NOTICE OF VIOLATION

Tennessee Valley Authority
Sequoyah Units 1 & 2

Docket Nos. 50-327 and 50-328
License Nos. DPR-77 and DPR-79
EA No. 97-232

During an NRC inspection conducted from March 24 through May 22, 1997, violations of NRC requirements were identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, the violations are listed below:

A. 10 CFR 50, Appendix B, Criterion XVI, requires, in part, that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.

Contrary to the above, the licensee failed to establish measures to assure that a significant condition adverse to quality was promptly identified and corrected and corrective action was taken to preclude repetition. Specifically,

1. On March 23 and March 24, 1997, during an evolution to drain the pressurizer to 25% level, the licensee failed to identify the inability to accurately monitor and control reactor coolant system (RCS) inventory, a significant condition adverse to quality. Specifically, several operations personnel observed a malfunction of the cold calibrated pressurizer level instrumentation and failed to promptly identify that the pressurizer cold calibration level indication was malfunctioning and take corrective action. This unidentified malfunction contributed to the inadvertent draining of the pressurizer to less than 0% cold calibration level.

2. On September 11, 1995, and on April 24, 1996, the cold calibration reference legs for Unit 1 and Unit 2, respectively, were backfilled after rapid depressurization of the RCS, and the licensee failed to take measures to ensure that RCS inventory could be properly monitored and controlled in that the cause of the reference leg voiding was not identified and corrective actions to preclude repetition of the reference leg voiding were not taken. (01013)

Enclosure 1

B. Technical Specification 6.8.1.a requires, in part, that procedures shall be established, implemented, and maintained covering the activities recommended in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978, "Quality Assurance Program Requirements (Operation)." Appendix A of Regulatory Guide 1.33, Section 1, includes procedures for "Log Entries, Record Retention, and Review Procedures."

SSP-12.1, Conduct of Operations, Revision 16, Section 3.8.3 C. 3. requires, in part, that relevant information reflecting static or changing plant conditions shall be recorded in at least one narrative log. Section 3.8.5 D. requires, in part, that late entries shall be annotated by placing the current time and the words "LATE ENTRY", followed by the time the entry should have been made, and then the entry.

Contrary to the above, on March 23 and 24, 1997, relevant information reflecting static or changing plant conditions was not recorded in at least one narrative log, in that: (1) on March 23, a Unit 1 RCS drain down was initiated at approximately 11:00 p.m. and was not recorded; (2) on March 24, a Unit 1 RCS drain down was terminated at approximately 2:00 a.m. and was not recorded; and (3) on March 24, 1997, a Unit 1 RCS drain down was logged at 8:25 a.m. as being initiated at approximately 7:15 a.m. and terminated at approximately 7:45 a.m., and the log entry was not annotated as a "LATE ENTRY." (01023)

These violations represent a Severity Level III problem (Supplement I).

Pursuant to the provisions of 10 CFR 2.201, Tennessee Valley Authority (Licensee) is 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 Sequoyah facility, 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 Notice of Violation" and should include: (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 previously 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.

Under the authority of Section 182 of the Act, 42 U.S.C. 2232, this response shall be submitted under oath or affirmation.

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. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.790(b) to support a request for withholding confidential commercial or financial information). If safeguards information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21.

Dated at Atlanta, Georgia
this 10th day of July 1997

NRC OPEN PREDECISIONAL ENFORCEMENT CONFERENCE

SEQUOYAH NUCLEAR PLANT

JUNE 27, 1997

Enclosure 2

PREDECISIONAL ENFORCEMENT CONFERENCE AGENDA

SEQUOYAH

JUNE 27, 1997, AT 10:30 A.M.

NRC REGION II OFFICE, ATLANTA, GEORGIA

I. OPENING REMARKS AND INTRODUCTIONS
L. Reyes, Regional Administrator

II. NRC ENFORCEMENT POLICY
B. Uryc, Director
Enforcement and Investigation Coordination Staff

III. SUMMARY OF THE ISSUES
L. Reyes, Regional Administrator

IV. STATEMENT OF CONCERNS / APPARENT VIOLATION
J. Johnson, Director, Division of Reactor Projects

V. LICENSEE PRESENTATION

VI. BREAK / NRC CAUCUS

VII. NRC FOLLOWUP QUESTIONS

VIII. CLOSING REMARKS
L. Reyes, Regional Administrator

ISSUES TO BE DISCUSSED

A. 10 CFR 50, Appendix B, Criterion XVI, requires, in part, that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, defective material and equipment, and non-conformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition.

Specifically, as of March 24, 1997, the licensee failed to:

1) Correct the slope of the pressurizer cold calibration level instrument reference leg to the criteria of a slope of $\frac{1}{8}$ inch per foot of tubing run as listed on Mechanical Instruments & Controls Drawing 47W600-24, Revision 13;

2) Perform adequate root cause evaluations for the multiple backfills of the pressurizer reference legs between 1980 and 1997;

3) Effectively implement the corrective actions from the May 1993 Incident investigation Event Report for the 1993 inadvertent drain down, including:

- Ensuring that operators use multiple independent pressurizer level channels during drain down evolutions, including the use of the reactor vessel level indication system (RVLIS),
- Ensuring that operators use a pressurizer level correction curve during drain down evolutions,
- Implementing positive inventory controls during drain down evolutions.

NOTE: THE APPARENT VIOLATIONS DISCUSSED IN THIS PREDECISIONAL ENFORCEMENT CONFERENCE ARE SUBJECT TO FURTHER REVIEW AND ARE SUBJECT TO CHANGE PRIOR TO ANY RESULTING ENFORCEMENT DECISION.

B. Technical Specification 6.8.1.a requires, in part, that procedures shall be established, implemented, and maintained covering the activities recommended in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978, "Quality Assurance Program Requirements (Operations)." Appendix A of Regulatory Guide 1.33, Section 1, includes procedures for "Authorities and Responsibilities for Safe Operation and Shutdown.

SSP-12.1, Conduct of Operations, Revision 16, Section 2.1.A.1. states that Operations personnel on each shift must "Be knowledgeable of those aspects of plant status relevant to their responsibilities." Section 3.1.4 B. and C. state respectively that the shift manager (SM) responsibilities include "on-shift management and oversight of all Plant Group activities to ensure safe and reliable plant operation...," and to "maintain a broad perspective of operation conditions affecting the safety of the plant as a matter of highest priority at all times." Section 3.17.2 B. states, "The SM, as the senior manager and resource manager, is in complete charge of shift activities. Section 3.1.5 F. lists one responsibility of the unit supervisor as "Coordinate the activities of the unit operators with other Operations and plant personnel to achieve safe, reliable, and efficient operation of the unit.

SSP-12.1, Conduct of Operations, Revision 16, Section 3.2.7, Responses to Indications, states, in part, "When an instrument failure is suspected the following actions shall be taken to determine the true condition and to implement compensatory actions: A. Stabilize or limit plant conditions until all aspects of the instrument failure are understood and compensatory actions taken."

SSP-12.1, Conduct of Operations, Revision 16, Section 3.8.3 C. 3. requires, in part, that relevant information reflecting static or changing plant conditions shall be recorded in at least one narrative log. Section 3.8.5 D. requires, in part, that late entries shall be annotated by placing the current time and the words "LATE ENTRY", followed by the time the entry should have been made, and then the entry.

1) On March 24, 1997, the on-coming and off-going SMs were not knowledgeable of those aspects of plant status relevant to their responsibilities, and did not maintain on-shift management and oversight of all Plant Group activities to ensure safe and reliable plant operation, and did not maintain a broad perspective of operation conditions affecting the safety of the plant as a matter of highest

priority at all times, and was not in complete charge of shift activities, in that the SMs were not aware that a reactor coolant drain down was initiated for Unit 1 at approximately 6:58 a.m. on March 24, 1997. The unit supervisor did not coordinate the activities of the unit operators with other Operations and plant personnel to achieve safe, reliable, and efficient operation of the unit, when he failed to notify the shift manager of the restart of the drain down evolution.

2) On March 24, 1997, the oncoming shift manager did not stabilize or limit plant conditions when he suspected a failure or possible problem with the pressurizer level indicators.

3) On March 23, 1997, relevant information reflecting static or changing plant conditions was not recorded in at least one narrative log, in that on March 23, a Unit 1 reactor coolant system drain down was initiated at approximately 11:00 p.m. and was not recorded.

4) On March 24, 1997, relevant information reflecting static or changing plant conditions was not recorded in at least one narrative log, in that on March 24, a Unit 1 reactor coolant system drain down was terminated at approximately 2:00 a.m. and was not recorded.

5) On March 24, 1997, relevant information reflecting static or changing plant conditions was not recorded in at least one narrative log, in that a Unit 1 drain down was re-initiated at approximately 6:58 a.m., and was terminated at approximately 8:30 a.m., and was incorrectly entered into the logs at 8:25 a.m. as having been initiated at 7:15 a.m. and terminated at 7:45 a.m.

6) On March 24, 1997, a late entry to the logs was not annotated by placing the current time and the words "LATE ENTRY", followed by the time the entry should have been made, and then the entry; in that a reactor coolant system drain down was logged at 8:25 a.m. as being initiated at approximately 7:15 a.m. and terminated at approximately 7:45 a.m., and the log entry was not annotated as a "LATE ENTRY."

NOTE: THE APPARENT VIOLATIONS DISCUSSED IN THIS PREDECISIONAL ENFORCEMENT CONFERENCE ARE SUBJECT TO FURTHER REVIEW AND ARE SUBJECT TO CHANGE PRIOR TO ANY RESULTING ENFORCEMENT DECISION.

Tennessee Valley Authority

Sequoyah Nuclear Plant

TVA/NRC Meeting

Predecisional Enforcement Conference

Pressurizer Level Reduction

June 27, 1997

Enclosure 3

NRC/TVA Meeting
Predecisional Enforcement Conference
Pressurizer Level Reduction
June 27, 1997
Agenda

Introduction	O. J. Zeringue
Reference Leg Design and Operation History	R. K. Gladney
Event Evolution	W. R. Lagergren
Operations Crew Performance	W. R. Lagergren
Corrective Actions	H. H. Butterworth
Management Initiatives	J. T. Herron
Conclusions	O. J. Zeringue

Sequoyah Nuclear Plant

Introduction

Sequoyah Nuclear Plant
Introduction

- Close Examination of Event and Associated Instrumentation
- Conclusion of Review
  - Loss of Reference Leg Attributed to Rapid Depressurization Method
  - Inadequate Operator Performance Primary Weakness
  - Corrective Actions for 1993 Pressurizer Event were Reasonable and Consistent with General Industry Practice
- Measures Taken to Strengthen Operator Understanding of Expectations and to Enhance Controls on Plant Evolutions
- Measures Taken to Increase Management Oversight of Plant Activities in Noncritical as Well as Critical Functions
- Broad Management Initiatives Underway to Evaluate Effectiveness of Past Corrective Actions
  - Review of 1985 - 1988 Nuclear Plant Performance Programs
  - Review of 1993 Restart Programs
  - Review of Corrective Action Program Database from 1988 to 1997
  - Review of selected operational events and reactor trips

Sequoyah Nuclear Plant

Reference Leg Design and Operation History

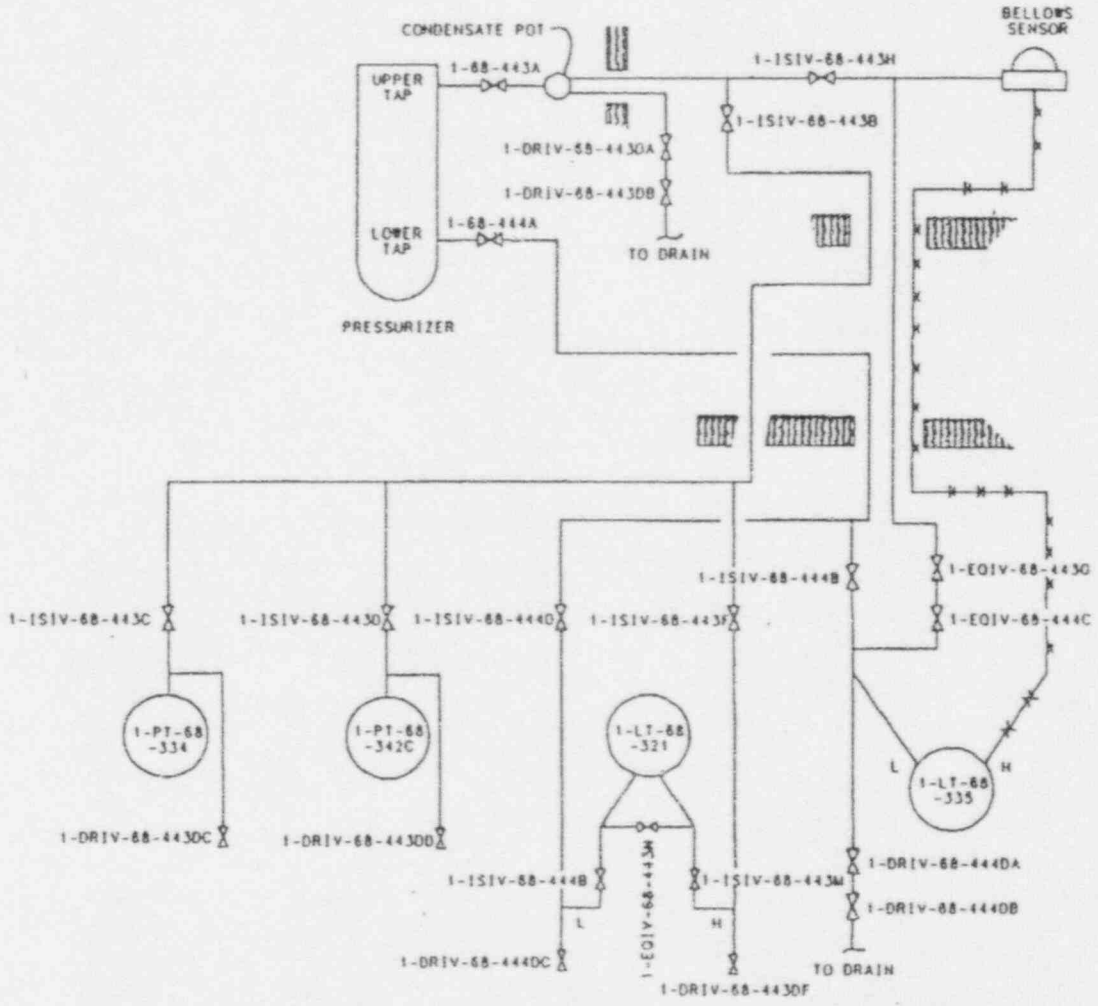
Sequoyah Nuclear Plant
Reference Leg Design and Operation History

- Basic Reference Leg Design and Operation
  - Cold cal instrument operates with an open reference leg
  - Condensate pot at top of reference leg keeps the reference leg filled
  - Loss of reference leg can occur by leakage, loss of condensate pot function, or gas liberation following rapid depressurization that carries liquid with it (champagne effect)
  - Small loss rates caused by leakage can generally be replenished by the condensate pot with no significant loss of the reference leg column
  - Large loss rates caused by rapid depressurization cannot be replenished immediately by the condensate pot

Sequoyah Nuclear Plant
Reference Leg Design and Operation History

- Basic Reference Leg Design and Operation (cont.)
  - Condensate pots are nonfunctional if a steam bubble does not exist in the pressurizer or if a condensate dam is formed in the sense line
  - Loss of reference leg caused by rapid depressurization in solid water operation cannot be recovered until the reference leg is backfilled

PRESSURIZER COLD CAL LEVEL CHANNEL SENSE LINE ROUTING



Sequoyah Nuclear Plant
Reference Leg Design and Operation History

- Historical Information - Sense Line Slope and Bow
  - In 1988, instrument sense lines servicing safety-related instruments were walked down to verify that the original construction specification of 1/8"/foot slope on horizontal runs was satisfied
  - Sense lines that did not meet this requirement were either evaluated by Engineering for acceptability or repaired
  - The sense line bow discovered during the investigation of this event was documented during these 1988 walkdowns
  - The bow was evaluated in 1988 as acceptable because loss of the reference leg for the safety-related pressure transmitter would not occur until system pressure was below operating span
  - Decision to not fix the cold cal transmitter sense line bow was based on lack of safety significance but was a bad decision
  - The investigation of the 1997 event found that the sense line bow did not contribute to the reference leg loss
    - Decision in 1988 to leave bow in line was, however, narrow in focus and line has been repaired after the 1997 event

Sequoyah Nuclear Plant
Reference Leg Design and Operation History

- Historical Information - Root Valve Configuration
  - In 1985, Engineering issued a design change to replace the pressurizer upper tap root valve for 1-LT-68-339 (hot cal level). The existing valve was an angle valve and was suspected of creating a condensate dam that was preventing steam from migrating to the condensate pot resulting in loss of reference leg
  - The design replaced the angle valve with a straight valve that was not capable of collecting condensed steam
  - Instrument performance shows the modification was successful at eliminating backfills at power
  - This validates the original theory that condensate damming in the angle valves was causing loss of reference leg during power operation
  - In 1988, a DCN was prepared to replace upper tap root valves on the remaining channels. A bad decision was made to not implement this DCN
  - The remaining angle valves will be replaced; schedule is being developed

Sequoyah Nuclear Plant
Reference Leg Design and Operation History

- Historical Information - Depressurization Method
  - Method of RCS depressurization changed in 1995 from a slow steam bubble collapse to a more rapid depressurization while operating in a solid water condition
  - Rapid depressurization during solid water operation causes liberation of hydrogen gas that carries liquid with it (champagne effect)
  - The champagne effect causes a loss of reference leg regardless of sense line slope, bow, or root valve configuration

Sequoyah Nuclear Plant
Reference Leg Design and Operation History

- Historical Information - 1993 Loss of Reference Leg
  - Caused by extended leakage with no steam bubble to refill
  - Comprehensive corrective actions proceduralized; focused on high risk region, ~20% to mid-loop
    - Noncoincident eduction and draindown
    - Positive inventory controls
    - Redundant instrumentation for operation outside normal pressurizer level range (LLG, ULMS, pre-Mansell, etc.)
    - Hot/cold calibration correlation curve
    - Level indication cross comparisons
    - Training accomplished on procedure changes
  - Heightened controls while draining to mid-loop consistent with industry practices
  - Suspected leaking valve replaced - loss of fill occurrences considered within expected performance

Sequoyah Nuclear Plant
Reference Leg Design and Operation History

- Historical Information - 1993 Accumulation of Nitrogen in Reactor Vessel
  - Use of RVLIS evaluated as useful but recognized often out-of-service for maintenance
  - In 1997 RVLIS taken out-of-service for maintenance while draining in region above RVLIS indication
- Historical Information - Post 1995 Experience
  - Modified 0-GO-7 procedure for pressurizer fill and accelerated depressurization
    - Modeled after enhanced industry outage practices
  - 0-GO-13 procedure not affected by this change
  - Modified procedure successfully implemented in 1995 and 1996
    - Reference leg loss recognized and addressed by refill
  - In 1997, operators failed to recognize reference leg loss after depressurization (level instrument discrepancies)

Sequoyah Nuclear Plant

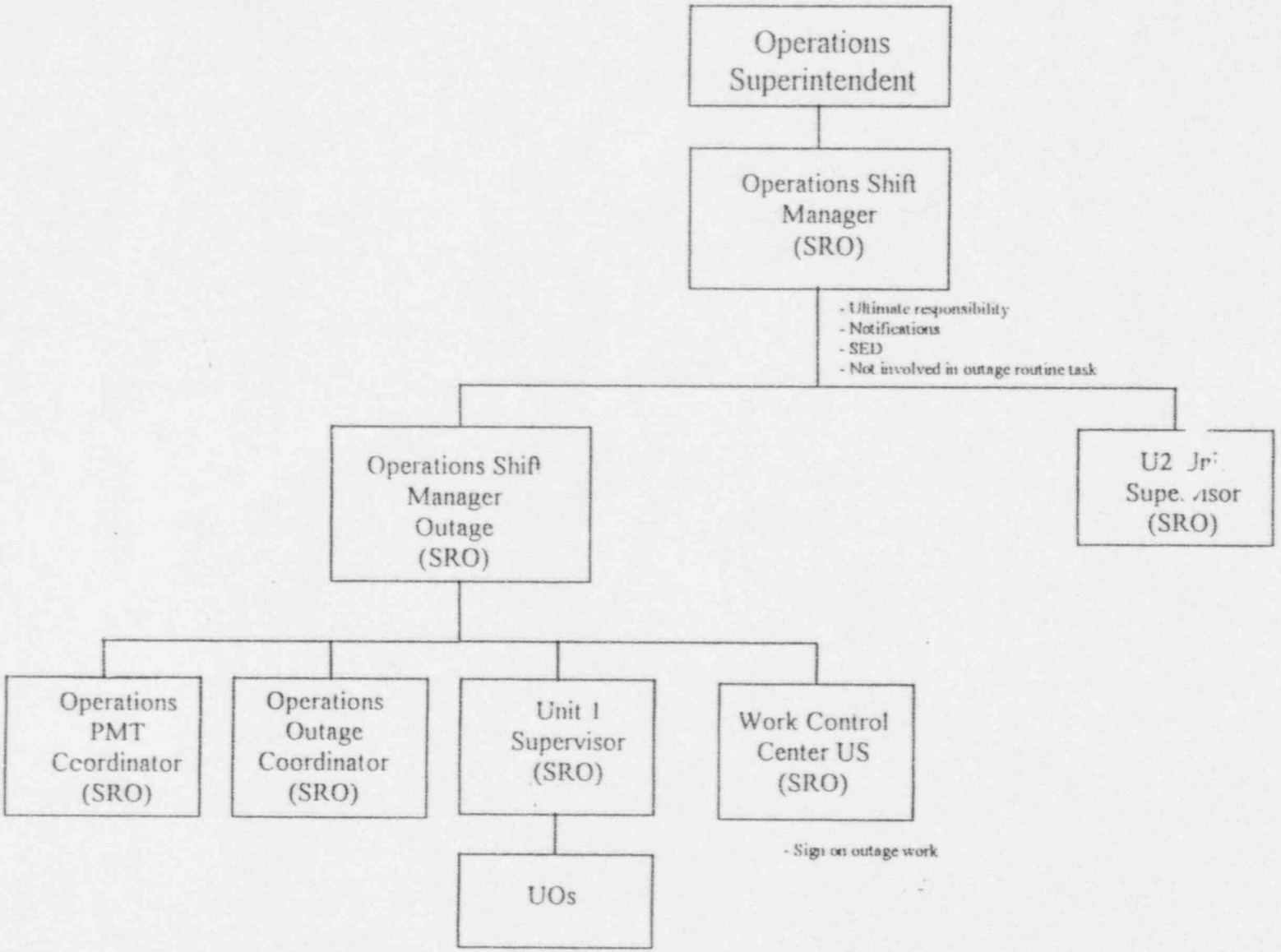
Event Evolution

Sequoyah Nuclear Plant
Event Evolution

Background

- Unit 1 Shut Down for Cycle 8 Refueling Outage
  - Operations outage organization headed by Outage Shift Manager (SRO)
    - Second outage for this management structure
    - Schedule for outage developed and approved by onshift SROs; reviewed and approved by Operations Superintendent and Operations Manager
    - Shift Managers' duties and responsibilities briefed prior to outage
  - Outage scope presented to licensed operators prior to outage
  - Licensed and nonlicensed operators went on four-group, twelve-hour shift the week prior to start of outage

Operations Outage Organization
U1C8 Refueling Outage



Sequoyah Nuclear Plant
Event Evolution

Background (cont.)

- Pressurizer level instrumentation part of initial qualification and requalification training
- Just-In-Time Training for RCS inventory reduction presented earlier in week
  - Expectations of volume and level change covered
  - Focus on RCS drain from pressurizer using outage specific instrumentation
  - Training targeted at three control room crews expected to be onshift at the time of the evolution
    - Crews received classroom training that covered "Mid-loop Operation" and Diablo Canyon event
    - Saturday evening and Sunday day shift crews received simulator training on taking RCS solid and draining to 60% pressurizer level
    - Sunday night shift crew received simulator training starting at 25% pressurizer level and draining below that point
    - No simulator training provided for pressurizer level changes in the normal operating range of 60% and 25%

Sequoyah Nuclear Plant
Event Evolution

Background (cont.)

- Prerequisite actions for inventory reduction to detension head ensured
  - Onsite and offsite power source available (switchyard protected)
  - Both charging pumps available with makeup capability from RWST
  - One safety injection pump available
  - Both residual heat removal pumps available
  - Four steam generators filled, do not take credit after RCS depressurized
  - Additionally, four cold leg accumulators filled at 100 pounds
- Adequate defense-in-depth for inventory recovery capability and loss of RHR contingency

Sequoyah Nuclear Plant
Event Evolution

Background (cont.)

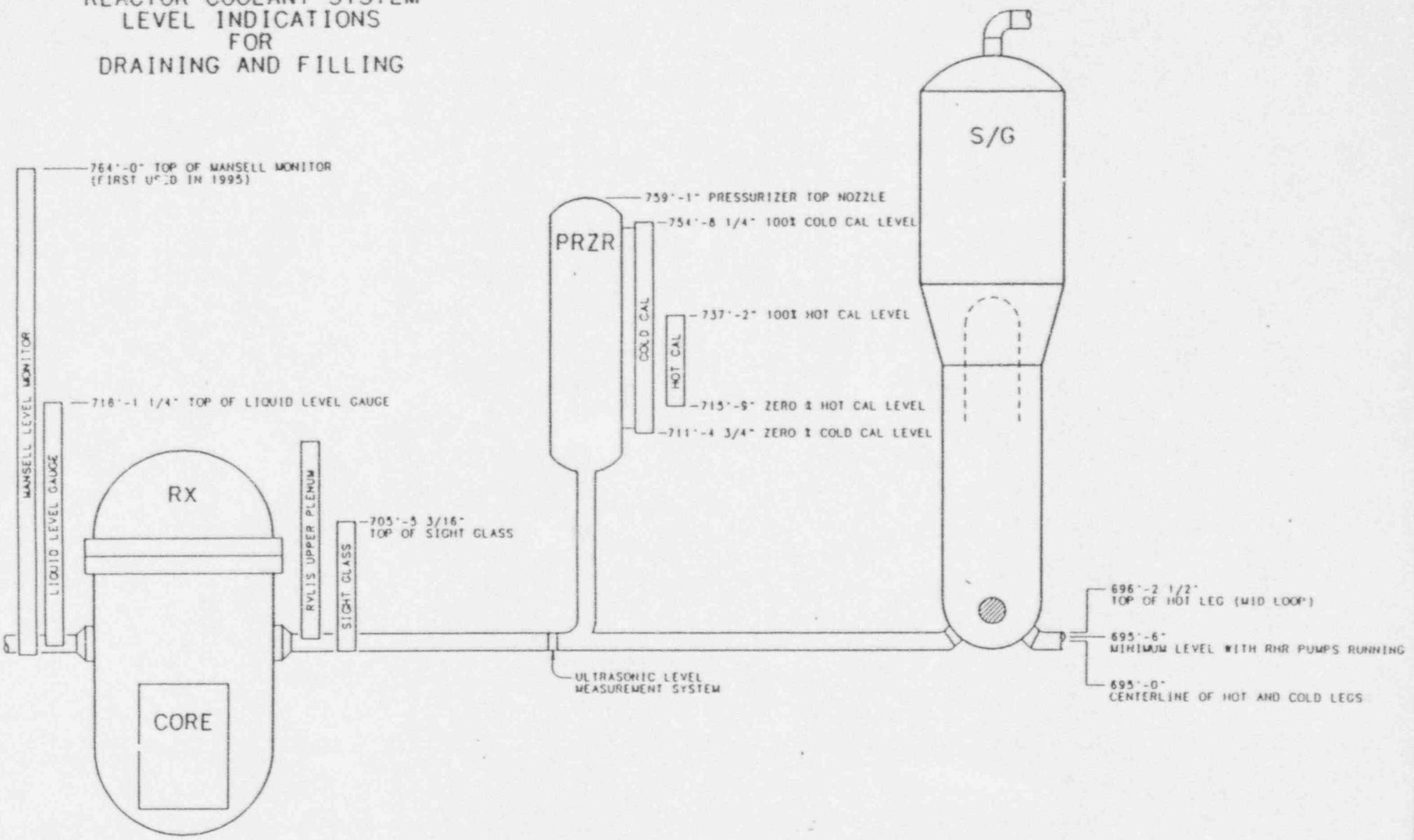
- Unit Entered Mode 5 and RCS Taken Solid
  - RCS pressure at 350 psig with two reactor coolant pumps in service
  - Third refueling outage in which pressurizer inventory reduction methods were similar
- Pressurizer Drain to 25% Actual Level Performed Using 0-GO-7, "Shutdown From Hot Standby To Cold Shutdown"
  - Four level instruments available
    - Three protection set (hot cals)
    - One open reference leg (cold cal)
  - Just-In-Time Training discussed availability of these instruments

Sequoyah Nuclear Plant
Event Evolution

Background (cont.)

- Pressurizer Drain Below 25% and Subsequent RCS Drain Would Be Performed Using 0-GO-13, "Reactor Coolant System Drain and Fill Operations"
  - Recurrence control actions included as a result of a 1993 inventory reduction event
    - Noncoincident eduction and draindown
    - Positive inventory controls
    - Redundant instrumentation for operation outside normal pressurizer level range (LLG, ULMS, pre-Mansell, etc.)
    - Hot/cold calibration correlation curve
    - Level indication cross comparisons
    - Training accomplished on procedure changes
  - Two additional level instruments required to be used to drain the RCS (not designed to operate with RCS pressurized)
    - Mansell level monitor
    - Liquid level gauge

REACTOR COOLANT SYSTEM LEVEL INDICATIONS FOR DRAINING AND FILLING



Sequoyah Nuclear Plant
Event Evolution

Sequence of Events

Previous Week

- Just-In-Time Training Conducted
- GL 88-17 Training Conducted

March 22, 1997

- 1330 - 1-LT-068-321 (Cold Cal Level) Checked for Calibration
  - Good correlation hot and cold cal instruments
  - Two RCPs in service, RCS at 350 psig, pressurizer bubble

March 23, 1997

- 0237 - Started Fill to Take RCS Water Solid
- 0955 - Pressurizer Solid, Two RCPs In Service at 350 psig
  - Good correlation hot and cold cal instruments during level increase
- 1755 - Stopped No. 4 RCP, No. 2 RCP In Service at 350 psig
  - Water solid

Sequoyah Nuclear Plant
Event Evolution

Sequence of Events (cont.)

- 2230 - Prejob Briefing Held Prior to Inventory Reduction Evolution
- 2257 - Stopped No. 2 RCP, Started RCS Depressurization
  - 2302 RCS pressure <200 psig
  - Started decreasing pressurizer level

March 24, 1997

- 0025 - Pressurizer Cold Calibration On Scale
- 0038 - Pressurizer Hot Cal On Scale

  First opportunity to notice indication was wrong
- 0150 - Stopped Pressurizer Inventory Reduction to Support Diesel Generator Surveillance Test (Cold Cal at 56%, Hot Cal At 25%)
  - Hot cal protection channels must be >17% to support surveillance
- 0630 - Cold Cal at 56%, Hot Cal at 25%, RVLIS at 102%

Sequoyah Nuclear Plant
Event Evolution

Pressurizer Level

Pressurizer Level (elevation)	Expected		Actual	
	Hot Cal	Cold Cal	Hot Cal	Cold Cal
737' 2" (Top of Hot Cal)	100%	60%	~99%	~94%
721' 1"	25%	22%	~25%	~56%
719'	15%	18%	~15%	~51%
716' 3"	4%	12%	~4%	~40%
708' 2" (Minimum level reached)	Offscale - low	Offscale - low	Offscale - low	~ 38%*

- Cold cal indication will not decrease after level decreased below lower tap

Sequoyah Nuclear Plant
Event Evolution

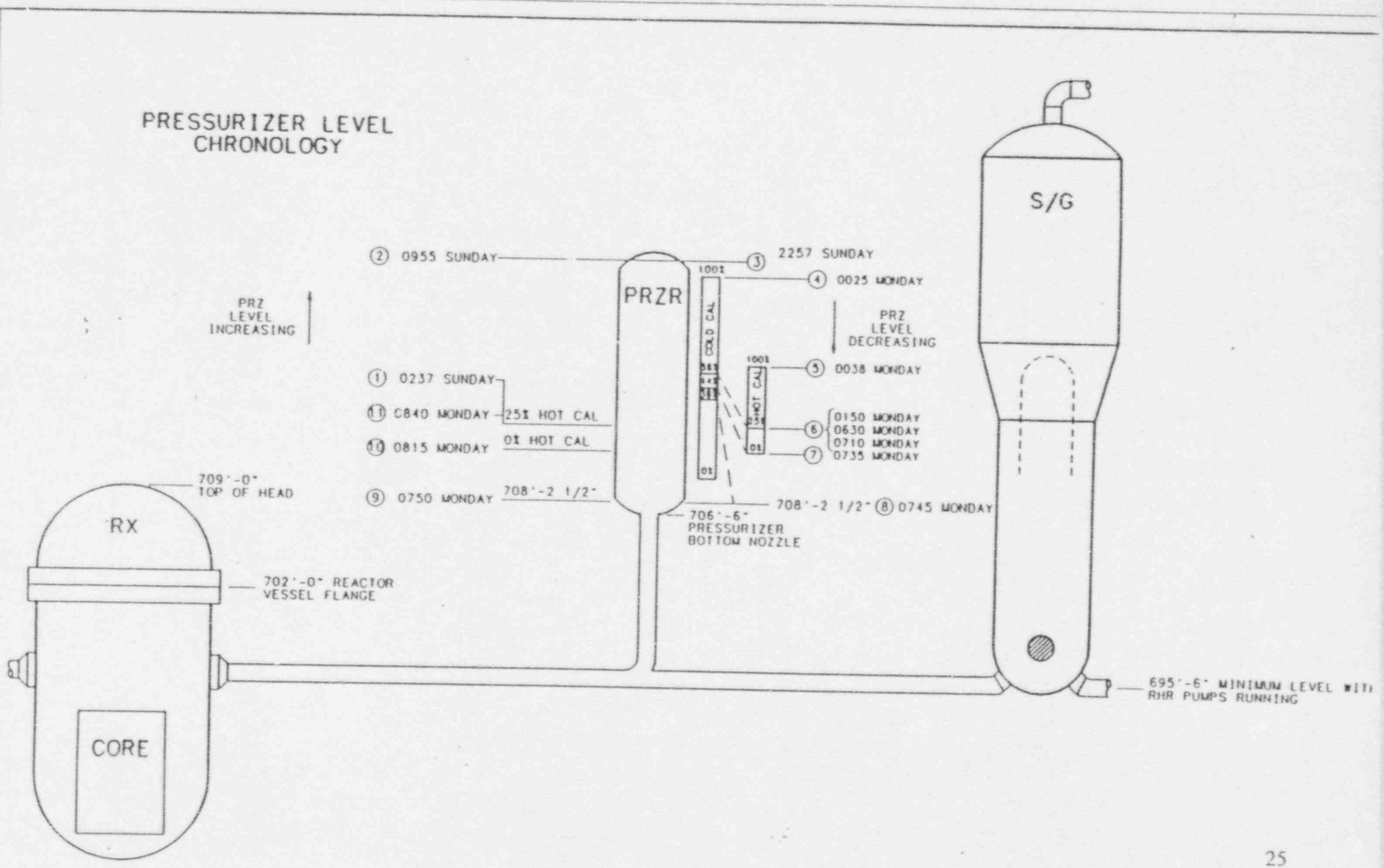
Sequence of Events (cont.)

- At ~ 0710 - Pressurizer Inventory Reduction Was Resumed
- 0711 and 0712 - Two Alarms Came In (Letdown Isolation and Pressurizer Low Level)
- At ~ 0735 - Day Shift US and UO Assumed Shift and Noted Cold Cal at 44% and Hot Cal at 0%
- At ~ 0745 - Operator Noted That Cold Cal Stopped Decreasing (38%), Inventory Reduction Was Terminated - Pressurizer Level ~ Two Feet Above Bottom of Pressurizer
- At ~ 0750 - Operators Started Increasing Charging
- At ~ 0815 - Pressurizer Hot Cal Came On Scale

Sequoyah Nuclear Plant
Event Evolution

Sequence of Events (cont.)

- 0816 - Charging Low Flow Alarm Cleared
- 0825 - Two Log Entries Made Documenting Start of Pressurizer Inventory Reduction and When Problem Noted
- At ~ 0840 - Pressurizer Hot Cal Level 25%
- At ~ 1500 - Cold Cal Level Instrument Reference Leg Backfilled, Hot Cal/Cold Cal Levels Were in Proper Agreement


PRESSURIZER LEVEL
CHRONOLOGY
S/G
PRZR
PRZ
LEVEL
INCREASING
PRZ
LEVEL
DECREASING
COLD CAL
HOT CAL
100%
25%
0%
② 0955 SUNDAY
③ 2257 SUNDAY
④ 0025 MONDAY
⑤ 0038 MONDAY
⑥ 0150 MONDAY
0630 MONDAY
0710 MONDAY
⑦ 0735 MONDAY
① 0237 SUNDAY
⑪ 0840 MONDAY
25% HOT CAL
⑩ 0815 MONDAY
0% HOT CAL
⑨ 0750 MONDAY
708'-2 1/2"
708'-2 1/2"
⑧ 0745 MONDAY
709'-0"
TOP OF HEAD
RX
702'-0" REACTOR
VESSEL FLANGE
CORE
706'-6"
PRESSURIZER
BOTTOM NOZZLE
695'-6" MINIMUM LEVEL WITH
RHR PUMPS RUNNING

Sequoyah Nuclear Plant

Operations Crew Performance

Sequoyah Nuclear Plant
Operations Crew Performance

- The Night Shift Crew Did Not Perform to Expectations
  - Unit Supervisor (US) did not perform adequate prejob briefing
  - Unit Operator (UO) did not perform an inventory balance on transferring liquids
  - UO did not recognize abnormal/off-normal plant indication using diverse and redundant information (cold/hot cal instrumentation, letdown isolation alarm, and low pressurizer level alarm)
  - The shift crew questioned instrumentation differences but incorrectly concluded that there was no problem
  - US/UO did not follow plant procedures pertaining to logbook entries
  - Outage SM did not exercise good oversight of inventory reduction evolution

Sequoyah Nuclear Plant

Corrective Actions

Sequoyah Nuclear Plant
Corrective Actions

- Corrective Actions Already Taken
  - Reinforced management expectations of Operations personnel
    - Standdown meetings were held with Operations personnel to review management expectations and review the event
    - In addition, the Plant Manager also held a meeting with the Shift Managers to discuss his expectations for performance
  - Surveyed industry for inventory reduction information
    - Several similar design PWRs were contacted to gather information related to inventory reduction techniques
    - Range of controls found, but most had no special controls for operation with level in normal operating range

Sequoyah Nuclear Plant
Corrective Actions

- Corrective Actions Already Taken (cont.)
  - Enhanced General Operating Procedure
    - Clarified the use of pressurizer level instruments
    - Required the use of positive inventory control
    - Installation of the Mansell level gauge
    - Backfill of the cold cal channel before lowering pressurizer level
  - Enhanced Licensed Operator Training
    - Review of the principles, use, and expected response of the pressurizer level instruments
    - Review of the 1997 inventory reduction event
  - Appropriate constructive discipline for involved personnel

Sequoyah Nuclear Plant
Corrective Actions

- Additional Corrective Actions
  - Communication of specific expectations with Operations personnel
    - Develop specific expectations for Operations personnel and meet with each individual to ensure their understanding and acknowledgment
  - Improve crew interaction and performance
    - Evaluate individual performance attributes
    - Strengthen/balance crew composition
    - Return onshift personnel to a common crew rotation schedule
    - Develop and use crew-specific performance indicators to monitor performance

Sequoyah Nuclear Plant
Corrective Actions

- Additional Corrective Actions (cont.)
  - Further Operations self-assessment
    - Focus on specific problem areas such as logkeeping, prejob briefings, and conservative decision making
    - Expand to include extended tours with Assistant Unit Operators and control room personnel
    - Expand participation by including additional senior management and line management
    - Expand emphasis on backshifts and weekends
  - Conduct an independent assessment of the Operations department using selected peers from San Onofre, Palo Verde, and South Texas Project
  - Conduct periodic assessments of operator knowledge in fundamental principles and feed back the results to training

Sequoyah Nuclear Plant

Management Initiatives

Sequoyah Nuclear Plant
Management Initiatives

- Examples of Increased Management Monitoring of Activities
  - Plant trip hazards
  - Surveillance instructions with ESF potential
  - LCOs less than 72 hours
  - Risk significant actions per Probabilistic Safety Assessment
    - Management assigned to evolutions
    - Contingency plans
    - Additional controls
- Focused on Key Return to Service Processes to Preclude Future Events
  - Status control
  - PMT process
  - Surveillance Program
  - Sensitive activities (includes pre/post-job briefs)
  - Procedure adherence

Sequoyah Nuclear Plant
Management Initiatives

- Expand Plan of Day Meeting
  - Enhance daily evaluation of plant performance/status
- Daily Management Review Committee Meeting
  - Senior management cognizance of identified problems
- Other Process Controls to be Reviewed/Improved
  - Just-In-Time Training
  - Prejob briefings
    - Special training
    - Special management oversight
    - Worker feedback
  - Crew implementation of positive inventory controls
  - Conduct of operations adherence
  - Procedure change process affecting equipment/plant operation
  - Equipment performance monitoring process

Sequoyah Nuclear Plant
Management Initiatives

- Reinforced Expectation for Conservative Decision Making
  - Management unknowingly conditioned the operating crews to treat the initial pressurizer level reduction to 25% as a noncritical evolution

Sequoyah Nuclear Plant
Management Initiatives

- Additional Management Initiatives to Preclude Events
  - Review of 28 areas identified in 1985 - 1988 Sequoyah Nuclear Plant Performance Programs
    - Review is continuing in six areas
    - To date, review indicates no operational impacts
  - Review of 1993 restart programs to be conducted
  - The Corrective Action Program database (1988 to 1997) is being reviewed for operational events, reactivity management issues, hold order problems, PMT problems, and configuration problems. Ninety-eight (98) corrective action documents were identified and are being reviewed
    - Adequacy of root cause evaluations
    - Whether corrective actions address root cause determinations
    - Whether corrective actions have generic impact
    - Negative performance trends in above areas

Sequoyah Nuclear Plant
Management Initiatives

- Additional Management Initiatives to Preclude Events (cont.)
  - Review of four most recent reactor trips and two operational events being conducted
    - Analysis complete
    - Conclusions and recommendations under management review
- Plant Material Condition Initiatives Previously Described to NRC on Schedule

Sequoyah Nuclear Plant

Conclusions

Sequoyah Nuclear Plant
Conclusions

- Broad Event Evaluation
  - Technical review of instrumentation system
  - Crew performance and conduct of operations
  - Evaluation of training effectiveness
  - Prejob briefing content
  - Procedure review/revisions process
  - Management involvement and reinforcement
  - Equipment performance monitoring
- Comprehensive Review of Past Corrective Actions to Assess Effectiveness
  - Review of 1985 - 1988 Nuclear Plant Performance Program
  - Review of 1993 Restart Program
  - Review of Corrective Action Program Database from 1988 to 1997
  - Review of Selected Operational Events and Reactor Trips

Sequoyah Nuclear Plant
Conclusions

- Technical Issues Associated with Reference Leg Design/Installation Did Not Cause Event - Bow, Slope, Angle Valves
- Management Established Reasonable Expectations and Controls Following 1993 Event Which Were Consistent With General Industry Practices
  - Noncoincident eduction and draindown
  - Positive inventory controls
  - Redundant instrumentation for operation outside normal pressurizer level range (LLG, ULMS, pre-Mansell, etc.)
  - Hot/cold calibration correlation curve
  - Level indication cross comparisons
  - Training accomplished on procedure changes
  - Replaced drain valves

Sequoyah Nuclear Plant
Conclusions

- Pressurizer Level Indication Inaccuracy Identified by Oncoming Crew
- Level Decrease Terminated with Over 1-1/2 Feet Water Remaining in Pressurizer
- Event Had No Safety Consequences - Pressurizer Was Not Emptied

Sequoyah Nuclear Plant
Conclusions

- Progression to Loss of RHR Not Credible
  - Thirteen hours to drain to mid-loop condition
  - Loss of reference leg for cold cal indicator resulted in constant (nondecreasing) indication despite continuing draindown - thirteen hours of monitoring with no indicator movement coincident with draindown not credible
  - Outage sequenced activities for day shift would trigger draindown progress checks
  - Defense-in-depth contingencies available for loss of RCS inventory and loss of RHR
    - Offsite and onsite power
    - Two charging pumps
    - One SI pump
    - Full RWST level (300,000 gal.)
    - Four steam generators filled
    - Four cold leg accumulators filled
- No Potential Safety Significance

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