

Official copy

MAR 17 1994

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

Tennessee Valley Authority
ATTN: Mr. Oliver D. Kingsley, Jr.
President, TVA Nuclear and
Chief Nuclear Officer
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Gentlemen:

SUBJECT: ENFORCEMENT CONFERENCE SUMMARY - SEQUOYAH UNITS 1 AND 2

On March 10, 1994, the NRC staff held an enforcement conference at the Region II office with representatives of the Tennessee Valley Authority (TVA) Sequoyah Nuclear Plant management staff. The conference was held to discuss the circumstances surrounding nitrogen accumulation in the Sequoyah Unit 1 reactor coolant system. Enclosure 1 is a list of the individuals who attended the meeting and Enclosure 2 is the handout material supplied by TVA.

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 letter, please contact us.

Sincerely,

(Original signed by J. Jaudon)

Jon R. Johnson, Director
Division of Reactor Projects

Enclosures:

1. List of Attendees
2. Presentation Notes

cc w/encls: (See page 2)

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MAR 17 1994

Tennessee Valley Authority

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Tennessee Valley Authority


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P. J. Kellogg, RII
S. E. Sparks, RII
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DRP/RII

SSparks:vyg
03/15/94

DRP/RII

PKellogg
03/15/94

ENCLOSURE 1

LIST OF ATTENDEES

NRC

S. D. Ebnetter, Regional Administrator, Region II (RII)
E. W. Merschoff, Deputy Regional Administrator, RII
J. P. Jaudon, Acting Deputy Director, DRP, RII
P. J. Kellogg, Section Chief, Branch 4, Section 4A, DRP, RII
S. E. Sparks, Project Engineer, DRP, RII
W. E. Holland, Senior Resident Inspector, DRP, RII
S. M. Shaeffer, Resident Inspector, DRP, RII (telecon)
B. Uryc, Acting Director, Enforcement and Investigation Coordination Staff,
RII
C. F. Evans, Regional Counsel, RII
F. J. Hebdon, Director, Project Directorate II-4, Office of Nuclear Reactor
Regulation (NRR)
D. E. LaBarge, Project Manager, Project Directorate II-4, NRR
M. A. Caruso, Section Chief, Reactor Systems Branch, NRR

TVA

O. J. Zeringue, Senior Vice President, Nuclear Operations
M. O. Medford, Vice President, Technical Support
K. P. Powers, Acting Site Vice President, Sequoyah
R. R. Baron, General Manager, Nuclear Assurance
B. S. Schofield, Manager, Nuclear Licensing and Regulatory Affairs
N. A. Welch, Operations Superintendent
R. H. Shell, Licensing Manager
M. J. Burzynski, Engineering Manager
M. E. Frye, Technical Support
K. E. Meade, Site Licensing
G. I. Sanders, Shift Operating Supervisor

ENCLOSURE 2

NITROGEN GAS ACCUMULATION
ENFORCEMENT CONFERENCE
TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT - UNIT 1

March 10, 1994
NRC Region II Office

NRC/TVA MEETING
MARCH 10, 1994

AGENDA

- INTRODUCTION K. P. POWERS
- SEQUENCE OF EVENTS N. A. WELCH
- SAFETY SIGNIFICANCE M. J. BURZYNSKI
- DISCUSSION OF REGULATORY ISSUES
 - SSP-9.3 M. J. BURZYNSKI
 - TS 3.4.1.4 N. A. WELCH
 - SSP-12.1 N. A. WELCH
 - RVLIS GRAPH M. E. FRYE
 - CRITERION XVI - APRIL 1993 EVENT M. E. FRYE
 - CRITERION XVI - NER R. H. SHELL
 - 10 CFR 50.59 - CILRT R. H. SHELL
- REGULATORY PERSPECTIVE R. H. SHELL
- CONCLUSIONS K. P. POWERS

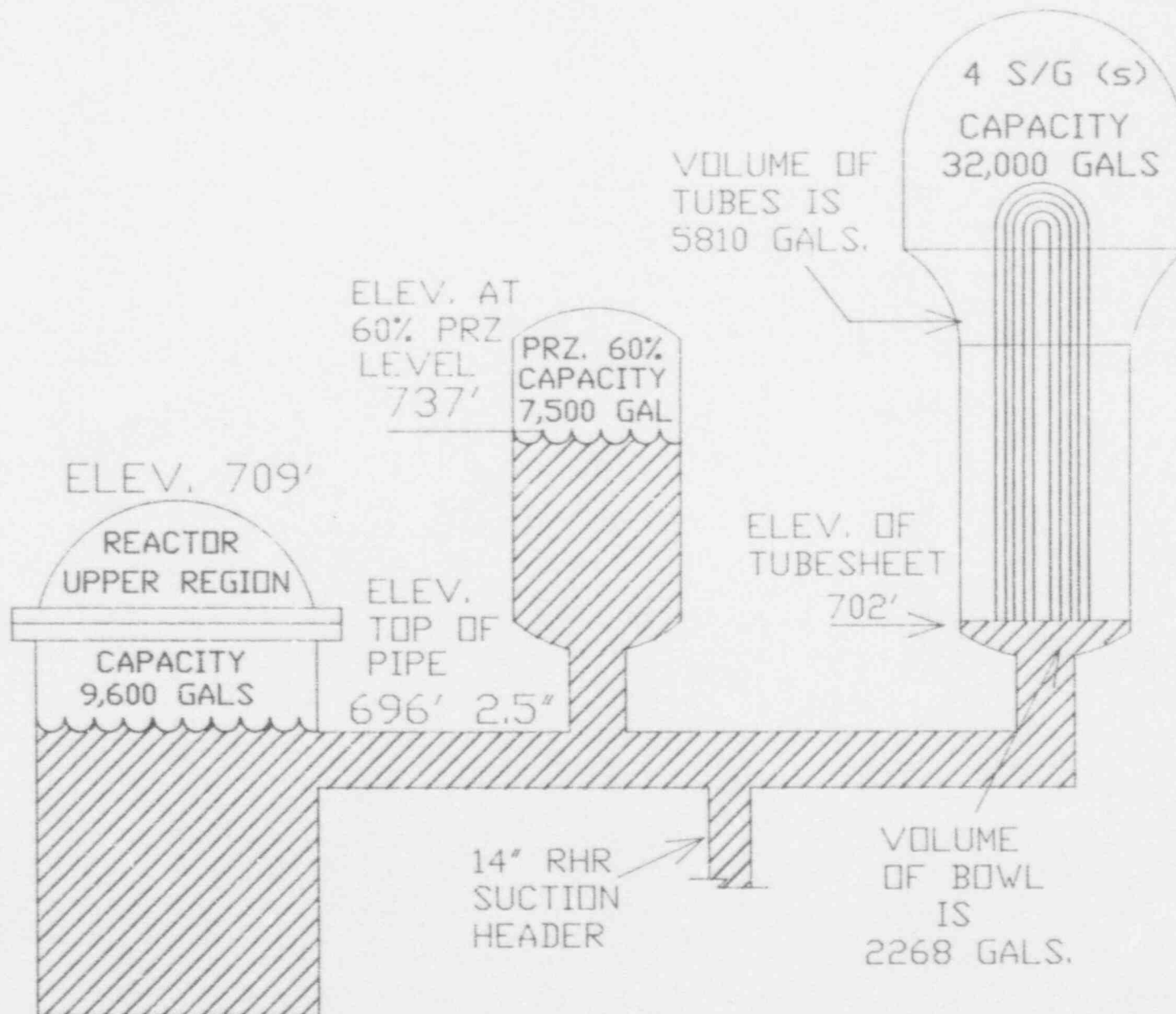
INTRODUCTION

- TVA recognizes the significance of the length of time this condition existed without our knowledge.
- Plant management was focused on successful Unit 2 operation and placing Unit 1 in the most conservative condition (depressurized).
- Insufficient knowledge and questioning attitude concerning management evaluation of off-normal plant conditions and failure to fully understand nitrogen solubility led to this event.
 - Actions will be taken to ensure this situation does not occur again.
- Appropriate actions were taken upon discovery of the gas accumulation.
 - In-depth investigation followed.
- Safety and regulatory significance of event minimal.

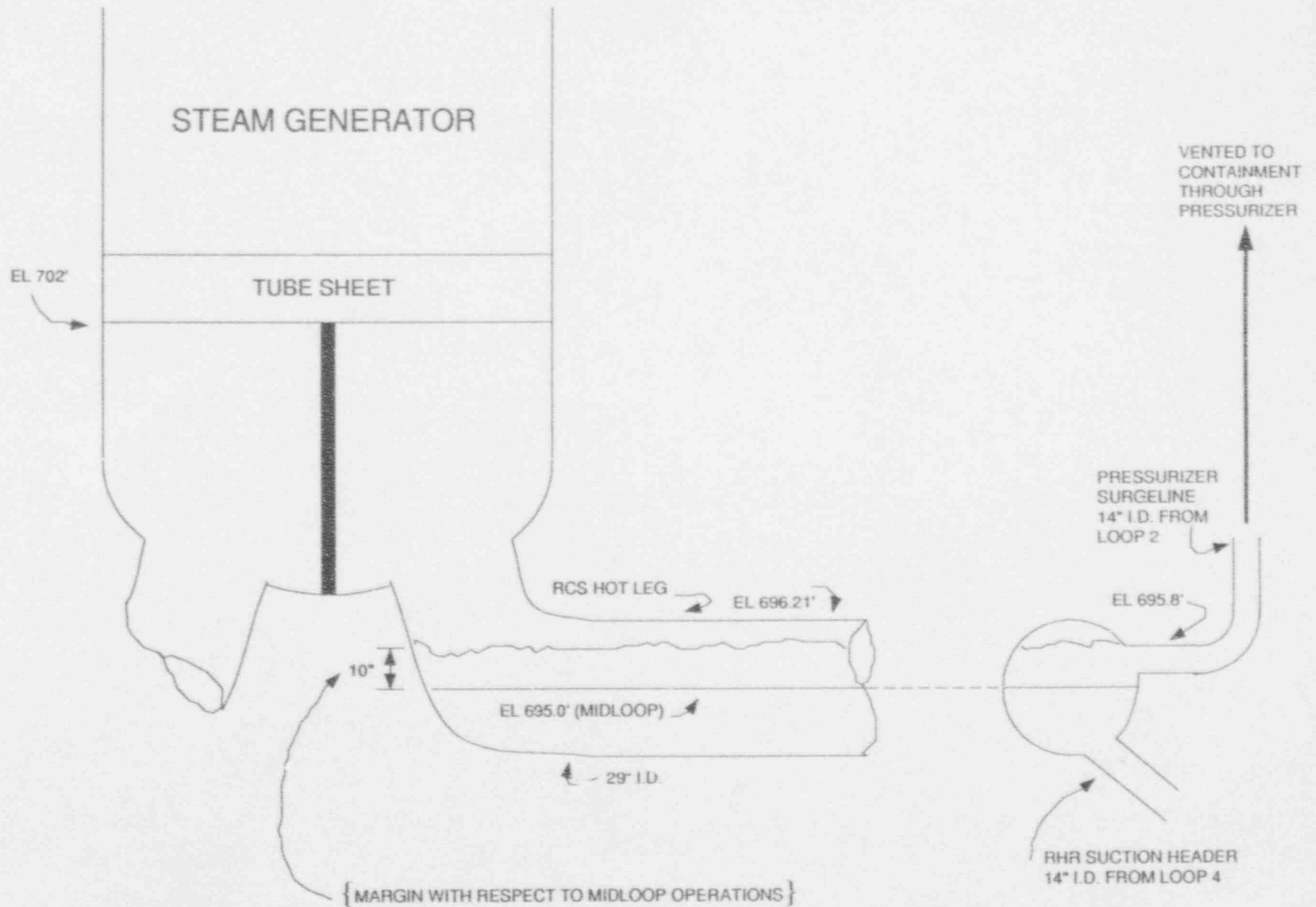
THERMODYNAMICS OF EVENT

- Gas transported from the VCT to the reactor coolant system via the charging system.
- As the result of the pressure change from the VCT (20 psig) to the RCS (atmosphere) and temperature differences, gas came out of solution in both the reactor head and the steam generator tubes.
- Pressurizer surge line is off the top section of the RCS piping. RHR suction line is off the bottom section of the pipe.
- Once gas filled the reactor head and steam generator tubes, gas traveled down the hot legs and was vented through the pressurizer surge line to the containment atmosphere.
- Condition had reached equilibrium. System design prevents reactor vessel water level from decreasing any further.
- Loss of shutdown cooling could not have occurred as a result of the gas accumulation.

VOLUMETRIC AREAS OF REACTOR COOLANT SYSTEM



WORST CASE GAS DISTRIBUTION IN RCS



CHRONOLOGY OF EVENT

- 09/06/93 RCS sweeps and vents complete.
- PZR level monitored (two channels) and maintained at 60%.
- 12/17/93 CILRT commences.
- PZR level decreased.
- CILRT hold - PZR level restored.
- Senior Operations and plant management involved.
- Shutdown cooling evaluated.
- 12/20/93 CILRT completed.
- RCS inventory removed.
- Decision made not to substitute filled RCS for RHR loop.
- 12/21/93 Operations documents inventory change during CILRT in a PER.
- Operations vents head.
- 12/22/93 Tech Support calculates water added and released during the CILRT.
- Confirmed that gas was present in the reactor head and steam generator tubes.
- 12/28/93 Investigation considers utilization of RVLIS trends on PEDS in order to determine magnitude of gas.
- Confirms RVLIS could be utilized.
- Operations issues a shift order to vent reactor head at 80% on RVLIS.

- 01/07/94 Tech Support determines nitrogen from the VCT is the source of the gas accumulation.
- 01/13/94 Tech Support investigation determines reactor vessel water level had been as low as the top of the RCS hot legs.
- 01/14/94 NRC Residents briefed.
- 01/24/94 RCS sweeps and vents performed. RCS pressurized.

SAFETY SIGNIFICANCE

INITIAL CONDITIONS

- Unit 1 was in mode 5.
 - RCS temperature approximately 120 degrees F.
 - RCS pressure - atmospheric - vented to containment.
- PZR level at 60%.
- Nitrogen gas in the reactor head and the steam generator tubes.
- One train of RHR always in service.
- Both trains available 96% of the time.
- Low decay heat level (.87 MW thermal).

SAFETY SIGNIFICANCE

CONSEQUENCES OF THIS CONDITION

- Loss of RHR from gas accumulation could not occur.
 - Piping configuration prevents water level from approaching mid-loop elevation.
 - RCS level would not drop to the point where RHR pumps would ingest gas - adequate suction head remained.
 - 7,500 gallons of water available in the pressurizer--substantial margin maintained.
 - Any remaining dissolved nitrogen would remain in solution at the RHR pump inlet.
 - NPSH is not affected by dissolved gases in solution.
 - Minimal decrease in safety margin based on gas accumulation.

Conclusion: This condition could not lead to a loss of RHR cooling.

SAFETY SIGNIFICANCE

CONSEQUENCES IF RHR WERE LOST FOR ANY REASON

- Boiling would not occur for approximately 135 minutes.
- Sufficient vent path available to release steam as the result of boiling.
- 7,500 gallons of water available in the pressurizer for RCS input.
 - Would drain into the reactor coolant loops and reactor head as the result of the low decay heat level.
 - Several other water sources available to restore any lost RCS inventory.
 - Redundant PZR level indications provide for direct monitoring of any RCS water inventory change.
- Capability to close containment was maintained.
 - All containment breaches were being administratively controlled.
 - Containment closure would have been initiated early during loss of RHR cooling per procedure.

Conclusion: Sufficient operator response time would have been available to mitigate the consequences of a postulated loss of RHR cooling event with the gas accumulation in the RCS.

SAFETY SIGNIFICANCE

SAFETY SIGNIFICANCE OF VARIOUS MODE 5 PLANT OPERATIONS

- The configuration associated with gas accumulation in the reactor head hydrostatically acts the same as RCS after mode 6, just before sweeps and vents.
 - Gas accumulation in reactor head is the only difference.
 - RCS water inventory significantly greater than mid-loop conditions.
 - Pressurizer must completely drain before RCS would approach mid-loop.
- Rank of various mode 5 plant operations from least risk to most risk.
 - RCS filled and vented to containment.
 - RCS inventory prior to sweeps and vents.
 - RCS inventory change due to gas accumulation.
 - Closed RCS with no hot leg vent path.
 - Mid-loop operation.
- RCS heat removal capability with the gas accumulation is similar to a partially-filled RCS following mid-loop operation (i.e., steam generator tubes are empty during both conditions). These plant conditions present less risk than mid-loop operation.

SAFETY SIGNIFICANCE

CONCLUSION

This condition was not as safety significant as other routine refueling outage conditions. Adequate margin was maintained as the result of PZR level. Redundant pressurizer level indications would have provided direct indication of changing RCS inventory conditions. This condition did not have the capability to worsen on its own accord due to the system piping design. The minor decrease in margin as the result of the gas accumulation represents minimal safety significance.

DISCUSSION OF REGULATORY ISSUES
SSP-9.3 PLANT MODIFICATIONS AND DESIGN CONTROL

Technical Specification (TS) 6.8.1 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. Appendix A of Regulatory Guide 1.33 includes administrative procedures for conduct of operations and conduct of modifications to the facility. Inherent in these requirements is that the procedures be adequate.

- (a) SSP-9.3, Plant Modifications and Design Control, Revision 6, contains specific requirements for the preparing, planning, and control of plant modifications. DCN M09505A and WO 93-09179-00 were developed under the control process guidance of SSP-9.3 to implement a modification to the Unit 1 Component Cooling System. However, DCN M09505A and/or WO 93-09179-00 were inadequate, in that, equipment modification and testing was not completed prior to returning the equipment to service. This condition resulted in an inadvertent cooldown of the volume control tank on December 1, 1993.

TVA POSITION

- TVA agrees with the Staff's position on this issue.
- This condition did not affect the reduction in reactor vessel water level.
 - The cooldown of the VCT occurred on 12/01/93.
 - RVLIS indicates the reactor vessel water level was at the top of the RCS hot legs on or before 11/29/93.

ROOT CAUSE

- The governing procedure lacked the proper guidance to ensure a modification was properly managed from start to finish.

CORRECTIVE ACTIONS

- The appropriate site procedures will be revised to ensure that a task manager owns each modification. This will ensure proper coordination of activities associated with the modification.

TS 3.4.1.4

Technical Specification (TS) 3.4.1.4 requires, in part, that two residual heat removal (RHR) loops be operable and at least one RHR loop be in operation while in MODE 5. The TS has provisions allowing the substitution of four filled reactor coolant loops for one RHR loop. However, between September 6, 1993, to December 21, 1993, one RHR loop was declared inoperable for 13 percent of that period. Subsequent to December 21, 1993, the licensee determined that four filled reactor coolant system loops were not available during the same period. This resulted in the licensee failing to enter the ACTION of TS 3.4.1.4 for the applicable periods.

TVA POSITION

- TVA agrees with the Staff's position on this issue.
- Operations personnel were not aware of the subject condition and thus did not formally enter the TS action statement when one train of RHR was declared inoperable. However, compliance with TS 3.4.1.4 action statement was maintained. In addition, both trains of RHR were available 96% of the time.

ROOT CAUSE

- Insufficient knowledge and questioning attitude concerning:
 - Management evaluation of off-normal plant conditions.
 - Solubility of N₂ in the RCS.

CORRECTIVE ACTIONS

Prompt Actions (Completed)

- Interim decision made to not substitute four filled reactor coolant loops for an RHR loop.
- Operations vented the reactor head.
- Performed RCS sweeps and vents - RCS pressurized.

Long-term

- SQN will review the lessons learned from this event with the appropriate site personnel.
 - Off-normal plant conditions.
 - N₂ solubility.
 - Depressurized RCS condition.
 - Monitoring plant parameters.
- Appropriate plant procedures will be revised to address operation of the RCS at atmospheric pressure.
- Utilization of RVLIS in areas other than post-accident and mid-loop conditions will be evaluated.

SSP-12.1 CONDUCT OF OPERATIONS

Technical Specification (TS) 6.8.1 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. Appendix A of Regulatory Guide 1.33 includes administrative procedures for conduct of operations and conduct of modifications to the facility. Inherent in these requirements is that the procedures be adequate.

- (b) SSP-12.1, Conduct of Operations, Revision 6, paragraph 3.1.2.J.2, assigns, in part, shared responsibilities to the Unit Operator, the Operator at the Controls, and all operations personnel assigned to the control room for maintaining cognizance of plant status. However, during the period between September 6 through December 21, 1993, operators and other applicable personnel failed to maintain cognizance of reactor coolant system level parameters. This resulted in the actual vessel level being at or near the top of the reactor coolant system loop piping, when the reactor coolant system was considered to be full.

TVA POSITION

- TVA disagrees with the Staff's position on this issue.
- Consistent with training and procedural requirements, Operations personnel were monitoring the RCS and were cognizant of the RCS parameters.
 - Two channels of (hot- and cold-calibrated) pressurizer level were available to the operators to monitor reactor vessel water level.
 - Based on training and procedural guidance, operators reasonably believed that pressurizer level was an accurate reflection of reactor coolant inventory (in hindsight, this was not a correct conclusion).
 - Operators adequately monitored these two PZR level channels. This was shown during the CILRT when, due to a decrease in PZR level, operators stopped the test and notified management.
 - Consistent with NRC requirements, operator training details utilization of RVLIS in accident conditions and during mid-loop operation.
- Technical specifications require RVLIS to be operable in modes 1, 2, and 3. There is no tech spec or administrative requirement to monitor RVLIS with the subject conditions.
- TVA has concluded that since Operations personnel were monitoring the appropriate parameters; SSP-12.1 was not violated.

RVLIS GRAPH

10 CFR 50, Appendix B, Criterion III, Design Control, requires, in part, that design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program.

However, the licensee did not establish design control measures for graph information data regarding the RVLIS contained in O-GO-4.0, RCS Drain and Fill Operations, Revision 7. This resulted in unsubstantiated information being available to operators for use during evolutions which could affect safety-related parameters.

TVA POSITION

- TVA disagrees with the Staff's position on this issue.
- The graph represents a simple calculation that is easily derived from Westinghouse data. The graph has been verified to be accurate.
- The graph information is contained within a General Operating Instruction. The purpose of the graph is to provide general guidance to plant personnel.
- TVA concludes that the calculational method utilized to derive this graph meets the requirements of 10 CFR 50, Appendix B, Criterion III.

SQN

1,2

RCS DRAIN AND
FILL OPERATIONS

0-GO-4.0

Rev: 8

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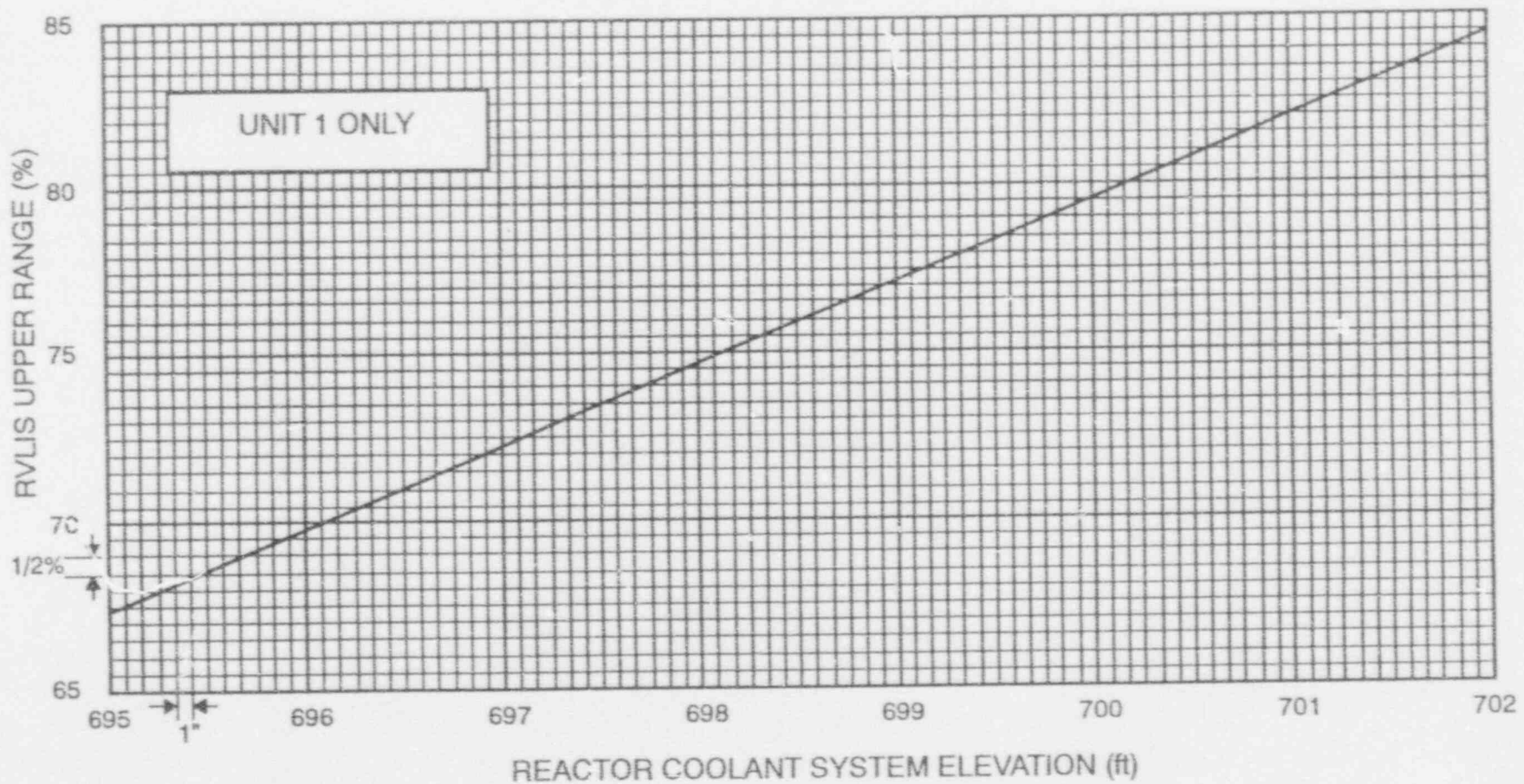
Date

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APPENDIX B

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RVLIS UPPER RANGE VS RCS ELEVATION
(RVLIS head sensor bellows drained)



CRITERION XVI
APRIL 1993 EVENT and NER

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

In April of 1993, an event occurred which involved an unknown loss of RCS level due to the failure of a pressurizer level indicating channel during RCS draindown evolutions. In that event, operators were not aware of a significant decrease in the RCS inventory.

In addition, other previous industry information had been available which could have alerted the licensee to the potential issue in order to preclude the event.

During the period between September 6 through December 21, 1993, a second event occurred regarding gas migration into the RCS which resulted in an unobserved RCS level decrease.

However, the licensee failed to take effective corrective actions for the April 1993 event to prevent recurrence of a similar problem involving the unknown reactor coolant system level perturbation which was identified on December 17, 1993.

TVA POSITION - APRIL 1993 EVENT

- TVA disagrees with the Staff's position on this issue. The corrective actions from the April 1993 event would not have prevented gas from forming in the reactor head or steam generator tubes.
- The April 1993 event involved a condition associated with the failure to have independent indications when reactor vessel water level was fluctuating (draining or filling).
- Corrective action for the April 1993 event included ensuring two methods of monitoring reactor vessel water level were available.
- Both the cold-calibrated and the hot-calibrated pressurized level channels were available during the period between the RCS sweeps and vents in September and the RCS sweeps and vents in January.
- RVLIS is required to be removed from service during outage periods for calibration. Therefore, RVLIS cannot be in service during the entire outage.
- SQN's utilization of RVLIS is consistent with the rest of the industry.
- TVA concludes that the corrective actions for the April 1993 event were appropriate and effective.
- TVA concludes that the two events, although related to reactor vessel water level, involved completely different circumstances which require completely different corrective actions.

TVA POSITION - NER

- TVA disagrees with the Staff's position on this issue.
- TVA agrees that, in hindsight, the review of Information Notice 87-46, "Undetected Loss of Reactor Coolant," was not sufficiently comprehensive. However, it is not clear that a comprehensive review would have anticipated this event.
- North Anna event involved numerous different circumstances (i.e., draining of the RCS, one channel of PZR level, expedited maintenance activity, RCS leak).
- TVA performed an evaluation of information notices from 1986 to 1990 to ensure the lessons learned from this event have been appropriately captured. This evaluation reviewed those notices assigned to Operations or Training to determine if similar review weaknesses existed. No additional discrepancies were identified.

10 CFR 50.59 - CILRT

10 CFR Part 50.59 (b) (1) states, in part, that the licensee shall maintain records of changes in the facility and changes in procedures made pursuant to this section, to the extent that these changes constitute changes in the facility as described in the safety analysis report or to the extent that they constitute changes in procedures as described in the safety analysis report. These records must include a written safety evaluation which provides the bases for the determination that the change, test, or experiment does not involve an unreviewed safety question.

However, it was determined that a safety evaluation was not performed after discovery of an unknown amount of gas accumulation in the reactor coolant system. The existence of the gas was identified during the performance of the Unit 1 CILRT on December 17, 1993. Due to the condition, the licensee revised the CILRT procedure to address the effect of the gas on the CILRT and its effect when the containment was to be depressurized from the CILRT conditions. An evaluation for the gas accumulation was not performed to address the effect of the gas on the reactor coolant system inventory. Specifically, the effect of the gas on the reactor vessel and steam generator levels was not considered.

TVA POSITION

- TVA disagrees with the Staff's position on this issue.
- TVA recognizes the initial evaluation of gas accumulation was not extensive.
- The purpose of 10 CFR 50.59 is to determine if a licensee can make a change to the facility as described in the Safety Analysis Report, a change to a procedure as described in the Safety Analysis Report, or conduct a test or experiment not described in the Safety Analysis Report without prior Commission approval unless the proposed change, test, or experiment involves a change in tech specs or a USQ.
- The subject procedure is not described in the Safety Analysis Report, does not involve a change in tech specs, and does not involve a USQ
 - therefore, a 10 CFR 50.59 review is not required.
- The change to the subject procedure only added a note to remind personnel to monitor PZR level when depressurizing from the CILRT.
 - This was a non-intent procedure change.
 - A non-intent change does not require a 10 CFR 50.59 evaluation.
- Therefore, 10 CFR 50.59 was not violated.

REGULATORY PERSPECTIVE

TVA's review of regulatory requirements concludes:

- Minimal safety significance.
 - Cumulative effect of the length of time this condition existed has been considered.
- Venting of the reactor head on 12/21/93 increased margin of safety.
- Prompt immediate and long-term corrective actions taken.
- Review of apparent violation examples.

Related to Gas Accumulation

- Acknowledge failure to enter TS 3.4.1.4.
- Do not agree with characterization of the previous reactor vessel water level event--effective and appropriate corrective actions were taken.
- Comprehensive review of NER item would not have anticipated this event

Not Related To Gas Accumulation

- Acknowledge that the modification process was inadequate.
- RVLIS graph information met Criterion III requirements.
- Operations personnel complied with SSP-12.1.
- The procedure change associated with the CILRT did not violate 10 CFR 50.59.

CONCLUSIONS

- TVA recognizes the significance of the length of time this condition existed without our knowledge.
- TVA has learned from this event regarding potential effects of long-term shutdown with the RCS depressurized.
- Corrective actions will be taken to prevent recurrence.
- Minimal loss of safety margin.
- Personnel performance remains good, progress is continuing.
 - Does not represent ineffective communication of expectations to licensed personnel.
 - Does not represent continuing problems in configuration control.