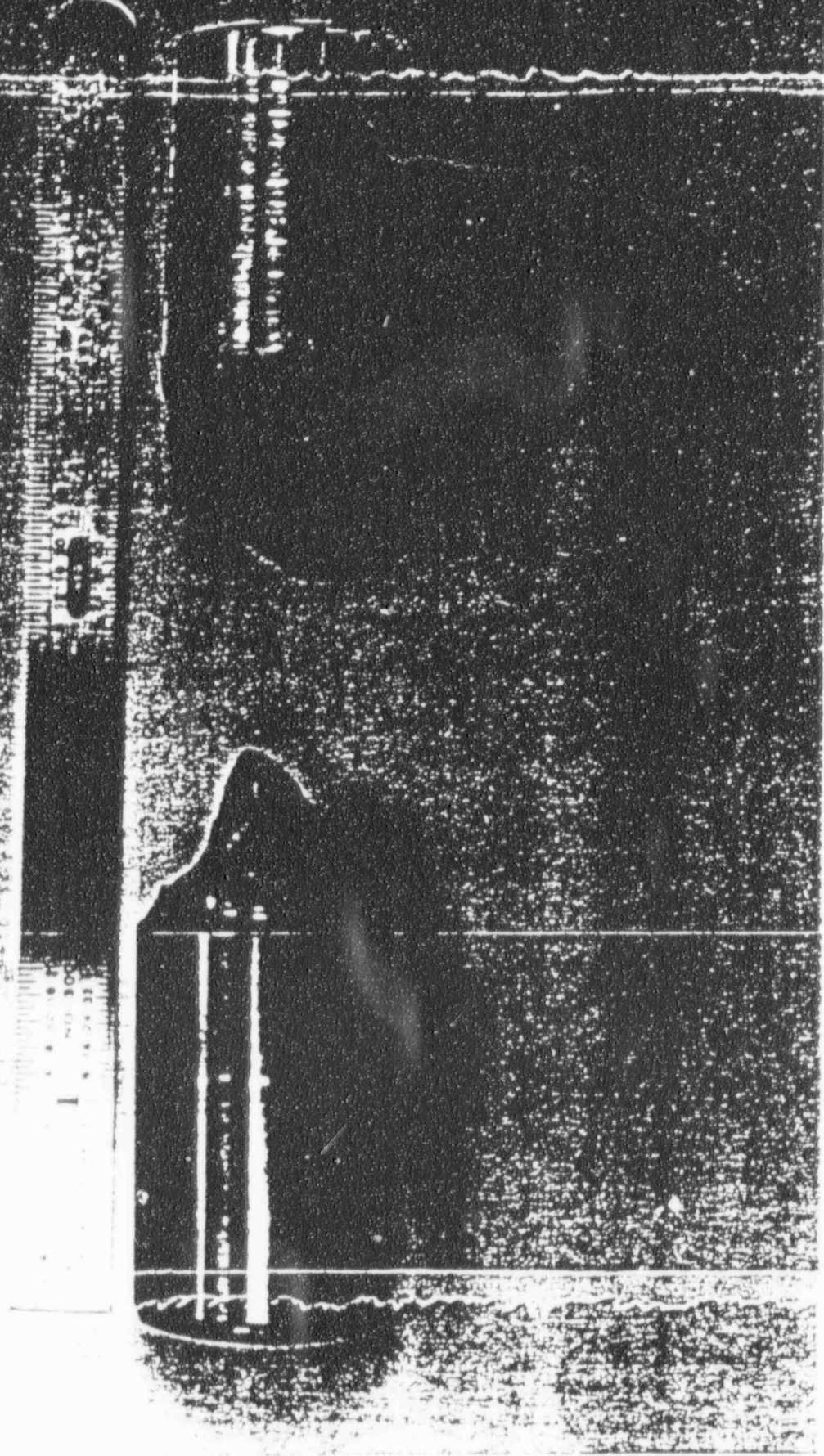
LPCI Injection Flowpath

SMB-0 through 4



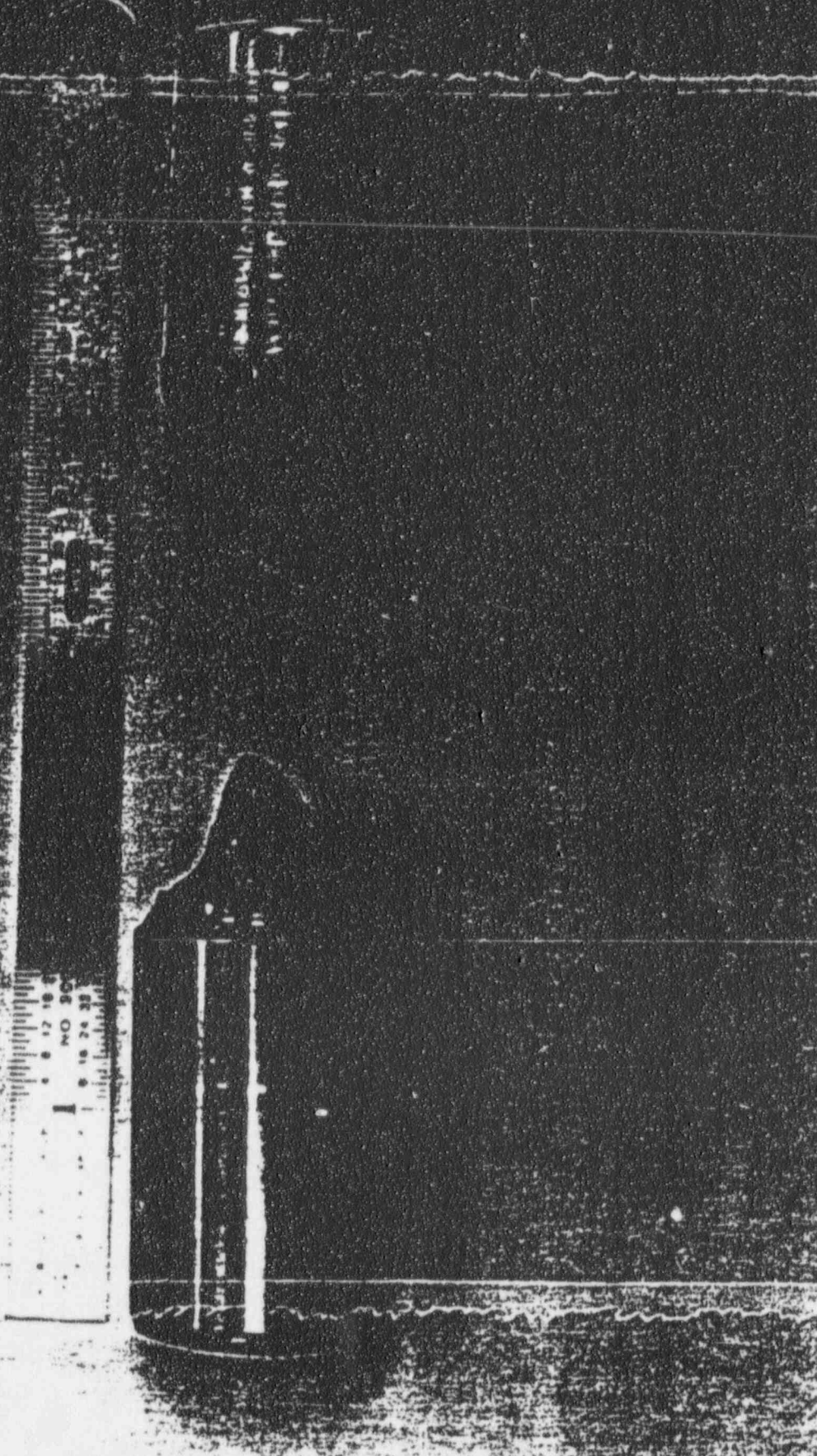
**MOTOR
END**

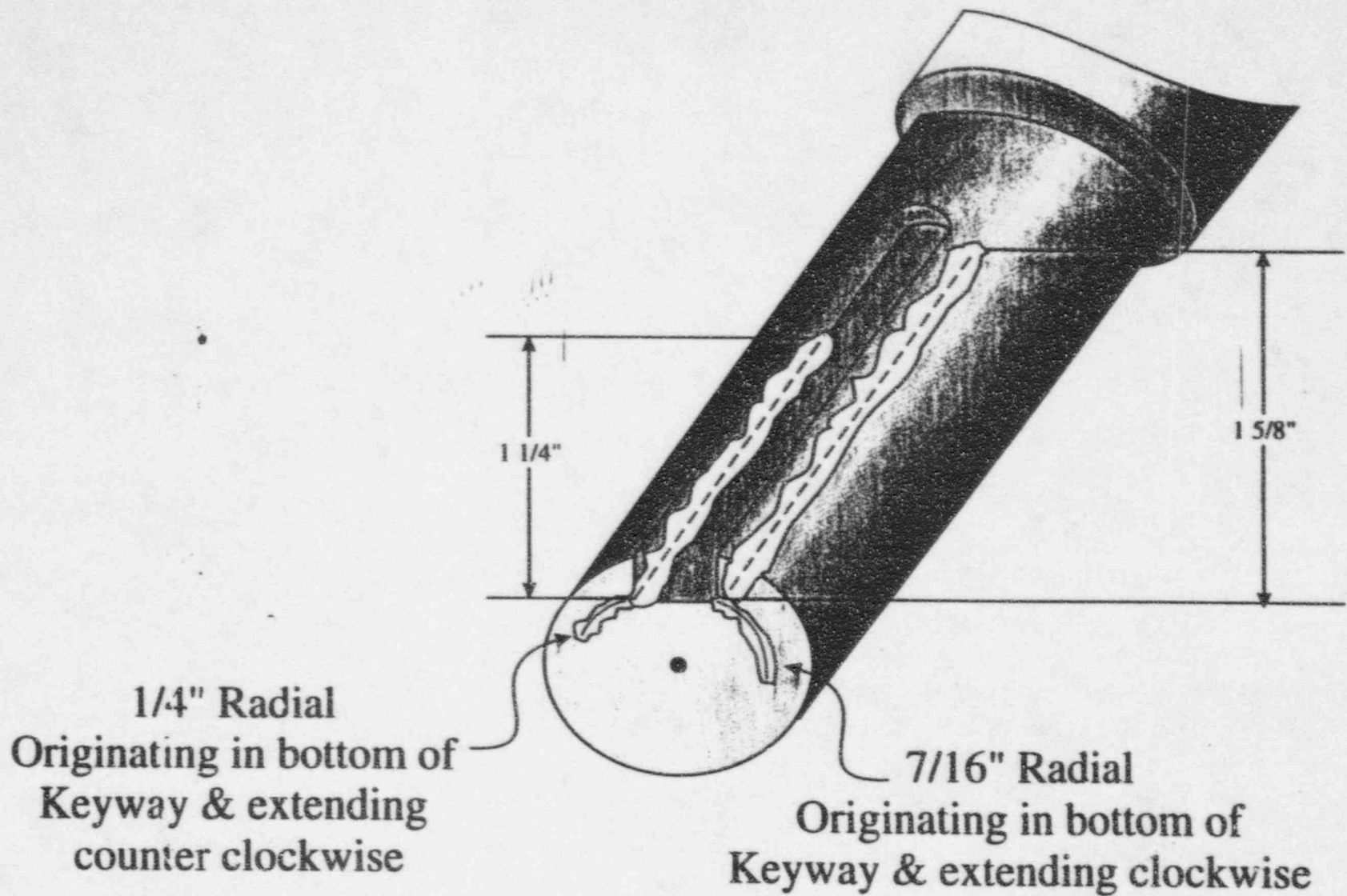
**OPERATOR'S
END**



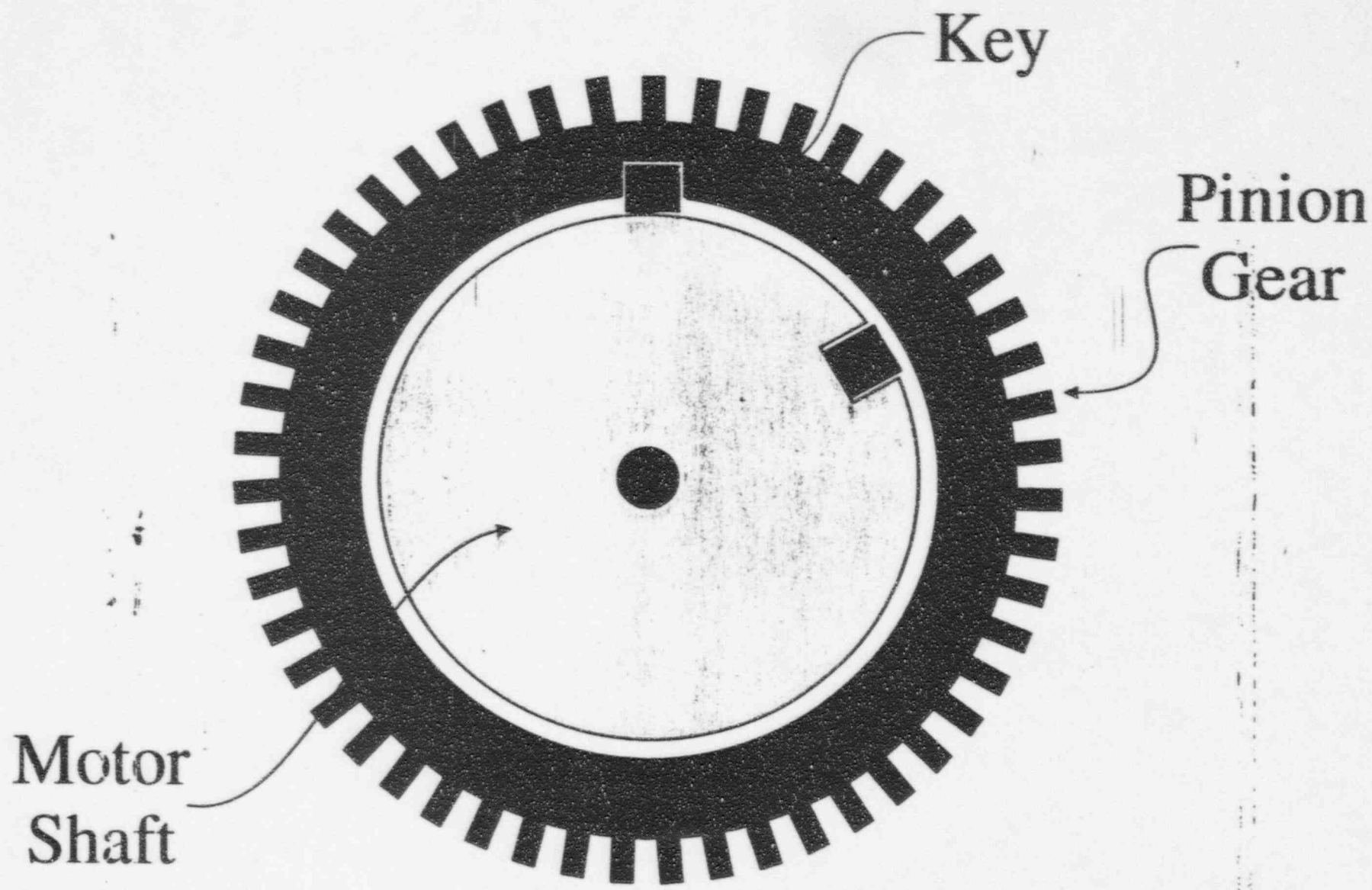
**MOTOR
END**

**OPERATOR
END**





Cracked Shaft (2E11-F015B)



Sheared Key (1E11-F015A)

NRC Slides

APPARENT VIOLATION

10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions", as implemented by the George Power Company, Hatch Quality Assurance Program, Revision 44, Section 16.1, requires, in part, that measures be established to assure that conditions adverse to quality, such as failures, malfunctions, defective material and equipment, are promptly identified and corrected.

The licensee failed to promptly correct significant conditions adverse to quality, namely, the degradation of safety-related LPCI and CS valves. These failures are evidenced by the following examples:

- The licensee performed surveillance testing on LPCI valve 2E11F015B on June 18, 1995. Even though a condition adverse to quality had been identified, surveillance tests were performed which required operation of the valve above its established motor and actuator ratings (thrust rating). Subsequent motor failure occurred.
- Following failure of valve 2E11F015B actuator motor on May 19, 1995, and June 18, 1995, the licensee failed to take prompt corrective actions to inspect the other LPCI valves to determine if they were experiencing similar problems. After valve 1E11F015B failed its surveillance test on July 2, 1995 the A valves were inspected and degradation was noted.
- Due to leakage of system check valves reactor coolant pressure leaked into the LPCI and CS valve bonnets. The licensee failed to take prompt corrective actions on these conditions adverse to quality in that pressure locking of these valves could occur during accident conditions. The licensee did not consider the potential of these check valves leaking in their original pressure locking evaluation.

"The apparent violations discussed at this conference are subject to further review and are subject to change prior to any resulting enforcement action."

PREDECISIONAL ENFORCEMENT CONFERENCE AGENDA

HATCH

SEPTEMBER 13, 1995, AT 10:00 A.M.

NRC REGION II OFFICE, ATLANTA, GEORGIA

- I. OPENING REMARKS AND INTRODUCTIONS
S. Ebnetter, Regional Administrator
- II. NRC ENFORCEMENT POLICY
B. Uryc, Director
Enforcement and Investigation Coordination Staff
- III. SUMMARY OF THE ISSUES
S. Ebnetter, Regional Administrator
- IV. STATEMENT OF CONCERNS / APPARENT VIOLATION
A. Gibson, Director
Division of Reactor Safety
- V. LICENSEE PRESENTATION
- VI. BREAK / NRC CAUCUS
- VII. NRC FOLLOWUP QUESTIONS
- VIII. CLOSING REMARKS
S. Ebnetter, Regional Administrator

PUBLIC