February 25, 2005

Gregg R. Overbeck, Senior Vice President, Nuclear Arizona Public Service Company P.O. Box 52034 Phoenix, Arizona 85072-2034

SUBJECT: MEETING SUMMARY DISCUSSING PALO VERDE APPARENT VIOLATIONS

Dear Mr. Overbeck:

This refers to the Pre-decisional Enforcement and Regulatory Conference conducted at the NRC Region IV Office, Arlington, Texas, on February 17, 2005. The meeting attendance list and a copy of the presentations are included as Enclosures 1 and 2. No commitments were made by the licensee during the conference.

In accordance with Section 2.390 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 available electronically for public inspection in the NRC's Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this matter, we will be pleased to discuss them with you.

Sincerely,

Troy W. Pruett, Chief Project Branch D Division of Reactor Projects

Dockets: 50-528 50-529 50-530
Licenses: NPF-41 NPF-51 NPF-74

Enclosures:
1. Meeting attendance list
2. Presentations
Arizona Public Service Company

cc w/enclosures:
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Arizona Corporation Commission
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Chairman
Maricopa County Board of Supervisors
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Phoenix, AZ 85003

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Palo Verde Nuclear Generating Station
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Southern California Edison Company
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Robert Henry
Salt River Project
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Scottsdale, AZ 85251

Brian Almon
Public Utility Commission
William B. Travis Building
P.O. Box 13326
1701 North Congress Avenue
Austin, TX 78701-3326
Arizona Public Service Company

Electronic distribution by RIV:
Regional Administrator (BSM1)
DRP Director (ATH)
DRS Director (DDC)
DRS Deputy Director (MRS)
Senior Resident Inspector (GXW2)
Branch Chief, DRP/D (TWP)
Senior Project Engineer, DRP/D (GEW)
Team Leader, DRP/TSS (RLN1)
RITS Coordinator (KEG)
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T=Telephone  E=E-mail  F=Fax
**PREDECISIONAL ENFORCEMENT & REGULATORY CONFERENCE ATTENDANCE**

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<th>LICENSEE/FACILITY</th>
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<td>USNRC Region IV Offices Arlington, Texas</td>
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**NRC REPRESENTATIVES**

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<thead>
<tr>
<th>NAME (PLEASE PRINT)</th>
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<tbody>
<tr>
<td>Bruce Mallett</td>
<td>USNRC Region IV</td>
<td>Regional Administrator</td>
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<tr>
<td>Art Howell</td>
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<td>Tony Vegel</td>
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<tr>
<td>Troy Pruett</td>
<td>USNRC Region IV</td>
<td>Chief, Projects Branch D</td>
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<tr>
<td>Mike Hay</td>
<td>USNRC Region IV</td>
<td>Action Chief, Projects Branch C</td>
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<td>Scott Schwind</td>
<td>USNRC Region IV</td>
<td>SRI, Cooper Nuclear Station</td>
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<td>Gary Sanborn</td>
<td>USNRC Region IV</td>
<td>Director, ACES</td>
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<td>Karla Fuller</td>
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<tr>
<td>David Loveless</td>
<td>USNRC Region IV</td>
<td>Senior Reactor Analyst</td>
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<td>Greg Warnick</td>
<td>USNRC Region IV</td>
<td>SRI, PVNGS</td>
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<td>Greg Werner</td>
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<td>Nick Taylor</td>
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<tr>
<td>Jeff Clark</td>
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<td>Chief, Engineering Branch, DRS</td>
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<tr>
<td>Linda Smith</td>
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<td>Chief, Plant Engineering Branch, DRS</td>
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<td>Neil Keith</td>
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<tr>
<td>Greg Morell</td>
<td>USNRC Office of Enforcement</td>
<td>Enforcement Specialist</td>
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<td>Charlie Stancil</td>
<td>USNRC Region IV</td>
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<tr>
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<tr>
<td>John Huang</td>
<td>USNRC Office of Nuclear Reactor Regulation</td>
<td>Division of Engineering</td>
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<td>Cale Young</td>
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<tr>
<td>Bo Pham</td>
<td>USNRC Office of Nuclear Reactor Regulation</td>
<td>DLP</td>
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<tr>
<td>Andrew Howe</td>
<td>USNRC Office of Nuclear Reactor Regulation</td>
<td>DSSA/SPSB</td>
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<tr>
<td>Bill Cook</td>
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<tr>
<td>Warren Lyon</td>
<td>USNRC Office of Nuclear Reactor Regulation</td>
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<td>Robert E. Henry</td>
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<td>Sr. V.P.</td>
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<td>Robert J. Hammersley</td>
<td>FAI</td>
<td>V. P.</td>
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<tr>
<td>F.P. Ferrazaccio</td>
<td>WESTINGHOUSE</td>
<td>Fellow Eng./Proj. Mgr.</td>
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<tr>
<td>Robert Lindqvist</td>
<td>APS</td>
<td>Consulting Engineer</td>
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<tr>
<td>Ruben Espindosa</td>
<td>WESTINGHOUSE</td>
<td>Principal Engineer</td>
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<tr>
<td>Mark Janke</td>
<td>Westinghouse</td>
<td>Principal Engineer</td>
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<tr>
<td>Hans Giesecke</td>
<td>MPR Associates Inc.</td>
<td>Engineer</td>
</tr>
<tr>
<td>Robert W. Henry</td>
<td>SRP</td>
<td>Site Rep.</td>
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<tr>
<td>George Andrews</td>
<td>APS</td>
<td>Rx Eng Section Leader</td>
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<td>Jim MacDonald</td>
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<tr>
<td>Gerald Sowers</td>
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<td>PRA Section Leader</td>
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<tr>
<td>Scott Bauer</td>
<td>APS</td>
<td>Reg Affairs Dept. Ldr</td>
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<tr>
<td>Tom Weber</td>
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<td>Licensing Section Ldr</td>
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<td>Terry Radtke</td>
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<td>Dave Smith</td>
<td>APS</td>
<td>Plant Manager</td>
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<td>Jim Levine</td>
<td>PNW</td>
<td>Exec VP Generation</td>
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<tr>
<td>Mike Winter</td>
<td>APS</td>
<td>Nuclear Engineering Director</td>
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<td>M. Dwayne Carnes</td>
<td>APS</td>
<td>Director, Reg Affairs/Info Assurance</td>
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<td>Mark Rodspinna</td>
<td>APS</td>
<td>Systems Engineering Sect Lead</td>
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<td>Glenn Michael</td>
<td>APS</td>
<td>Senior Engineer, Licensing</td>
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<tr>
<td>Rodney Wilford</td>
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## PUBLIC ATTENDEES

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<td>Site PV Representative</td>
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<td>Fred Madden</td>
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<td>David Lochbaum</td>
<td>Union of Concerned Scientists</td>
<td>Nuclear Safety Engineer</td>
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<tr>
<td>Ken Mann</td>
<td>Pinnacle West Capital Corporation</td>
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PREDECISIONAL ENFORCEMENT AND REGULATORY CONFERENCE AGENDA

CONFERENCE WITH ARIZONA PUBLIC SERVICE COMPANY

February 17, 2005

NRC REGION IV, ARLINGTON, TEXAS

8:00 - 8:30 a.m.
Introductions & Opening Remarks
Art Howell, Director, Division of Reactor Projects
Tony Vegel, Deputy Director, Division of Reactor Projects

Enforcement process
Gary Sanborn, Director, Allegation Coordination & Enforcement Staff (ACES)

Apparent Violations
Scott Schwind, Senior Resident Inspector, Project Branch C, Division of Reactor Projects

8:30 a.m. - 12:00 p.m. (Breaks at 10 a.m. and 12:00 p.m. for public comment)

Opening Remarks
Jim Levine, Executive Vice President, Generation System

Investigation Overview
Mike Winsor, Director, Nuclear Engineering Testing Results and Safety Analysis
Mark Radspinner, Section Leader, System Engineering, Mechanical NSSS

Risk Significance Evaluation
Gerry Sowers, PhD, Section Leader, Probability/Risk Assessment

12:00-1:00 p.m.
Lunch Break

1:00 - 4:30 p.m. (Break at 2:00 p.m. for public comment)

Root-cause Investigation
Gerry Sowers, PhD, Section Leader, Probability/Risk Assessment

10 CFR 50.59
Tom Weber, Section Leader, Licensing

CRDR/OD
George Andrews, Section Leader, Reactor Engineering

Operational Decision-Making Lessons Learned
Terry Radtke, Director, Operations
Predecisional Enforcement Conference with Arizona Public Service Co.  
February 17, 2005  
Arlington, Texas

Key Points

- Most violations at power reactors processed under SDP
- 10 CFR 50.59 violations processed under Enforcement Policy
- Main difference are CP factors
- Significance of 50.59 violations determined by risk
- No final decisions have been made
Decision Process

- Determine whether violation occurred
- Determine significance of violation
- Evaluate all circumstances
- Determine sanctions

Factors in Determining Significance

- Actual safety consequences
- Potential safety consequences
- Impact on NRC’s regulatory process
- Willfulness
Significance of 50.59 violations

Enforcement Policy, Supplement I:
Severity Level III .... A failure to obtain prior Commission approval required by 10 CFR 50.59 for a change, in which the consequence of the change, is evaluated as having low to moderate, or greater safety significance (i.e., white, yellow, or red) by the SDP.

Possible Outcomes

- No action
- Notice of Violation
- NOV with Civil Penalty ($)
- Order
Key Points About Civil Penalties

- Considered for Level I, II, and III violations
- May be assessed for each violation or grouping of violations and for each day violation occurred
- Based on type of license and significance of violations
- Current base penalty for power reactors is $130,000 (for Level I violation)*

*$120,000 in this case

Factors in Assessing Civil Penalties

- History of significant violations
- Willfulness
- Circumstances surrounding identification
- Corrective action taken
- Discretion (judgment)
CP Flow Chart

Post-Conference Process

- Review all information
- Panel to reach final decision
- Develop actions
- Notify licensee & issue actions
- Issue press release for civil penalties and orders
Appeal Rights

- Any agency action may be challenged
- Challenge may result in reconsideration of action or hearing
- Civil penalties and orders provide hearing rights
Operational Decision Making
Lessons Learned

Terry Radtke
Director
Operations

Four major issues identified from the RAS sump event:
- Control room notification of issues impacting operability not performed in a timely manner
- Operability assessment not performed in a timely manner
- Compensatory action credited without a completed 50.59 review
- Indeterminate condition not recognized, requiring entry into LCO 3.0.3
Operational Decision Making
Lessons Learned

Management review team process implemented
- Engages diverse and specialized expertise to discuss issues
- Shift manager’s role has been clarified to station personnel and reinforced with shift managers to ensure they are
  - Immediately notified
  - Involved in the technical discussions as they evolve
  - Continuously assessing operability
  - Ultimately responsible for making operability determinations

Operational Decision Making
Lessons Learned

Management review team process implemented
- Operational decision-making practice utilized
  - Defines scope of condition
  - Operational significance determined
  - Determines best technical solutions
  - Considers operational challenges, licensing compliance and effects on safety margin
  - Appoints designated skeptic
Operational Decision Making
Lessons Learned

- We have had a number of opportunities to exercise the MRT concept since the RAS sump event
  - Areas of improved performance
    - Shift managers are engaged
    - Heightened sensitivity to enter the operability determination process
    - Roles and responsibilities are established for making and implementing decisions
    - A designated skeptic challenges decision making

Operational Decision Making
Lessons Learned

- Areas of improved performance
  - Implementation plans are developed to effectively communicate actions, responsibilities, compensatory measures and contingencies to ensure successful outcomes
  - Potential consequences of operational challenges are clearly defined, and alternative solutions are rigorously evaluated
  - Provides structured, facilitative approach using a specialized and diverse group of people
Operational Decision Making
Lessons Learned

🌱 Areas where improvement is still needed
- Promptly reporting conditions that potentially challenge safe, reliable operation to the control room for resolution
- Recognizing corrective actions that, in themselves, create a degraded or non-conforming issue that require an operability determination
- Continuing to lower the threshold for when the operability determination process is entered

Operational Decision Making
Lessons Learned

🌱 Conclusions
- We have learned
  • Prompt notification of issues impacting operability to the control room is essential
  • Implementation and execution of the operability determination and 50.59 processes has to be flawless
  • Shift managers have to be engaged in the technical discussions, continuously assessing operability and ultimately making the operability calls
  • Heighten the sensitivity and lower the threshold for entering the operability determination process
Operational Decision Making
Lessons Learned

♦ Conclusions
  – What we have changed
    • Implemented MRT process for significant events and issues
    • Clarified and reinforced the shift manager’s role
    • Revised the operability determination procedure
    • Updated procedures and communicated expectations to station personnel concerning prompt notification to the control room on issues impacting operability
    • Established an operational decision making tool
Station Response

George Andrews
Section Leader
Reactor Engineering

Agenda

♦ Review of NRC inspection report finding
♦ Evolutionary/background information
♦ Corrective action program
♦ Operability determination program
NRC Inspection Report Finding
Non-Cited Violation (NCV)

"...failure of Engineering and Operations personnel to implement requirements in the station's condition reporting and operability determination procedure following identification of a degraded condition."

♦ We agree with this finding

Background Information

♦ Station evolution to remove potential distractions from the control room
  – Work Control process
  – Site manager position
  – Role of STA section leader
  – Engineering desire to provide a solution to a problem
Corrective Action Program

Agenda

♦ Sequence of events/discussion
♦ Causes
♦ Transportability
♦ Corrective actions
♦ Summary of conclusions

Corrective Action Program

Sequence of Events/Discussion

Condition reporting procedure requirements

If the condition meets either of the following criteria:
1. The condition requires immediate action to ensure the safety of plant personnel or equipment,
   OR
2. The condition is a non-conforming condition or may cause a degraded condition (i.e., loss of quality or function) in a plant system, structure or component

Then the originator SHALL:
1. Promptly notify the Shift Manager of the affected unit(s)
2. Initiate and/or take any required immediate actions
Corrective Action Program
Sequence of Events/Discussion
Thursday, July 29

♦ (1527) The design engineer initiated a condition report (CRDR) and electronically selected "control room review" required option but did not notify the shift manager

♦ The Design Engineering section leader did not review the CRDR verbiage and also did not ensure that the shift manager was notified of the condition

Corrective Action Program
Sequence of Events/Discussion
Friday, July 30

♦ (~0700) The Design Engineering section leader requested operations support from the Shift Technical Advisor section leader

♦ (~0730) STA Section Leader immediately informed the shift managers and Operations director

♦ (~0800) Operations, including the shift managers discussed the condition and entered the operability determination program
Corrective Action Program
Causes and Transportability

♦ Causes
- Failure to follow the condition reporting procedure (timeliness of notification of shift manager)
- Inadequate knowledge of electronic condition reporting process

♦ Transportability
- Work control process
- Deficiency work order (DFW0) process

Corrective Action Program
Corrective Actions

Condition reporting procedure revision (complete)

If the condition noted requires
1. Immediate action to ensure the safety of personnel or plant equipment
   OR
2. The condition is a non-conforming condition or may cause a degraded condition (i.e., a less of quality or function) in a plant system, structure or component
   The originator SHALL
   (A) Immediately notify (in person or by telephone) the shift manager of the affected unit(s)
   AND
   (B) Initiate and/or take any required compensatory actions
Corrective Action Program
Corrective Actions

- Site-wide communications via For Your Information (FYI) process (complete)
- Formal briefing on condition reporting procedure requirement (complete)
- Revise work control process (complete)
- Revise DFWO process (complete)
- Revise electronic CRDR process to route to control room directly (complete)

Corrective Action Program
Corrective Actions

- Electronic CRDR tool enhancement (complete)
Corrective Action Program
Corrective Actions

♦ Engineering Industry Events Training,
  – To be completed by March 31, 2005
♦ Classroom training for procedure use and adherence for all station personnel
  – To be completed by December 31, 2005

Corrective Action Program
Conclusion

♦ In this situation, station personnel failed to correctly implement the condition reporting procedure resulting in untimely notification of the shift manager of a significant condition adverse to quality
Operability Determination Program Agenda

- Sequence of events/discussion
- Causes
- Transportability
- Corrective actions
- Summary of conclusions

Operability Determination Program Sequence of Events/Discussion

- Design engineer identified the condition
- Previous design engineer was out of town, unavailable to provide support
- Design Engineering section leader wanted to perform further review and believed he had three working days to complete review
- Engineering contacted STA section leader for additional support
Operability Determination Program
Sequence of Events/Discussion
Friday, July 30

♦ (~0730) STA section leader notified the shift managers and Operations management of issue

♦ (~0800) Engineering, Operations and management believed the condition was too obvious to have gone undetected for such a long period of time
  – Nothing had changed for 20 years
  – “A calculation or evaluation of the configuration must exist”

♦ (~0800) The operability determination program was entered

Operability Determination Program
Sequence of Events/Discussion
Friday, July 30

♦ (~0800) STA section leader stated immediate operability call must be made by end of shift

♦ (~0800) Engineering began system behavior evaluation

♦ (~1000) Operations began developing process to fill the empty pipes

♦ (~1100) Compensatory action was identified to eliminate large portion of void
Operability Determination Program
Sequence of Events/Discussion
Friday, July 30

- (~1300) Engineering stated that a calculation could be done but it would not be completed by the end of shift
  - Issue #1

- (~1300) Engineering evaluation concluded that the void would not vent back to containment following a RAS
  - Issue #1

Operability Determination Program
Sequence of Events/Discussion
Friday, July 30

- (~1400) Compensatory action was discussed and accepted by Operations management to eliminate large portion of void
  - Issue #1

- Shift managers were aware of condition but were not directly involved in discussions between Engineering and Operations management
  - Issue #2
Operability Determination Program
Sequence of Events/Discussion
Friday, July 30

(~1400) Engineering’s understanding: No further immediate support required as Operations was going to eliminate void via compensatory action and addition of water

(~1700) Operations’ understanding: The compensatory action would eliminate the large portion of the void and only the small void must then be addressed prior to the end of the current shift

Operability Determination Program
Sequence of Events/Discussion
Friday, July 30

(~1730) At the end of the shift, Engineering provided judgment that the small void would not impact pump operation

(~1800) Operations completed the “immediate” operability assessment, concluding ECCS was operable based on compensatory action and engineering judgment on the small void

– Issue #3
Operability Determination Program
Sequence of Events/Discussion
Friday, July 30 – Saturday, July 31

♦ Recognizing the significance of relying on the compensatory action, direction was given to expeditiously fill the piping with borated water

♦ In the process of developing a method to fill the piping, it was determined necessary to fill the containment sumps as well

Operability Determination Program
Sequence of Events/Discussion

♦ Issue #1: The immediate operability determination was not timely

♦ Issue #2: An indeterminate condition was not recognized and thus Technical Specification LCO 3.0.3 was not entered

♦ Issue #3: A compensatory action was inappropriately credited to maintain operability and without completion of a 50.59 evaluation
Operability Determination Program
Causes and Transportability

♦ Causes
  – Failure to follow the operability determination procedure
  – Management failed to recognize the significance of the issue
  – Operations management – directive versus facilitative
    • Took lead to ensure an evaluation complete by the end of shift
    • Inadvertently insulated/failed to keep shift managers informed of evolution of information
  – Misconception of how to apply 10 CFR 50.59 to compensatory actions to maintain operability

♦ Transportability
  – Previous operability determinations with compensatory actions
    • 10 CFR 50.59 reviews performed after crediting the action
Operability Determination Program
Corrective Actions

Training
- Training for Operations’ licensed personnel and shift technical advisors on operability determination program, process and requirements (complete)
- Targeted training on operability determination process and the use of compensatory actions – To be completed by December 31, 2005

Operability Determination Program
Corrective Actions

Operability determination procedure revision
- Requires the shift manager to make and document an immediate operability call ASAP and generally within two hours following notification of Operations (complete)
- Management review team concept is required (complete)
- Clarifies requirements associated with crediting compensatory actions and review pursuant to 10 CFR 50.59 (complete)
- Includes a checklist and flow chart to aid the shift manager in the immediate operability determination (complete)
Operability Determination Program
Corrective Actions

Operational decision making process
♦ External assessment of Operations leadership style and operational decision making
   – in progress, to be completed by February 28, 2005
♦ Internal assessment of operational decision making
   – scheduled for 3rd quarter 2005

Operability Determination Program
Conclusion

♦ In this situation, station personnel failed to correctly implement the operability determination procedure resulting in an untimely and incorrect assessment of operability
Containment ECCS Sump
Suction Line
Root Cause Investigation

Gerald Sowers, PhD
Section Leader
Probability Risk Assessment

Agenda

♦ Investigation team
♦ Condition description
♦ Cause of condition
♦ Transportability
♦ Extent of condition
♦ Missed opportunities
Investigation Team Charter

Perform required significant CRDR investigation associated with ECCS sump suction piping found unfilled including

- Root cause and contributing causes
- Transportability of the physical condition to other structures, systems and components
- Extent of the condition
- Determine through review of internal and external operating experience
  - Opportunities that existed to identify the problem earlier
  - Identify lessons learned from those opportunities

Investigation Team

- Engineering
  - Team leader
  - 3 design engineers
  - 1 system engineer
  - 1 maintenance engineer
- Operations
  - 1 operations standards advisor
  - 1 STA (part time)
- Performance Improvement International consultant
- Essentially full time from September to December
Condition Description

♦ A section of ECCS suction piping was discovered to be unfilled. This was
  – Contrary to the original design intent, and
  – Unanalyzed
♦ This unanalyzed condition has existed since plant start-up and went unaddressed until July 2004

Cause Investigation

Review of
♦ All operation, surveillance and test procedures related to the sump suction line and
♦ Interviews with plant operators

confirmed that there never was a procedural requirement to fill the section of sump piping as a prerequisite to placing the system in operation
Cause Investigation

♦ Three potential failure modes

1. The design requirement was specified, but the end user failed to consider the design requirement and did not incorporate it into station procedures

2. The design requirement was recognized, but there was a breakdown in communicating the design requirement to the end user

3. The design requirement was not recognized by the responsible design organization

Cause Investigation

♦ A review of the historical documents used as references for the development of operating and test procedures found no mention of the need to maintain the sump suction line filled

- System Description Manual (Bechtel)
- Design Criteria Manual (Bechtel)
- CE procedure guidelines
- CE interface requirements
- Engineering Evaluation Requests (APS)
- Startup documents
Cause Investigation

- Three peripheral documents were identified that referred specifically to the need to fill this section of pipe
  - Independent design review transcripts (May 1981)
  - CE letter to Bechtel about leaking seats on the sump isolation valves and the need for Type C testing (1/5/1984)
  - CE calculation providing information for NRC Bulletin 85-03 (MOV switch settings) response (11/26/1986, after Unit 1 license)
- None of these documents were intended or expected to be used by procedure authors as references for operating procedure development

Cause Investigation

- Several documents (FSAR, PVNGS SER) refer to filling the SI piping in general with no reference to specific parts of the system, in the context of prevention of water hammer
- Technical Specifications only required verifying that the discharge piping was full and did not mention the suction piping
Cause of Condition

♦ Cause #1 – A breakdown in communicating the design requirement to the end user
  - The documents used as references for writing the operating and test procedures did not include the requirement to maintain the sump line in a filled condition

♦ Corrective action — Added the requirement to the Safety Injection Design Basis Manual (complete)

♦ Corrective action — Changed procedure to require filling the pipe with borated water (complete)

Cause of Condition

♦ Cause #2 — The PVNGS technical specifications only required verifying full the discharge piping and did not mention the suction piping
  - This is consistent with the prevention of water hammer

♦ Corrective action — Added periodic verification that ECCS sump containment penetration lines are full to station procedures (complete)
Cause of Condition

♦ Contributing cause - The design of the system did not facilitate filling this section of piping
  – The original “vent and drain” connections were installed to facilitate leak rate tests
  – The connections were not standard vent and drain connections
  – No fill source was provided
♦ Corrective action – Changed the design to add vents, drains and a fill source (complete U3; to complete U1 and U2 in 2005)

Transportability Approach

♦ The transportability started with the obvious look for other sections of unfilled pipe
♦ The transportability evaluation was extended to identify parts of systems not normally in use and not periodically functionally tested
Transportability Scope

- Safety-related and selected important to safety systems
  - Fluid systems
  - I&C systems
    - GL 96-01, testing of safety-related circuits
  - Electrical systems

Transportability Results

- Fluid systems
  - No other piping sections identified as not filled
  - Not flow tested
    - A Section of the containment spray piping
      - CRDR 2760630, piping verified filled
    - RMWT to AF pumps (RMWT is not the safety-related water source; it is a backup to the CST)
  - No problems found
Transportability Results

♦ I&C systems – Generic Letter 96-01 reviewed for untested actuation circuits
  – Initial GL review was comprehensive

♦ Electrical systems - Circuits either normally energized, periodically energized (e.g., alternate battery chargers) or periodically tested
  – No problems found

Extent of Condition Approach

♦ All LERs since initial operation were reviewed to establish instances in which a similar condition was identified
  – LERs documenting failure to implement design requirements into operating basis
  – LERs categorized into three generic failure modes

♦ Distribution of failures examined to establish extent of condition
  – Global
  – Local
  – Isolated
More instances (three) in SI than other systems
SI instances appear to be unrelated
A review of all 19 LERs did not identify issues related by cause
Condition is considered to be isolated
Missed Opportunities

- Two "direct" opportunities identified
  - Instruction Change Request 58646 - 11/16/1992
    • Failed to initiate a corrective action document
  - Design basis reconstitution project
    • Failed to follow project procedures
      Action – Review sample of IDR transcripts (Sept. 2005)

Conclusions

- Configuration was not maintained as the design intended due to failure of the original design organizations to adequately communicate the design requirement to the operating organization
- Isolated case
Palo Verde Investigation of Unfilled Emergency Core Cooling Piping

Mike Winsor
Director Nuclear Engineering
Investigation Director

Agenda
MORNING SESSION
Evaluation of Condition and Significance Determination

- System & Investigation Overview  
  Mike Winsor  
  Director  
  Nuclear Engineering

- Testing Results and Safety Analysis  
  Mark Radspinner  
  Section Leader  
  System Engineering  
  Mechanical NSSS

- Risk Significance Evaluation  
  Gerry Sowers, PhD  
  Section Leader  
  Probability/Risk Assessment
System Overview

♦ Combustion Engineering safety injection system
  – Two independent trains
    • High-pressure safety injection pump (HPSI)
    • Containment spray pump (CS)
    • Low-pressure safety injection pump (LPSI)
    • Recirculation sump
  – Inboard and outboard containment isolation valves
  – Recirculation actuation signal (RAS) opens valves and stops LPSI
  – System response to a LOCA scenario
A significant investigation was initiated in accordance with our corrective action program to

- Determine root cause of why the condition existed, the missed opportunities to identify the condition and extent of the condition/cause
- Evaluate the safety significance of the as-found condition
- Perform an assessment of the adequacy of the station response upon discovery of the condition

Three teams formed, comprised of more than 20 Palo Verde and consulting personnel
- Contracted with testing, engineering and industry experts
  - Westinghouse
  - Fauske and Associates
  - Wyle Labs
  - MPR and Associates
  - Performance Improvement International
  - LeBlond and Associates
- Established an independent oversight group using recognized industry and academic experts
Investigation Oversight Committee

- Chartered by executive management to
  - Review team charters
  - Periodically review team direction
  - Review findings and proposed corrective actions
    - Provide critical feedback and consultation on methods, scope, results, corrective actions and conclusions for all areas of the investigation

Executive Oversight Committee

Committee members

- Ed Fox – Executive Chairman, APS VP Communication, Environmental and Safety
- Warren Peabody – PVNGS Nuclear Oversight Committee, retired Utility Executive
- Joe Callan – PVNGS Nuclear Oversight Committee, retired NRC
- Andy Kaufman – Senior Associate, Continuum Dynamics, Inc.
- Norton Shapiro – Senior Consultant Engineer Safety Analysis, Westinghouse
- Michael Mancini – Consultant, former VP, Ingersoll Pump Co.
Root Cause and Extent of Condition

♦ Charter
- Determine root cause for leaving the piping unfilled since plant startup
- Identify and evaluate causes for missed opportunities to correct the condition
- Determine the extent of cause and condition

Plant Response

♦ Charter
- Review adequacy of plant response
  • Condition reporting
  • Timeliness of control room notification
  • Operability determination
  • Compensatory actions
  • 50.59 adequacy, including program review
  • Human performance analysis
Safety Significance

♦ Charter
  – Develop a full understanding of the system response to the void and the resulting fluid conditions delivered to the pumps
  – Determine pump performance from the resulting fluid conditions
  – Using the pump and system response to the as-found condition, determine the safety significance
Plant Response Significant CRDR Investigation

Tom Weber
Section Leader
Licensing

Plant Response Significant CRDR Investigation

♦ Charter
  - 10 CFR 50.59 program
  - Corrective action program (CRDR)
  - Operability determination program (OD)
Plant Response Significant CRDR Investigation

♦ Investigation director
  – Michael Winsor

♦ Team members
  – Jon Sears, qualified CRDR investigator
  – Thomas Weber, lead for 10 CFR 50.59
  – George Andrews, lead for CRDR/OD
  – Peter LeBlond, LeBlond and Associates

Violations

♦ Apparent violation
  – 1992 procedure change

♦ Green non-cited violation
  – Three examples
Apparent Violation

1992 Procedure Change

- Technical specification surveillance test
  - Emergency core cooling system (ECCS) leakage test
    - Tested every 18 months during outages
    - Performed in Mode 5 or lower when ECCS is not required to be operable
  - Test sequence (prior to procedure change)
    - Attach temporary test rig
    - Fill piping with demineralized water
    - Pressurize line to >40 psig
    - Walk down system to identify leakage
    - Remove temporary test rig
1992 Procedure Change

♦ ASME Section XI surveillance test
  – ECCS sump valves stroke test
    • Tested every quarter
    • Performed in any mode
    • Performed subsequent to ECCS leakage test
  – Test sequence
    • Valves stroked open then closed
    • Resulted in demineralized water being drained into RAS sump

1992 Procedure Change

♦ Instruction Change Request 61008, May 1992
  – Written against ECCS leakage test
  – Concerned with cleanup needed after demineralized water drained into RAS sump
  – Requested steps to remove demineralized water after TS testing was complete
  – TS surveillance test procedure changed – June 1992
    (10 CFR 50.59 determined to be not applicable)
1992 Procedure Change

- Procedure change was maintenance activity
  - Removed demineralized water (test medium) after testing (prior to ASME test)
  - Restored piping to as-found condition (no change)
  - Perpetuated erroneous plant configuration (piping not filled)

10 CFR 50.59 Non-cited Violation

- Manually open inboard ECCS suction valves
- Filling the ECCS sump
- 10 cubic feet of air
Manually Open Inboard ECCS Suction Valves

♦ Two concerns with 50.59 review
  – Not completed prior to implementation
  – Ended at screening step

Manually Open Inboard ECCS Suction Valves

♦ Not completed prior to implementation
  – Cause
    • Failure to follow procedure
  – Completed corrective actions
    • STAs instructed to complete 10 CFR 50.59s prior to implementation
    • Revised the operability determination procedure
Manually Open Inboard ECCS Suction Valves

- Ended at screening step
  - Cause
    • Focused on degraded condition
    • Failed to understand change under review
  - Completed corrective action
    • Withdrew compensatory action and cancelled screening
  - Pending formal training, licensing review required prior to implementation
    • 10 CFR 50.59s needed for OD/compensatory actions
    • OD procedure revised to include this interim measure

Filled ECCS Sump

- Not completed prior to implementation
  - Cause
    • Failed to re-evaluate the change after the decision was made to add water to sump
      - Initially only piping was planned to be filled
      - Scope changed to include sump
  - Completed corrective actions
    • Entered condition in corrective action program
    • Performed the 10 CFR 50.59
Filled ECCS Sump

- Ended at screening step
  - Cause
    - Failed to demonstrate change was NOT adverse
    - Evaluation criteria used in screening step
  - Completed corrective action
    - Completed 10 CFR 50.59 evaluation

---

10 Cubic Feet of Air

- Area of disagreement with inspection report
  - The NRC cited Palo Verde for not performing a written safety evaluation prior to filling the line
- NEI 96-07, Rev 1, Section 4.4 states
  - “Three general courses of action are available to licensees to address nonconforming and degraded conditions. Whether or not 10 CFR 50.59 must be applied, and the focus of the 10 CFR 50.59 evaluation if one is required, depends on the corrective action plan chosen by the licensee.”
10 Cubic Feet of Air

Three courses of action

1. The licensee intends to restore the structure, system or component back to as-designed condition. The activity is not subject to 10 CFR 50.59

2. An interim compensatory measure is taken to address the condition. 10 CFR 50.59 applies to the interim compensatory measure, not the degraded condition.

3. The licensee intends to accept the condition "as-is" resulting in something different than its as-designed condition, or to change the facility or procedures. The final corrective action becomes the proposed change that would be subject to 10 CFR 50.59.

The 10 cubic feet of air was a non-conforming condition subject to GL 91-18

- The acceptability of the non-conforming condition was evaluated in the OD process
- Was not the final corrective action
- Final corrective action was to fill the piping with borated water to restore to original design condition

NEI 96-07, Rev 1, Section 4.4 states
- "This activity is not subject to 10 CFR 50.59."

In compliance with NEI 96-07 and GL 91-18, no 10 CFR 50.59 performed
Extent of Condition

- Reviewed 283 operability determinations
  - Four previous ODs had 10 CFR 50.59s associated with compensatory actions
    - All four 10 CFR 50.59s were completed after the actions were implemented
    - Two of the four 10 CFR 50.59s inappropriately stopped at the screening step
  - Condition was limited to STAs in completing 10 CFR 50.59s for OD compensatory actions

- Completed corrective actions
  - Revised the OD procedure
  - Completed the evaluation for the 10 CFR 50.59 that inappropriately stopped at the screening step

- Additional corrective actions
  - Provide formal training to STAs
    - OD compensatory actions and the application of 10 CFR 50.59 by May 31, 2005
10 CFR 50.59 Program Review

♦ Oversight/Evaluations
  - Program manager review
    • 80% of the screenings and evaluations
  - NRC Inspection Report (10 CFR 50.59 program inspection)
    • 8 evaluations and 14 screenings
    • No findings
  - PVNGS self-assessment
  - Trend CRDR

♦ Areas requiring attention
  - Program entry requirements
  - Screening vs. evaluation
  - Thoroughness of documentation

♦ Qualified 10 CFR 50.59 personnel to complete enhanced requalification training
  - Individuals who have not completed the training by March 31 will have their qualifications revoked
Summary

- Problem identified with performing 10 CFR 50.59s for compensatory actions within ODs
- Corrective actions implemented
- Areas requiring attention are being addressed
Risk Significance Determination

Gerald Sowers, PhD
Section Leader
Probability Risk Assessment

Significance

♦ Calculation assumptions
♦ Calculation
♦ Conclusion
### Significance

<table>
<thead>
<tr>
<th>Region IV analysis assumptions without testing results</th>
<th>PVNGS analysis assumptions with testing results</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPSI always fails on RAS</td>
<td>HPSI fails on RAS for breaks &lt; 2.3” diameter</td>
</tr>
<tr>
<td>CS always fails on RAS</td>
<td>CS never fails</td>
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<tr>
<td>Operators recover HPSI</td>
<td>No recovery</td>
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<tr>
<td>Operators recover CS</td>
<td>CS never fails</td>
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<tr>
<td>No backup to HPSI</td>
<td>Depressurize, LPSI or CS as backup per EOPs</td>
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<tr>
<td>RCP seal LOCAs contribute to risk</td>
<td>RCP seal LOCA does not contribute to risk</td>
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### Significance Calculation - Internal Events

<table>
<thead>
<tr>
<th>Initiating Event</th>
<th>Region IV Approx. (ΔCDP)</th>
<th>PVNGS (ΔCDP)</th>
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<tbody>
<tr>
<td>Large LOCA</td>
<td>1.44e-06</td>
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<tr>
<td>Medium LOCA</td>
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<td>Small LOCA</td>
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<tr>
<td>Transients (PSV)</td>
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<td>2.7e-7</td>
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<tr>
<td>LOOP (RCP seal LOCA)</td>
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<tr>
<td>Total</td>
<td>1.59e-05</td>
<td>4.8e-6</td>
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Significance Calculation – External Events

<table>
<thead>
<tr>
<th>Initiating Events</th>
<th>Region IV (ΔCDP)</th>
<th>PVNGS (ΔCDP)</th>
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</thead>
<tbody>
<tr>
<td>Seismic</td>
<td>7.90e-06</td>
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<td>Internal Floods</td>
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<td>Fire</td>
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<td>Total External</td>
<td>8.83e-06</td>
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Significance Calculation
Conclusions

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<thead>
<tr>
<th>Events</th>
<th>Region IV (ΔCDP)</th>
<th>PVNGS (ΔCDP)</th>
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<tr>
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<td>External Events</td>
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