ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket No.:	50-397
License No.:	NPF-21
Report No.:	50-397/97-11
Licensee:	Washington Public Power Supply System
Facility:	Washington Nuclear Project-2
Location:	3000 George Washington Way Richland, Washington
Dates:	June 2-6, 1997, and In-Office Inspection Until October 1, 1997
Team Leader:	J. E. Whittemore, Senior Reactor Inspector, Maintenance Branch
Inspectors:	T. L. Huang, Nuclear Engineer, Reactor Systems Branch Office of Nuclear Reactor Regulation
	E. D. Kendrick, Nuclear Engineer, Reactor Systems Branch Office of Nuclear Reactor Regulation
Accompanying Personnel:	J. M. Cuta, Pacific Northwest Laboratory
	C. E. Beyer, Pacific Northwest Laboratory
	J. March-Leuba, Oak Ridge National Laboratory
Approved By:	Dr. Dale A. Powers, Chief, Maintenance Branch Division of Reactor Safety

ATTACHMENT: Supplemental Information

EXECUTIVE SUMMARY

Washington Nuclear Project-2
NRC Inspection Report 50-397/97-11

This inspection included a review of the analytical methodology to assess performance of a mixed core containing Asea Brown Boveri/Combustion Engineering (ABB/CE) and Siemens Power Corporation (SPC) fuel assemblies, and the licensee's corrective action in response to a 10 CFR Part 21 nonconformance report submitted by a reactor fuel vendor. A review of a proposed facility license amendment was performed. Additionally, a review of the licensee's corrective action in response to the failure of fuel assembly debris filters was also conducted. This report covers a 1-week onsite period of inspection and in-office followup review by a region-based inspector, personnel from the Office of Nuclear Reactor Regulation, and NRC contracted personnel.

Engineering

- The licensee's initial methodology used for confirmation of the ABB/CE correlation to predict the thermal behavior of SPC fuel was deficient in that it could not detect absolute errors in the SPC correlation, or in the application of the SPC correlation to obtain the data matrix used for the development of the ABB/CE correlation (Section E1.1).

- For Cycle 13 operation, (1) the licensee applied a 0.975 conservative multiplier to the operating limit minimum critical power ratio (OLMCPR) calculated using the ABB/CE methodology for SPC resident fuel and (2) the power level of the most reactive (twice-burned) SPC resident fuel will be lower than in the previous cycle. These conditions provided sufficient confidence that operating SPC fuel at the OLMCPR, would not challenge the safety limit minimum critical power ratio (SLMCPR) should an anticipated operational transient occur during Cycle 13 (Section E1.1).

- The licensee's on-line monitoring of the nodal core operating limits with the Powerplex Monitoring Program was adequate (Section E1.2).

- The licensee operated Cycles 7-12 with incorrect and nonconservative core operating limit report (COLR) values for the OLMCPR. The OLMCPR was not calculated in accordance with NRC-approved topical reports referenced in Technical Specification 5.6.5.b. The licensee's staff determined that the corrected and more conservative OLMCPR was exceeded during each of the Cycles 7-12 (Section E1.3).

- The licensee had not completed a planned review and, as a result, had not yet determined if the SLMCPR would have been exceeded for anticipated operational transients (Section E1.3).

- A proposed facility license amendment did not assure conservative limits for Cycle 13 operation and, thus, was not acceptable (Section E1.3).

- There were fuel assembly debris filters whose springs failed in Cycle 12. The potential for the failures might have been detected by a better testing and examination program of the debris filters prior to their commercial introduction (Section E1.4).

- The corrective action by the licensee to remove the fuel assembly debris filters and modify the lower support pieces was satisfactory (Section E1.4).

- The licensee's fuel assembly examination and review of vendor information provided an adequate basis to conclude that significant fretting damage to fuel cladding, due to broken fuel assembly debris filter springs, had not occurred (Section EI.4).

Report Details

Summary of Plant Status

During the onsite portion of the inspection, the unit was in the refueling mode and preparing for Cycle 13 operation.

III. Engineering

E1 Conduct of Engineering

This inspection included an engineering followup review of the WNP-2 corrective action in response to a 10 CFR Part 21 nonconformance report from SPC regarding the Technical Specification SLMCPR for ATRIUM-9 (SPC 9x9-9X) fuel supplied to the WNP-2 facility for Cycles 7 through 11. The SPC data base did not provide a sufficient number of data points to support the correlation used to describe the performance of the SPC fuel. This safety limit error also affected the OLMCPR value contained in the COLR.

The erroneous SPC SLMCPR was also used in Cycle 12, and in combination with an ABB/CE error, affected the OLMCPR, as described in Section E1.1.b. The inspection also assessed the licensee's corrective action in response to the failure of ABB/CE fuel assembly debris filters from the ABB/CE 10x10 fuel supplied for Cycle 12.

The inspectors examined the licensee's application of the approved ABB/CE OLMCPR methodology for the completed Cycle 12 and the proposed Technical Specification changes for Cycle 13.

E1.1 Evaluation of Vendor Correlation Applications

a. Inspection Scope (92903)

The inspectors reviewed information provided by the licensee to an independent third party contractor to ensure adequate consideration of the prior vendor, SPC, critical heat flux correlation database as it related to resident SPC fuel. The statistical methodology employed by the third party contractor was evaluated. The inspectors also assessed the impact of the problem identified in the 10 CFR Part 21 report related to the SPC advanced nuclear fuel - boiling (ANFB) correlation, and determined the adequacy of the final results. The inspectors also reviewed information for Cycles 12 and 13, related to the ABB/CE US96A7 correlation, developed to predict the change in critical power ratio in the SPC fuel during anticipated operational transients.

b. Findings and Observations

The inspectors identified concerns related to the adequacy of the method for calculating the OLMCPR. These concerns eventually resulted in a startup issue for WNP-2 Cycle 13. A basic problem with the analysis of the core with.mixed fuel types was that the new fuel vendor did not have access to proprietary information about the design of the previous vendor's resident fuel. Therefore, conservatism in the correlation to describe behavior of the previous vendor's fuel was paramount.

The inspectors determined that the licensee had not satisfied conditions set forth in the licensing safety evaluation report that approved the fuel reload methodology used for Cycle 12. The conditions were specified in the generic topical report CENPD-300-P-A, "Reference Safety Report for Boiling Water Reload Fuel," July 1996. This document was listed as Reference 2 for Technical Specification Basis B.3.2.2, "Minimum Critical Power Ratio (MCPR)," and noted to provide analytical methods and assumptions for establishing operating limits. In particular, the licensee's methodology for developing core limits did not demonstrate conformance with Restriction 7 of Report CENPD-300-P-A. This restriction stated that the ABB/CE methodology for determining the OLMCPR for non-ABB/CE fuel was acceptable only when each licensee application of the methodology identified the value of the conservative adder to the OLMCPR. In addition, the correlation the licensee's contractor applied to the experimental data to determine the value of the adder was required to meet a statistical (95/95) confidence. The inspectors determined that the comparison of the ABB/CE US96A7 correlation results against experimental data was deficient because both the validation procedure and the database were inadequate to validate the statistical accuracy of the correlation.

Following the onsite portion of the inspection, the licensee provided additional information to NRC that supported Cycle 13 startup using the OLMCPR determined by use of the ABB/CE correlation for non-ABB/CE resident fuel. The information provided was:

- A comparison of critical power ratio (CPR) values predicted by the SPC ANFB correlation and the ABB/CE US96A7 correlation for all SPC fuel assemblies at all expected operating conditions during Cycle 13 (a total of 5276 benchmark points). This comparison showed a standard deviation of 0.008 and a mean value of -0.021. For this comparison, the licensee and ABB/CE used the same procedures and correlations used to calculate the transient CPR for anticipated operational occurrences, which formed the bases for the OLMCPR. These 5276 benchmark calculations provided a high level of confidence that the ABB/CE correlation results were conservative with respect to results using the SPC correlation when a conservative multiplier of 0.975 was used on the SPC fuel assemblies.

- A comparison of peak uncontrolled (no control rod blade) fuel assembly power for planned operation during Cycle 13 for ABB/CE and SPC fuel. This comparison indicated that the lower reactivity for the twice-burned SPC fuel resulted in a 15 percent reduction in peak uncontrolled fuel assembly power with respect to the ABB/CE fuel during Cycle 13. Additionally, the peak fuel assembly power for Cycle 13 SPC fuel would be at least 10 percent lower than the peak fuel assembly power achieved during Cycle 11 for the same SPC fuel. Thus, uncertainties in the ABB/CE correlation for SPC fuel were compensated by the lower reactivity and fuel assembly power of the twice-burned SPC fuel.

- The licensee included the uncertainty multiplier into the ABB/CE OLMCPR for Cycle 13 in the correlation fit to the SPC matrix data.

The inspectors were initially concerned that the methodology used to validate the ABB/CE correlation was deficient because of the potential to propagate absolute errors in the SPC ANFB correlation or in its application to obtain the calculated data matrix used for the development of the ABB/CE correlation. However, the inspectors concluded that the revised SLMCPR would be acceptable because: (1) the Cycle 13 SPC peak fuel assembly power was expected to be at least 15 percent lower than the ABB/CE peak fuel assembly power and at least 10 percent lower than the same SPC fuel during Cycle 11; (2) the Cycle 13 specific benchmark between SPC and ABB/CE results showed that the ABB/CE US96A7 correlation was conservative when a 0.975 multiplier was used; (3) that a 0.975 conservative multiplier was applied to the OLMCPR ABB/CE methodology for SPC resident fuel; and (4) inspection team members had recently reviewed the application of additive constant uncertainties to the SPC ANFB correlation and found it to be acceptable to monitor the safety limit. The supporting documentation indicated that all requirements of the generic topical report CENPD-300-P-A for Cycle 13 had been satisfied.

c. <u>Conclusions</u>

The initial methodology used to confirm the ABB/CE correlation for SPC fuel did not satisfy Restriction 7 of CENPD-300-P-A. This method was deficient because absolute errors were propagated by the application of the SPC correlation to obtain the data matrix used for the development of the ABB/CE correlation. However, the inspectors concluded that the 0.975 conservative multiplier in the OLMCPR ABB/CE methodology for SPC resident fuel in conjunction with the 0.975 multiplier applied to the Cycle 13 benchmark calculations provided sufficient confidence that SPC fuel, operating at the OLMCPR, would not challenge the SLMCPR should the analyzed anticipated operational transients occur during Cycle 13.

E1.2 Review of the Use of ANFB Correlations in the Powerplex Monitoring Program

a. Inspection Scope (92903)

The inspectors reviewed the licensee's process for using the SPC ANFB correlations in the licensee's Powerplex Monitoring Program. The Powerplex software calculated fuel assembly CPR level on operating fuel measured parameters such as neutron flux and temperature. The inspectors reviewed the available documentation for the core monitoring system and the Powerplex input deck for Cycle 12. An assessment was made to determine if the correlation used to design and analyze core load was adequate to monitor against core thermal limits during operation.

b. Findings and Observations

The inspectors initially understood that the licensee had used the nonsafety grade Powerplex Monitoring Program to generate an SPC data base matrix to correlate to the ABB/CE US96A7 correlation. The inspectors determined that this method was not appropriate. Additional clarifying information was provided in licensee Report WPPSS-FTS-131-A, Revision 1, that indicated that the calculated matrix of data points was developed using the licensee's reload core design methods that had been previously approved by the NRC, and not by using the Powerplex Monitoring Program.

The inspectors found that the engineering documentation in support of the core Cycle 12 input deck was adequate.

c. Conclusions

The licensee's on-line monitoring of the nodal core operating limits was adequate.

E1.3 Adequacy of Methods for Calculating Limits

a. Inspection Scope (92903)

The inspectors reviewed the licensee and vendor methods for calculating core power distribution safety and operating limits. The review verified that the use of separate fuel vendor correlations would predict conservative results for transient analysis. The changes in vendor critical heat flux correlation additive constants were evaluated for the effect on acceptability of the licensee's methods for developing limits. A review of a proposed facility license amendment for Cycle 13 was also performed.

b. Findings and Observations

During WNP-2 Cycles 7-11, the plant was operated with incorrect Technical Specification values for the SLMCPR. This occurred because the licensee did not ensure that the OLMCPR and SLMCPR values were calculated in accordance with methods described in vendor and Technical Specification references given below:

- ANF-1125 (P)(A) and Supplements 1 and 2, "ANFB Critical Power Correlation," April 1990

- ANF-NF-524 (P)(A) Revision 2 and Supplements 1 and 2, "Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors," November 1990

- Technical Specifications Section 5.6.5, "Core Operating Limit Report," for Cycles 7-11

Specifically, SLMCPR (and OLMCPR) values were not generated in accordance with Section 4.0, "Technical Position and Limitations," of the staff safety evaluation report for ANF-NF-524 (Limitation 2), stating, "Since the ANFB correlation uncertainties depend on fuel design, in plant-specific applications the uncertainty value used for the ANFB additive constants should be verified (Section 3.4)."

The determination of the additive constants for the 9x9-9X fuel design were not determined in accordance with Section 6.0, "Statistical Analysis Methodology," of ANF-1125, Supplement 1, and did not comply with the staff safety evaluation report Section 3.3 (Limitations 3), stating, "The use of the ANFB correlation shall be limited to assessments with the additive constants given in Reference 2 [Supplement 1]. If a new fuel design results in additive constants outside the range of Reference 2, then these must be justified."

Thus, the OLMCPR values in the COLR were incorrect and were not in accordance with Technical Specification 5.6.5.

A design defect in the application of the referenced methodologies was reported by SPC in a 10 CFR Part 21 notification dated May 22, 1997, which resulted in larger uncertainties in additive constants for 9x9-9X fuel . As a result of this reported defect and the licensee's, failure to ensure that SER limitations were met on the above-listed, reference-specific methodology, erroneous and nonconservative values for OLMCPR and SLMCPR were developed and implemented for each of the five noted operating cycles. By specifying a nonconservative OLMCPR in the COLR, there was added risk of exceeding the SLMCPR that assured the integrity of the fuel in the event of an anticipated operational occurrence. The development and implementation of the incorrect limits called into question the adequacy of the licensee's program to assure an accurate process for developing and implementing correct facility license limits for Cycles 7-11. The NRC's review of the adequacy of this program was identified as an unresolved item (50-397/9711-01).

During Cycle 12, the licensee operated the core with an incorrect Technical Specification value for SLMCPR and COLR value for the OLMCPR because the application was not in accordance with ANF-1125 (P)(A) and ANF-NF-524 (P)(A), in that the correlation additive constant was not evaluated or changed when the fuel design was changed. Both of these documents were referenced in the Technical Specifications. In addition, the licensee did not follow the new fuel vendor methodology specified in Technical Specification 5.6.5, Reference 11, Report CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactor Reload Fuel," July 1996, Section 5.3.2.5, which described the methodology for renormalization of an approved ABB/CE correlation to establish the MCPR performance of resident SPC fuel in a mixed core. The licensee and current fuel vendor did not establish an accurate description of MCPR behavior of all the resident fuel in Cycle 12 partly because proprietary test data describing the CPR behavior of the SPC resident fuel was not available in its entirety to test and verify the ABB/CE correlation. The licensee's implementation of the ABB/CE correlation in accordance with Report CENPD-300-P-A and validation procedures discussed with the NRC during the NRC review of Report CENPD-300-P might have identified the SPC design defect prior to Cycle 12 operation. The adequacy of the process measures to develop and implement accurate and conservative facility limits under somewhat different circumstances for Cycle 12 was questionable and this issue will be addressed as part of unresolved item (50-397/9711-01).

The licensee was performing an evaluation to determine if corrected and more conservative OLMCPR or SLMCPR were exceeded during the operating cycles. Slow analyzed transients were evaluated and a determination was made that safety limits would not have been reached or exceeded. The evaluation resulted in a preliminary indication that the OLMCPR was exceeded at least once during each of Cycles 7-12. The NRC evaluation of the licensee's failure to conform with a facility license operating limit over six core cycles was identified as an unresolved item (50-397/9711-02).

As part of the ongoing review and evaluation, the licensee further evaluated all of the fast transients that occurred during Cycles 7-12 and concluded that the SLMCPR was not exceeded during the actual events. In addition, the licensee was evaluating anticipated operational occurrences that would result in fast transients to determine if any of these type of transients would have resulted in exceeding the SLMCPR. The evaluation was still in progress, and scheduled for completion in November 1997. The NRC evaluation of the licensee's review of the potential to exceed a newly calculated safety limit during an analyzed fast transient was identified as a unresolved item (50-397/9711-03).

b.2 Adequacy of A Proposed Facility License Amendment for Cycle 13

The following determinations resulted from the review of the licensee's proposed facility amendment for Cycle 13 (see Attachment).

1. The use of approved methodologies referenced in the Cycle 12 COLR and Section 5.6.5 of Technical Specifications included General Electric, SPC, and ABB/CE topical reports, however; there were no General Electric fuel assemblies in Cycle 13. The licensee was informed that an update of the list of the approved methodologies referenced for the current cycle operation was necessary.

2. The Cycle 12 operation used the same SLMCPR as Cycle 11, because identical specific parameters for power distribution, core loading, and control rod pattern versus exposure were used for both cycles. However, the validity of using the Cycle 11 SLMCPR for Cycle 12 and Cycle 13 operation was not justified since the additive constants and the additive constant uncertainty for SPC 9x9-9X fuel was no longer the same as the data input to the Cycle 11 analysis.

3. The additive constants for SPC 9x9-9X fuel were originally given to NRC in a letter dated September 20, 1990, from R. A. Copeland (SPC) to L. Phillips (NRC). However, the revised additive constants for SPC 9x9-9X were proposed to the licensee by SPC in a letter dated April 9, 1997, from K. V. Walters (SPC) to R. A. Vopalensky (WPPSS). These new additive constants were derived from use of the procedures stated in ANFB-1125(P)(A), Supplement 1.

4. A 10 CFR Part 21 nonconformance report, dated May 22, 1997, was issued by SPC regarding CPR correlation additive constants developed for SPC 9x9-2 fuel that were not applicable to SPC 9x9-9X fuel.

The inspectors informed the licensee that the proposed license amendment was not acceptable to the NRC without assurance that the additive constants would provide conservative limits.

c. Conclusions

For Cycles 7-12, the licensee operated the core with incorrect values for the OLMCPR specified in the COLR and the SLMCPR specified in the Technical Specifications. The determination methodology was not in accordance with applicable licensing documents referenced in the Technical Specifications. The adequacy of the programmatic process for developing licensee limits for Cycles 7-12 was an unresolved item. The failure to conform with the OLMCPR during Cycles 7-12, was an unresolved item. The determination of the potential to exceed a safety limit for Cycles 7-12 analyzed anticipated operational transients was an unresolved item. The proposed license amendment did not assure conservative limits for Cycle 13 operation and, thus, was not acceptable.

E1.4 Fuel Assembly Debris Filter Failures

a. Inspection Scope (92903)

The inspectors reviewed the fuel rod failure history for WNP-2 and the fuel vendor's failure database to understand the history of fuel assembly debris filter failures and assess the adequacy of any pre-installation testing. These filters consisted of parallel spiral-wound springs in slight compression installed at the fuel assembly inlet. Failure occurred when springs broke and small sections of spring turns were released into the reactor coolant system. Additionally, the evaluation used to install the newly modified fuel assemblies, and the licensee's assessment of the adequacy of criteria and testing used to support the change was reviewed. The inspectors also reviewed the licensee's methodology for determining fuel cladding surface condition acceptability, the bases for the decision to reuse any fuel assemblies that had contained failed fuel assembly debris filters, and the safety impact of any debris resulting from the failed filters that remained in the reactor system coolant.

b. Observations

b.1 Fuel Rod and Fuel Assembly Debris Filter Failure Histories

The licensee indicated that there had been five to seven fuel rod failures over 12 cycles of WNP-2 operation.

Cycle 2 operation produced the first evidence of fuel failure, but this fuel was twice burned and unfortunately discharged without examination for the number or cause of fuel rod failures.

Cycle 4 had high offgas activity indicating the presence of fuel failures, but unfortunately there were sipping equipment problems during the outage and the licensee did not identify the number or cause of fuel rod failures.

Cycle 5 also exhibited high offgas activity and four fuel assemblies with failures were identified. Visual examination of these assemblies identified two rods failed due to crud-induced localized corrosion, one rod was split, and one failed due to fretting wear from debris trapped between a spacer and a fuel rod.

Historically, the licensee has not been aggressive in investigating the causes of fuel rod failures; however, the failure of the fuel assembly debris filters during Cycle 12 did not result in any fuel failures.

The first reload fuel assemblies using the debris filters were introduced into two European plants in 1995. The new design was introduced into the WNP-2 core during the Spring of 1996 for Cycle 12, and consisted of 104 fuel assemblies. The fuel vendor informed the licensee in a letter dated April 9, 1996 (ABBWP-96-029) that fretting wear had been observed in the springs of the debris filters during recent out-of-reactor flow testing. However, the vendor believed this wear was due to atypical conditions compared to those conditions found in the WNP-2 reactor. The vendor further stated that the in-reactor operation of fuel assembly debris filters continued to be satisfactory and it was unlikely that a problem existed with the fuel at WNP-2.

The licensee examined all 104 fuel assemblies at the end of Cycle 12 and identified broken debris filter springs in 26 assemblies. Four fuel assemblies had more than 12 spring turns missing. All springs were accounted for except a total of 4.5 spring turns. The licensee suspected that the missing spring pieces were lost when the subassemblies were removed from their channels in the spent fuel pool. It was also possible that some of the pieces were lodged in fuel assemblies still in the core, or remained in the reactor coolant system.

b.2 <u>Pre-Installation Testing of Fuel Assembly Debris Filters</u>

Prior to the licensee's decision to utilize the fuel assembly debris filters in Cycle 12, the vendor declared in Report BKB-94-152, Revision 1, that the results of an out-of-reactor endurance flow test on a fuel assembly with the debris filter demonstrated satisfactory performance of the debris filters. This report also noted that visual examination of two lead test fuel assemblies with the debris filters demonstrated satisfactory performance following one and two cycles of operation in a European facility. However, three subsequent out-of-reactor tests and lead test fuel assembly examinations from other reactors performed during 1996 indicated that fretting wear was evident in the three new out-of-reactor tests, and failure had occurred in some debris filters of the lead test fuel assemblies.

The licensee's representative stated that the vendor did not observe fretting wear on the springs in the debris filters after the initial two out-of-reactor tests in 1994 because the vendor failed to closely examine the debris filters after testing. Specifically, the vendor's Report BKB-94-152 looked for fretting wear on the fuel rods and did not appear to examine the debris filters closely. The licensee's evaluation of the debris filter failures, documented in Problem Evaluation Request 297-0341, provided a basis to conclude that the failures occurred due to inadequate vendor testing and examination of the debris filters.

The inspectors noted that detailed examination of irradiated lead test fuel assemblies was difficult, but that detailed examination of the out-of-reactor tested debris filters was possible. The inspectors were aware that past practice of vendors was to lead test redesigned fuel assemblies in two or three plants before using the design as reload fuel in a domestic plant. The licensee decided to utilize the debris filters in January 1995, based on the report of examination of two lead test fuel assemblies from one plant. Subsequently, WNP-2 experienced about a 25 percent failure rate of the debris filters during Cycle 12 operations. The inspectors determined that the licensee's conclusion of an inadequate vendor test program was appropriate.

b.3 Design Change Process for Fuel Assembly Debris Filter Removal and Testing of New Design

The inspectors reviewed the licensee's actions performed to recover from the use of failed fuel assembly debris filters. The licensee elected to discontinue use of debris filters. The planned action required removing the filters, removing the old lower fuel support pieces from positions that contained the fuel assemblies with filters, and installing a redesigned lower support piece. The redesigned lower support piece was installed under all of the affected fuel assemblies.

The design change to the lower support piece was documented in Basic Design Change EI 2.8 (BDC 97-0040-OA), approved on April 22, 1997. The design change consisted of omitting debris filter springs and adding a lip to the inside surface of the fuel assembly inlet orifice to provide flow restriction sufficient to obtain the same pressure drop that resulted from use of the filters. The inspectors reviewed results of subsequent vendor testing, which verified that the design change resulted in the same pressure drop as the previous support piece containing the filters.

Additionally, the licensee required the vendor to perform long-term flow endurance tests on the newly designed fuel assembly with the new lower support piece. This test, as documented in Report BLB 96-013E, dated April 15, 1997, verified that this design change did not cause any fuel rod fretting. The inspectors determined that the design change process and the testing performed to validate the adequacy of the design change were adequate.

b.4 Basis for Reuse of Modified Fuel Assemblies

Licensee personnel conducted visual examination of each of the subassemblies from each fuel assembly that previously contained failed fuel filters. These examinations did not reveal any damage to the fuel assemblies, including the fuel rods. There

were broken springs in the debris filters and there were broken and loose spring turns in the bottom spacer span of some fuel assemblies. The loose spring turns had the potential for causing fretting to the fuel rod cladding, which could eventually result in fuel rod perforation. The inspectors observed 4 of the 10 available videotapes of the visual examinations and did not see any indication of damage to the fuel rod cladding. However, the examination technique could only reveal slightly beyond the four outer faces of a fuel assembly and only about 40 percent of the total fuel rod cladding surface could be examined for fretting wear. Therefore, the licensee's conclusion that no damage to the fuel rods resulted from the failed debris filters, was partially based on sampling. In addition, the fuel vendor stated to the licensee that a European plant with failed debris springs and two spring turns found in the lower span of one subassembly did not experience any fuel rod damage. On the bases of the inspection results and information from the vendor, the licensee elected to use all of the fuel assemblies that previously contained failed debris filters.

b.5 Potential Safety Risk Due to Debris from Failed Fuel Assembly Debris Filters

The inspectors determined that a potential safety issue was if this small amount of debris (4.5 spring turns) became trapped between the assembly channels and a control blade path. However, this scenario was not likely since the blade channel flow restrictors would prevent the spring turns from entering this pathway. The likely locations of the missing spring turns included the bottom of the pressure vessel, in a fuel assembly at a location not observable, in down stream piping or components, or in the spent fuel pool. The most plausible potential problem was that the spring turns might result in debris-induced fretting failures of one or more fuel rods in subsequent cycles. However, fretting failures due to debris from failed debris filters have not been reported by plants experiencing this problem.

c. Conclusions

The inspectors concluded that the failure to identify the potential for deficient fuel assembly debris filters in Cycle 12 was due to inadequate testing and examination of the debris filters prior to their commercial introduction. From a historical review, the inspectors concluded that the licensee had not been aggressive in the investigation of the cause of fuel failures. The corrective action performed by the licensee to implement a design change that eliminated the filters and modified the lower support piece was satisfactory. The inspectors further concluded that the licensee's fuel assembly examination and acceptance of vendor information were adequate bases to conclude that damage to fuel cladding had not occurred. Additionally, there were no safety concerns due to the spring turns that may have remained in the reactor coolant system.

V. Management Meetings

X1 Exit Meeting Summary

A telephonic exit meeting was conducted with the licensee on October 1, 1997, to inform the licensee of the inspection findings. The licensee personnel acknowledged the findings. The NRC personnel acknowledged the receipt of proprietary information during the inspection and stated that most had been returned. NRC personnel committed to destroy or return proprietary information still in possession after NRC resolution of the unresolved items discussed in this inspection report.

X3 Management Meeting Summary

Following a debrief at the end of onsite inspection activities, telephone conference calls with personnel from the licensee, the licensee's contractors, the Office of Nuclear Regulatory Regulation, and Region IV were conducted on June 9, 12, and September 18, 1997. On June 23, 1997, a meeting with the licensee was held at NRC Headquarters. These conference calls and meeting were conducted to provide additional information to the NRC in order that issues related to the inspection could be resolved.

ATTACHMENT

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

D. Atkinson, Manager, Quality Assurance
R. Barbee, Assistant Manager, System Engineering
S. Bian, Supervisor, Reactor/Fuels Engineering
D. Coleman, Manager, Regulatory and Industry Affairs (Acting)
P. Inserra, Manager, Licensing
W. Kiel, Regulatory Programs Specialist
T. Meade, Manager, System Engineering
M. Monopli, Manager, Operations
J. Parrish, Chief Executive Officer
T. Powell, Licensing Specialist
J. Swailes, General Manager, Engineering
D. Swank, Manager, Regulatory and Industry Affairs
J. Teachman, Principal Engineer, Reactor/Fuels
R. Torres, Manager, Reactor Fuels Engineering

NRC

Z. Abdullahi, Engineer, Reactor Systems Branch
D. Powers, Chief Maintenance Branch
H. Wong, Chief, Reactor Projects Branch E

INSPECTION PROCEDURES USED

IP 92903 Followup-Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-397/9711-01	URI	Failure to Control Design of Facility License Limits (Section E1.3)
50-397/9711-02	URI	Potentially Exceeding OLMCPR During Core Cycles 7-12 (Section E1.3)
50-397/9711-03	URI	Determination of Potential to Exceed SLMCPR During Anticipated Operational Transients (Section E1.3)

PROCEDURES REVIEWED

1.10.4	External Operating Experience Review, Revision 12
1.3.12	Problem Evaluation Request, Revision 24
1.3.12A	Processing of Problem Evaluation Request, Revision 24
1.10.1	Notification and Reportable Events, Revision 17
1.10.3	10 CFR Part 21 Requirements and Reporting, Revision 7
EMF-1886(P)	Powerplex-II CMSS User Manual

DOCUMENTS REVIEWED

Basic Design Change 97-0040-0A

NE-02-96-05, Powerplex Input for Cycle 12

CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactor Reload Fuel," July 1996

Report No. SLI 94-04, "An Assessment of the ABB Method for Determining the Critical Power for the Resident SPC 9x9-9 Fuel Assemblies in the WNP-2 Core"

UR-89-210-P-A, "SVEA-96 Critical Power Experiments on a Full Scale 24-Rod Sub-Bundle"

NE-02-94-31, "ANFB CPR for ABB Analysis"

Performance Evaluation Requests:

297-0283
297-0285
297-0341

WNP-2 Core Operating Limits Reports (COLRs):

COLR 96-12 - Cycle 13, Revision 1
COLR 96-12 - Cycle 13, Revision 0
COLR 95-11 - Cycle 13, Revision 0
COLR 94-10 - Cycle 12, Revision 2
COLR 94-10 - Cycle 11, Revision 1
COLR 94-10 - Cycle 10, Revision 0
COLR 93-9 - Cycle 9, Revision 1
COLR 93-9 - Cycle 9, Revision 0
COLR 92-8 - Cycle 8, Revision 1
COLR 92-8 - Cycle 8, Revision 0
COLR 91-7 - Cycle 7, Revision 0

ABB/CE Letters and Reports:

ABBWP-94-058, ABB SVEA-96 CPR Correlation for Powerplex
ABBWP-94-076, Response to Technical Review
ABBWP-96-029, Results of Debris Filter Testing
ABBWP-96-070, Late Test Loop Test Results
ABBWP-96-087, Letter Recommending Debris Filter Removal
BR 94-616, ABB/CE Report on Pressure Drop Tests
ABB/CE NPSD-802-P, WNP-2 Cycle 12 Transient Analysis Report
ABB/CE NPSD-820-P, WNP-2 Cycle 13 Transient Analysis Report

Licensee Letters:

G02-97-102, WNP-2 Operating License NPF-2 Exigent Request for Amendment: Minimum Critical Power Ratio Safety Limits, P. R. Bemis (Supply System) to NRC Document Control Desk, dated May 20, 1997

G02-97-115, Exigent Request for Amendment of SLMCPR - Modification of Request, P. R. Bemis (Supply System) to NRC Document Control Desk, dated June 6, 1997