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Report No. 50-397/94-02

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Licensee: Washington Public Power Supply System
P. O. Box 968
Richland, WA 99352

Facility Name: Washington Nuclear Project No. 2 (WNP-2)

Inspection at: WNP-2 site near Richland, Washington

Inspection Conducted: January 10 through 28, 1994

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Summary:

Inspection on January 10-28,1994 (Report No. 50-397/94-02)

Areas Inspected: An announced, team inspection of WNP-2 engineering and technical support. The areas examined were design changes, temporary plant modifications, engineering involvement, design bases, engineering capabilities, and self-assessment programs. NRC Inspection Manual Chapters 61726, 62703, 37700, 40500, and a draft inspection procedure entitled "Engineering and Technical Support" were used for guidance.

Results of Inspection and General Conclusions: The inspection found that the licensee had recently implemented several important improvement initiatives which appear to be having positive results. Examples of these initiatives included engineering backlog reduction, temporary modification reduction, and an improved interface between engineering and other organizations. The team

also observed that the licensee had decided to install new metallic-seated containment purge and supply isolation valves in order to end a longstanding problem with leaks in the rubber-seated valves. Two significant unresolved items were identified involving the adequacy of the proposed modification and the 10 CFR 50.59 safety evaluation for the BWR level instrumentation backfill system; and the presence of flow limiting orifices, which are larger than described in the FSAR, for 115 instrumentation lines penetrating containment.

Significant Safety Matters: None.

Summary of Violations and Deviations: One violation was identified for the failure to periodically verify the position of manual containment isolation valves in accordance with technical specification requirements. The involved valves were 115 manual bypass valves for the containment isolation excess flow check valves.

No deviations were identified.

Six open items were identified for followup.

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1.0 Introduction

The inspection was performed to assess the licensee's engineering and technical support activities, particularly the effectiveness of the Engineering organization to perform routine and reactive site activities, including the identification and resolution of technical issues and problems.

2.0 Executive Summary

The team inspection was conducted at the WNP-2 site for two separate weeks. The team consisted of a team leader, three NRC inspectors, and two contractors.

The purpose of the inspection was to assess the effectiveness of engineering and technical support at WNP-2. The areas examined were design changes, temporary plant modifications, engineering involvement, design bases, engineering capabilities, and self-assessment programs. For inspection samples, important systems and components were selected for examination using generic and plant specific probabilistic risk assessment (PRA) data.

The inspectors noted that the licensee had recently implemented several important improvement initiatives which appear to be having positive results. Examples of these initiatives included engineering backlog reduction, temporary modification reduction, and improved interface between engineering and other organizations. The inspectors considered that the licensee's decision to install new metallic-seated containment purge and supply isolation valves in order to end a longstanding problem with leaks in the rubber-seated valves was commendable.

The inspectors also noted two significant unresolved items which suggest additional improvement and management attention is warranted. The unresolved items involved the adequacy of the proposed modification and the 10 CFR 50.59 safety evaluation for the Boiling Water Reactor (BWR) level instrumentation backfill system and secondly, the presence of flow limiting orifices, which are larger than described in the Final Safety Analysis Report (FSAR), in 115 instrumentation lines penetrating containment.

The inspection also identified a violation involving the failure to periodically verify the position of manual containment isolation valves in accordance with Technical Specification requirements. The valves involved were 115 manual bypass valves for the containment isolation excess flow check valves.

<u>Detailed Conclusions</u>

The inspection concluded that completed modifications generally appeared to meet regulatory requirements. In reviewing modifications in process the inspection concluded that engineering appeared to be actively involved. Their involvement was evident in the identification and resolution of a longstanding technical issue involving leaking containment supply and exhaust isolation valves. The inspection also observed that engineering had been actively involved in the development of the reactor vessel level indication backfill modification. Their activities included involvement with the Boiling Water Reactor Owner's Group (BWROG) in the development of the modification as well as close coordination with operations and maintenance. However, the inspection identified an unresolved item regarding the adequacy of the proposed backfill modification from the standpoint of the credibility of initiating an unanalyzed event through the blockage of a single instrumentation line, and regarding the adequacy of the licensee's 10 CFR 50.59 review and safety analysis. Also, in conjunction with the inspector's review of the modification, the inspection identified a longstanding violation involving the failure to verify that the bypass valves for the 115 excess flow check valves were closed or locked in their closed position. Additionally, the inspection identified another longstanding problem regarding improper instrument line orifice sizes.

In the review of temporary modifications, the inspection concluded that the licensee had initiated programs which significantly improved their oversight and management of the temporary modification program. For example, the number of temporary modifications and the age of the modifications had been significantly reduced. However, some problems were identified in the area of temporary modifications. One problem involved an inadvertent design change to the Post-Accident Sampling System (PASS) caused by closing normally-open, manually-operated, demineralized water valves. This resulted in the loss of the ability to remotely flush portions of the PASS to reduce area radiation levels. A second problem involved a weakness in the administrative procedures for controlling valve lineup exceptions.

Improvements were noted in the involvement of engineering in the plant activities. A review of nonconformances indicated that engineering was involved in the identification and resolution of technical issues affecting the plant. Likewise, engineering was found to be involved in major plant maintenance. Specifically, it was observed that engineering was actively involved in the reactor pressure vessel nozzle and safe-end stress improvement process planned for the upcoming outage. On the other hand, the inspection concluded that the licensee's examination of a recurrence of waterhammer in the Standby Service Water system in late 1993 was not as thorough as would be expected for a repetitive problem. Additionally, the licensee's interim disposition of increasing the valve stroke time was not correctly calculated and may have contributed to another waterhammer event. However, the team noted that engineering involvement in an apparent waterhammer event in the High Pressure Core Spray system that occurred during the inspection was prompt, thorough, and responsive to the needs of the plant. Engineering assistance was evident, and the appropriate degree of analysis and root cause determination was performed.

The inspection concluded that, although areas requiring improvement remained, the degree and effectiveness of the support provided by the engineering organizations for plant operations was clearly improving. This was further evidenced by observed improvements in the implementation of the licensee's programs for personnel and equipment performance. For example, the inspection concluded that System Engineering appeared to have improved and was poised for more improvement, although certain oversights in program definition were observed. Additional staff needs were being addressed, and interviews with operators indicated that System Engineering support of plant operations had improved.

Also, the inspection concluded that the licensee's plant performance monitoring and trending programs could have been better managed. For example, the program administrative control document did not address all of the various performance monitoring activities being performed and certain monitoring activities were being performed without benefit of a management-approved procedure.

The inspection also concluded that the various engineering improvement initiatives that were in progress or planned should improve the effectiveness of engineering support for the operation of the plant. Specifically, the work that had been done on reducing the engineering backlog had already shown a significant impact. Furthermore, the plant staff's visits to other sites with successful programs appeared to be effective in improving performance in key areas such as System Engineering. Additionally, the licensee's increased involvement in external committee activities appeared to improve focus on ongoing industry initiatives. However, the inspection concluded that it was too early to assess long term effectiveness of the engineering initiatives and some weaknesses were identified. For example, the inspection noted that licensee management had not established an agreed upon set of expectations to assure the effectiveness of Design Engineering interface with Operations or System Engineering. Also, the inspection found that design requirements documents did not contain sufficient information to make them useful to plant users. In addition, the validation and verification of most of the documents was not well controlled and resulted in varying degrees and types of validation and verification.

3.0 Persons Contacted

Washington Public Power Supply System

*J. V. Parrish, Assistant Managing Director for Operations
*M. P. Flasch, Engineering Director
*J. C. Gearhart, Quality Assurance Director
*J. H. Swailes, Plant Manager
*G. O. Smith, Operations Division Manager
*R. L. Webring, Technical Services Manager
*M. M. Monopoli, Maintenance Division Manager
*J. M. Benjamin, Quality Assessments Manager
*J. R. Sampson, Maintenance Production Manager
*R. J. Barbee, System Engineering Manager
*R. L. Koenigs, Design Engineering Manager
C. M. Whitcomb, Engineering Management Support Manager
*D. W. Coleman, Acting Regulatory Programs Manager
J. P. Albers, Radiation Protection Manager
H. E. Kook, Jr., Licensing Manager
*W. S. Davison, Quality Assurance, Plant Support Assessments Manager
*W. D. Shaeffer, Operations Manager
*S. H. Peck, Equipment Engineering Manager
*K. B. Lewis, Licensing Engineer
*J. Snyder, Plant Support Engineer
*J. Baker, Technical Training Manager
*C. D. Scott, Supervisor, Plant Support Engineering
*R. Matthews, Design Engineering
*D. Myers, Design Engineering
*G. Moore, Supervisor, Engineering Data Bases
*P. J. Inserra, Supervisor, Technical Services
*J. R. Bauman, Executive Assistant to the Managing Director
*T. L. Meade, Supervisor, Technical Services
*D. L. Larkin, Manager, Engineering Services
W. La Frambroise, Structural Engineer

Bonneville Power Administration

*A. Rapacz
*R. F. Mazurkiewicz

United States Nuclear Regulatory Commission

*P. H. Johnson, Chief, Project Section I, Region V
*R. C. Barr, Senior Resident Inspector
*S. P. Sanchez, Resident Inspector
*D. L. Proulx, Resident Inspector
*T. P. Gwynn, Director, Division of Reactor Safety, Region IV
*T. F. Westerman, Chief, Engineering Branch, Region IV

*Attended the Exit Meeting on January 28, 1994.

The inspectors also interviewed various control room operators; shift supervisors and shift managers; and maintenance, engineering, quality assurance, and management personnel.

4.0 Examination of Design Changes

4.1 In-Process Modifications

The inspector evaluated the extent and quality of engineering involvement in modifications which were in progress during the inspection. In-process modifications were selected to assess the effectiveness of recent engineering initiatives.

4.1.1 Sample and Criteria

The inspector reviewed portions of the existing design packages for the following in-process plant modifications:

- Purchase Order 236550-001, Containment Isolation Valve Replacement

- Basic Design Change (BDC) 93-0089, Reactor Water Level Instrumentation Backfill Modification

The inspector discussed the development of the modifications with cognizant licensee personnel, reviewed the associated procedures, and walked down accessible portions of the modified components and systems.

4.1.2 Findings

4.1.2.1 Containment Isolation Valve Replacement

The inspector found that the containment isolation valve modification was in the preliminary stages of design and procurement. The modification affected four butterfly valves that provide the supply and exhaust for the primary containment atmosphere (CSP V-3, V-4, and CEP V-1A, V-2A). These valves were normally closed during power operation with the containment atmosphere inerted. However, the valves can be open during certain low power operating modes and are required to automatically close for containment integrity. The licensee had experienced persistent problems in obtaining acceptable leak test results following repositioning of the valves during outages.

The inspector discussed the development of the licensee's design and the engineering involvement in improving the reliable sealing of the valves. The inspector also reviewed six problem evaluation requests (PERS) identifying problems related to the containment isolation valves. The inspector found that engineering had been involved in attempting to improve the existing butterfly valves for a period of four years. This effort involved improvements in both the design of the resilient seals and maintenance practices for the installation of the seals. While achieving some success in these efforts, acceptable valve sealing performance was not sustained.

In May 1993, the licensee found apparent valve body distortion which affected the valve's sealing capability. According to the licensee, the distortion appeared to have been induced by valve flange bolting. Due to the observed lack of rigidity of the valve body, the licensee abandoned further efforts to improve the existing equipment and initiated the procurement of higher reliability replacement valves.

The inspector reviewed Procurement Specification No. 12111, Revision 1, and Purchase Order 236550-001 for the new butterfly valves. The replacement valves consisted of cast valve bodies with metal seals, rather than the resilient seals.

Conclusion

The inspector found that engineering had been involved in the development of improved performance for the containment isolation valves. In particular, the inspector noted that the licensee's decision to replace the existing butterfly valves with higher reliability valves represented a substantial resource commitment to improve the safety-related performance of the valves and the overall reliability of the unit.

4.1.2.2 Reactor Water Level Instrumentation Backfill Modification

The inspector reviewed Modification BDC 93-0089 and walked down accessible portions of the modification, which had been partially installed. The modification involved the reactor vessel water level instrumentation. The modification installed a backfill system for the reference leg of the condensing pots in response to NRC Bulletin 93-03, "Resolution of Issues Related to Reactor Vessel Water Level Instrumentation in BWR's". The licensee planned to install the modification either during the next forced outage of sufficient duration or during their next planned refueling outage in April 1994.

Background

The licensee initiated this modification to address a generic concern for dissolved gases accumulating in the reference legs of the reactor vessel water level instrumentation in boiling water reactors (BWR). A high concentration of dissolved gases in the reference legs has the potential to cause reactor vessel water level deviations known as "notching". A generic modification had been developed by the Boiling Water Reactor Owner's Group (BWROG) to continuously backfill the reference legs with water containing a low dissolved gas concentration in order to reduce the concentration of dissolved gases.

Potential problems with this generic modification were described in NRC Information Notice 93-89, "Potential Problems with BWR Level Instrumentation Backfill Modifications". The information notice described the potential effects of the inadvertent closure of a existing manual root valve in the instrument line and the severe reactor transient which would result.

At WNP-2, the modification also introduced a potential pressure source from the Control Rod Drive (CRD) system, which provided a small continuous backfill flow into each reference leg for the level instrumentation. Inadvertent isolation of a reference leg from the reactor vessel would result in the reference leg being pressurized by the CRD pump, thereby causing the instrumentation connected to the reference leg to indicate erroneous plant conditions. Each reference leg supplied other instruments in addition to the reactor vessel water level instrumentation. For the worst case, one common reference leg supplied the pressure switches associated with automatic opening of 18 safety relief valves (SRVs). Consequently, the inadvertent pressurization of the one reference leg that controls the actuation of the 18 SRVs would result in the lifting of all 18 SRVs and a blowdown of the reactor coolant inventory.

At WNP-2 all of the 18 SRVs can be self-actuated (spring lift) or power-actuated (pneumatic). The SRVs self-actuate to lift as ASME Code safety valves. In addition, the SRVs are actuated automatically to control steam pressure during a large load rejection. Additionally, the Automatic Depressurization System (ADS) utilized seven of the SRVs as part of the ECCS system to blowdown the reactor coolant system in the event of a small break LOCA, to allow the function of low pressure injection. However, the inadvertent pressurization of one instrumentation reference leg would only actuate one channel of the sub-logic for the ADS, but would not cause an actuation of the ADS.

Observations

The inspector found that the licensee had evaluated Information Notice 93-89 and the consequences of inadvertent instrumentation line root valve closure as part of their safety evaluation for the modification. For the worst case instrument line, the licensee had determined that the inadvertent closure of the manual isolation valve with the backfill system in operation would increase pressure in the instrument line up to the CRD system pressure of 1450 psi, which exceeded the normal reactor pressure of 1050 psi. The instrument line pressurization would result in the simultaneous false signals of low reactor vessel water level and high reactor pressure. The false high reactor pressure signal would actuate the pressure switches for all of the 18 safety relief valves (SRV) because the pressure sensed was from one common instrument line. Since the normal CRD pressure exceeded the setpoint for the SRV relief function, all 18 SRVs would open and blowdown of the reactor coolant system into the suppression pool would occur. The licensee indicated that this blowdown would not be bounded by the FSAR analysis, which addressed only the inadvertent opening of one SRV.

Another consequence of the inadvertent pressurization of an instrument line was that one division of the residual heat removal and low pressure core spray (RHR/LPCS) systems would be inhibited due to the false high reactor pressure signal. Despite actual depressurization of the reactor coolant system resulting from the SRV blowdown, the low pressure permissive interlocks for the RHR/LPCS injection valves would prevent the valves from opening due to the false high reactor pressure signal. However, the other division of RHR/LPCS low pressure injection would be available, unless a single failure was assumed. The most critical single failure that the licensee assumed was the failure of the low pressure injection line interlock for the opposite division. In that case, the licensee concluded that the operators would not have low pressure injection available and core damage would most likely result, except as mitigated by the Emergency Operating Procedure (EOP) actions for beyond-design-basis accidents using nonsafety-related systems for core flooding.

The inspector discussed the vulnerability of the licensee's design in comparison with the other designs referenced in Information Notice 93-89. The inspector found that the operators at WNP-2 did not have a keylock switch to bypass the low pressure injection interlock permissive as described in the information notice as a mitigating feature at another utility. The WNP-2 backfill injection point was on the instrument rack side of the manual isolation valve. Other utilities referenced in the information notice with this design had revised their original design to inject on the reactor side of the manual isolation valve.

The inspector noted that the licensee's original design recognized the potential for the reactor coolant blowdown scenario, but the licensee had concluded that they had implemented adequate administrative controls to prevent the inadvertent closure of the instrument root valves. The administrative controls consisted of a chain and lock for the valve handwheel, which was procedurally controlled. Because of the severe, unanalyzed event which could occur at WNP-2 following the inadvertent closure of one instrumentation line root valve, the inspector was concerned that the licensee's measures to preclude inadvertent closure did not appear to be appropriate. Later, during the inspection, the licensee decided that more positive control of the valve was warranted. The licensee initiated a revision to their design to weld a device on the open root valve to preclude valve operation. The licensee has committed to complete this design modification for the one root valve which affects all eighteen SRV's.

The inspector also noted an additional potential for an event initiator beyond the potential for inadvertent closure of the instrumentation root valve discussed in Information Notice 93-89. The inspector noted that the instrumentation tubing from the instrument rack to the root valve was exposed to potential damage and inadvertent crimping. At the time of inspection, the tubing was in an area where scaffolding had been erected for an upcoming unrelated modification. The tubing had a 1/2-inch outer diameter and a wall thickness of 1/16-inch. Therefore, the inspector concluded that it was susceptable to being crimped or crushed. In addition, the tubing contained an expansion loop which appeared to be especially vulnerable to damage.

Additionally, the inspectors noted that there was a potential for a foreign object to block the small passages in the line. Components, such as the excess flow check valves and flow limiting orifices, contained restricted passages which could become blocked by foreign objects from normal maintenance tasks on the instrument racks. The inspector recognized the fact that maintenance work is performed under cleanliness controls, but was concerned that these controls may not be completely effective to preclude the occurrence. The inspector also noted that there could be other methods for line blockage, which had not been addressed. Discussions with the licensee indicated that the blocking of the instrumentation line, the opening of all eighteen valves to the suppression pool, and the subsequent reactor transient were not bounded by accidents described in the FSAR.

10 CFR 50.59 Evaluation

The inspector reviewed the 10 CFR 50.59 evaluation performed by the licensee for the backfill modification and discussed the basis for the licensee evaluation with cognizant licensee personnel. The licensee had concluded that the modification did not involve an unreviewed safety question. The licensee considered that the circumstances necessary to block the instrument line either through valve closure or any other mechanism were not credible occurrences. The licensee considered that the potential accident resulting from the closure of the root valve with the backfill system in operation was less likely than the events analyzed in the FSAR since closure of the root valve would require, what the licensee considered to be, two active failures (or operator errors). The licensee stated the first failure (or error) would be the issuance of the key by the shift supervisor and the second failure would be the use of the key by an operator to unlock and close the valve. The licensee stated that the modification met the single failure design criteria since no single failure would result in closure of the root valve. Therefore, the licensee considered that they had met the single failure criteria and had established adequate preventative measures to assure that a new accident scenario would not be introduced by the modification.

The licensee identified that their 10 CFR 50.59 evaluation used two screening criteria for addressing the question of whether a new accident could be created by a modification. The first criteria addressed whether a new accident could be created. The second criteria addressed whether that new accident was credible. The licensee used the industry guidance contained in Nuclear Management and Resources Council, NSAC 125, "Guidelines for 10 CFR 50.59 Safety Evaluations," in conducting their 10 CFR 50.59 evaluation. The guidance contained an example which stated that meeting the single failure criteria was sufficient. That is, if multiple safety system failures were required to initiate a new accident, then the new accident would not be considered credible. The guidance established that meeting the single failure design criteria assured that the probability of occurrence of subsequent accidents due to the failure of the safety systems to perform their safety function would be equivalent to that of the accidents originally analyzed in the FSAR.

The licensee's 10 CFR 50.59 evaluation for the backfill modification considered that multiple failures of administrative controls would be required to initiate the new accident. The licensee also considered that the redundant administrative controls satisfied the single failure criteria for the system design, in that multiple administrative failures would be required to initiate the accident scenario. As a result, the licensee concluded that the modification did not introduce an accident of a new type because their design satisfied their interpretation of single failure criteria. The inspector did not agree with the licensee's interpretation that the breaching of two administrative control systems would constitute two independent single failures. The inspector considered that the closure of a single valve constituted a single failure, regardless of how many administrative control boundaries were established.

Conclusions

The inspector concluded that the engineering and technical support groups had been actively involved in the development of the modification for the backfill system. For example, the licensee had participated in the BWROG testing in the development of the generic modification, and had conducted extensive mockup testing and preoperational system testing had been conducted to verify and optimize the system performance prior to installation. In addition, the inspector found that the licensee had coordinated inputs from Operations, Maintenance, Engineering and industry in the expeditious development and installation of the modification. However, the inspector identified unresolved concerns in the following areas:

- The adequacy of the proposed backfill modification from the standpoint of the credibility of initiating an unanalyzed event through the blockage of a single instrumentation line from any line blocking mechanism.

- The adequacy of the licensee's 10 CFR 50.59 review and safety analysis determining whether the modification involved an unreviewed safety question.

The licensee acknowledged the inspector's concerns. These concerns will be considered an unresolved item pending further NRC review. (Unresolved item 50-397/94-02-01)

4.1.2.3 Excess Flow Check Valves

The inspector identified a separate issue regarding containment integrity as a result of the review of the BWR backfill modification. The inspector had reviewed the design of the excess flow check valves installed in the instrument lines involved in the backfill modification for the reactor vessel water level instrumentation. The inspector found that the excess flow check valves contained an integral manual bypass valve which was normally closed. However, these manual bypass valves had not been included in the list of manual containment isolation valves that were required to be locked closed or verified shut every 31 days in accordance with the Technical Specification requirements.

The function of the manual bypass valve was to temporarily equalize pressure across the excess flow check valve after actuation of the excess flow check valve. This allowed the check valve return spring to restore the check valve to an open position. The inspector found that the manual bypass valve was not uniquely identified on the plant drawings. In addition, there was no position indication for the manual bypass valve, either locally or remotely in the control room. The inspector was concerned that, if the valve was left open, it would bypass the excess flow check valve which was credited in the FSAR as an automatic containment isolation valve in accordance with the guidance of Regulatory Guide 1.11, "Instrument Lines Penetrating Primary Reactor Containment."

The licensee indicated that they had an informal practice of removing the valve handle after closing the valve and storing the handle in the control room to preclude unauthorized manipulation. However, the inspector noted that several manual bypass valve handles were installed, which indicated that this informal practice was not always carried out.

In response to the inspector's concern, the licensee initiated PER 240-032. The licensee performed a surveillance of all accessible excess flow check valves and found that they were all correctly positioned. Based on the results of their surveillance, the licensee concluded that all the manual bypass valves were closed. In addition, the licensee added the manual bypass valves to Surveillance Procedure PPM 7.4.6.1.1 pending the resolution of the PER.

The licensee stated that they did not consider the Technical Specification surveillance requirement to be applicable to the manual bypass valves. Although they noted that the excess check valves were identified in Technical Specification Table 3.6.3-1 as containment isolation valves, they stated that neither the excess flow check valves, nor the integral manual bypass valves were required to close in an accident. The licensee stated that they based their position on the FSAR Chapter 15 analysis of the blowdown and dose consequences which did not take credit for the check valve functioning in the event of an instrument line break outside of containment.

Nevertheless, the inspector concluded that the excess flow check valves were required to be closed in an accident. The inspector based this position on the following Technical Specification requirements for operable excess flow check valves and the guidance of Regulatory Guide 1.11.

- Technical Specification 3.6.3 required that the reactor instrumentation line excess flow check valves, shown in Table 3.6.3-1 to "...be OPERABLE during OPERATIONAL CONDITIONS 1, 2 and 3."

- Regulatory Guide 1.11 provided guidance that each excess flow check valve should function as an automatic isolation valve in order to satisfy General Design Criteria 55 and 56 (for containment integrity).

- Regulatory Guide 1.11 stated that "...there should be a high probability that the valve...will close if the instrument line is ruptured downstream."

- Regulatory Guide 1.11 provided guidance that each instrument line contain a flow-restricting orifice appropriately sized to independently limit the consequences of an instrument line failure outside of containment. The inspector found that the FSAR Chapter 15 analysis supported the appropriate sizing of the orifice; however, the FSAR analysis did not obviate the need for the excess flow check valves to perform the safety function to automatically close as isolation valves.

- FSAR Paragraph 6.2.4.3.2.4 stated, in part, "The Excess Flow Check (EFC) valves each have an integral manual bypass valve which may be used to reset an actuated disc. In order to minimize a possible potential impact upon the integrity and functional performance of the secondary containment and its associated filtration systems should an instrument line failure occur, the bypass valves are periodically verified to be closed."

Conclusion

Technical Specification 4.6.1.1.b required that all non-automatic containment isolation valves that are required to be closed during an accident be checked monthly to demonstrate primary containment integrity. Licensee procedure PPM 7.4.6.1.1, "Primary Containment Integrity Verification," implemented the surveillance requirement of TS 4.6.1.1.b. The inspector found that the manual bypass valves for 115 excess flow check valves identified in Table 3.6.3-1 were not included in the Surveillance Procedure PPM 7.4.6.1.1. The failure to verify that the manual bypass valves for the 115 excess flow check valves specified in Technical Specification Table 3.6.3-1 were closed or locked in their closed position is a violation of Technical Specification 4.6.1.1.b. (Violation 50-397/94-02-02)

4.1.2.4 Incorrect Orifice Size

The inspector identified another problem regarding improper instrument line orifice sizes as a result of the review of the BWR backfill modification. The inspector found that the Master Equipment List (MEL) identified that 0.375-inch diameter orifices were installed in the instrument lines for the water level instrumentation. However, FSAR Chapter 15.6.2, "Instrument Line Break Analysis," indicated that the blowdown analysis for a rupture of an instrument line was based on 1/4-inch diameter orifices. The licensee subsequently determined that the larger orifices had been installed during original construction and potentially affected all 115 instrument lines.

The licensee identified that an orifice was installed in each instrument line per Regulatory Guide 1.11 to limit releases in the event of a break of the instrument line to 10 CFR Part 100 limits. Regulatory Guide 1.11 stated that the combination of an orifice and excess flow check valve was an acceptable alternative design for two automatic isolation valves for the containment isolation. In addition, the licensee indicated that their FSAR safety analysis calculations for offsite releases had been based on the 1/4-inch orifice sizes.

The licensee initiated a problem evaluation request (PER) on January 27, 1994, to resolve the issue. Their initial analysis indicated that the larger size orifice would be acceptable and not significantly change the FSAR Chapter 15.6.2 analysis. The licensee also stated that they considered that they would be able to justify the adequacy of the larger orifices, recognizing the fourfold increase in the blowdown into the secondary containment and the dose consequences.

The inspector considered that the initial licensee actions were adequate. However, this item is considered an unresolved item pending review of the licensee's evaluation of the radiological consequence, and the root cause of the discrepancy between the as built orifice sizes and the FSAR description.
(Unresolved item 50-397/94-02-03)

4.1.3 Conclusions

The inspector concluded that engineering appeared to be actively involved in ongoing modifications. For example, they were actively involved in the identification and resolution of a longstanding technical issue involving leaking containment supply and exhaust isolation valves. The inspector also observed that engineering had been actively involved in the development of the reactor vessel backfill modification. Their activities included involvement with the BWROG in the development of the modification, as well as close coordination with operations and maintenance.

The inspector concluded that the licensee performance in the implementation of the reactor vessel backfill modification could have been improved. Specifically, the inspector identified unresolved items regarding, (1) the credibility of initiating an unanalyzed event through the blockage of a single instrumentation line; (2) the adequacy of the licensee's 10 CFR 50.59 review and safety analysis; and (3) improper instrument line orifice sizes. The inspector also identified a violation involving the licensee's failure to periodically verify that the manual bypass valves for the 115 excess flow check valves were closed or locked in their closed position.

4.2 Completed Modifications

4.2.1 Sample and Criteria

The inspector performed a limited review of completed modifications. In addition, NRC Inspection Report 50-397/93-25, issued August 13, 1993, examined six design changes for conformance to regulatory criteria. That inspection found that the design changes generally met the regulatory criteria. However, the inspection also identified one violation for failure to update preventative maintenance records pursuant to the modification.

During this inspection, the inspector reviewed several modifications including Plant Modification Request (PMR) 91-0309-0, "Diesel Generator Heat Exchanger Service Water Flow Balance." The objective of the review was to assess whether the modification package was well-organized, the modification was clearly described, the design calculations were correct, the 10 CFR 50.59 evaluations were adequate, and the post-modification test requirements and acceptance criteria were accurately specified.

4.2.2 Findings

The inspector found that the modification met the regulatory requirements. However, the inspector noted one minor discrepancy wherein the modification description was not clear. Specifically, the modification description stated that, "It is the intent of this modification to distribute at least 45% of the total service water flow to the two heat exchangers in each loop to any one heat exchanger.... Additionally, the ability to achieve a combined flow rate of 1650 gpm for both heat exchangers in each loop must be confirmed." The inspector noted that 45 percent of 1650 gpm is 742.5 gpm, which was less than the 825 gpm described in the reason for the modification. The licensee agreed that the reference to 825 gpm in the modification package was misleading. The inspector's observation did not constitute a safety concern, and was provided to the licensee as an observation.

4.2.3 Conclusions

Based on the results of Inspection Report 50-397/93-25 and this inspection, the completed modifications generally appear to meet regulatory requirements.

4.3 Temporary and Minor Modifications

The inspector reviewed the licensee's overall program for control of Temporary Modifications (TMODs). The purpose of the review was to determine how well the licensee was managing the number of TMODs and the level of involvement by operations and engineering personnel in the TMOD process.

4.3.1 Sample and Criteria

The inspector reviewed the licensee's list of active TMODs and selected two safety-related modifications for review. This review included discussions with the system engineer and operators concerning the modification, and a field verification of the modification installation.

The purpose of the review was to determine if: (1) the TMOD was developed, reviewed, and implemented per plant procedure manual (PPM) 1.3.9, "Temporary Modification Control," (2) a proper 10 CFR 50.59 evaluation was conducted, (3) plans to restore the TMOD or install a permanent design change existed, and (4) all necessary technical and regulatory requirements were addressed in the TMOD.

4.3.2 Findings

4.3.2.1 Overall Program Review

The inspector noted that the number of active TMODs was reduced from 34 in April 1993 to 15 with a goal of 10 after the next refueling outage. One shift manager was assigned to ensure that operations personnel played an active role in the TMOD process. Participation in the process was evident by the knowledge the operators had concerning the status of the active TMODs, and also by routine audits of the TMOD log. Several of these audits identified administrative errors in some of the TMODs, and the shift managers were holding the system engineers accountable to correct the errors. Although this type of management oversight was not evident earlier in 1993 (see NRC Inspection Report 50-397/93-24), the inspector concluded that the licensee had improved their oversight of TMODs.

4.3.2.2 Main Steam Isolation Valve (MSIV) Modification

The inspector reviewed Temporary Modification Request (TMR) 93-004. This TMOD installed resistance temperature detectors (RTDs) on the main steam isolation valve (MSIV) limit switches in the steam tunnel to establish an accurate temperature profile for the limit switches. The limit switches were moved in 1990 as part of a design change so that they were further from the steam lines. The TMOD was installed to quantify the actual temperature profile so that the equipment qualification (EQ) life of the limit switches could be validated. The limit switches had a calculated EQ life of 2.7 years, and were replaced every two years.

The inspector concluded that the TMOD was properly processed and installed per the licensee's procedures. Additionally, the 10 CFR 50.59 safety evaluation was thorough. For example, the effect of the additional weight of the RTDs on the seismic design requirements was included in the evaluation. Overall, the inspector concluded that the installation of the TMOD was a good initiative by engineering.

4.3.2.3 Disabled Control Room Annunciator

The inspector reviewed TMOD 92-012, which was installed in 1989. This TMOD disabled a continuous annunciator alarm input caused by the abnormal position of the switch in the fire remote transfer panel (FRTP) for Fan WNA-53B, the recirculation fan for the Division 2 switchgear room. The switch was purposely kept in the abnormal emergency position to ensure that the control for this fan was maintained at the FRTP. This was necessary as a temporary remedial action due to a licensee-discovered condition where a degraded voltage condition would prevent starting the fan from the control room. The fan operation would be satisfactory if the fan were started from the FRTP. This problem with the degraded voltage condition was documented in LER 89-013, Plant Engineering Request (PER) 2-89-0323, and Nonconformance Report 289-0322. By disabling this particular annunciator, an alarm would be received if any of the other remote transfer switches were placed in the emergency position. The inspector observed that the appropriate plant procedure manual (PPM) had been changed to allow control of the fan from the FRTP.

Additionally, the inspector noted that the 10 CFR 50.59 screening process at the time of the change (i.e., 1989) did not require an evaluation or justification of the abnormal condition since the normal location of fan control was not described in the Final Safety Analysis Report. However, the inspector noted that the licensee had recently improved their 10 CFR 50.59 process due to weaknesses identified in NRC Inspection Report 50-397/93-36. The licensee's new procedure for 10 CFR 50.59 evaluations would have required an evaluation of the condition. The inspector further concluded that, even though an evaluation was not performed, normal operation of the fan from the FRTP did not adversely impact overall plant safety.

The inspector concluded that a permanent solution for the problem had not been aggressively pursued by the licensee. Even though the licensee stated in LER 89-013 that the operation of the fan from the FRTP was a "temporary solution", the licensee allowed the abnormal situation to exist for almost five years. The inspector noted that a plant modification request (PMR) was initiated to correct the problem by installing a voltage regulator in the control room starting circuit, but the PMR was continually deferred due to higher priorities. The inspector also noted that the licensee's current efforts to identify and reduce the number of old TMODS also identified this particular delay in implementing a correction to the situation. As a result, PMR 92-083 was approved and scheduled for refueling outage R-9.

4.3.2.4 Inadvertent Design Changes

The inspector reviewed completed valve lineup sheets and the Component Status Change Order (CSCO) log to determine if any inadvertent design changes had been introduced by the changes to the valve lineups. The inspector identified one inadvertent design change and a valve lineup discrepancy.

Post Accident Sample System (PASS) Demineralized Water (DW) valves

The inspector noted that valves DW-757 and DW-758, which are DW supply isolation valves for the residual heat removal (RHR) PASS sample flush lines, had been cautioned-tagged shut since 1987. The valves were originally shut in 1987 due to leakage past two isolation valves and a check valve which caused contamination of the DW system from the RHR system. One of the isolation valves and the check valve were repaired; however, DW-757 and DW-758 remained shut as a precaution to preclude further DW contamination. The primary isolation valves, PSR-V-003A and PSR-V--003B, were not repaired. There was an open work order for these valves, but it continued to be deferred.

The inspector observed a chemistry technician simulate taking a PASS sample from the RHR system and noted that the procedure being used could not be completed as written since the sample lines could not be remotely flushed per the procedure's requirements. Entry into high radiation areas would have been required to manually open the isolated valves. The inspector concluded that keeping the DW valves shut for seven years was an inadvertent design change in that the ability to remotely flush the sample lines was removed. Although PER 293-317 had been written, it only documented the problem with the system leakage. The licensee had not evaluated the effect of not being able to flush the sample lines on general area radiation levels if a sample was required during an accident.

The inspector concluded that the safety significance of the inability to remotely flush the PASS sample lines after an accident sample was minimal because operability of the PASS system was not affected and there was no requirement to perform the flush. However, the inspector noted that the flush was a prudent measure to reduce general area radiation levels.

PASS Valve Lineup Discrepancy

During a review of the CSCO log in the control room, the inspector noted that manual isolation valves RHR-746 and RHR-747 were listed as shut. The valves were on PASS sample lines from the RHR system. The normal position of the valves was open to allow obtaining a remote PASS sample of the RHR system using other solenoid-operated valves. The date of the CSCO sheet was May 1, 1993. Further review identified another record, the master system valve lineup, which indicated that the valves were opened on June 10, 1993. The licensee conducted a field verification and determined that the valves were opened as shown on the master system valve lineup. The licensee then corrected the CSCO entry.

The inspector noted a procedure weakness, in that the administrative procedures for controlling the CSCO log did not provide any instructions to review the CSCO for necessary updates after performing the master system valve lineups.

Corrective Actions

The licensee conducted an audit of the CSCO log and the master valve lineup data sheets and identified several other discrepancies between the valve lineups and the CSCO log. None of these errors were safety significant. In response to this concern, the Operations Manager instituted a new administrative requirement to audit the CSCO logs every 28 days. In addition, the license initiated a change to PPM 3.1.1, "Master Valve Lineup," to require shift managers to review the CSCO when a master lineup was completed. The inspector concluded that the licensee's actions were appropriate.

4.3.3 Conclusions

The inspector concluded that the licensee had initiated programs which significantly improved their oversight and management of the TMOD program. Additionally, program oversight appeared to be effective, in that the age and number of temporary modifications were being significantly reduced.

Although the inspection identified one minor problem regarding a longstanding temporary modification involving an abnormal position of the switch on the fire remote transfer panel for the recirculation fan for the Division 2 switchgear, this problem had been previously identified by the licensee's program and corrective action had already been scheduled for the next outage.

Two minor problems were identified in the area of temporary modifications. One problem involved an inadvertent design change to the PASS system caused by closing normally-open, manually-operated, demineralized water valves. As a result, the ability to remotely flush portions of the PASS to reduce area radiation levels was removed. A second problem involved a weakness in the administrative procedures for controlling valve lineup exceptions. The licensee took appropriate corrective action for these problems.

No violations or deviations of NRC requirements were identified.

5.0 Engineering Involvement in Plant Problems

5.1 Nonconformance Review

5.1.1 Sample and Criteria

The inspector reviewed the Quality Assurance (QA) procedures addressing the identification and processing of plant problems to verify conformance with regulatory requirements. The inspector selected 15 Nonconformance Reports (NCRs) out of a total of 64 issued in 1993. These 15 NCRs were reviewed for evidence of engineering involvement with the resolution.

5.1.2 Findings

NCR Review

The inspector found that 11 of the 15 NCRs required, and received, engineering support in resolving the technical issues affecting the plant. Engineering support was evident in the form of design changes, design calculations, evaluations of proper set points, performance of probabilistic risk analysis (PRA), and root cause analysis. The remaining four NCRs required no engineering input.

Lack of Overview of PERs

The inspector observed that Plant Procedures Manual (PPM) 1.3.12, "Problem Evaluation Request (PER)," described the method for initiation of a PER to report potential or actual conditions adverse to quality. PPM 1.3.12, Section 6.0, required that an individual discovering a condition adverse to quality document the condition by initiating a PER. However, not all potential plant problems were required to be logged in. Only those problems determined by the supervisor as being valid were logged in and assigned a PER number. Problems judged not to warrant a PER were returned to the originator with the reason described on the form.

The inspector concluded that PPM 1.3.12 did not provide strong provisions for overview of non-valid PERs. The inspector was concerned that in the event of an error in judgement on the part of the supervisor potential plant problems which might represent actual conditions adverse to quality would not receive any oversight. The licensee's process did not provide for any additional overview beyond the supervisor's screening.

The inspector discussed his concerns with the licensee. The licensee committed to revise PPM 1.3.12 to require non-validated PERs to be filed, and also to perform periodic quality assurance audits of the files. The licensee's actions will be reviewed in a future inspection. (Followup Item 50-397/94-02-04)

5.1.3 Conclusions

The inspector concluded that the sampled nonconformances indicated that engineering involvement was evident in the identification and resolution of technical issues affecting the plant.

5.2 Engineering Involvement in the Reactor Pressure Vessel (RPV) Nozzle/Safe-End Stress Improvement Process

5.2.1 Sample and Criteria

The inspector assessed engineering involvement through an examination of the engineering controls over a planned, complex, maintenance activity which involved the reduction of reactor pressure vessel (RPV) stresses. The inspector examined the selection of the contractor, the review of contractor procedures, and the adequacy of contractor quality control. The purpose of this review was to evaluate the adequacy of engineering involvement and to ensure compliance with regulatory requirements and industry codes and standards.

5.2.2 Findings

In response to NRC Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," dated January 25, 1988, the licensee was planning to perform stress improvement on 44 weld joints of the RPV nozzles and safe-ends. The stress improvement technique planned was the use of the Mechanical Stress Improvement Process (MSIP). MSIP was considered by the NRC technical staff to be a qualified process for providing resistance to intergranular stress corrosion cracking (IGSCC) in BWR austenitic stainless steel piping. The stress improvement was scheduled to be completed in 11 days during the next refueling outage in April 1994.

The inspector reviewed the procurement documents that qualified the contractor, AEA O'Donnell, Inc., to be placed on the licensee's Evaluated Supplier List (ESL). The audit of the contractor was performed by the Nuclear Procurement Issues Committee (NUPIC), an external organization whose members represent various nuclear utilities and licensees. The inspector found that Procurement Engineering's evaluation of the NUPIC audit appropriately addressed the licensee's requirements for the scope of work to be provided. The inspector also found that the contractor's QA program included controls of their subcontractors.

The inspector reviewed Contract Number C30831, dated December 8, 1993, for AEA O'Donnell, Inc. The inspector verified that the contract included a provision that the supplier have a documented Quality Assurance (QA) program that: (1) complied with the requirements of 10 CFR 50, Appendix B, and (2) extended appropriate QA requirements to sub-tier suppliers. The inspector also confirmed that the contract included supplier acknowledgement for reportability pursuant to 10 CFR Part 21, "Reporting of Defects and Noncompliance."

Contract C30831, Appendix A, "Statement of Work," required the contractor to provide the following to the Supply System by January 14, 1994: (1) procedures that would be used for the stress improvement process, and (2) information about any special equipment that would be brought on site. The inspector was informed by the licensee that both these requirements were met by the required date.

Licensee responsibilities for the MSIP program were shown in Attachment 5 of Contract C30831. Specific responsibilities included approval of the AEA O'Donnell, Inc., engineering procedures, training program, field service procedures, and nonconformance reports. Review and approval of the contractor quality control (QC) inspector's qualifications was specified in the contract as a licensee responsibility. During the inspection, the licensee was in process of revising the contractor's MSIP traveler to include the licensee's engineering review and verification of process acceptance.

5.2.3 Conclusions

The inspector concluded that engineering was actively involved in the RPV nozzle and safe-end stress improvement process planned for the upcoming outage. This was evident by the amount of engineering oversight and quality controls over the contractor's mechanical stress improvement process.

5.3 Waterhammer Incidents in the Standby Service Water System (SSWS)

5.3.1 Sample and Criteria

The inspector reviewed engineering involvement in waterhammer incidents in the Standby Service Water System (SSWS). The inspector reviewed the completeness and accuracy of the problem evaluation reports (PERs) including root cause evaluations and interim dispositions. The inspector also examined Engineering's support to Systems Engineering for this problem.

5.3.2 Findings

The SSWS had experienced waterhammer problems for several years. The problem occurred following pump starts due to the fact that the system piping drained and emptied when the system was not in service. The licensee's operational strategy for avoiding these waterhammer events was to automatically fill the system through a time-sequenced, controlled opening of Motor-Operated Valves (MOV) SW-V-2A and SW-V-2B just downstream of SSWS pumps SW-P-1A and SW-P-1B. The valve opening scenario consisted of a 12-second stroke time from full closure, which resulted in the valve opening approximately 20 percent; followed by a 50-second hold period in the throttled position. This sequence allowed flow to be gradually established in the SSWS, and filled the system at a substantially lower flow than full flow. After the 50-second hold period, the valve resumed opening to full-open position. During a previous inspection in February 1993, the inspectors had examined the waterhammer problem, discussed the licensee's operating strategy to avoid waterhammer, and witnessed a test which demonstrated the satisfactory system start without waterhammer.

The inspector discussed the additional waterhammers that had occurred since the last team inspection and examined the circumstances surrounding the new occurrences.

Valve Overstroke Caused Waterhammer

On November 15, 1993, Loop B of the SSWS experienced a waterhammer event. Problem Evaluation Request (PER) 293-1319 was written to investigate this event. The licensee attributed the waterhammer event to the fact that butterfly valve SW-V-2B had overstroked its closed position by 13 percent. This condition was discovered after the valve was opened and inspected. At its closed position, the valve disk had passed its central stop position (i.e., the middle of the seating surface). This condition was possible with the particular butterfly valves in use because of their large seating surface. As a result of the overstroked position, the licensee determined that the valve had opened only 3 to 5 percent instead of the intended 20 percent during the first 12 seconds of valve opening. Consequently, during the subsequent 50-second hold period, very little to no flow was provided to fill the SSWS. The licensee confirmed this theory with plant computer data, which indicated minimal to no flow had been achieved. During the subsequent stoke of the valve to the full-open position, flow entered the almost empty SSWS at substantial flow rates and caused a waterhammer.

Inadequate Guidance in Setting Valve to Its Fully Closed Position

PER 293-1319 stated that the root cause for valve SW-V-2B overtravel was inadequate guidance in the Motor-Operated Valve (MOV) Master Data Sheet. The Master Data Sheet contained applicable information on the MOV such as switch setting and stroke time requirements. It did not contain information which required the closed position to be checked for angle. The overtravel condition was established when a closed limit switch adjustment was made on May 14, 1993, during a baseline MOV test. The licensee's test procedure required the Master Data Sheets to be used along with the maintenance work request for setting up the valve parameters. The licensee stated that during the MOV baseline test, the technicians followed the standard practice of adjusting the closed limit switch until an increase in the torque required to close the valve was detected. This practice had been successful previously on butterfly valves with small seating areas, but was apparently not appropriate for valve SW-V-2B, which had a large seating area and needed to open to a precise throttle position. The wide seating surface introduced a substantial error in the opening angle to initiate flow.

The licensee stated that they planned corrective action to revise the Master Data Sheet to specify that valve SW-V-2B was fully closed when the stem keyway was directly in line with the SW pipe centerline, thus eliminating the angular error. The inspector considered the licensee's action appropriate.

Apparent Differences in Valve Opening Times

In examining the event data, the inspector noted an inconsistency in the opening time data recorded for valve SW-V-2B. The data taken on May 13, 1993, for ASME inservice testing (IST) stroke time trending and data taken on May 16, 1993, for a special test for Generic Letter 89-10 testing of motor-operated valves differed by 12 seconds. The inspector noted that the timing of the valve's opening was controlled by an Agastat time delay relay, SW-RLY-V/2B5. Consequently, the inspector also examined the periodic relay calibration records and found that the Agastat relay had an as-found setting of 62 seconds, which was proper and consistent with the expected results. However, the inspector noted that the motor-operated valve test data recorded for the Generic Letter special test using a diagnostic computer had recorded a stroke time of 50 seconds; even though the IST test data showed a 62-second timeout. The licensee had not investigated the cause of this 12 second difference between the apparent valve stroke times for SW-V-2B. This difference was mentioned in the PER 293-1319, but had not been pursued by the licensee. During the inspection, the licensee prepared PER 294-0051 to address the cause of the apparent difference.

The inspector concluded that the licensee's actions in response to the inspector-identified problem appeared to be appropriate. Furthermore, the inspector concluded that the licensee should have independently noted and responded to the differences in stroke time data.

Abandonment of the SSWS Keep-full System

The inspector observed that in October 1993, the licensee had abandoned a nonsafety-related, keep-full system which had served the SSWS. Although the system had not been fully effective in keeping the SSWS full due to excessive valve leakage, the system abandonment appeared to coincide with the reappearance of system waterhammer. The assessment performed by the licensee in mid-1993 concluded that the keep-full system was not needed for the prevention of waterhammer. The inspector noted that PER 293-1319 did not address the abandonment of the keep-full system in its assessment of the recurrence of SSWS waterhammer. The inspector also noted that no waterhammer events had been recorded from May 16, 1993, until the shutdown of the keep-full system. The licensee stated that they would reassess the keep-full system's role in causing waterhammers.

The inspector considered the licensee's actions to be appropriate in response to the inspector's question.

Inappropriate Interim PER Disposition

In review of the event records, the inspector noted an interim disposition of PER 293-1319 which did not appear to have a sound technical basis. The interim disposition by Systems Engineering compensated for the overtraveled position of valve SW-V-2B by adjusting the time-delay relay setting to add approximately 17 seconds to the original 12-second partial stroke time. The inspector calculated that this would result in approximately a 30 percent valve opening. This was substantially larger than the previously successful 20 percent opening associated with the 12-second stroke time.

The inspector was concerned that a 30 percent opening would substantially increase flow and the chances for a waterhammer in the SSWS. Although, the licensee indicated that post-modification testing following the timing adjustment on November 30, 1993, did not result in a waterhammer, the inspector noted that another waterhammer occurred on December 2, 1993. An assessment performed by Design Engineering after this second event confirmed that "...at roughly 30 to 35 percent of full open position, SW-V-2B can have full flow through the valve, which is what the [plant computer] printout indicated." The inspector concluded that System Engineering's interim fix of a 17-second opening stroke was not adequately evaluated, in that it did not prevent another waterhammer event.

Waterhammer Analysis Capabilities

The inspector reviewed Design Engineering's modelling of the last waterhammer incident. The licensee used a commercially-available, computer program, "LIQT". The program predicted some general trends; however, LIQT had not been validated for safety-related applications and did not have the capability to calculate the dynamic loadings due to waterhammer events. The inspector concluded that Design Engineering had developed some capabilities to address waterhammer, but that the capabilities had not been developed to the degree that could predict system performance during a waterhammer event under various scenarios.

5.3.3 Conclusions

The inspector concluded that the licensee's examination of the recurrence of waterhammer in the SSWS was not as thorough as would be expected for a repetitive problem. The licensee actions appeared to stop short of a thorough examination and the evaluation appeared to stop at the first viable explanation of the event. Additionally, the licensee's interim disposition to increase the time of the initial valve opening was not adequately evaluated and may have contributed to another waterhammer event.

5.4 Suspected HPCS Waterhammer Event

5.4.1 Sample and Criteria

The inspector reviewed engineering's involvement in an event, which occurred at WNP-2 during the inspection, to assess the involvement and effectiveness of engineering support of plant activities. Specifically, the inspector reviewed an event that was noted in the control room log on January 11, 1994, involving the performance of the quarterly High Pressure Core Spray System (HPCS) Surveillance Test, PPM 7.4.5.11, Revision 14.

5.4.2 Findings

The log entry documented a noise the operators had heard and characterized as a waterhammer. The noise was also heard in the Radwaste Control Room. The noise was reported to have occurred when valves HPCS V-10 and V-11, in the flow test return line to the Condensate Storage Tank, were closed and the minimum flow valve, HPCS V-12, started to open. The log further noted that the system was walked down and no damage was reported. The test was completed satisfactorily and the system was determined to be operable since it met all the requirements of the test procedure and no system damage was evident. Operations initiated Problem Evaluation Report (PER) 294-0021 and requested that System Engineering resolve the deficiency.

The inspector reviewed the initial issue of the PER and followed up on engineering's involvement in the investigation and evaluation of the event. In addition, the inspector discussed the event with the Operations Manager and was briefed by a plant support engineer, who was assisting the system engineer.

5.4.3 Conclusion

The inspector concluded that engineering involvement during this event was prompt, thorough, and responsive to the needs of the plant. Engineering assistance was evident, and the appropriate degree of analysis and root cause determination was performed.

5.5 Spray Pond Icing

5.5.1 Sample and Criteria

The inspector examined the actions taken by the licensee in response to questions regarding pond icing. These questions had been raised by the NRC service water team inspection conducted in February 1993, and documented in NRC Inspection Report 50-397/93-201.

Background

In February 1993, the NRC inspectors had observed five inches of ice covering the service water spray ponds and questioned the operability of the ponds from the standpoint of structural adequacy in an earthquake. The ice had formed across the pond and was around the pipe supports which supported the spray nozzle piping rings. It appeared that the weight of ice attached to the supports might be excessive in a dynamic seismic event. The licensee wrote Problem Evaluation Request (PER) 293-140, dated February 5, 1993. The licensee judged the condition to be acceptable and stated that an evaluation would be completed by November 1, 1993.

5.5.2 Findings

The licensee had closed the PER on February 19, 1993, based on the preparation of Request For Technical Services (RFTS) 93-02-057 to perform a calculation. The calculation was recorded on Calculation Modification Record (CMR) 93-0896, dated October 21, 1993. The inspector reviewed the calculation with the cognizant structural engineer. The Supply System contracted with an outside consultant to evaluate the ice loading on the pond structures. The consultant's report was EQE International Report, "The Effect of Ice on the Support Structures Inside WNP-2 Spray Ponds," dated October 1993. The licensee utilized the results of that calculation in conjunction with their own calculations to evaluate the effects of a seismic event and found the effects acceptable.

The inspector noted that the licensee had not assessed the worst climate conditions for ice and had assumed that the five inches observed in 1993 was the worst case. The licensee also limited the study to a continuous five-inch slab of ice from pond wall-to-wall versus forming in the middle of the pond first near the exposed-to-atmosphere metal piping and structure heat sink. Although the inspector did not consider these assumptions to be conservative, the inspector noted that the licensee's study was based on an analysis of the weakest structure in the pond, which was conservative.

In response to the inspector's concern, the licensee performed a further study, contacted other agencies for historical weather information, and performed Calculation CMR-94-0080, dated January 24, 1994. The licensee concluded that the formation of ice was acceptable and that the maximum credible ice thickness, based on historical weather records, was 10 inches. The study concluded that ice would form as a sheet, and that the ice would act as a supporting diaphragm and would provide lateral support to the pond structures until the ice broke due to sloshing effects. The sloshing effects were seen as breaking the ice away from the structure leaving a small mass of ice attached to the structure. Furthermore, the licensee concluded that: (1) there would only be one cycle of sloshing which would not produce significant lateral movement; (2) interaction of the broken ice with the support structures would not be significant; (3) the weight of ice that remained attached to the structure after sloshing broke the ice would be 231 lbs. with a maximum allowable of 400 lbs; (4) the inertia load of the ice did not need to be combined with the structure uplift pullout loads due to sloshing since the uplift and inertial loads would not occur at the same time; and (5) the melting of the ice will likely occur from the edges of the pond leaving a potentially larger mass of ice attached to the structure for the period of time it takes the ice to melt. The inspector noted that the licensee did not specifically analyze this case which they concluded would only be applicable for brief periods of time. In addition, the inspector noted that the licensee did not have any information regarding the licensing basis for ice considerations.

5.5.3 Conclusions

The inspector concluded that the acceptability of the licensee's assumptions concerning pond icing required further NRC review. The inspector considered that the assumptions of ice breakage and movement were crucial to the licensee's conclusions regarding the structural integrity of the spray pond piping. This issue has been referred to the Office of Nuclear Reactor Regulation for further evaluation and will be considered a followup item pending the NRC evaluation. (Followup item 50-397/94-02-05).

No violations or deviations were identified.

6.0 Engineering Communications and Programs

The inspector assessed the degree and effectiveness of the support provided by the Engineering and the System Engineering organizations to plant operations. The inspector also examined the status of implementation of the licensee's programs for personnel and equipment performance.

6.1 Sample and Criteria

The inspector selected certain systems and components which had exhibited a history of recurring problems during the past year and conducted the following activities:

- Examined the historical records for the past year of plant entries by the responsible system engineers, design system engineers, and their supervision and management to assess whether these persons were spending time in the plant assessing the state of the plant conditions.

- Examined the licensee's system for identifying equipment performance problems to engineering for resolution.

- Examined the licensee's expectations for system walkdowns by the system engineers, design system engineers, and operations staff.

- Examined the licensee's expectations for time-in-plant for key staff members. Assessed the degree of understanding of the management expectations and the degree of implementation of those expectations. Assessed the methods used by the licensee's management to monitor the implementation of their guidance and assess the effectiveness of the plant walkdowns.

- Examined the effectiveness of the joint walkdowns of the selected systems by Engineering, System Engineering, and Operations.

- Examined the licensee's program for equipment and system performance monitoring including collecting, analyzing, and trending performance data. Determined whether minimum acceptable performance levels and criteria were specified. Assessed whether the program effectiveness was periodically evaluated by management for needed improvements.

The inspector conducted the above examinations by interviewing plant operators, shift managers, operations supervision and management, system engineers and their supervision and management, and design engineers and their management. The inspector also reviewed the administrative control documents and technical documentation.

6.2 Findings

6.2.1 System Engineering Performance

The inspector found that the System Engineering and Design Engineering organizations were in a state of transition. The System Engineering Program had been significantly revised beginning in October 1993 in order to correct inadequacies identified in the program during 1992 and early 1993. The revised program provided workload adjustments to provide more time for the system engineers to focus on system performance and problems.

Plant Support Engineering

The inspector noted that the licensee had implemented a particularly important initiative with the creation of a Plant Support Engineering staff under Design Engineering to provide additional support for emerging plant issue resolution, 10 CFR 50.59 safety evaluations, and day-to-day communications with Operations and System Engineering. In preparation for changing the old program, the licensee attended industry counterpart meetings on the subject and conducted information gathering visits to their counterpart utilities for selection of successful practices which might be applicable to WNP-2.

Responsibilities

The inspector examined the new Administrative Control Procedure, TI 2.1, "System Engineering," for the System Engineering Program. The inspector noted that the old system engineer's responsibilities had been completely listed in a letter, dated November 20, 1991; however, the new procedure did not provide a clear, complete listing of the system engineer's responsibilities. Although the licensee had proposed certain workload adjustments in a letter dated November 15, 1993, the inspector concluded that the system engineer responsibilities were not clearly specified and communicated in the new procedure. Nevertheless, discussions with the system engineers and their supervision, indicated that there was a good understanding of the responsibilities for the program implementation.

The lack of clear communication of the system engineer's responsibilities did not appear to be causing a problem because supervision was so closely involved in system engineer activities. The licensee pointed out that the performance plan for each engineer contained a more complete listing of the system engineer's expectations. Nevertheless, the performance plans did not contain a complete listing of responsibilities. The licensee observed that the program was still under development and that the administrative control procedure would be evaluated regarding the desirability of providing a complete identification of system engineer responsibilities.

System Walkdowns

The System Engineering Program provided for routine tours of the systems at a frequency agreed upon by the supervisor and the system engineer and for a quarterly walkdown by the system engineer and responsible personnel from the Operations, Maintenance and Design Engineering Departments. However, the inspector noted that the licensee was experiencing start-up problems with participation in the quarterly walkdowns from the other organizations.

The inspector also found that there were some missed opportunities to include the views of other interested organizations in the definition of the System Engineering Program. The licensee had rank ordered the systems according to perceived importance. Both the Operations and System Engineering staff participated in this process. The inspector pointed out that this process apparently missed the opportunity to have risk management organizations participate in the rank ordering, an oversight which the licensee agreed to correct. In addition, the inspector noted that the System Engineering staff had defined tour frequency expectations and defined the parameters which would be monitored and trended to assess system performance. The inspector observed that the opinions of Operations and the risk management organization were not solicited in the definition of tour frequency and parameters to be monitored. The licensee also agreed to solicit these opinions.

The inspector examined documentation of system engineering tours and concluded that tours were being performed in accordance with agreed upon frequencies, that problems were being identified, and system performance parameters were being monitored and trended.

The inspector noted that the licensee had established a program for System Engineering management and supervision to participate in system tours and impart their expectations to the responsible system engineers. Supervisors were to accompany the engineers on one system tour per week and management was to accompany the engineers on one tour per month. The inspector considered this to be a well-conceived initiative to assure that expectations were communicated. However, the inspector pointed out that it may have been desirable for senior plant and utility management to have participated in the tour process to assure that the broadest possible perspectives were effectively communicated to the system engineers. The licensee indicated that this comment would be evaluated.

Design Basis Document Use

The inspector asked whether the system engineers used the licensee's design basis documents in the performance of their duties and was informed that the system engineers made little use of these documents. The inspector noted that the documents were not readily available and were only located in the supervisor's office. In addition, the system engineers and supervisor stated that the information in the documents was not useful in the performance of their jobs. It also became apparent that neither the system engineers, nor the supervisors, had communicated their concerns regarding the usefulness of the information to anyone in the engineering organization responsible for producing the design documents. The inspector considered this poor communication to be a missed opportunity to influence the preparation of the design basis documents.

Interface

Interviews of the operations staff indicated that system engineer presence in the plant, response timeliness, and credibility had improved. These interviews suggested that problems regarding System Engineering staff stability had improved and discussions with System Engineering supervision and management indicated that certain initiatives were underway to improve plant presence and stability. These initiatives included items such as presence at some shift turnovers, development of backup capability, and development of a replacement staff trainee program for some positions.

The licensee's program provides for performance of a joint design system engineer/operations/system maintenance engineer walkdown, to be led by the system engineer nine weeks prior to the quarterly scheduled system outage for maintenance. In addition, joint system walkdowns by the same team are conducted prior to return to power following a refueling outage.

Status Reports

The licensee had recently begun producing a system status report by System Engineering management for Operations and other senior management. The depth of system analysis in this report was under refinement.

Staffing

Staffing levels in System Engineering was discussed with various managers, supervisors and staff. The licensee stated that there are currently about 28 personnel in the Systems Engineering staff. The licensee acknowledged that this staffing level was at the low end of the average for single large utility plants and the licensee planned to add five new positions in the near future to bring the staffing in line with their current needs.

Conclusion

The inspector concluded that the System Engineering Program appeared to have improved, although certain oversights in program definition were observed. Specifically, the inspector concluded that the procedure for the System Engineering Program did not provide a clear, complete listing of the system engineer responsibilities, and the expectations of senior management for the functions of a System Engineering Program had not been clearly communicated to the mid-level managers responsible for developing the program and implementing procedures. The inspector also noted that additional staff needs were being addressed, and that interviews with operators indicated that system engineering support of plant operations had improved.

6.2.2 Plant Performance Monitoring and Trending Program

Performance Monitoring

The licensee's plant performance monitoring program was described in Administrative Control Procedure, PPM 1.5.9, Revision 5, "Plant Performance Monitoring Program," dated October 11, 1993. The procedure recognized the use of the Technical Specification Testing Program and the Reliability-Centered Maintenance Program in monitoring selected plant systems and equipment, including the collection, evaluation, and reporting of data. The inspector found that this procedure did not provide a complete identification and coordination of all the various parameter monitoring and trending activities performed by the Supply System. For example, the procedure did not include the parameters monitored by the System Engineering Department and the Specialty Programs Group.

The inspector considered that the lack of a well-defined program procedure indicated that management had not ensured that their expectations had been communicated. Further, the Specialty Programs Group was conducting business as specified by informal, internally-generated guides without the benefit of a procedure. The licensee acknowledged that the performance monitoring program would be further assessed and more formally integrated with the company goals and expectations of management.

Reliability-Centered Maintenance (RCM) Program Status

The inspector discussed the Reliability-Centered Maintenance (RCM) Program with responsible licensee personnel. The program consisted of reliability-centered maintenance information analysis, data obtained from a variety of sources, and equipment condition monitoring, (e.g., thermography, vibration, oil, lubricant, and motor current signature analyses).

The licensee had contacted industry counterparts and EPRI during the development of the program. The program was based upon the EPRI process regarding the selection of equipment and the preventive maintenance tasks which may be done to improve performance. The methodology for program implementation was chiefly determined by those activities which were applicable to the Supply System organizations and the existing organizational responsibilities. The Supply System had obtained EPRI agreement with the methodology used to scope the program.

The licensee's program monitored about 1300 pieces of equipment and reported the results of the monitoring and trends to the System Engineering organization for review. The licensee indicated that 130 systems were scheduled to be analyzed. The licensee also intended to perform a fault-tree analysis on key plant equipment and to build component basis files. These files would include the kind of preventive maintenance done on component types and a description of the maintenance necessary as a function of operating environment and other attributes. The licensee had completed an analysis on the Residual Heat Removal and Circulating Water systems. The results of these analyses recommended changes to the preventive maintenance program and other documents and programs. The licensee was working on methods to quickly extract and analyze trended data.

Condition Monitoring

The licensee's condition monitoring program was specified by Administrative Procedure, PPM 1.19.3, "Condition Monitoring Program." This program consists of process parameter monitoring for safety-related and balance-of-plant (BOP) equipment. Examples of equipment included in the program were safety-related pumps, valves, batteries, and emergency diesel generators. The BOP monitoring included thermal-cycle monitoring for the Service Water, Circulating Water, and Fuel Pool Cooling systems. The program also included heat exchanger monitoring (thermal performance and pressure drop testing), thermography, vibration monitoring, oil analysis, and motor current signature analysis.

Trending

The trending program trended almost all of the parameters collected by the various organizations in the conduct of the performance monitoring program; prepared trend plots covering three month or three year periods depending upon the frequency of data collection; and distributed the trended information to system engineers, operations and others. Special reports on potential problems were issued as warranted. For example, a special report described vibration anomalies on Reactor Recirculation Pump 1A, suggested the possible existence of a small pump shaft crack, and provided recommendations to avoid propagation along with additional monitoring suggestions.

Conclusions

Although the licensee's plant performance monitoring and trending programs were generally developing adequately, the inspector concluded that they could have been better defined and did not fully reflect the expectations of management. For example, the program administrative control document did not address all of the various performance monitoring activities being performed and certain monitoring activities were being performed without benefit of a approved procedure.

6.2.3 Design Engineering Effectiveness

The inspector held discussions with the Director of Engineering, the Manager of Design Engineering, and several of their staff. The inspector found that Engineering had an extensive number of improvement initiatives in various stages of completion and concluded that completion of these could only improve the effectiveness of engineering support of operations. Each initiative was assigned a responsible manager and appeared to be updated in status regularly.

Plant Tracking Log

As an example of improvement, in late October 1993, Engineering achieved zero overdue items on the plant tracking log, indicating that emergent work and backlogs were being effectively managed. In addition, the zero overdue item condition had continued since achieving that milestone.

To better understand what was in the plant tracking log (PTL) and how it was being used, the inspector requested a list of all the open engineering items in the PTL and several specific items representing engineering work that was due to be completed during the period of January 17-28, 1994. The inspector used these lists in discussions with various engineering managers and supervisors to obtain an understanding as to how the PTL was used and how various departments tracked their workloads and determined their resource requirements. The inspector determined that:

- The PTL was not very interactive or user friendly. It had not been used as the primary tracking tool, nor had it been used for determining resource needs. Specific subsets of open items, which were sorted by name and due dates, were used. In addition, other status tools had been developed by individual departments for their individual monitoring.

- Engineering managers and supervisors were keenly aware of open action items for which they were responsible.

- The inspector noted that the Engineering Improvements Document, which listed several enhancements and improvements (either planned, in progress, or completed) included a Quality Action Team (QAT) which had completed the development of an enhanced action item tracking system to replace the PTL. The licensee stated that the QAT results were being reviewed and a plan was under development to implement the proposed changes.

Engineering Backlog

The inspector held discussions with the Design Engineering Manager and several individuals who were closely involved with the request for engineering technical services (RFTS) backlog reduction efforts. The inspector determined that, as of July 1992, there were about 2500 items in the backlog. The licensee had performed an initial comprehensive review to define the content. The inspector examined the results of the licensee's comprehensive review, the methods of accomplishment, and the documented results. In summary, the backlog was determined to consist of about 70 percent active tasks and future work. About 10 percent were items that were essentially complete, but needed closure documentation. About three percent were abandoned tasks and required purging. The balance consisted of drawings needing corrections, unassigned tasks, and long-range planning work. The licensee performed a second comprehensive review in July 1993 of about 850 remaining items that were set up prior to July 1991 using similar criteria. About 50 percent were drawing corrections, and the balance were active work or candidates for closure.

The inspector concluded that a significant effort had been conducted to manage the work backlog and that Engineering had been successful in reducing the backlog to the current level of about 1100 RFTS. The majority of the items closed represented real work, with relatively few categorized as abandoned or redundant items. The inspector also noted that the reduction efforts did not result in stifling the generation of new RFTS, as is sometimes experienced in backlog reduction programs. The inspector considered this indicative of a well-managed program.

Benchmarking Initiatives

The inspector reviewed the results of the licensee's Benchmarking Initiatives Program, which was an effort to become more aware of industry initiatives and good practices by visiting other sites that have been cited as good performers in selected areas, such as system engineering and commitment tracking. The licensee used the information from these benchmarking trips to determine a starting point for developing improved practices both in the Engineering Department and in other plant organizations. The benchmarking trips were made by key managers, supervisors, and staff. The inspector also noted that there had been significant involvement by the licensee's staff in outside committee activities and meetings. An example of a recent benchmarking trip was a December 1993 visit by the Manager of Technical Services to the Monticello and Callaway nuclear power plants to review their System Engineering Programs.

Operations Interface with Design Engineering

Interviews with Operations Department personnel indicated a lower degree of satisfaction with the effectiveness of Design Engineering support than had been expressed for System Engineering. Improvement opportunities suggested by the operations staff included getting more and earlier operations input into design change planning, spending more time in the plant so as to better preclude interference problems, improving communications with the operators and operations staff, and speeding up the minor modification process. The licensee had recently embarked upon a program to speed up the minor modification process.

The inspector's discussions with Engineering personnel indicated that they were not aware that operations did not view the efforts of the Engineering organization in accordance with their own opinion of the effectiveness of their operations support. The inspector observed that the expectations of the licensee's senior management regarding engineering support for operations were not clearly defined and communicated to the Engineering organization. In some cases, the inspector found that Engineering Department personnel did not clearly identify their support activities to the operations management and staff. These two situations contributed to the disparity of views regarding the effectiveness of engineering support for operations. The licensee indicated that expectations would be assessed and communicated to improve relationships between the two organizations.

Subsequent to these discussions, the inspector was informed that the licensee began holding periodic staff lunches. The purpose of these lunches was to provide the plant staff with information regarding the role of Design Engineering and their current activities. A selected cross section of plant personnel were invited to the sessions, and opportunities were provided for questions. According to the licensee, these sessions generated good questions and a better understanding of the role of Design Engineering and their activities. The licensee stated that they planned to continue the periodic lunches.

Conclusion

The inspector concluded that the various Engineering improvement initiatives that were in progress or planned should improve the effectiveness of engineering support for the operation of the plant. Specifically, the work that had been done on reducing the significant backlog of RFTS and other work had already had significant impact. The backlog reduction also demonstrated Engineering's willingness to improve their effectiveness in response to plant needs. Furthermore, the site's benchmarking activities, which included visits to other sites with successful programs, appeared to be effective in improving performance in key areas such as system engineering. The licensee's increased involvement in external committee activities appeared to improve focus on ongoing industry initiatives. Nevertheless, the inspector concluded that it was too early to assess long term effectiveness of these initiatives, but encouraged the licensee to continue their attention to the improvement initiatives. The inspector also noted that licensee management had not established an agreed upon set of expectations to assure the effectiveness of Design Engineering interface with Operations or System Engineering.

6.2.4 Project Management Activities

The licensee had recently established a group dedicated to assuming project management responsibilities for plant modifications and selected major maintenance tasks. The group was called "WNP-2 Projects", and reported to the Assistant Managing Director for Operations. The licensee stated the group was formed to provide an adjustment to the system engineer workload and to provide better management and coordination of major plant work efforts. A responsibility document and charter had been drafted and agreed to by senior management. Daily implementation of the charter had been the subject of informal table-top guides, describing how the project management functions were to be accomplished. The formal functional procedures for the organization had not yet been issued.

The licensee stated that the project management team had been envisioned to include system engineering, maintenance, health physics, design engineering, operations, outage management, work planners, schedulers, estimators, and site support craft representatives. The team output was envisioned to be a project proposal to the Plant Review Committee (PRC) for the PRC to set priorities and approve implementation. The inspector suggested that, in addition to the normal Operations Department individual responsible for design change interface, the licensee consider inclusion of the various Operations Department individuals who were expert in and responsible for the particular system involved in a particular design change in order to improve the quality of the Operations Department contribution. The licensee stated that they recognized the potential improvement and would consider its implementation.

6.2.5 Design Basis

The inspector reviewed the adequacy of the procedures for the generation of Design Requirements Documents (DRDs), sampled DRDs to assess the accuracy and completeness of information they contained, and assessed the perceived usefulness of the DRDs through interviews with licensee personnel.

Validation and Verification of Design Requirements Documents

The licensee's DRD program included DRD preparation, design database review and reconstitution, DRD verification and validation, and documentation and resolution of open items. The procedure which defined the processes to be followed in developing the Design Requirements Documents was EDP 2.23, "Preparation of Design Requirements Documents," Revision 1, dated October 1, 1993. The inspector considered that the procedure satisfactorily addressed all of the above items. However, the inspector noted that prior to July 1, 1993, Engineering Standard PDS-6, "Design Requirements Document Program Description and Writer's Guide," outlined the DRD Program Plan and defined the structure and format of documents written to consolidate the design bases and requirements of

WNP-2 systems and specialty subjects. Since DRDs are part of WNP-2 Design Specifications, the relevant procedure EI 2.3, "Preparation and Revision of WNP-2 Design Specifications," which delineated responsibilities, was also applicable.

The inspector was concerned that procedure PDS-6 (which was no longer applicable) was weak in specifying the requirements for the licensee's DRDs. This was of concern because the procedure was used to develop a majority of the DRDs and the licensee did not intend to revise these older DRDs to the requirements of their current procedure. An example of the weakness of the older DRD procedure was the validation (comparison to the physical plant configuration) and verification (correct transfer of information from source documents into DRDs) processes. Although there was a requirement in PDS-6 for DRD validation, the procedure did not describe the details of how such a validation should have been accomplished. The inspector found that this generally resulted in a lack of a detailed validation of approximately 90 percent of the DRDs generated prior to implementing the new procedure, EDP 2.23. The licensee had an open issue regarding the adequacy of the validation of the DRDs produced under PDS-6 in their Revised DRD Program Plan, dated December 15, 1993. The licensee's action appeared to be appropriate.

Omissions Noted in Design Requirement Documents

The inspector identified some omissions in Design Requirement Document (DRD) 309, "Standby Service Water System." For example, DRD 309 did not clearly refer to an important calculation for system design (Calculation ME-02-91-41) which calculated SSWS flows and temperatures. DRD 309 was limited to referenced Calculation ME-02-92-43, which only computed room temperatures based on room heat loads. In addition, DRD 309 described the requirement for the time-dependent opening of valve SW-V-2A(2B) to prevent SSWS waterhammer. However, the DRD did not provide the basis for the time dependent profile.

Conclusions

The inspector found the license's Design Requirement Document Program documents did not contain information sufficient to make them useful to plant users. In addition, the validation and verification process used for the DRD's resulted in varying amounts and types of validation and verification. As discussed in Section 6.2.1 of this inspection report, the inspector also found that the system engineers made little use of the design basis documents primarily due to the lack of details in those documents.

6.3 Conclusions

The inspector concluded that the degree and effectiveness of the support provided by the Engineering Directorate and the System Engineering organizations for plant operations was clearly improving. This was evidenced by observed improvements in the implementation of the licensee's programs for personnel and equipment performance. The inspector also concluded that System Engineering appeared to have improved although certain oversights in program definition were observed. Additional staff needs were being addressed, and interviews with operators indicated that System Engineering support of plant operations had improved.

Also, the inspector concluded that the licensee's plant performance monitoring and trending programs could have been better managed, and that they did not appear to have had the benefit of the guidance and expectations of senior management. For example, the program administrative control document did not address all of the various performance monitoring activities being performed and certain monitoring activities were being performed without benefit of a approved procedure.

The inspector also considered that the various Engineering improvement initiatives that were in progress or planned should improve the effectiveness of engineering support for the operation of the plant. Specifically, the work that had been done on reducing the significant backlog of RFTS's and other work had already had significant impact. The backlog reduction also demonstrated Engineering's willingness to improve their effectiveness in response to plant needs. Furthermore, the site's benchmarking activities, which included visits to other sites with successful programs, appeared to be effective in improving performance in key areas such as system engineering. The licensee's increased involvement in external committee activities appeared to improve focus on ongoing industry initiatives. Although the inspector observed that it was too early to assess long term effectiveness of those initiatives, the licensee was encouraged to continue their attention to the improvement initiatives. The inspector also noted that licensee management had not established an agreed upon set of expectations to assure the effectiveness of Design Engineering interface with Operations or System Engineering.

No violations or deviations were identified.

7.0 Licensee Self Assessment

7.1 Quality Assurance Oversight

7.1.1 Sample and Criteria

The inspector examined the activities of the Quality Assurance (QA) organization in the oversight of engineering effectiveness. The quality assurance organization had performed about 20 audits and surveillances during the past 18 to 20 months looking at the broad area of engineering support of operations.

7.1.2 Findings

The inspector found that the QA organization audits had identified several penetrating findings with a lower rate of findings during the most recent time frame. The licensee stated that the recent lower rate of findings was due to the fact that the last six-month period consisted of mostly steady-state power operation with little opportunity for extensive engineering interface with operations. The QA activities indicated that: Design Engineering had improved in their understanding of Project Modification Request technical requirements; communications with operations had improved slightly; improvement was needed in engineering participation in the definition of post-modification testing; and there was a lack of consistency in the quality of the engineering interface with operations due, in part, to loosely defined management expectations and administrative controls.

The inspector subsequently conducted an additional review of several Technical Assessments, QA Surveillances and a QA Audit listed below:

TA 92-015, Set Point Program Review
TA 92-017, MOV Program Implementation Verification
TA 93-001, Assessment of Long Term Corrective Actions for Core Instability Event.
TA 93-003, Technical Communication between Engineering and Operations.
TA-93-004, Design Review of Selected R-8 Outage Modifications.
SR 292-0038, SW Expansion Joint Adjustment
SR 292-0088, Design and Inst of ECCS Pump Room Seals
SR 293-0027, Safety System Modification Adequacy for R-8
SR 293-0038, 8/93 Forced Outage and Startup Oversight Activities.
QA Audit 93-612, Corrective Action Program, Specifically Procedural Adherence.

Engineering Responsibility Clarification

The inspector reviewed Technical Assessment (TA) 93-04, in which the QA Department performed a review of selected modifications scheduled for implementation during the eighth refueling outage. The assessment found that the design control process was adequate and resulted in acceptable design change packages. However, the assessment also stated that Design Engineering's input to post-modification testing (PMT) requirements was minimal, and should be increased. Quality Finding Report (QFR) No. 93-001 was issued to Engineering on January 26, 1993, to document the finding.

Design Engineering's response to the problem, which was included in TA 93-04, stated that, "Presently there is no requirement for Design Engineering to specify or review normal acceptance criteria. There is a perceived deficiency that Design Engineering should document and specify all required Post-Modification Testing requirements." Programs and Audits accepted the Design Engineering response. They recorded their rationale for acceptance in the technical assessment which stated the response was acceptable: "...because adequate PMT was actually performed even though Design Engineering's involvement was minimal and undocumented."

The inspector noted that Engineering Instruction, EI 2.8, "Generating Facility Design Change Process," Revision 7, dated February 8, 1989, required Design Engineering to provide post-modification test requirements. Specifically, Section 3.1, Action 16, stated that, "Cognizant and Participating Engineer...If installation, functional or performance test requirements need to be considered, prepares a Test Requirement Summary in accordance with Attachment 5.5 and includes [Basic Design Change] BDC." The Test Requirement Summary is described as requiring the inclusion of the test acceptance criteria.

As a result of this concern, the licensee determined that a procedure clarification was required to clearly specify what test acceptance criteria should be provided by Design Engineering. The licensee also stated that they intended to revise EI 2.8 to clarify the test requirements.

7.1.3 Conclusions

The inspector considered that the assessments, surveillances and audits were thorough, insightful, and contained good findings and recommendations. The inspector also noted that the audits had been responded to in a generally timely manner and that the responses appeared adequate. The inspector noted that completed actions were being reviewed and verified by the QA organization.

No violations or deviations were identified.

8.0 Exit Meeting

On January 28, 1994, the inspector met with licensee representatives (as noted in Section 3.0) to discuss the inspection findings. The licensee did not identify as proprietary any of the materials discussed with or reviewed by the inspectors during this inspection.