UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

November 16, 2007

Carolina Power and Light Company
ATTN: Mr. J. Scarola
Vice President
Brunswick Steam Electric Plant
P. O. Box 10429
Southport, NC 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT - NRC SPECIAL INSPECTION REPORT NO. 05000325/2007011 AND 05000324/2007011

Dear Mr. Scarola:

On September 21, 2007, the U.S. Nuclear Regulatory Commission (NRC) completed the onsite portion of a special inspection at your Brunswick Steam Electric Plant. The inspection reviewed the circumstances surrounding the Unit 1, B loop service water (SW) motor operated supply valve 1-SW-V105 Failure on July 26, 2007, the 1D Residual Heat Removal (RHR) SW Booster Pump Failure on August 21, 2007, and foreign material issues in the SW system. A Special Inspection was warranted based on the risk and deterministic criteria specified in Management Directive 8.3, "NRC Incident Investigation Program." The determination that the inspection would be conducted was made by the NRC on August 2, 2007, and the inspection started on August 2, 2007. The preliminary inspection results were discussed with you and members of your staff on September 21, 2007. Subsequently, additional in-office reviews were conducted and the enclosed inspection report documents the inspection results, which were discussed by telephone with you and members of your staff on October 9 and November 9, 2007.

This inspection was performed in accordance with Inspection Procedure 93812, "Special Inspection," and focused on the areas discussed in the inspection charter described in the report. The inspection examined activities conducted under your licenses as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your licenses. The team reviewed selected procedures and records, conducted field walkdowns, observed activities, and interviewed personnel.

The report documents two NRC-identified findings of very low safety significance (Green). Both of these findings were determined to involve violations of NRC requirements. However, because of the very low safety significance and because they are entered into your corrective action program, the NRC is treating these two findings as non-cited violations (NCVs) consistent with Section VI.A.1 of the NRC Enforcement Policy. If you contest any NCV in this report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN.: Document Control Desk, Washington DC 20555-0001; with copies to the Regional Administrator Region II; the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington DC 20555-001; and the NRC Resident Inspector at the Brunswick Steam Electric Plant.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Charles A. Casto, Director
Division of Reactor Projects

Docket Nos. 50-325, 50-324
License Nos. DPR-71, DPR-62

Enclosure: Inspection Report 05000325/2007011 and 05000324/2007011
w/Attachment: Supplemental information

cc w/encl: See page 3

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Letter to J. Scarola from Charles A. Casto dated November 16, 2007

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.:	50-325, 50-324
License Nos.:	DPR-71, DPR-62
Report Nos.:	05000325/2007011 and 05000324/2007011
Licensee:	Carolina Power & Light (CP&L)
Facility:	Brunswick Steam Electric Plant, Units 1 & 2
Location:	8470 River Road SE Southport NC 28461
Dates:	August 2 - November 9, 2007
Inspectors:	S. Vias, Senior Reactor Inspector, Initial Team Lead M. King, Resident Inspector - Harris Nuclear Plant G. MacDonald, Senior Reactor Analyst, Supplemental Team Lead
Approved by:	Randall A. Musser, Chief Reactor Projects Branch 4 Division of Reactor Projects

Enclosure

SUMMARY OF FINDINGS

IR 05000325/2007-011, 05000324/2007-011; 08/02/2007 - 11/09/2007; Brunswick Steam Electric Plant, Units 1 and 2; Special Inspection.

This report documents special inspection activities performed onsite and in the Region II office by a senior reactor inspector, a senior reactor analyst, and a resident inspector to review the Brunswick Unit 1 Service Water (SW) train B motor operated supply valve (1-SW-V105) failure on July 26, 2007, and to review the subsequent Residual Heat Removal (RHR) Service Water Booster Pump 1D failure and SW Foreign Material Issues . The inspectors identified two Green findings which were determined to be violations of NRC requirements. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 4, dated December 2006.

A. NRC-Identified and Self-Revealing Findings

Cornerstone: Mitigating Systems

- Green. The inspectors identified an NCV of 10 CFR 50 Appendix B, Criterion XVI, for failure to promptly identify and correct a condition adverse to quality related to foreign material in the service water system (SW) resulting from Fisher butterfly valve rubber lining failures. There had been a number of failures of Fisher butterfly valve rubber linings since 1985 including a Unit 1 failure in 2004 and a Unit 2 failure in 2005. The examples in 2004 and 2005 were examples where valve lining material was missing from Fisher valves and all the material was not accounted for and removed from the SW system. On August 16, 2007, the licensee detected reduced flow from the 1B Residual Heat Removal (RHR) room cooler and on August 18, 2007, identified foreign material in the inlet piping to the cooler. Additional rubber lining material was also found in the 1 A RHR room cooler. An additional example of Fisher valve foreign material in the SW system was noted in 2005 in the Unit 2 2B Turbine Building Component Cooling Water Heat Exchanger. The licensee entered this issue into the corrective action program.

  The failure to maintain the SW system free of foreign material was considered a performance deficiency and a finding in the mitigating systems cornerstone. This finding is greater than minor because it affected the availability and reliability of the RHR room coolers which support the emergency core cooling equipment used to mitigate the consequences of an accident. Although related to degradation in the service water system, the finding is of very low safety significance because the licensee detected the change in SW flow and removed the material prior to the flow reduction reaching the minimum required flow for accident mitigation. There was no loss of safety function from either train of service water. This finding has an appropriate and timely corrective action aspect in the cross-cutting area of problem identification and resolution because the licensee failed to recognize the foreign material as a condition adverse to

quality and implement timely corrective action to locate the source of and remove all the material from the SW system (IMC 0305, P.1.d). (Section 4OA5.03.b)

- Green. The inspectors identified an NCV of 10 CFR 50 Appendix B, Criterion V, for an inadequate loose parts analysis / operability evaluation performed following the failure of SW valve 1-SW-V105 to open on July 26, 2005, due to the loss of both taper pins which connected the stem to the valve disc. Inadequate testing of the impact of a butterfly valve taper pin on an operating RHR SW booster pump and incorrect communication of the results of this testing led to returning the SW system to service without retrieving the second taper pin. The pin was later retrieved when on August 21,2007, the pin caused a failure of the 1D RHR SW booster pump. The licensee entered the issue into the corrective action program, removed the pin from the pump, replaced the motor and returned the pump to operable status.

  The inadequate loose parts analysis / operability evaluation for the missing SW butterfly valve taper pin was considered as a performance deficiency and a finding in the mitigating systems cornerstone. This finding is greater than minor because it affected the reliability and availability attribute of one RHR SW booster pump, a mitigating system component. The finding was of very low safety significance because only one RHR SW booster pump was affected, it did not represent a loss of a safety function of either train of service water. This finding has a thorough evaluation of an identified problem in the cross-cutting area of problem identification and resolution because the licensee failed to thoroughly evaluate the condition adverse to quality which resulted in additional unavailability of the 1D RHR SW booster pump (IMC 0305, P.1.c). (Section 4OA5.04.b)

B. Licensee-Identified Violations

None.

REPORT DETAILS

Summary of Plant Events

Fisher Butterfly Valve Taper Pin

On July 26, 2007, both Unit 1 Residual Heat Removal Service Water (RHR SW) B loop pumps tripped on low suction pressure while attempting to place the pumps in service to support a Reactor Core Isolation Cooling (RCIC) surveillance. The cause of the pump's trip was determined to be a failure of the Nuclear Service Water Supply Header RHR SW Pump Suction Isolation Valve, 1-SW-V105 to open. The Fisher butterfly valve's disc and stem had separated due to the taper pins, which are designed to secure the disc to the stem, falling out. NRC Region II initiated a Special Inspection per NRC MD 8.3 on August 2, 2007. One taper pin was retrieved from the Service Water (SW) System. A search of sections of the RHR SW pump suction piping with a remote camera and boroscope and limited boroscope inspections of the 1B and 1D RHR SW Pump internals did not find the missing taper pin. Valve 1-SW-V105 was replaced and an operability evaluation concluded that the remaining taper pin had passed through the RHR SW pump to the 1B RHR heat exchanger, where it would remain in the heat exchanger SW inlet endbell, not passing through the tubesheet. The evaluation indicated that the 1B RHR heat exchanger was scheduled for inspection in the Spring 2008 Unit 1 refueling outage when the heat exchanger would be opened to search for and retrieve the missing taper pin.

By August 8, 2007, the licensee completed replacing RHR SW motor operated valves (MOVs) SW-V101 and SW-V105 for both units and inspecting SW-V100 and SW-V104 for both units. On August 14, 2007, the RHR SW System was operated for system vibration and High Pressure Coolant Injection (HPCI) operability testing for 3 hours. From August 15, 2007 at 10:00 p.m. to August 16, 2007 at 09:00 a.m., the 1B and 1D RHR SW pumps were run to support torus cooling. On August 21, 2007, at 4:41 p.m., the 1D RHR SW pump seized during a start attempt and the remaining taper pin was found binding the pump. On August 25, 2007, the 1D RHR SW pump rotating element was replaced but the pump test failed due to motor overheating issues. The motor was replaced and on August 30 at 01:25 a.m. the pump was declared operable.

The root cause evaluation for the failure of 1-SW-V105 was provided to NRC on August 30, 2007, and it concluded that the most probable cause was incorrect reassembly of the valve during refurbishment at the vendor repair facility. The SW special inspection team (SIT) was directed to re-examine SW valve vulnerability in light of this refurbishment concern. The SIT requested the licensee to determine the history of vendor SW valve refurbishment and determined that only 1-SW-V104 had been refurbished at the vendor facility and did not have its taper pins staked or welded.

Fisher Model 9100 Butterfly Valve Rubber Lining Foreign Material

On May 10, 2007, during scheduled performance of OPT-24.1.2 "SW Miscellaneous Valve Operability Test", the 1B RHR room cooler SW Discharge Valve 1-SW-V124 failed to open. The failure could not be repeated, and the 1B RHR room cooler was declared inoperable. Valve 1-SW-V124 was failed open under engineering change (EC) 1-EC-07-054 restoring the

cooler to operable status and establishing continuous flow through the cooler. During normal operation, there is no flow through the room cooler. The room coolers start automatically on high temperature. Continuous flow was established from the SW vital header to the 1B RHR room cooler which would draw waterborne foreign material towards that portion of the SW System.

On August 2, 2007, an investigation (AR 232573) was initiated when normal control board monitoring by operations identified a lowering trend in indicated SW cooling flow through the 1B RHR room cooler. Normal flow was approximately 380 gallons per minute (gpm) and flow had reduced to 250 gpm. On August 16, 2007, flow through the 1B RHR room cooler decreased to 210 gpm and the 1B RHR room cooler and RHR Loop B were declared inoperable (AR 243322). Inspection of the 1B RHR room cooler on August 18, 2007, identified foreign material in the inlet piping to the room cooler and AR 243465 was initiated on August 23, 2007. Most of the material was identified to be pieces of a Fisher Model 9100 butterfly valve rubber lining. The initial review indicated that the rubber lining material was most likely from a 20 inch butterfly valve. The only remaining installed 20 inch model 9100 Fisher butterfly valve with this material was valve 1-SW-V20. On August 27, 2007, NRC expanded the special inspection charter to include review of the foreign material discovered in the SW system.

The licensee assumed that the foreign material came from the 1B Nuclear Service Water (NSW) Discharge Valve, 1-SW-V20, as this was the only Fisher model 9100 rubber lined butterfly valve upstream of the SW vital header. As a precaution, the 1B NSW pump was tagged out and valve 1-SW-V20 was closed to prevent further release of its seat material into the SW system. The amount of material removed from the 1B RHR room cooler piping was approximately 30 percent of the valve seat of a 20 inch Fisher model 9100 butterfly valve. The operability evaluation assumed that the remaining material had been found and removed from the system and that with valve 1-SW-V20 closed no further foreign material would be introduced in the SW system. The operability evaluation concluded that the SW system was operable but degraded and that normal system monitoring would be effective at discovering any unrecovered pieces. Brunswick's documentation of Fisher Model 9100 rubber lined butterfly valve failures demonstrates a significant number of cases in which valve seat material was released into the SW flow stream as foreign material. Work Orders (WOs) documented these failures, which showed valve seat material released into the system. The WOs did not detail whether all foreign material had been accounted for and the corrective action was generally to replace the valve. There were very few cases where the failures were entered into the Corrective Action Program as action requests (ARs) and there was not any comprehensive corrective action to replace remaining Fisher model 9100 valves, only to address problems one by one as they failed.

The operability evaluation for the rubber lined valve foreign material focused on valve 1-SW-V20 and why foreign material would not be transported to other vital components cooled by the SW system. The NRC SIT questioned the conclusion of operable but degraded because the licensee did not account for the missing material, made assumptions that the material came from 1-SW-V20 which had not been inspected, and because weak documentation details in previous valve failures could not rule out old foreign material (referred to as legacy foreign material by the licensee). Since legacy foreign material couldn't be ruled out, it was not likely that the operability evaluation's conclusion of operable but degraded was reasonable. The

entire basis for operability was based on the amount of material left on 1-SW-V20, and how this amount of material would impact the SW system, yet the status of 1-SW-V20 was unverified.

On August 29, 2007, the NRC SIT expressed its concerns to the licensee and Regional Management and on August 31, 2007, the licensee informed the SIT that they were planning a forced outage to inspect the SW system on Unit 1. On September 9, 2007, Unit 1 was shutdown for a forced outage to drain and inspect the SW system. Valve 1-SW-V104 was replaced with a valve which had staked taper pins to remove the vulnerability to vendor refurbished valves losing taper pins. The SW system was inspected except for the main conventional header, which was scheduled for cleaning and inspection in the Spring 2008 refueling outage, and the 1A RHR heat exchanger which had been opened for cleaning in May 2007. Prior to the Unit 1 forced outage, the licensee discovered a picture of valve 1-SW-V19, taken when the valve was removed from the system for inspection and maintenance during 2004, which showed missing seat material. On September 5, 2007, AR 245478 was written to document the adverse condition which had not been initiated in 2004 when the valve was inspected and replaced. On September 11, 2007, a visual inspection of valve 1-SW-V20 revealed no missing rubber lining material which confirmed that the foreign material retrieved from the 1B RHR room cooler was not from 1-SW-V20 but was in fact legacy foreign material most probably from 1-SW-V19 in 2004. During the SW system inspection, some additional foreign material was discovered in the system. The additional foreign material identified consisted of two smaller pieces of the butterfly valve rubber lining material which was found in the inlet piping and inside of the 1A RHR room cooler, and two pieces of SW strainer tie rods with retaining nuts, which were found in the main header and in the 1B RHR heat exchanger. Oyster shells were also found at various locations inspected including in the inlet piping and inside the 1A RHR room cooler. All of the foreign material found during the system visual inspections was removed except for one small piece of rubber valve lining and several shells in the 1A RHR room cooler. At the completion of the Unit 1 SW inspection, the licensee evaluated the status of the taper pin vulnerability and the foreign material and determined that Unit 1 was operable and Unit 1 was restarted on September 20, 2007. Part of the SW system inspection was observed by augmented resident inspection staff including the evaluation of the SW pump discharge strainer foreign material. This inspection is documented in NRC Integrated Inspection Report (IR) 05000325,324/2007004.

Inspection Scope

Based on the deterministic and conditional risk criteria specified in Management Directive 8.3, "NRC Incident Investigation Program," a Special Inspection was initiated in accordance with NRC Inspection Procedure 93812, "Special Inspection Team." An initial charter was developed on August 2, 2007, and a revised charter was developed on August 28, 2007. The inspection focus areas included the following special inspection charter items which were developed from combining both inspection charters:

1. Develop a complete description of the Unit 1, B loop service water motor operated supply valve failure on July 26, 2007, and the Unit 1, D RHR service water pump failure that occurred on August 21, 2007; and a complete sequence of events related to the valve and pump failures.

2. Develop a complete description of the Unit 1, B RHR room cooler service water line blockage that occurred on August 17, 2007, and a complete sequence of events related to the line blockage.

3. Review the current state of the service water system as it relates to debris and effect on system operability by assessing the adequacy of the licensee's operability determination.

4. Assess the adequacy of the licensee's operability determination for the event on July 26, 2007, when both (1B & 1D) RHR SW pumps tripped on low suction pressure.

5. Review the licensee's root cause analysis and extent of condition related to the failure of valve 1-SW-105. Assess the adequacy of the licensee's implemented and/or planned corrective actions (CAs) to address the root cause and the time line for completing the CAs on both units.

6. Assess if any common mode failure modes have been established, whether they are being addressed by the licensee, and what generic implications may exist related to foreign material in the service water systems on both units.

7. Collect data necessary to develop and assess the safety significance of any findings in accordance with IMC 0609, "Significance Determination Process."

8. Review licensee documents to determine the licensee's actions taken associated with related operating experience (NRC Information Notice (IN) 2005-023, Vibration-Induced Degradation of Butterfly Valves and Fisher Information Notice 93-3 supplement)

9. Review the maintenance program for Fisher Controls butterfly valves at the Brunswick Plant.

10. Review the corrective actions (CAs) and maintenance work order databases to determine the failure history of Fisher Controls butterfly valves at the Brunswick Plant.

11. Identify any potential generic safety issues and make recommendations for appropriate follow-up actions (e.g., Information Notices, Generic Letters, Bulletins).

4. OTHER ACTIVITIES

4OA5 Other Activities - Special Inspection (93812)

.01 Develop a complete description of the Unit 1, B loop service water motor operated supply valve failure on July 26, 2007, and the Unit 1, D RHR service water pump failure

that occurred on August 21, 2007; and a complete sequence of events related to the valve and pump failures(Charter Item 1)

Background Information

On July 26, 2007, the B loop SW supply valve 1-SW-V105 failed to open due to the loss of both taper pins which retain the disc to the stem of this Fisher butterfly valve. This was the first such failure at Brunswick. The licensee performed inspections to verify proper taper pin installation in all susceptible valves. The licensee later determined that the loss of the taper pins was due to improper installation during vendor refurbishment. Vendor and licensee records were checked and all refurbished valves were replaced with valves which had been staked to remove this vulnerability. One of the taper pins was retrieved but the second pin was not found during the initial search of the B loop SW suction piping and limited inspections of 1B and 1D RHR SW booster pumps. The second pin was later found when it caused a failure of the 1D RHR SW Booster pump.

Time Line

Mar 2000**:**	1-SW-V105 valve replaced due to torn liner. (WO 99AIEC1)
Mar 2004:	Unit 1 “B” Loop RHR SW inspection completed, which included inspection of the 1-SW-V105 and V104 (WO 00431058 08) (1PM-MEC506, 0ENP-2704)
August 1, 2005**:**	NRC IN 2005-23: Vibration-Induced Degradation of Butterfly Valves. The information notice required no specific action or written response. However, recipients were reminded that they are required by 10CFR50.65 to consider industry-wide operating experience (including information presented in NRC information notices) where practical, when setting goals and performing periodic evaluations.
August 12, 2005**:**	Nonconformance Report (NCR) 166395 initiated to perform Operability Evaluation (OE).
October 20, 2005**:**	Fisher Controls - Fisher Information Notice (FIN): FIN 93-3, Supplement. Recommended periodic maintenance and inspections and if these practices uncover problems with loose taper pins, it would be acceptable to positively secure the pins by either staking or seal welding.
November 17, 2005**:**	AR 166395-10 Evaluation of NRC IN 2005-23 completed. Two actions established: Revise FP-6950 vendor manual FP-6950 and add the FIN 93-3 Supplement instructions.

February 9, 2006:	Vendor manual FP-6950 revised and added the FIN 93- 3 Supplement instructions.
March 2006:	Unit 1 “A” Loop RHR SW inspection, which included inspection of the 1-SW-V101 and V100. The 1-SW-V105 was removed from the system for spool piece replacement.
January 8, 2007:	OCM-VBF500, “Fisher Butterfly Valves Series 9100", revised to add steps to stake or seal weld the stem to disc taper pin per Fisher Information Notice 93-3.
March 2007:	Unit 2 “A” Loop RHR SW inspection, which included inspection of the 2-SW-V101 (photo taken) and 2-SW-V100.
July 26, 2007:	Unit 1 “B” Loop RHR SW failure of motor operated butterfly valve 1-SW-V105. Both taper pins for the valve were missing preventing the valve from opening. Licensee replaced V105 and conducted PMT Pump Runs. They found 1 pin, conducted inspections for remaining pin but were unsuccessful. Transport analysis to support operability determination concluded pin most likely downstream of pump in the RHR heat exchanger. Operable but Degraded with intention to remove pin during next outage.
July 31, 2007:	Compensatory actions established 3 times per shift to monitor and log SW pump strainer D/Ps while awaiting replacement of other RHR SW MOV’s.
August 1, 2007:	Operability Determination (not an official OCR) was approved by SSO on August 1, 2007.
August 2, 2007:	EOOS model updated to reflect risk associated with RHR SW potential common cause mode.
August 8, 2007:	Finished replacing all RHR SW MOV’s 101, 105 for both units and inspected V100, V104 for both units.
August 14, 2007:	Ran RHR SW for system vibration and HPCI Operability test (3 hrs).
August 21, 2007:	RHR SW Pump 1D tripped on overcurrent. Pump rotating element bound by taper pin. Taper pin sent to Energy & Environmental Center for evaluation. 1D RHR SW Pump inoperable.

August 25, 2007**:** Replaced pump rotating element, but pump test failed due to motor overheat issues.

August 29, 2007**:** Post maintenance test of new motor completed successful. 1D RHR SW returned to operable status.

August 30, 2007: Root Cause Evaluation (240978) concludes loss of taper pins due to improper valve refurbishment at vendor facility.

September 9, 2007: Unit 1 shutdown for forced outage to inspect SW system.

September 20, 2007: Unit 1 restarted exiting forced outage. All valves vulnerable to loss of taper pins due to vendor refurbishment were replaced with valves with staked taper pins.

.02 Develop a complete description of the Unit 1, B RHR room cooler service water line blockage that occurred on August 17, 2007, and a complete sequence of events related to the line blockage(Charter Item 2)

Background Information

At Brunswick there has been a history of Fisher model 9100 butterfly valves failing where portions of the unbonded seat tear away from the valve and are released into the system. The first documented failure was in 1985 and the latest one was in 2006. The failures are documented in work orders (WOs) without much detail on whether liner material was released into the system and whether the foreign material was retrieved. Based on review of the data the inspectors determined at least 15 failures on Fisher model 9100 valves which documented liner failures of which 10 indicated that liner material was missing from the valve. Only one case was noted where a piece of a liner was missing from a bonded Fisher valve and it was a piece gouged out of the liner not a complete section of a liner. There were very few cases where ARs were generated. Procedure MNT-NGGC-0007, the Foreign Material Exclusion Program Procedure requires that an AR be generated if foreign material is found during breach of a system or component. If foreign material is found a condition report shall be initiated and the appropriate actions taken. This has been required since Rev. 2 in September 12, 2002. For most of the cases WOs documented the failures and the corrective actions were generally to replace the valve with a non-susceptible valve, but the Corrective Action Program (CAP) was not being utilized to determine root or contributing causes or to drive any comprehensive corrective action.

Time Line

1985**:** 85-ADSX1, Unit 2, 2-SW-V18, Valve liner found damaged, Valve replaced with rebuilt Jamesbury under PM 85-063.

1986: WO 86-AAIM1, Unit 2, 2-SW-V36, SW valve found badly corroded and rubber liner torn away from body during SW inspection. Rebuilt the valve, removed old liner and installed new liner per PM 85-063.

1989: WO 89-ATUE1, Unit 2 , Valve 2-SW-V20 Requires maintenance, Replaced w/ Jamesbury Butterfly valve via Plant Mod 89-026.

1991: WO 91-ARLU1, Unit 2, 2-SW-V105, Damage to rubber lining from fatigue, returned to vendor for repair, replaced w/ rebuilt Fisher valve, O-CM-MO506.

1991: WO 91-AQUQ1, Unit 2, 2-SW-V106, 50% rubber lining missing, new rubber liner installed.

1993: WO 93-AWMH1, Unit 1, 1-SW-V103, Replace w/ Rebuilt Valve, Missing approximately ½ Valve lining and body is corroding. Replaced w/Jamesbury Butterfly valve via Plant Mod 91-047.

1995: WO 95-AJYF1, Unit 2 , Valve 2-SW-V103, During routine SW inspection a portion of valve seat found in a RBCCW HX, believed to be V103 or V106, Noted unavailability of replacement Fisher valve, Replaced w/Jamesbury Butterfly valve via ESR 95-01747.

1995: WO 95-AJYH1, Unit 2 , Valve 2-SW-V106, During routine SW inspection a portion of valve seat found in a RBCCW HX, believed to be V103 or V106, Noted unavailability of replacement Fisher valve, Replaced w/Jamesbury Butterfly valve via ESR 95-01747.

1996: WO 96-AAGF1, Unit 1, 1-SW-V106, During routine SW inspection a portion of valve seat found in a RBCCW HX, believed to be V103 or V106, Noted unavailability of replacement Fisher valve, Replaced w/Jamesbury Butterfly valve via ESR 96-00074, WO 95-AHWF1, 1-SPP-MEC506

1997: WO 97-AGAF1, Unit 2, 2-SW-V19, SW Valve found damaged during SW inspection PM AQLM5001, Replaced w/Jamesbury Butterfly valve via ESR 97-00555.

1999: 99AAEZ2, Unit 1, 1-SW-V101, small piece of liner missing - rubber piece missing scooped out not fully through the cross section of the liner, piece size 2" X 2" X ½", damage was outside the seating surface.

2002: WO 31244, Unit 1, 1-SW-V101, Rubber liner torn (unknown if seat missing), replaced valve.

2003 WO 125800, Unit 2, 2-SW-V3, Missing portion of rubber lining, replaced with new valve.

2004 WO 470202, Unit 1, 1-SW-V19, Missing ½ of rubber lining, replaced w/ Jamesbury valve.

2005: Significant amount of foreign material found inside 2B-TBCCW-HX during routine inspection, AR 166611 was initiated, Investigation action identified, “This has been a historical problem at BNP for the rubber liner in valves to fail due to aging and cracking of the rubber in a chlorinated water environment. This valve is original to the plant and the rubber lined valves in the Service Water system have been replaced with a non-rubber lined valve when the lining has failed.” Corrective action was to replace valve upstream of HX, but when implementing work order, valve inspection revealed no missing material so WO was cancelled and AR was closed. This represents a failure of the licensee to recognize a common cause failure, and an indication of the lack of sensitivity to FME in their SW system, since the source of the FME was not pursued.

2006: WO 242212, Unit 1, 1-SW-V3, Missing portion of rubber lining, replaced with new valve.

2007**:** A decreasing trend in the SW flow indication to the 1A RHR room cooler led to an inspection which identified foreign material in sections of upstream supply piping which is normally not in the scope of routine SW inspections. The licensee’s Operability Determination concluded that the likely source of the foreign material was a 20" Fisher butterfly valve downstream of the 1B NSW Pump and upstream of the 1B RHR room cooler. This valve is the last Fisher valve in the upstream piping.

2007: Unit 1 shutdown for a forced outage (09/09/07 - 09/20/07) to inspect the majority of the Unit 1 SW system for foreign material. Valve 1-SW-V20 was found intact. Some additional foreign material identified in 1 A RHR room cooler, 1B RHR HX and in system piping. Unit 1, 1-SW-V20, Replaced with a Model A11 Fisher valve (no rubber seat) as a precaution during the FME inspection of Unit 1.

.03 Review the current state of the service water system as it relates to debris and effect on system operability by assessing the adequacy of the licensee’s operability determination.(Charter Item 3)

a. Inspection Scope

The inspectors reviewed the operability evaluation (243465) which documented the status of the SW system as it related to debris prior to the forced outage and the results of the forced outage to determine if the licensee had adequately addressed potential foreign material impacts to system operability. The inspectors also reviewed some of the video inspections performed on the system. Some of the forced outage inspection was observed and documented in NRC integrated inspection report 05000325,324/2007004. The inspectors reviewed the operability documents prepared for briefing the plant nuclear safety committee (PNSC) prior to Unit 1 restart and attended the PNSC meeting.

b. Findings

Assessment of Operability Determination

The inspectors determined that the licensee performed an adequate search of the majority of the Unit 1 SW system and documented the search. Only a small amount of foreign material which was identified was not able to be removed and that was in the 1A RHR room cooler. The licensee evaluated this material and showed that it would not pose a threat to maintaining accident flowrates in the most limiting portions of the system. The remaining Fisher unbonded valve located upstream of vital header components (1-SW-V20) was replaced. No unbonded Fisher valves remain in the Unit 1 SW system upstream of the vital SW header.

Introduction: The inspectors identified a Green NCV of 10 CFR 50 Appendix B, Criterion XVI for failure to promptly identify and correct a condition adverse to quality related to foreign material in the service water system (SW) resulting from Fisher butterfly valve rubber lining failures. There had been a number of failures of Fisher butterfly valve rubber linings since 1985 including a Unit 1 failure in 2004 and a Unit 2 failure in 2005. The instances in 2004 and 2005 were examples where valve lining material was missing from Fisher valves and all the material was not accounted for and removed from the SW system.

Description: On August 16, 2007, the licensee detected reduced flow from the 1B Residual Heat Removal (RHR) room cooler and on August 18, 2007, identified foreign material in the inlet piping to the cooler. The issue was entered into the corrective action program and the licensee assumed that the foreign material came from the 1B Nuclear Service Water (NSW) Discharge Valve, 1-SW-V20, as this was the only Fisher model 9100 rubber lined butterfly valve upstream of the SW vital header. As a precaution the 1B NSW pump was tagged out and valve 1-SW-V20 was closed to prevent further release of its seat material into the SW system. The amount of material removed from the 1B RHR room cooler piping was approximately 30 percent of the valve seat of a 20 inch Fisher model 9100 butterfly valve. The operability evaluation assumed that the remaining material had been found and removed from the system and that with valve 1-SW-V20 closed no further foreign material would be introduced in the SW system. The operability evaluation concluded that the SW system was operable but degraded and that normal system monitoring would be effective at discovering any unrecovered pieces. The NRC SIT questioned the conclusion of operable but degraded because the licensee did not account for the missing material, made assumptions that the material came from 1-SW-V20 which had not been inspected, and because weak documentation details in previous valve failures could not rule out old foreign material (referred to as legacy foreign material by the licensee).

On September 9, 2007, Unit 1 was shutdown for a forced outage to drain and inspect the SW system. Upon inspection, the valve lining of valve 1-SW-V20 was found to be intact and the material was determined to be most likely from a failure of valve 1-SW-V19 in 2004. Additional rubber lining material was also found in the 1 A RHR room

cooler. Two small pieces of SW strainer threaded rods with nuts attached were discovered in the SW main header and in the 1B RHR heat exchanger. Oyster shells were also discovered in the 1A RHR room cooler and at several other locations. The inspectors noted that vendor representatives inspected several of the valves during the forced outage and noted that Brunswick was utilizing extra gaskets when installing the rubber lined valves contrary to recommended practice. This was viewed as a contributor to the liner failures. The inspectors also noted that the vendor manual did not recommend the use of additional gaskets when installing the Fisher rubber lined valves into the system. An additional example of Fisher valve foreign material was noted in 2005 in the 2B Turbine Building Closed Cooling Water Heat Exchanger (2B-TBCCW-HX). In this example, foreign material was identified inside 2B-TBCCW-HX during routine inspection, and AR 166611 was initiated. Investigation action identified "This has been a historical problem at BNP for the rubber liner in valves to fail due to aging and cracking of the rubber in a chlorinated water environment. This valve is original to the plant and the rubber lined valves in the Service Water system have been replaced with a non-rubber lined valve when the lining has failed." The corrective action was to replace the valve upstream of the HX, but when the valve inspection revealed no missing material, the WO was cancelled and the AR was closed. This represents a failure of the licensee to recognize a common cause failure, and an indication of the lack of sensitivity to foreign material in their SW system, since the source of the foreign material was not pursued.

Analysis: The failure to maintain the SW system free of foreign material was considered a performance deficiency and a finding in the mitigating systems cornerstone. This finding is greater than minor because it affected the availability and reliability of the RHR room coolers which support the emergency core cooling equipment used to mitigate the consequences of an accident. Although related to degradation in the service water system, the finding is of very low safety significance because the licensee detected the change in SW flow and removed the material prior to the flow reduction reaching the minimum required flow for accident mitigation. There was no loss of safety function from either train of service water. This finding has an appropriate and timely corrective action aspect in the cross-cutting area of problem identification and resolution because the licensee failed to recognize the foreign material as a condition adverse to quality and implement timely corrective action to locate the source of and remove all the material from the SW system (IMC 0305, P.1.d).

Enforcement: 10 CFR 50 Appendix B, Criterion XVI requires that measures be established to assure that conditions adverse to quality are promptly identified and corrected. Licensee procedure MNT-NGGC-0007, Revisions 2 through 6, required that when foreign material is discovered during breach of a system or a component, a condition report shall be initiated and the appropriate corrective actions taken. Contrary to the above, when the licensee replaced valve 1-SW-V19 in March 2004, no condition report was initiated until September 5, 2007, and all foreign material was not verified to have been removed from the Unit 1 SW system until the completion of the forced outage in September, 2007. Another example was noted in August, 2005 when AR 166611 was initiated upon discovery of foreign material in the SW side of Unit 2 2B TBCCW heat exchanger. This AR was cancelled on March 26, 2007 after inspection of

2-SW-V4 revealed no missing material. There was no documentation that the source of the foreign material had been identified and that all the foreign material had been retrieved from the system. Because this finding is of very low safety significance and has been entered into the licensee's corrective action program as ARs 243465 and 245478, this violation is being treated as an NCV consistent with Section V.A.1 of the NRC Enforcement Policy: NCV 05000325,324/2007011-01, Inadequate Corrective Action for Fisher Model 9100 Unbonded Butterfly Valve Failures. Additional observations related to the SW pump discharge strainer foreign material are addressed in NRC integrated inspection report 05000325,324/2007004.

.04 Assess the adequacy of the licensee's operability determination for the event on July 26, 2007, when both (1B & 1D) RHRSW pumps tripped on low suction pressure.(Charter Item 4)

a. Inspection Scope

The inspectors reviewed the loose parts analysis / operability evaluation (240978) performed for the failure of SW supply valve 1-SW-V105 to open on July 26, 2007 due to the loss of both valve taper pins. The evaluation documented the search for the taper pins which retain the disc to the stem of the Fisher butterfly valve.

b. Findings

Introduction: The inspectors identified a Green NCV of 10 CFR 50 Appendix B, Criterion V, for an inadequate loose parts analysis / operability evaluation performed following the failure of SW valve 1-SW-V105 to open on July 26, 2007, due to the loss of both taper pins which connected the stem to the valve disc. Inadequate testing of the impact of a butterfly valve taper pin on an operating RHR SW booster pump and incorrect communication of the results of this testing led to returning the SW system to service without retrieving the second taper pin. The pin was later retrieved when on August 21, 2007, the pin caused a failure of the 1D RHR SW booster pump. The licensee entered the issue into the corrective action program, removed the pin from the pump, replaced the motor and returned the pump to operable status.

Description: On July 26, 2007, both Unit 1 Residual Heat Removal Service Water (RHR SW) B loop pumps tripped on low suction pressure caused by a failure of the Nuclear Service Water Supply Header RHR SW Pump Suction Isolation Valve, 1-SW-V105 to open. The Fisher butterfly valve's disc and stem had separated due to the taper pins, which are designed to secure the disc to the stem, falling out. One taper pin was retrieved from the Service Water (SW) System. A search of sections of the RHR SW pump suction piping with remote camera and boroscope and limited boroscope inspections of the 1B and 1D RHR SW Pump internals did not find the missing taper pin. Valve 1-SW-V105 was replaced and an operability evaluation concluded that the remaining taper pin had passed through the RHR SW pump to the 1B RHR heat exchanger, where it would remain in the heat exchanger SW inlet endbell, not passing through the tubesheet. The evaluation indicated that the 1B heat exchanger was

scheduled for inspection in the Spring 2008 Unit 1 refueling outage when the heat exchanger would be opened to search for and retrieve the missing taper pin.

The inspectors observed the scope of the licensee's search for the missing pin and viewed video records of the inspection of the 1B and 1D RHR SW booster pump casings. The pump casing inspections were not as rigorous as the piping inspection and access was very limited. The inspectors witnessed the testing performed on a spare pump impeller in the warehouse to attempt to determine if a taper pin would pass through the pump. The loose parts analysis documented that a spare pin was dropped into the casing of a spare RHR SW pump. The pin fell through immediately which indicates clearances are sufficient to pass the pin through the pump. When the inspectors requested that the test be described, the licensee demonstrated that a pin would drop through the stationary impeller on a bench. No material was passed through a pump casing and there was not a spare pump casing for the inspectors to examine. The inspectors examined pump drawings from the vendor manual and noted that clearances between the impeller, diffuser and casing were less than the length of the pin. The inspectors asked the licensee if they had contacted the vendor about the likelihood of a 4.5" long taper pin weighing 0.3 pounds passing through an operating pump running at 3600 rpm. The licensee subsequently contacted the vendor to obtain pump internal clearance dimensions not shown on vendor drawings and to ask about the pin passing through the pump. The vendor indicated that they could not predict if the pin would pass through the pump. The operator logs documented that pump clearances were large enough so that the pin is expected to have passed through the pump with no difficulty. The inspectors noted differences in the testing performed in the warehouse and that documented in the evaluation and provided to other parts of the licensee's organization. This was discussed with the system engineer and the Operations shift personnel involved with the event and they were not aware of the shortcomings of the actual testing performed. The inspectors concluded that the testing performed on a spare impeller did not provide confidence that the pin would pass through the pump and that poor communications and control of testing led to a misleading transport analysis conclusion. Had all parts of the licensee's organization been aware of the true extent of the testing it was possible that further inspection may have been performed to find the missing pin and possibly prevented the subsequent failure of 1D RHR SW pump on August 21, 2007.

On August 14, 2007, the RHR SW System was operated for system vibration and High Pressure Coolant Injection (HPCI) operability testing for 3 hours. From August 15, 2007 at 10:00 p.m. to August 16, 2007 at 09:00 a.m., the 1B and 1D RHR SW pumps were run to support torus cooling. On August 21, 2007, at 4:41 p.m., the 1D RHR SW pump seized during a start attempt and the remaining taper pin was found binding the pump. On August 25, 2007, the 1D RHR SW pump rotating element was replaced but the pump test failed due to motor overheating issues. The motor was replaced and on August 30 at 01:25 a.m., the pump was declared operable.

Analysis: The inadequate loose parts analysis / operability evaluation for the missing SW butterfly valve taper pin was considered as a performance deficiency and a finding in the mitigating systems cornerstone. This finding is greater than minor because it

affected the reliability and availability attribute of one RHR SW booster pump, a mitigating system component. The finding was of very low safety significance because only one RHR SW booster pump was affected, it did not represent a loss of a safety function of either train of service water. This finding has a thorough evaluation of an identified problem aspect in the cross-cutting area of problem identification and resolution because the licensee failed to thoroughly evaluate the condition adverse to quality which resulted in additional unavailability of the 1D RHR SW booster pump (IMC 0305, P.1.c).

Enforcement: 10 CFR 50 Appendix B, Criterion V requires that activities affecting quality be prescribed by documented instructions, procedures or drawings of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures and drawings. Licensee procedure OPS-NGGC-1305, Operability Determinations, Revision 1, requires that a thorough determination be performed when evaluating the impact of degraded conditions on plant operability. Contrary to the above, the loose parts analysis / operability determination performed for AR 240978, approved on August 1, 2007, made conclusions based on unverified assumptions and did not perform thorough testing and accurate reporting of the testing conducted. The resulting loose parts analysis conclusion provided a false sense that the RHR SW booster pumps were not vulnerable to the missing taper pin and likely led to a premature end of the search and the eventual failure of RHR SW booster 1D on August 21, 2007. Because this finding is of very low safety significance and has been entered into the licensee's corrective action program as AR 244448, this violation is being treated as an NCV consistent with Section V.A.1 of the NRC Enforcement Policy: NCV 05000325/2007011-02, Inadequate Loose Parts Analysis /Operability Evaluation for Fisher Butterfly Valve Taper Pin.

.05 Review the licensee's root cause analysis and extent of condition related to the failure of valve 1-SW-105. Assess the adequacy of the licensee's implemented and/or planned corrective actions (CAs) to address the root cause and the time line for completing the CAs on both units.(Charter Item 5)

a. Inspection Scope

The inspectors compared the root and contributing causes with information obtained from the review of licensee work control documents, procedures, other references listed in the Attachment and discussions with licensee personnel. The inspectors reviewed the extent of condition, implemented and planned corrective actions and the time line for corrective action completion.

b. Findings

No findings of significance were identified. The inspectors evaluated the root cause and found that it adequately assessed the cause of the loose taper pin and that the extent of condition adequately addressed the potential vulnerability to other butterfly valves in the plant. The inspectors noted that root cause evaluation was thorough, detailed, and comprehensive. The planned and completed actions properly addressed the root and

contributing causes. The immediate actions as described in the 4OA5.01 timeline, were adequate to address the vulnerability to improper valve refurbishment. All valves vulnerable to loss of taper pins due to vendor refurbishment were replaced with valves which had welded or staked taper pins prior to Unit 1 restart on September 20, 2007. Long term corrective actions on non-vendor refurbished valves are scheduled to be performed during subsequent outages.

.06 Assess if any common mode failure modes have been established, whether they are being addressed by the licensee, and what generic implications may exist related to foreign material in the service water systems on both units (Charter Item 6)

a. Inspection Scope

The inspectors reviewed the failure modes for the Fisher butterfly valve loose taper pin issue and the foreign material from failed Fisher butterfly valve seats to determine if any potential common mode failures were identified and how they were addressed.

b. Findings

No findings of significance were identified. The inspectors determined that the licensee had determined potential common failure modes for both issues. The inspectors reviewed the corrective action documents and interviewed personnel involved and determined that the licensee had properly determined the extent of condition for the issues and was developing comprehensive corrective action to address common failure modes in the SW system and in other potentially affected systems. The licensee evaluated the common cause aspects of both issues on Unit 1 prior to restart on September 20, 2007 and on Unit 2 by September 30, 2007. See Section 4OA5.11.b of this report for generic implications.

.07 Collect data necessary to develop and assess the safety significance of any findings in accordance with IMC 0609, “Significance Determination Process (SDP).” (Charter Item 7)

a. Inspection Scope

The inspectors reviewed the safety significance of the finding related to Fisher valve foreign material in the U1 SW system and its affect on the system safety functions. The safety significance of the finding related to an inadequate loose parts analysis / operability evaluation related to the missing 1-SW-V105 taper pin was also reviewed.

b. Findings

No findings of significance were identified. The safety significance of the Fisher valve foreign material finding is described in Section 4OA5.03.b of this report. The safety significance of the inadequate loose parts analysis / operability evaluation for the missing 1-SW-V105 taper pin is described in Section 4OA5.04.b of this report.

.08 Review licensee documents to determine the licensee's actions taken associated with related operating experience (NRC IN 2005-023, Vibration-Induced Degradation of Butterfly Valves and FIN 93-3 Supplement) (Charter Item 8)

a. Inspection Scope

The inspectors reviewed the licensee's response to NRC IN 2005-023 and FIN 93-3 to verify that all potentially affected valves were included and that actions addressed the concerns in the notices. NCR 166395 which documented the operating experience (OPEX) evaluation was reviewed.

b. Findings

No findings of significance were identified. The inspectors noted that the initial review did not include manual valves. An NCR (241828) was issued to expand the scope of the inspection to include manual valves. Based on the initial review scope, only four valves were identified as being potentially vulnerable to taper pin failures. Two actions were issued as a result of the OPEX evaluation. The first was to revise the vendor technical manual by adding copies of the NRC and Fisher INs. The second action was to revise the series 9200 maintenance procedure to include a precaution to stake or tack weld the taper pins. No other actions were taken. The inspectors noted that no action was taken to revise the inspection procedure to include specific inspection criteria to ensure proper installation of taper pins. Instead of revising the inspection procedure, the plant relied on "skill of the craft" to identify any taper pin issues. It was assumed that any discrepancies with taper pins noted during routine SW inspection would be captured in a WO which would reference the updated vendor technical manual / procedures.

The inspectors reviewed the associated root cause analysis for the failure of 1-SW-V105, and concluded that the failure mechanism was not related to the concerns detailed in the 2005 NRC and Fisher INs, rather, it was related to inadequate vendor practices. No acceptance criteria existed in the vendor manual for the taper pins. If acceptance criteria was added to the routine SW inspection procedure, it would not have prevented this failure since there was no routine SW outage inspection on the affected train since the NRC IN was issued. Given the fact that there was no opportunity for any changes to the inspection procedure as a result of the OPEX evaluation to prevent this failure, and the fact that this failure mode was not related to the NRC IN and Fisher IN, it is unlikely that any action taken as a result of the INs could have prevented the failure of 1-SW-V1-05.

.09 Review the maintenance program for Fisher Controls butterfly valves at the Brunswick Plant (Charter Item 9)

a. Inspection Scope

The inspectors reviewed the vendor manuals, specifications, related operating experience, maintenance procedures and maintenance history for Fisher butterfly valves. Maintenance and engineering personnel were interviewed and the SW

monitoring results and maintenance rule databases were examined. The review considered both the butterfly valve taper pin and failed valve seat material issues.

b. Findings

No findings of significance were identified. Vulnerable SW butterfly valves are inspected every other outage such that one train of SW is inspected every outage as part of routine SW inspection activities. The butterfly valves are removed from the system and visually inspected. The inspectors noted that no details existed in the vendor manual or maintenance procedure regarding acceptance criteria for ensuring correct taper pin installation. The maintenance procedure had been revised to require staking or tack welding taper pins. The corrective actions for the taper pin issue included revision of the vendor manual and procedures to include correct taper pin installation dimension details from the root cause evaluation.

The vendor manual and associated maintenance procedures did not contain specific acceptance criteria for inspecting the butterfly valve liners during the system inspections. The inspectors reviewed the Fisher technical representative correspondence, (Fisher Valves Examination Report dated September 13, 2007) and noted that the use of additional gaskets when installing Fisher rubber lined butterfly valves was not recommended by the vendor. The vendor manual for Fisher butterfly valves also indicated that additional gaskets should not be used. The licensee's system specification had always called for additional gaskets in the SW system. The vendors report indicated that the extra gaskets could be a contributing cause to the loss of valve material from the unbonded valves. The licensee initiated condition report 246861to address this concern.

.10 Review the corrective actions (CAs) and maintenance work order databases to determine the failure history of Fisher Controls butterfly valves at the Brunswick Plant (Charter Item 10)

a. Inspection Scope

The inspectors reviewed the CAP database and work order databases to obtain a listing of all Fisher butterfly valve failures. The data was reviewed and sorted to determine how many valve failures occurred, the failure modes, and which failures documented missing material. The work orders and condition reports were reviewed to determine what corrective actions were taken to repair the valve and to maintain the operability of the SW system.

b. Findings

The results of this review are detailed in paragraph 4OA5.02 which lists the valve failures. Section 4OA5.03.b details a finding related to inadequate corrective action for the Fisher valve failures.

.11 Identify any potential generic safety issues and make recommendations for appropriate follow-up actions (e.g., Information Notices, Generic Letters, Bulletins).(Charter Item 11)

a. Inspection Scope

The inspectors reviewed the generic implications of the Fisher model 9100 unbonded rubber lined valve failures. The valve failure history data, vendor manual and vendor representative's assessment were reviewed. The system specifications, maintenance procedures and corrective action documents assessing failure modes and contributing causes were inspected.

For the Fisher butterfly taper pin failure, the inspectors reviewed the root cause evaluation, vendor manual and maintenance procedures. The inspectors reviewed the purchase specification, the procurement documentation for the vendor rebuild services and the licensee's generic communication to the industry issued after the failure.

b. Findings

No findings of significance were identified. Regarding the loss of valve seat material from Fisher unbonded valves, the inspectors concluded that no generic communication was necessary as the failure mode was well understood and the contributing cause of using additional gaskets was already detailed in the vendor manual. Regarding the improper taper pin installation in Fisher butterfly valves during vendor valve refurbishment, the inspectors recommend that NRC IN 2005-023 be revised and reissued to detail this additional vulnerability.

4OA6 Meetings, Including Exit

On September 27, 2007, the special inspection team leader presented the preliminary inspection results to Mr. J. Scarola, Brunswick Site Vice President, and members of his staff. Subsequently, additional in-office reviews were conducted and the final inspection results were discussed by telephone with Mr. Scarola and members of his staff on October 9 and November 9, 2007. The licensee acknowledged the inspection findings. No proprietary information is included in this inspection report.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

E. Harcom, SW System Engineer
T. Hobbs, Plant General Manager
S. Howard, Manager - Operations
R. Ivey, Manager - Site Support Services
W. Murray, Licensing Specialist
A. Pope, Supervisor - Licensing/Regulatory Programs
S. Rogers, Manager - Maintenance
J. Scarola, Site Vice President
T. Sherrill, Engineer - Technical Support
T. Trask, Manager - Engineering
J. Titrington, Manager - Nuclear Assessment Services
M. Turkal, Lead Engineer - Technical Support
B. Waldrep, Director - Site Operations
M. Williams, Manager - Operations Support

NRC Personnel

J. Austin, Senior Resident Inspector, Brunswick, Region II
H. Christensen, Deputy Director Division of Reactor Projects, Region II
R. Musser, Chief, Reactor Projects Branch 4, Division of Reactor Projects Region II
S. Rutledge, Acting Resident Inspector, Brunswick, Region II

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

Opened and Closed

05000325,324/2007011-01	NCV	Inadequate Corrective Action for Fisher Model 9100 Unbonded Butterfly Valve Failures (Section 4OA5.03.b)
05000325/2007011-02	NCV	Inadequate Loose Parts Analysis / Operability Evaluation for Fisher Butterfly Valve Taper Pin (Section 4OA5.04.b)

Discussed

None

Attachment

DOCUMENTS REVIEWED

Procedures

OPS-NGGC-1305, Operability Evaluations, Revision (Rev.) 1
OPT-08.1.4b, RHR Service Water System Operability Test - Loop B, Rev. 56
1OP-43, Service Water System Operability Procedure, Rev. 86
MNT-NGGC-0007, Foreign Material Exclusion Program, Rev. 2
MNT-NGGC-0007, Foreign Material Exclusion Program, Rev. 3
MNT-NGGC-0007, Foreign Material Exclusion Program, Rev. 4
MNT-NGGC-0007, Foreign Material Exclusion Program, Rev. 5
MNT-NGGC-0007, Foreign Material Exclusion Program, Rev. 6
OPM-STR500, RP Adams Self-Cleaning Strainer, Models VWS-10 through VWS-40, Rev. 14
OPM-STR501, Inspection of RP Adams Self-Cleaning Strainers, models VWS16 and VWS34, Rev. 3
OENP-2704, Administrative Control of NRC Generic Letter 89-13 Requirements, Rev. 12
1PM-MEC506, Nuclear service Water Header Inspection, Rev. 1
1APP-UA-05 1-9, FAN CLG UNIT CS PUMP RM A INL PRESS LO, Rev. 30
1APP-UA-05 2-9, FAN CLG UNIT CS PUMP RM B INL PRESS LO, Rev. 30
1APP-UA-05 3-9, RHR FAN A FAIL TO START, Rev. 30
1APP-UA-02 5-7, STM LEAK DET AMBIENT TEMP HIGH, Rev. 33
1APP-UA-02 6-7, STM LEAK DET $\triangle$ TEMP HIGH, Rev. 33
1APP-UA-02 3-2, RHR PUMP 1A SEAL CLG FLOW LOW, Rev. 33
1APP-UA-02 4-2, RHR PUMP 1C SEAL CLG FLOW LOW, Rev. 33
1APP-UA-02 3-9, RHR PUMP 1B SEAL CLG FLOW LOW, Rev. 33
1APP-UA-02 4-9, RHR PUMP 1D SEAL CLG FLOW LOW, Rev. 33
OCM-VBF500, Fisher Butterfly Valve Series 9100, Rev. 4

Drawings

F-38484, Cross Sectional Drawing 20" Double R/L Valve 150' ANSI w/ Philadelphia Gear Unit, Rev. C
0-FP-81594, Jamesbury 20" W/S Valve ANSI CL. 150 Flanged, sheet 1 of 3, Rev. A
0-FP-81594, Jamesbury 20" W/S Valve ANSI CL. 150 Flanged, sheet 2 of 3, Rev. A
0-FP-81594, Jamesbury 20" W/S Valve ANSI CL. 150 Flanged, sheet 3 of 3, Rev. A
0-FP-06757, Reactor Building Unit 1 & 2 Fisher Controls Valve, Rev. C
FP-6756, Reactor Building Unit 1 & 2 Fisher Controls Valve, Rev. C
FP-6758, Cross Sectional Drawing 24" Heavy Pattern Valve with Philadelphia Gear, Rev. B
D-02537, Sheet 1, Reactor Building SW System Piping Diagram, Rev. 85
D-02537, Sheet 2, Reactor Building SW System Piping Diagram, Rev. 81
BN-43.0.01, SW System, Rev.0
D-20041, SW System Piping Diagram, Sheet 2, Rev. 52
C-24009, Sheet 152-1, Unit 1 Inservice Inspection Isometric For RHR Service Water Pump Suction Hanger Locations, Rev. 3
F-188032, 8X13AD Critical Dimensions part no. 62587126, rev.0
FP 20227, Page S8F-43, Rev. F
D25037, Sheet 1,Reactor Building SW System Piping Diagram, Rev. 88
D28046, Sheet 823, Stress Analysis Isometric Reactor Building SW System 6" Vital Header Supply, Rev. 1

D22050, Sheet 942, Diesel Generator Building SW to DG Jacket Water Coolers Unit 1 Stress Isometric, Rev.0
D28046, Sheet 607, Stress Isometric Reactor Building El 17.0 SW System 6" Supply Header North, Rev. 6
D28046, Sheet 754, Stress Analysis Isometric Reactor Building Unit 1 SW System, Rev.0
1-FP-22313, Unit 1 Service Water Underground Piping, Rev. D
1-FP-22335, SW Intake Structure Piping Isometric, Rev. CE
D28046, Sheet 529, Stress Analysis Isometric RHR System & SW System Cooling Water Piping for RHR HX 1 B Unit 1, Rev. 0
D28046, Sheet 585, Unit 1 Stress Analysis Isometric SW System RHR SW Pumps 1B & 1D Discharge Piping, Rev. 2
D2846, Sheet 663B, Unit 1 Stress Analysis Isometric SW System Fan Cooling Unit 1B Supply Header, Rev.2
D28046, Sheet 741B, Unit 1 Stress Analysis Isometric SW System RHR Pump 1B & 1D Seal Cooling Heat Exchanger Inlet Piping, Rev. 3
D28046, Sheet 751, Stress Analysis Isometric Reactor Building, Unit 1 SW System 8" Well Water Flush to SW, Rev. 0
D28046, Sheet 752, Stress Analysis Isometric Reactor Building, Unit 1 SW System Booster Pump Suction 1B & 1D, Rev.0
FSP-26095, Piping Line Isometric Reactor Building SW Piping, Rev.2
D28046, Sheet 753, Stress Analysis Isometric, Unit 1 SW System Salt Water supply to RBCCW Heat Exchanger, Rev. 0
D28046, Sheet 755, Stress Analysis Isometric, Unit 1 SW System Salt Water supply to RBCCW Heat Exchanger, Rev. 0
D28046, Sheet 823, Stress Analysis Isometric reactor Building SW System 6" Vital Header Supply, Rev. 1
D28046, Sheet 824, Stress Analysis Isometric Reactor Building SW System 4" Supply to CS Pump Room Cooling Unit 1B, Rev. 1
D28046, Sheet 825, Stress Analysis Isometric Reactor Building SW System CS Pump Room Cooling Unit 1B Supply and Return, Rev. 1
D28046,Sheet 607, Stress Analysis Isometric Reactor Building SW System El. 17.0 6" Supply Header North, Rev.6
D28046, Sheet 715B Unit 1 Stress Analysis Isometric SW System RHR Pps 1A & 1C Seal Cooling Heat Exchanger Inlet Piping, Rev. 1
D28046, Sheet 717A, Stress Analysis Isometric Reactor Building CS Pump Room SW Supply Piping to Fan Cooling Unit 1A, Rev. 0
D28046, Sheet 750, Stress Analysis Isometric, Reactor Building Unit 1 SW System Booster Pump Suction Pumps 1A & 1C, Rev. 0
D28046, Sheet 662B, Unit 1 Stress Analysis Isometric Diagram SW System RHR Pump room cooler 1A Supply Header, Rev. 2

Miscellaneous Documents

Vendor Manual FP-20234, Strainers, Poro-Edge Automatic, R.P.Adams Co. Inc, Rev. J
Vendor Manual FP-6950, Valves, Butterfly and Actuators, Fisher, Rev. L
Vendor Manual FP-6950, Valves, Butterfly and Actuators, Fisher, Rev. K
Correspondence File B10-4060, Serial BSEP/85-1053, Implementation of Priority Service Water Phase III Plant Modifications, June 5, 1985

Plant Modification 89-026, Examination, Evaluation and Repair of the Unit 2 Service Water System Piping and Associated Components, Rev. 0
Plant Modification Number 91-047, Inspection and Repair of U1 NSW System, Rev. 0
ESR 9700555, Replacement of 2-SW-V19, Rev. 0
ESR 9600074, 1-SW-V103 and 1-SW-V106, Rev. 0
System Description SD-37.1, reactor Building HVAC, Rev.10
Progress Energy, Training Lesson Plan - Basic Valve Repair, MEG207G, Rev. 12
System Description SD-43, Service Water System, Rev. 13
History of Rubber Lined RHRSW Valves
Unit 1 Service Water Valve Database
Unit 1 Fisher Valve Database
Fisher Valve Technical Representative Correspondence (Valves Examination Report - September 13, 2007)
Repair History for Fisher Valves Refurbished @ Columbia SC Facility
Specification no. 248-141, Procurement of Replacement Class IB Fisher Butterfly Valves, rev. 1
OE25461 - Service Water System Butterfly Valve Disk-Stem Taper Pin Failure (Brunswick)
Calculation 0SW-0097, RHR and Core Spray room cooler Performance, Rev. 1
SW Strainer Inspection History
Analysis of Strainer rods Received (10-03-07)
Fracture Surface Comparison BNP SW Pump Strainer Components
Unit 1 Service Water Foreign Material Inspection Report
Unit 1 Service Water Foreign Material Extent of Condition
Unit 2 Service Water Foreign Material Extent of Condition
Unit 2 SW Strainer Extent Of Condition
Licensee Event Report, 50-361/2005-002
NRC Information Notice 2005-023, Vibration-Induced Degradation of Butterfly Valves
Fisher Information Notice 93-3 Supplement 1, October 10, 2005
OE On Butterfly Valve Taper Pin Problems
Service Water Trend Display Plot 5/1-8/29/07 for Vital Header CSW Flow Unit 1
Service Water Trend Display Plot 5/1-8/29/07 for Vital Header NSW Flow Unit 1
Service Water Trend Display Plot 5/1-8/29/07 for RHR SW Pump 1D Stator Temp
Service Water Trend Display Plot 5/1-8/29/07 for RHR SW Pump 1B Stator Temp
Service Water Trend Display Plot 5/1-8/29/07 for NSW Pump 1B Stator Temp
SW Maintenance Rule Database for all SW PMGs for 1/1/2002 through 8/8/2007
History of SW System Component and Visual Inspection and Flow Testing
1B RHRSW Booster Pump Flow Trending
1D RHRSW Booster Pump Flow Trending
Fisher Controls Repair Purchase Order 1C5258AN dated 1-29-1992
BNP Unit 1 Operations Logs for selected dates July 26 through October 9, 2007

Condition Reports

240978, OCR for 2A, 2B,1B RHR Loops
241630, Low Flow Indicated Through 1B RHR room cooler
243465, FME Found in 1B RHR room cooler Inlet Piping
240768, Unplanned LCO Entry
243867, 1D RHRSW Booster Pump Motor Trip
246324, 1B RHRSW Booster Pump Inspection

246395, Rework 1D RHR SW BSTR PMP MTR
166395, OE Item NRC IN 2005-23 Vibration Induced Failure - Butterfly Valves
166611, FME Found Inside SW Inlet Side of 2-TCC-2B-HX
9502553, Foreign Material in RBCCW System
203878, 1C RHR Pump Seal Cooler Reduced Flow Rate
232573, Valve 1-SW-V124 Failed to Open during Testing
243322, Unplanned LCO Entry 1B RHR room cooler

Condition Reports Generated During Inspection

241828, Manual Butterfly Valves Not in Evaluation for NRC IN 2005-023
245478, Potential Legacy FME Issue From 1-SW-V19
246206, FME - ½" Threaded, Double Nutted Fitting Found in NSW HDR
246790, 1A CSW PMP Strainer Tube Sheet Fasteners
246900, FME Identified in Supply Line to RHR room coolers (Shells)
246886, Unusual Marine Buildup / Corrosion on the 1-SW-V118
247050, Shells Found in A Loop RHR Pump Seal Cooler supply Lines
247051, Rubber Valve Seat Material in A Loop RHR Rm Cooler
247053, Shells in 1A RHR room cooler & Inlet Piping
247201, End of 1 Ty-Rod Missing From 1C Conv Pmp Strainer
241166, Investigation of Adverse Trend of Unit 1 SW
246861, Use of Gaskets When Installing Rubber Lined Fisher Valves
244448, Foreign Object Search and Retrieval

Work Orders

00557488, 1-SW-103-24-157, Replace Spool Piece
00411066, Clean Disassemble & Inspector the CSW Header
00431058, Clean Disassemble & Inspector SW System Piping on B Loop RHR SW and B Loop Discharge Piping
01120855 04, 1A NSW Pump Discharge Strainer Inspection
01120655 01, 1B NSW Pump Discharge Strainer Inspection
01121223 01, 1B CSW Pump Discharge Strainer Inspection
01121226 01, 1C CSW Pump Discharge Strainer Inspection
109576, B Loop RHRSW Booster Pumps Tripped, Rebuild/Replace Valve 1-SW-V105

LIST OF ACRONYMS

AR	action request
CA	corrective action
CAQ	condition adverse to quality
CFR	Code of Federal Regulations
CR	condition report
CS	core spray
ECCS	emergency core cooling system
LOCA	loss of coolant accident
MOV	motor operated valve
NPSH	net positive suction head
NRC	U.S. Nuclear Regulatory Commission
OpE	NRC operating experience database
PRA	probabilistic risk assessment
RCS	reactor coolant system
RHR	residual heat removal
SDP	significance determination process
UFSAR	Updated Final Safety Analysis Report
WO	work order