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

March 1, 2005

Tennessee Valley Authority
ATTN: Mr. Karl W. Singer
Chief Nuclear Officer and
Executive Vice President
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT - NRC SAFETY SYSTEM DESIGN AND PERFORMANCE CAPABILITY INSPECTION REPORT NOS. 05000260/2005010 AND 05000296/2005010

Dear Mr. Singer:

On January 28, 2005, the U. S. Nuclear Regulatory Commission (NRC) completed a safety system design and performance capability team inspection at your Browns Ferry Nuclear Plant. The enclosed report documents the inspection findings which were discussed on January 28, 2005, with Mr. M. Skaggs and other members of your staff. Following completion of additional review in the Region II office, a final exit was held by telephone with Mr. T. Abney of your staff on February 7, 2005, to provide an update on changes to the preliminary inspection findings.

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 inspection team reviewed selected procedures and records, observed activities, and interviewed personnel.

Based on the results of the inspection, no findings of significance were identified.

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 R. Ogle, Chief
Engineering Branch 1
Division of Reactor Safety

Docket Nos.: 50-260, 50-296
License Nos.: DPR-52, DPR-68

Enclosure: NRC Inspection Report 05000260/2005010 and 05000296/2005010
w/Attachment: Supplemental Information

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U.S. NUCLEAR REGULATORY COMMISSION

REGION II

Docket Nos.:	50-260, 50-296
License Nos.:	DPR-52, DPR-68
Report Nos.:	05000260/2005010 and 05000296/2005010
Licensee:	Tennessee Valley Authority
Facility:	Browns Ferry Nuclear Plant, Units 2 & 3
Location:	10833 Shaw Road Athens, AL 35611
Dates:	January 10-14, 2005 and January 24-28, 2005
Inspectors:	R. Moore, Senior Reactor Inspector (Team Lead) N. Merriweather, Senior Reactor Inspector R. Cortes, Reactor Inspector P. Fillion, Senior Reactor Inspector M. Thomas, Senior Reactor Inspector L. Mellen, Senior Reactor Inspector C. Peabody, Reactor Inspector in Training
Approved by:	Charles R. Ogle, Chief Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000260/2005-010, 05000296/2005-010; 01/10-14/2005 and 01/24-28/2005; Browns Ferry Nuclear Plant, Units 2 and 3; Safety System Design and Performance Capability Inspection.

This inspection was conducted by a team of inspectors from the NRC's Region II office. No findings of significance were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. NRC-Identified and Self-Revealing Findings

No findings of significance were identified.

B. Licensee-Identified Violations

None.

REPORT DETAILS

1. REACTOR SAFETY

Cornerstones: Initiating Events and Mitigating Systems

1R21 Safety System Design and Performance Capability (71111.21)

The team evaluated the capability of installed plant detection and mitigation equipment which provide the high pressure injection function (HPI) at Browns Ferry. The HPI function is provided by the high pressure coolant injection (HPCI) system and the reactor core isolation cooling (RCIC) system.

.1 System Needs

.11 Process Medium

a. Inspection Scope

The team reviewed the availability and reliability of water sources required for the HPI function. These included the condensate storage tanks (CST) for both Units 2 and 3 and the suppression pool for Unit 2. The review included design documentation, drawings, Updated Final Safety Analysis Report (UFSAR), Technical Specifications (TS), corrective actions history, foreign material exclusion history, volumetric calculations for both supplies, calculations of system capacity, HPCI and RCIC pumps' net positive suction head (NPSH) available and required, and minimum flow protection on both systems

Also, the team reviewed volume calculations to verify vortexing had been properly considered in CST suction piping design. Additionally, the team reviewed the most restrictive portions of the HPCI and RCIC systems to verify that the suppression pool suction strainers were sized accordingly. The team also reviewed the water quality history in the torus to verify there have been no recent conditions of sludge or fouling that could prevent an adequate suction through the strainers.

b. Findings

No findings of significance were identified.

.12 Energy Sources

a. Inspection Scope

The team reviewed design basis documentation (DBDs), drawings, and walked down accessible portions of the HPCI and RCIC systems to verify the steam supply would be available for turbine-pump operation during a design basis event. The team reviewed the HPCI steam supply drain pot flow orifice inspections, corrective action history on the steam traps on the supply and exhaust pipes, and maintenance records to verify that

water accumulation conditions in the piping that could cause water hammer and pump overspeed trip events had not occurred. The team reviewed functional valve testing for the HPCI and RCIC turbine exhaust vacuum relief check valves to verify adequacy of acceptance criteria and to verify that the vacuum relief function was being maintained.

The team reviewed test and design documents to verify that the 250 volt direct current (VDC) power supplies were adequate to meet minimum voltage specifications for electrical equipment during and following an event requiring HPI. The surveillance tests which demonstrated the battery chargers have the capacity and capability to recharge the batteries were reviewed. Design torque values for MOVs were reviewed to verify that safety functions (open / closed) based on minimum voltage conditions were adequately tested. Plant simulator demonstrations were utilized to check system response to loss of various 250 V DC power supplies as a means to check that power supplies met the requirements for redundancy. A specific list of components and documents reviewed is included in the Attachment to this report

b. Findings

No findings of significance were identified.

.13 Instrumentation and Controls

a. Inspection Scope

The team reviewed drawings depicting the electrical controls for actuation and shutdown of the turbine driven HPCI and RCIC pumps, including controls for the turbine steam supply valves, CST and suppression pool suction valves, and HPCI/RCIC injection valves, to confirm that the instrumentation and control circuits were consistent with the design basis documents. The team reviewed samples of surveillance test procedures for HPCI and RCIC logic functional testing to confirm that the logic paths were being tested in a manner to adequately demonstrate that the system would perform in accordance with design. The team selected a sample of the process instruments that provide input signals to HPCI and RCIC logic for examination such as reactor vessel level - low low, CST header level-low, suppression pool level-high, HPCI flow indicating controller, RCIC flow indicating controller, and HPCI pressure to verify that the instruments were available to support system operation. The last two completed instrument calibration records were reviewed for the selected instruments to verify that they had been calibrated in accordance with the setpoint documents and calibration procedures. The calibration records were also reviewed to verify that test deficiencies such as “out of tolerance conditions” were being entered into the corrective action program for evaluation and disposition. The components reviewed are included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.14 Operator Actions

a. Inspection Scope

The team reviewed plant operating instructions, including emergency operating instructions (EOIs), abnormal operating instructions (AOIs), alarm response procedures (ARPs), and operating instructions (OIs) that would be used to accomplish the HPI function during the identification and mitigation of a loss of coolant accident (LOCA) event. The team focused on installed equipment and operator actions that could be used to mitigate the event. The review was done to verify that the instructions were consistent with the UFSAR description of a LOCA event and with the Boiling Water Reactors Owners' Group (BWROG) Emergency Procedure Guidelines (EPGs), any step deviations were justified and reasonable, and the instructions were written clearly and followed the EOP writer's guide. The team held discussions with licensed operators and training instructors, reviewed job performance measures and training lesson plans pertaining to use of HPI equipment during a LOCA event to confirm that training was consistent with the applicable operating instructions.

In addition, the team observed simulation of LOCA scenarios on the plant simulator and walked down portions of applicable instructions to verify that operator training, procedure guidance, and instrumentation were adequate to identify a LOCA event and implement post-LOCA mitigation strategies. The manual operator action times for performance of LOCA mitigation activities related to HPI equipment were reviewed for consistency with accident analyses, EPGs, and operator training. Procedures reviewed are included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.15 Heat Removal

a. Inspection Scope

The team reviewed heat load calculations for the HPCI and RCIC rooms. The team also reviewed the calculated peak temperature responses during a station blackout and high energy line break for these rooms. The team reviewed the vendor manuals, drawings, RCIC and HPCI DBDs, trending information on lube oil temperature profile, and surveillance test documentation to assess the design and performance of the turbine lubricating oil systems on the HPCI and RCIC systems. A specific list of documents reviewed is included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.2 System Condition and Capability

.21 Installed Configuration

a. Inspection Scope

The team performed field walkdowns of HPI equipment and 250 volts direct current (VDC) power supplies to observe the existing conditions and configurations. The team walked down portions of the RCIC and HPCI systems as well as portions of the CST suction source to verify that they were properly aligned for existing plant conditions. During this walk down, the team compared valve positions with those specified in the system operating procedure line-ups and drawings, and observed the material condition of the plant to verify that it would be adequate to support operator actions and system operation. Equipment examined included the HPCI and RCIC pumps, steam traps and drain pots, system valves, piping, and related components. A specific list of components reviewed is included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.22 Operation

a. Inspection Scope

The team walked down selected portions of HPCI and RCIC operating instructions to check for human factors in the instructions and in the plant; including clarity, accuracy, labeling, lighting, noise, communications, and accessibility. The team also checked HPCI and RCIC system alignments to verify consistency with design and licensing basis assumptions, and the Technical Specifications (TS). These reviews included walkdown of venting procedure actions for the Unit 2 HPCI system and Unit 3 RCIC system.

The team reviewed operating instructions for switching various distribution panels in the 250 V DC system between their normal and alternate sources to evaluate whether these switching operations could result in inadvertent, undesirable consequences such as plant trips, loss of AC power or violation of the divisional separation requirements. Selected annunciator response procedures and operator rounds procedures were also reviewed from the viewpoint of whether anticipated problems such as grounds would be quickly identified and corrected.

b. Findings

No findings of significance were identified.

.23 Design

a. Inspection Scope

Mechanical Design Review

The team reviewed design calculations, specifications, and the UFSAR to verify that system and equipment design functions were appropriately evaluated and maintained. Surveillance test procedures and equipment monitoring activities were reviewed to verify the design criteria were appropriately translated into the acceptance criteria on the tests. The team reviewed DBDs, selected piping, selected TSs, PERs, and corrective maintenance history for HPCI and RCIC systems to assess the implementation and maintenance of the systems' design basis.

The team reviewed calculations and system configuration to assess the adequacy of the NPSH available to both RCIC and HPCI pumps. In addition, the team reviewed the most restrictive flow conditions in the systems to assess the sizing of the suppression pool strainers. The calculations which established the automatic CST to suppression pool swapover setpoint values were reviewed to verify the vortexing phenomenon was appropriately addressed. System design and configuration was reviewed to assure pump minimum flow requirements and run out protection was provided. A list of documents reviewed is included in the Attachment to this report.

Electrical, Instrumentation and Controls Design Review

The team reviewed system flow diagrams, mechanical control drawings, electrical elementary and schematic diagrams, instrument setpoint calculations, instrument scaling documents, as well as calibration procedures and calibration test records to verify that the instrumentation and controls for the RCIC and HPCI pumps were in accordance with design basis documents. Specifically, the team reviewed setpoint calculations for selected process instruments including reactor vessel level-low low, CST header level-low, suppression pool level-high, HPCI flow indicating controller, RCIC flow indicating controller, and HPCI pressure to verify that the calculations included appropriate instrument uncertainties. The last two completed calibration test records were reviewed to confirm that instrument setpoints were established consistent with setpoint calculations. Modifications and component replacements were reviewed to assess potential impact on system design function and capability.

The team reviewed the UFSAR and TS bases to determine the design basis mission time for the 250 VDC batteries which supply power to HPCI and RCIC. The team reviewed battery sizing calculations and voltage calculations. The review included accident scenarios and station blackout. The criteria for review of these calculations were that they were performed using methods delineated in industry standards and demonstrated that adequate power supply capacity would be available to meet design basis scenarios. Particular attention was paid to voltage at key motor operated valves, and it was checked that voltage calculations were coordinated with torque and thrust

calculations. In addition, MOVATS test results were reviewed to check that motor inrush currents were consistent with those used in the calculations. Selected samples within the calculation for sizing of thermal overloads were reviewed, and the methodology was compared to industry standards. The criterion for sizing thermal overloads was that they not inadvertently trip to defeat the design basis function of the motor operated valve. The team inspected installed equipment and recorded nameplate data and setpoint information for selected devices such as thermal overload heaters and molded-case circuit breakers and compared this data to design documents. Design and sensitivity of the ground detection devices were evaluated. The team inspected the battery rooms to verify that ventilation was provided for the battery rooms to handle battery off-gassing. A list of documents reviewed is included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.24 Testing and Inspection

a. Inspection Scope

The team reviewed performance and post-maintenance testing of pumps and valves to verify that the tests and inspections were appropriately verifying that the assumptions of the licensing and design bases were being maintained and that performance degradation would be identified. The team reviewed service and performance testing and electrical preventive maintenance procedures for the DC batteries. The review was performed in order to verify that specified acceptance criteria were met and that the equipment operation was consistent with the plant's licensing and design bases.

The team reviewed selected full flow surveillance test data to ensure that HPCI and RCIC systems' injection flow rates remained within system design calculations. The team reviewed documentation of completed surveillance tests and pump head curves to verify that equipment performance was appropriately monitored and maintained consistent with the design and licensing bases. Component testing reviewed included RCIC and HPCI pumps, vacuum relief check valves and feedwater check valves upstream of the injection point of the RCIC and HPCI systems.

The team reviewed valve operability stroke time testing, thrust and torque testing, differential pressure testing, and corrective maintenance records for selected HPCI and RCIC risk significant MOVs, including the steam admission valves and the injection valves for these systems. This review was conducted to verify the availability of the selected valves, adequacy of surveillance testing acceptance criteria, and monitoring of these valves for degradation. The team reviewed completed surveillance instruction test results related to HPCI and RCIC systems venting, and valve position verification, suppression pool level verification, reactor vessel level verification, and condensate storage tank level verification, to verify that testing was being performed in accordance with applicable TS requirements. Test records were reviewed to verify that permissives

and interlocks not normally tested during pump testing were verified during periodic surveillance testing. A list of documents reviewed is included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.3 Selected Components

.31 Component Degradation

a. Inspection Scope

The team reviewed maintenance and testing documentation, modifications, performance trending, and equipment history as identified by work orders, PERs, and system health reports to assess the licensee's actions to verify and maintain the safety function, reliability and availability of selected components. Equipment reviewed included the RCIC and HPCI pumps, including the booster pump, selected MOVs, vacuum reliefs for both systems, and selected feedwater check valves upstream of injection points for these systems. Field walkdowns were performed of the HPCI and RCIC rooms to assess material condition and identify degraded equipment.

The team also reviewed the potential for common cause failure mechanisms in maintenance. Additionally, the team reviewed in-service trending data for selected components, including the HPCI and RCIC pumps flow profiles, lubricating oil temperatures for the turbine, and vibration testing to verify that the components were continuing to perform within the limits specified by the test and design basis. A specific list of equipment and documents reviewed is included in the Attachment to this report.

The team performed a detailed inspection of two safety related batteries to assess the attributes of plate alignment, growth and color; jar integrity, and post-seal integrity; electrolyte level and clarity; and sedimentation, terminal corrosion, intercell spacers, and rack integrity. Walkdown inspections were performed of areas containing major equipment in the 250 VDC systems to look for evidence of component degradation such as broken control devices, dust, peeling paint, excessive temperature or noise, building leaks or leaks from nearby mechanical equipment and ambient conditions. Ammeters, voltmeters, ground detection and alarms on the DC system equipment were observed and evaluated in relation to the desired state or condition. Problem reports for the past two-year period dealing with grounds on the 250 VDC system were evaluated by the team.

b. Findings

No findings of significance were identified.

.32 Equipment/Environmental Qualification

a. Inspection Scope

The team reviewed qualification test data associated with the environmental testing of the CST header level switches and the HPCI steam line space high temperature switches. The test data was reviewed to confirm that the components were qualified for the worst case postulated accident environments where they are installed. The team also reviewed seismic test data on both instruments to verify that they would perform satisfactorily during and after a seismic event.

In addition to the above, the team reviewed the environmental classification for several other instruments associated with the HPCI system to determine if the components had been properly evaluated for inclusion in the Environmental Qualification (EQ) Program. The reviewed included the licensee's operability evaluation for an EQ issue documented in PER 04-00235-000 involving HPCI instruments that had been classified as essentially mild although they were located in a harsh environment. The team reviewed the PER and the associated operability evaluation to determine if the conclusions were reasonable and acceptable. The team conducted in-plant walkdowns to verify that the observable portions of selected mechanical components were suitable for the environment expected under all conditions, including high energy line breaks (HELBs). A list of documents reviewed is included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.33 Equipment Protection

a. Inspection Scope

The team walked down the spaces containing 250 VDC equipment and the HPCI and RCIC rooms and reviewed temperature switches' qualifications to verify the equipment was adequately protected against external events such as flood, missiles, and HELB.

b. Findings

No findings of significance were identified.

.34 Component Inputs/Outputs

c. Inspection Scope

The team reviewed selected MOV operator requirements calculations and evaluated the capability of the MOVs to perform their design function under degraded voltage and differential pressure conditions. The specific MOVs reviewed are referenced in Section

1R21.21a. The team reviewed vendor data demonstrating the operating characteristics for HPCI auxiliary relay 2-73-23A-15 (i.e., percent pickup and dropout voltage ratings) and compared it to the minimum expected calculated voltages from Calculation ED-Q0999-870066, Rev. 15 to verify that sufficient control voltage was available for satisfactory operation of the relay under worst case design basis voltage conditions. A list of documents reviewed is included in the Attachment to this report.

b. Findings

No findings of significance were identified.

.35 Operating Experience

a. Inspection Scope

The team reviewed the licensee's applicability evaluations, extent of condition reviews, and corrective actions for industry and station operating experience issues related to HPCI and RCIC equipment problems, use of non-conservative acceptance criteria in safety related pump surveillance tests, pump-turbine over speed events, and check valve problems to verify that plant specific issues were appropriately identified and addressed. Work orders, procedures, field observations and discussions with engineering staff provided verification that operating experience (OE) related corrective actions were accomplished. The team reviewed a report summarizing the results of the licensee's evaluation of safety related logic system testing in response to NRC Generic Letter 96-01. Specifically, the section of the report dealing with HPCI logic system testing was reviewed to verify that logic test deficiencies were properly evaluated. A vendor communication and a Licensee Event Report were reviewed in relation to the 250 VDC system that addressed the potential for spurious operation of protective relays as a result of perturbations on the 250 VDC system which could lead to loss of AC power. The specific industry experience issues and documents reviewed are listed in the Attachment to this report.

b. Findings

No findings of significance were identified.

.4 Identification and Resolution of Problems

a. Inspection Scope

The team reviewed selected system health reports, maintenance records, surveillance test records, and PERs to verify that design and performance problems were identified and entered into the corrective action program. The team assessed the scope of the licensee's extent-of-condition reviews and the adequacy of the corrective actions. The team reviewed calibration test records to verify that "out of tolerance" conditions were properly entered into the corrective action program for evaluation and disposition.

Additionally, the team reviewed a sample of corrective maintenance work orders on the RCIC and HPCI pumps and selected valves. A list of documents reviewed is included in the Attachment to this report.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES

4OA6 Meetings, Including Exit

The lead inspector presented the inspection results on January 28, 2005, with Mr. M. Skaggs and other members of the licensee staff. Following completion of additional review in the Region II office, a final exit was held by telephone with Mr. T. Abney of your staff on February 7, 2005, to provide an update on changes to the preliminary inspection findings. The licensee acknowledged the findings presented. Proprietary information is not included in this inspection report.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

T. Abney, Licensing and Industry Affairs Manager
B. Auckland, Assistant Plant Manager
J. Davenport, Licensing
J. Elmerick, Design Engineering
D. McCory, Engineering NSSS Supervisor
P Olson, Maintenance Manager
T. Rogers, System Engineer
M. Skaggs, Site Vice President

NRC (attended exit meeting)

C. Ogle, RII, Engineering Branch Chief
B. Monk, Acting Senior Resident Inspector

LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

None

Attachment

LIST OF DOCUMENTS AND EQUIPMENT REVIEWED

Report sections

1R21.11a Process Medium

Calculations:
ND-Q0999-880163, Calculation of the Volume of the Drywell and the Suppression Pool (Wetwell), Rev. 2
MD-Q0073-920184, Analytical Limits for HPCI Suction Automatic Transfer to Suppression Pool for LS-73-56A, 56B, 57A, and 57B, Rev. 7
MD-Q2071-87350, Reactor Core Isolation Cooling System Pump NPSHa, Rev. 4

Drawings:
67-M-4-47W309-1R0, Condensate Storage Tank, Rev. B
0-17W510-3, Mechanical Condensate, Demineralized Water and Misc Tunnel Piping, Rev.1
3-E20, Containment Vessel Sump Detail, Rev. 1
0-47W553-1, Mechanical Condensate Storage and Supply System, Rev. 2

Procedures:
0-TI-417, Inspection of Service Level I, II, III, Protective Coatings, Rev. 2
2-OI-73, HPCI System Valve Lineup Checklist attachment 1, 04/26/01
2-OI-71, RCIC System Valve Lineup Checklist attachment 1, 04/15/01

1R21.12a Energy Sources

Calculations:
MD-Q2073-910095, MOV-2-FCV-73-16 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910083, MOV-2-FCV-71-08 Operator Requirements and Capabilities, Rev. 6

Work Orders:
98-006750-000, Re-torque valve 2-FCV-73-16 and perform current verification ECI-0-000-MOV009, 06/12/98
03-024181-000, Replace packing in 2-FCV-73-16 HPCI turbine steam supply valve, 12/11/03
03-018700-000, HPCI main steam trap has leak, 11/08/03
01-004758-000, Auxiliary steam supply shutoff valve leaks, 3/8/03

Procedures:
2-SR-3.8.4.4, Surveillance Procedure, Main Bank 2 Battery Modified Performance Test, Results of Test Performed on 9/03/02
2-SR-3.8.4.4, Surveillance Procedure, Main Bank 2 Battery Modified Performance Test, Results of Test Performed on 1/19/05
1-SR-3.8.4.4, Surveillance Procedure, Main Bank 1 Battery Modified Performance Test, Results of Test Performed on 4/23/03

MCI-0-071-TRB001, RCIC System Turbine Disassembly, Rework, and Reassembly, Rev. 18
MPI-0-073-TRB001, HPCI Turbine Preventative Maintenance, Rev. 35

Components Reviewed

2-FCV-71-2, -3, -8, -9, -10
2-FCV-73-2, -3, -16, -18, -19
Steam Traps 2-TRP71-9, -10
Steam Traps 2-TRP73-5, -8
Steam Supply Drain Pot 2-CPOT-5
Turbine Inlet Drain Pot 2-MCP-73-5
RCIC Vacuum Relief Check Valves: 2-CKV-597, -598, -599, -600
HPCI Vacuum Relief Check Valves: 2-CKV-633, -634, -635, -636
Unit Batteries Nos 1 & 2

1R21.13a Instrumentation & Controls

Components Reviewed:

Reactor Vessel Water Level - Low Low, Level 2 (BFN-2-LS-3-58A, -B, -C, -D)
Drywell Pressure - high (BFN-2-PIS-64-58A, -B, -C, -D)
Reactor Vessel Water Level - High, Level 8 (BFN-2-LIS-3-208B and 208D)
Condensate Header Level - Low (BFN-2-LS-73-56A and B)
Suppression Pool Water Level - High (BFN-2-LS-73-57A and B)
HPCI Pump Discharge Flow - Low (BFN-2-FIS-73-33)
HPCI Flow Indicating Controller (BFN-2-FIC-73-33)
Instrument Loops (BFN-2-PS-73-1A, -1B, -1C, 1D; BFN-2-TS-73-2A, -B, -C, -D; BFN-2-TS-73-2E, -F, -G, -H; BFN-2-TS-73-2J, -K, -L, -M; BFN-2-TS-2N, -P, -R, -S)
HPCI Pressure Instrument Loops (BFN-2-PS-73-20A, -B, -C, -D and BFN-2-PS-73-22A and B)
RCIC Flow Indicator Controller (BFN-2-FIC-71-36A and B)
Pressure Switches (BFN-2-PS-71-13A and B; BFN-2-PS-71-21A; BFN-2-PS-71-11A, -B, -C, -D; BFN-2-PS-71-1A, -B, -C, -D)
Drain Pot Level Switch (BFN-2-LS-71-5)
Valves (2-FCV-73-26, -27, and -40)

1R21.14a Operator Actions

Procedures

0-OI-2B, Condensate Storage and Transfer System, Rev. 46
2-AOI-64-1, Drywell Pressure and/or Temperature High, or Excessive Leakage into Drywell, Rev. 21
2-ARP-9-3C, Alarm Response Procedure, Rev. 11
2-ARP-9-3F, Alarm Response Procedure, Rev. 18
2-EOI-1, RPV Control, Rev. 10
2-EOI Appendix-5C, Injection System Lineup, RCIC, Rev. 4

2-EOI Appendix-5D, Injection System Lineup, HPCI, Rev. 5
2-EOI Appendix-16E, Bypassing HPCI High Suppression Pool Water Level Suction Transfer Interlock, Rev. 3
2-OI-71, Reactor Core Isolation Cooling System, Rev. 50
2-OI-73, High Pressure Coolant Injection System, Rev. 69

Lesson Plans and Job Performance Measures

OPL171.040, Reactor Core Isolation Cooling (RCIC) System, Rev. 19
OPL171.042, High Pressure Coolant Injection, Rev. 16
OPL171.202, EOI-1 RPV Control, Rev. 6
OPL171.206, EOI Appendices, Rev. 6
JPM No. 19, EOI Appendix 5D - Injection System Lineup - HPCI, Rev. 7
JPM No. 327, 3-EOI Appendix 16E - Bypassing HPCI High Suppression Pool Water Level Suction Transfer, Rev. 0

Miscellaneous Documents

UFSAR Sections 4.7, 6.4, 6.5, 11.9, 13.6, and 14.6.3
TS Sections 3.3.3.1, 3.3.5.1, 3.3.5.2, 3.5.1, 3.5.2, 3.5.3, and 3.6.2.2
TS Bases Sections B3.3.3.1 B3.3.5.1, B3.3.5.2, B3.5.1, B3.5.2, B3.5.3, and B3.6.2.2
NRC Safety Evaluation Report, dated September 1988, of "BWR Owners' Group - Emergency Procedure Guidelines, Revision 4," NEDO-31331, March 1987
NRC Inspection Report No. 50-260/92-27, dated August 25, 1992
BWR Owners' Group Emergency Procedure and Severe Accident Guidelines, Rev. 1
10 CFR 50.59 Safety Evaluation for EOIPM and EOI/SAMG Flowcharts, dated 12/31/1998

Section 1R21.15.a: Heat Removal

Calculations:
MD-Q2073-910095, MOV-2-FCV-73-16 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910083, MOV-2-FCV-71-08 Operator Requirements and Capabilities, Rev. 6
ND-Q2999-980006, Reactor Building Temperature Response during SBO, Rev. 1
ND-Q2999-970011, Reactor Building Environmental Analysis for HELBs - Power Uprate, Rev. 0

Drawings:
2-47E610-73-2, Mechanical Control Diagram HPCI Oil System, Rev. 14
3-47E813-1, Flow Diagram RCIC System (unit 3), Rev. 45
2-47E812-1, Flow Diagram HPCI System (unit 2), Rev. 52

Work Orders:
03-015064-002, RCIC lube oil cooling water valve operator, 03/23/04
03-001451-000, RCIC lube oil cooling water leak, 7/14/03
03-015064-001, RCIC lube oil cooling water valve operator, 03/20/04

Procedures:

2-SR-3.5.1.7, HPCI Main and Booster Pump Set Developed Head and Flow Rate Test at Rated Reactor Pressure, Rev. 35
2-SR-3.5.3.3, RCIC System Rated Flow at Normal Operating Pressure, Rev. 30

Miscellaneous:

BFN-VTD-T147-0030, Operations and Maintenance Instructions for Terry Model CCS HPCI Turbine, Rev. 14
BFN-VTD-B260-0080, Installation, Operation, and Maintenance on Multistage Horizontal Pumps, Rev. 0
BFN-VTD-B580-0030, Technical Instructions for Byron Jackson HPCI Pumps, Rev. 0
CR-78-02, Proper Lubricating Oil for Terry Turbines, 04/78

Components Reviewed

RCIC Pump 2-PMP-19
RCIC Turbine 2-TRB-9
HPCI Pump 2-PMP-73-54
HPCI Booster Pump 2-PMP-73-29
HPCI Turbine 2-TRB-73-54

1R21.21a Installed Configuration

Procedures:

MCI-0-073-PMP002, HPCI Booster Pump Disassembly, Inspection, Rework, and Reassembly, Rev. 13
MCI-0-071-TRB001, RCIC System Turbine Disassembly, Rework, and Reassembly, Rev. 18
MPI-0-073-TRB001, HPCI Turbine Preventative Maintenance, Rev. 35
2-OI-73, HPCI System Valve Lineup Checklist attachment 1, 04/26/01
2-OI-71, RCIC System Valve Lineup Checklist attachment 1, 04/15/01

Drawings:

0-17W510-3, Mechanical Condensate, Demineralized Water and Misc Tunnel Piping, Rev.1
3-47E813-1, Flow Diagram RCIC System (unit 3), Rev. 45
2-47E812-1, Flow Diagram HPCI System (unit 2), Rev. 52

Work Orders:
02-009801-000, Replace actuator motor on 2-MOV71-3, 03/11/03
03-004108-000, Transfer switch is 90 degrees Off, 3/8/03

Miscellaneous:

BFN-VTD-C665-0120, Crane Steel Valve Installation and Maintenance Manual, Rev. 2
BFN-VTD-C665-0050, Crane List 900 and List 150 Gate Valves, Rev. 6
BFN-VTD-W030-0110, Walworth Technical Manual for MOVs (unit 1& 2), Rev. 3

Components Reviewed

3-FCV-71-2, -3, -8, -9, -10
3-FCV-71-17, -18, -19, -36, -38, -39
2-FCV-73-2, -3, -16, -18, -19
2-FCV-73-26, -27, -40, -35, -36, -44
RCIC Pump 3-PMP-19
RCIC Turbine 3-TRB-9
HPCI Pump 2-PMP-73-54
HPCI Booster Pump 2-PMP-73-29
HPCI Turbine 2-TRB-73-54]
Condensate Storage Tanks CST-1, -2, -3, -4, -5
Unit batteries Nos 1 & 2, Unit battery boards Nos 1 & 2, battery chargers 2A & 2B (1/11 & 12/05). Reactor MOV boards 2C & 3A & 3C & 2A, Unit 2 distribution panel 9-9, distribution panel 9-24 (1/13 & 14). Open reactor MOV board 2A compartment 5A, 6A, and 7A (½6/05)

1R21.22a Operation

Procedures

2-OI-71, Reactor Core Isolation Cooling System, Rev. 50
2-OI-73, High Pressure Coolant Injection System, Rev. 69
2-APR-9-7B, Annunciator Response Procedure, Rev. 16
2-APR-9-8C, Annunciator Response Procedure, Rev. 10
0-OI-57D, Operating Instruction DC Electrical System, Rev. 79
0-GOI-300-4, General Operating Instruction Switchyard Manual, Rev. 53

Completed Surveillance Procedures

2-SR-3.5.1.1 (HPCI), Maintenance of Filled HPCI Discharge Piping, completed 3/11/2004, 4/04/2004, 9/10/2004, and 12/15/2004
2-SR-3.5.1.1 (RCIC), Maintenance of Filled RCIC Discharge Piping, completed ½5/2004, 3/24/2004, 5/19/2004, and ½6/2005
2-SR-3.5.1.2 (HPCI), High Pressure Coolant Injection System Monthly Valve Position Verification, completed 1/01/2005
2-SR-3.5.3.2, Reactor Core Isolation Cooling System Monthly Valve Position Verification completed 12/04/2004

Miscellaneous

UFSAR Sections 4.7, 6.4, 6.5, 11.9, 13.6, and 14.6.3
TS Sections 3.3.3.1, 3.3.5.1, 3.3.5.2, 3.5.1, 3.5.2, 3.5.3, and 3.6.2.2
TS Bases Sections B3.3.3.1 B3.3.5.1, B3.3.5.2, B3.5.1, B3.5.2, B3.5.3, and B3.6.2.2

1R21.23a Design

Drawings

2-47E610-73-1, Mechanical Control Diagram HPCI System, R041
2-47E610-71-1, Mechanical Control Diagram RCIC system, R036
2-45E626-1, RCIC Schematic Diagram, R016
2-45E626-2, RCIC Schematic Diagram, R019
2-45E626-3, RCIC Schematic Diagram, R028
2-45E626-4, RCIC Schematic Diagram, R018
2-47E813-1, Flow Diagram RCIC, R045
2-45E670-23, ECCS Div II Analog Trip Units Schematic Diagram, R011
0-45E710-1, Wiring Diagram Instr & Controls DC & AC Power System Key Diagram, Rev. 12
0-45E710-2, Wiring Diagram Instr & Controls DC & AC Power System Key Diagram, Rev. 13
2-45E714-2, 250V DC Reactor MOV Bd 2A Schematic Diagram, R028
2-730E928, Sheet 1, Elementary Diagram HPCI System, R023
2-730E928, Sheet 2, Elementary Diagram HPCI System, R022
2-730E928-3, Elementary Diagram HPCI System, R021
2-730E928, Sheet 4, Elementary Diagram HPCI System, R009
2-730E928, Sheet 5, Elementary Diagram HPCI System, R024
2-730E928-7, Elementary Diagram HPCI System, R011
2-730E928-8, Elementary Diagram HPCI System, R021
T-31376, HPCI Booster Pump Head Curve, 03/03/70
T-31341, HPCI Main Pump Head Curve, 03/20/70
67-M-4-47W309-1R0, Condensate Storage Tank, Rev. B
0-17W510-3, Mechanical Condensate, Demineralized Water and Misc Tunnel Piping, Rev.1
3-47E813-1, Flow Diagram RCIC System (unit 3), Rev. 45
2-47E812-1, Flow Diagram HPCI System (unit 2), Rev. 52
2-47W455-4, Mechanical HPCI System (unit 2), Rev. 6
0-47W455-1, Mechanical HPCI System (unit 2), Rev. 16
2-47W455-7, Mechanical HPCI System (unit 2), Rev. 3
2-47A370-71-20, Mechanical Limit Switch and MOV Data FCV-71-02, Rev. 3
2-47B370-2, Mechanical MOV Testing Requirements, Rev. 7
3-E20, Containment Vessel Sump Detail, Rev. 1
0-47W553-1, Mechanical Condensate Storage and Supply System, Rev. 2
0-47W455-4, Mechanical HPCI System, Rev. 4
2-47W452-2, Mechanical RHR System, Rev. 3
2-47E803-1, Mechanical Flow Diagram Reactor Feedwater, Rev. 37
2-47E803-5, Flow Diagram Reactor Feedwater System, Rev. 29

2-47E610-73-2, Mechanical Control Diagram HPCI Oil System, Rev. 14

Calculations

Calculation EDQ2073900076, 2-PS-73-1A, 2-PS-73-B, 2-PS-73-1C, and 2-PS-73-1D Setpoint and Scaling Calculation, Rev. 4
Calculation EDQ0073930038, Setpoint and Scaling Calculation for 1-LS-73-56A/B, 2-LS-73-56A/B, and 3-LS-73-56A/56B, Rev. 4
Calculation EDQ0073930037, 1-LS-73-57A/B, 2-LS-73-57A/B, 3-LS-73-57A/B, Rev. 2
Calculation ED-Q2073-910081, Setpoint and Scaling Calculation for Time Delay Relay 2-63-73-29-1 HPCI Pump Suction Low Pressure Trip, Rev. 1
Calculation ED-N0071-880276, Demonstrated Accuracy Calculation 1,2,3-PS-71-21A, Rev. 5
SSDs 2T-073-0002A/B/C/D/E/F/G-00-02, Rev. 2
MD-Q0073-920184, Analytical Limits for HPCI Suction Automatic Transfer to Suppression Pool for LS-73-56A, 56B, 57A, and 57B, Rev. 7
MD-Q2073-910103, MOV-2-FCV-73-44 Operator Requirements and Capabilities, Rev. 5
MD-Q2073-910095, MOV-2-FCV-73-16 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910092, MOV-2-FCV-71-39 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910083, MOV-2-FCV-71-08 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-87350, Reactor Core Isolation Cooling System Pump NPSHa, Rev. 4
ED-Q2073-910081, Setpoint and Scaling Calculation for Time Delay Relay on HPCI Pump Suction Low Pressure Trip, Rev. 1
MD-Q0071-910235, RCIC System Design Pressure/Temperature, Rev. 8
ND-Q0999-880163, Calculation of the Volume of the Drywell and the Suppression Pool (Wetwell), Rev. 2
EDQ0248870041, Calculation - 250 V DC Unit Battery Load Study, Rev. 27
EDQ0999890059, Station Blackout - Unit Battery Capacity, Rev. 23
EDQ2999880715, Thermal Overload Heater Calculations for MOVs, Rev. 27
EDQ0248870043, 250 VDC Voltage Drop Calculations - Battery Boards, Rev. 21
0-GI-280-2/103, Setpoint Document for Battery Board 2 250 VDC Bus ground Indicator, Rev. 14

Scaling and Setpoint Documents (SSDs)

SSD 2P-073-001B-00-02, Rev. 2
SSD 2P-073-001A-00-02, Rev. 2
SSD 2P-073-001D-00-03, Rev. 3
SSD 2P-073-001C-00-02, Rev. 2
SSD 2L-073-056A-00-02, Rev. 2
SSD 2L-073-056B-00-02, Rev. 2
SSD 2L-073-057B-00-02, Rev. 2
SSD 2L-073-057A-00-02, Rev. 2
SSDs 2T-073-0002A/B/C/D/E/F/G-00-02, Rev. 2

Completed Calibration Test Records

2-SR-3.3.6.1.5 (3 B/A), 2/17/04 2-SR-3.3.6.1.5 (3 B/A), ½5/04

2-SR-3.3.6.1.5 (3 B/C), 2/17/04	2-SR-3.3.6.1.5 (3 B/C), ¼4/04
2-SR-3.3.6.1.5 (3 B/B), 4/18/02	2-SR-3.3.6.1.5 (3 B/B), 2/18/04
2-SR-3.3.6.1.5 (3 B/D), 5/17/03	2-SR-3.3.6.1.5 (3 B/D), 2/18/04
2-SR-3.3.6.1.2 (3B), 12/17/04	
2-SR-3.3.5.1.3 (D), 12/19/03	2-SR-3.3.5.1.3 (D), 12/17/03
2-SR-3.3.5.1.3 (E), 3/11/04	2-SR-3.3.5.1.3 (E), 12/18/03
2-SR-3.3.5.1.5 (RWL A), 3/1/03	2-SR-3.3.5.1.5 (RWL A), 4/17/01
2-SR-3.3.5.1.5 (RWL B), 2/6/04	2-SR-3.3.5.1.5 (RWL B), 3/1/03
2-SR-3.3.5.1.5 (RWL C), 3/2/03	2-SR-3.3.5.1.5 (RWL C), 4/18/01
2-SR-3.3.5.1.5 (RWL D), 3/2/03	2-SR-3.3.5.1.5 (RWL D), 4/18/01
2-SR-3.3.5.1.5 (HPCI B), 2/24/03	2-SR-3.3.5.1.5 (HPCI B), 4/14/01
2-SR-3.3.5.1.5 (HPCI B), 10/28/99	2-SR-3.3.5.1.5 (HPCI D), 2/25/03
2-SR-3.3.6.1.5 (4 B/A), 2/9/04	2-SR-3.3.6.1.5 (4 B/A), 4/8/02
2-SR-3.3.6.1.5 (4 B/B), 2/10/04	2-SR-3.3.6.1.5 (4 B/B), 4/9/02
2-SR-3.3.6.1.5 (4 B/C), 2/9/04	2-SR-3.3.6.1.5 (4 B/C), 4/8/02
2-SR-3.3.6.1.5 (4 B/D), 2/10/04	2-SR-3.3.6.1.5 (4 B/D), 4/9/02
2-SR-3.3.5.1.5 (F), 3/12/03	2-SR-3.3.5.1.5 (F), 4/16/01
2-SR-3.3.6.1.5 (4 C/A), 4/23/03	2-SR-3.3.6.1.5 (4 C/A), 6/20/01
2-SR-3.3.6.1.5 (4 C/C), 6/20/01	

WO 00-008781-000, Calibrate Loop 2-F-73-33, 4/9/01
WO 02-006431-000, Calibrate Loop 2-F-73-33, 1/17/03
WO 02-006485-000, Calibrate Loop 2-PT-73-29-1, 1/13/03
WO 00-008671-000, Calibrate Loop 2-PT-73-29-1, 4/16/01
WO 99-000864-0001, Calibrate 2-PS-71-21A and 21B, 4/14/99
WO 02-006318-000, Calibrate 2-PS-71-21A and 21B, 11/6/02

Procedures:

MCI-0-073-PMP002, HPCI Booster Pump Disassembly, Inspection, Rework, and Reassembly, Rev. 13
MCI-0-071-TRB001, RCIC System Turbine Disassembly, Rework, and Reassembly, Rev. 18

Design Basis Documents:

BFN-50-7073, High Pressure Coolant Injection System, Rev. 15
BFN-50-7071, Reactor Core Isolation Cooling System, Rev. 10
T-31341, HPCI Main Pump Head Curve, Dated 04/24/1970
T-31376, HPCI Booster Pump Head Curve, Dated 03/03/1970

Miscellaneous:

NUREG/CR-5500, Reliability Study: High-Pressure Coolant Injection (HPCI) System, 1987-1993, Vol. 4
NUREG/CR-5500, Reliability Study Update: High-Pressure Coolant Injection (HPCI) System, 1987-2003, Vol. 4
NUREG/CR-5500, Reliability Study: Reactor Core Isolation Cooling System, 1987-1993, Vol. 7

NUREG/CR-5500, Reliability Study Update: Reactor Core Isolation Cooling System, 1987-2003, Vol. 7
NUREG-1715, Component Performance Studies: Turbine Driven Pumps, 1987-2003, Vol. 1
0-TI-443, Condition Monitoring of Check Valves, Rev. 2
18-006, SAR Change Package: Battery Capacity, Amendment No. 18
DCN-T41301, Modify BFN-2-FCV-71-0039 and BFN-3-FCV-71-0039, Rev. 2
RCIC Pump Oil Analysis Trend Information (oil reservoir), 1997-2004
HPCI Pump Oil Analysis Trend Information (oil reservoir), 1997-2004
BFN-VTD-B260-0080, Gear Coupling Installation Manual , Rev. 0
BFN-VTD-W016-0010, Installation and Lubrication of Waldron Standard A Couplings, Rev. 0
Federal Register Amendment Request from Columbia Generating Station regarding RCIC, Volume 69, Number 216, 11/09/04
DCN-61488, Add Fuses to Panel 9-39 to Resolve HPCI Temperatures, Rev. A
RIS 01-014, Position on Reportability Requirements for RCIC, 07/19/01
Federal Register Amendment request RCIC System Suppression Pool Water Level - hi (pump suction transfer), Volume 69, Number 51, 03/16/04
SER on GL95-07 Pressure Locking and Thermal Binding of Safety Related Power Operated Gate Valves Supplemental Response, 06/29/99
BFN-VTD-B580-0270, Byron Jackson Technical Service Bulleting for Flexible Couplings, Rev. 0
R08-990219-789, GL95-07 Pressure Locking and Thermal Binding of Safety Related Power Operated Gate Valves Supplemental Response, 02/19/99
BFN-VTD-T147-0030, Operations and Maintenance Instructions for Terry Model CCS HPCI Turbine, Rev. 14
BFN-VTD-B260-0080, Installation, Operation, and Maintenance on Multistage Horizontal Pumps, Rev. 0
BFN-VTD-B580-0030, Technical Instructions for Byron Jackson HPCI Pumps, Rev. 0
BFN-VTD-C665-0120, Crane Steel Valve Installation and Maintenance Manual, Rev. 2
BFN-VTD-C665-0050, Crane List 900 and List 150 Gate Valves, Rev. 6
BFN-VTD-W030-0110, Walworth Technical Manual for MOVs (unit 1& 2), Rev. 3
PCR-04001076, Step Change for RCIC Time Delay Relay Calibration Procedure, 08/20/04

Work Orders:

98011152-000, UFSAR update of pages affecting RCIC and HPCI,10/9/98
03016734-000, Replacement of high and low drain lines,12/17/03
02-009801-000, Replace actuator motor on 2-MOV71-3, 03/11/03
03-004108-000, Transfer switch is 90 degrees off, 3/8/03
03-006021-000, Hook temp drain hose to TV-610 and 611, 9/25/03

1R21.24a Testing and Inspection

Completed Surveillance Procedures

0-GOI-300-1, Attachment 15.3, Operations Tours, 1/10-26/2005
2-SR-2, Instruments Checks and Observations, 1/14-21/2005
2-SR-3.5.1.1 (HPCI), Maintenance of Filled HPCI Discharge Piping, 3/11/2004,

4/04/2004, 9/10/2004, and 12/15/2004
2-SR-3.5.1.1 (RCIC), Maintenance of Filled RCIC Discharge Piping, ½5/2004, 3/24/2004, 5/19/2004, and ½6/2005
2-SR-3.5.1.2 (HPCI), High Pressure Coolant Injection System Monthly Valve Position Verification, 1/01/2005
2-SR-3.5.3.2, Reactor Core Isolation Cooling System Monthly Valve Position Verification 12/04/2004

Calculations

MD-Q2073-910103, MOV-2-FCV-73-44 Operator Requirements and Capabilities, Rev. 5
MD-Q2073-910095, MOV-2-FCV-73-16 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910092, MOV-2-FCV-71-39 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910083, MOV-2-FCV-71-08 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-87350, Reactor Core Isolation Cooling System Pump NPSHa, Rev. 4

Work Orders:

02-009801-000, Replace actuator motor on 2-MOV71-3, 03/11/03
02-008103-000, Perform preventive maintenance inspection per MPI-0-000-ACT001, 07/24/02
98-006750-000, Re-torque valve 2-FCV-73-16 and perform current verification per ECI-0-000-MOV009, 06/12/98
03-024181-000, Replace packing in 2-FCV-73-16 HPCI turbine steam supply valve, 12/11/03
03-002779-000, HPCI packing exhauster local switch damaged, 2/21/03
03-006021-000, Hook temp drain hose to TV-610 and 611, 9/25/03
03-015064-001, RCIC lube oil cooling water valve operator, 03/20/04
02-009705-000, MOVATS of 2-MVOP-071-002, 03/03/03
99-001012-002, MOVATS of 2-MVOP-071-002, 04/28/99
00-011874-001, MOVATS of 2-MVOP-071-003, 04/03/01
98-014104-000, MOVATS of 2-MVOP-071-003, 05/01/99
01-000169-001, MOVATS of 2-MVOP-071-008, 04/23/02
98-015340-002, MOVATS of 2-MVOP-071-038, 05/01/99
99-007875-001, MOVATS of 2-MVOP-071-038, 03/27/01
99-007595-002, MOVATS of 2-MVOP-071-039, 03/27/01
99-001012-005, MOVATS of 2-MVOP-071-039, 04/25/99
02-008295-000, MOVATS of 2-MVOP-073-044, 03/04/03
00-009449-000, MOVATS of 2-MVOP-073-044, 01/18/01
W29831-002, MOVATS of 2-MVOP-073-040, 11/04/94
02-008294-000, MOVATS of 2-MVOP-073-040, 01/17/03
02-008292-000, MOVATS of 2-MVOP-073-016, 01/13/03
99-008592-001, MOVATS of 2-MVOP-073-016, 04/01/01
99-001012-009, MOVATS of 2-MVOP-073-036, 02/17/99
02-009769-000, MOVATS of 2-MVOP-073-036, 01/15/03
02-000354-000, MOVATS of 2-MVOP-073-002, 03/02/03
99-010316-000, MOVATS of 2-MVOP-073-002, 04/13/01
00-010237-000, MOVATS of 2-MVOP-073-003, 04/15/01

99-001012-008, MOVATS of 2-MVOP-073-026, 04/15/99
95-009768-000, MOVATS of 2-MVOP-073-027, 08/22/96
98-014200-002, MOVATS of 2-MVOP-073-035, 02/16/99
02-008539-000, MOVATS of 2-MVOP-073-038, 08/05/02
03-006021-000, Hook temp drain hose to TV-610 and 611, 9/25/03
03-015064-001, RCIC lube oil cooling water valve operator, 03/20/04
02-009705-000, MOVATS of 2-MVOP-071-002, 03/03/03
99-001012-002, MOVATS of 2-MVOP-071-002, 04/28/99
00-011874-001, MOVATS of 2-MVOP-071-003, 04/03/01
98-014104-000, MOVATS of 2-MVOP-071-003, 05/01/99
01-000169-001, MOVATS of 2-MVOP-071-008, 04/23/02
98-015340-002, MOVATS of 2-MVOP-071-038, 05/01/99
99-007875-001, MOVATS of 2-MVOP-071-038, 03/27/01
99-007595-002, MOVATS of 2-MVOP-071-039, 03/27/01
99-001012-005, MOVATS of 2-MVOP-071-039, 04/25/99
02-008295-000, MOVATS of 2-MVOP-073-044, 03/04/03
00-009449-000, MOVATS of 2-MVOP-073-044, 01/18/01
W29831-002, MOVATS of 2-MVOP-073-040, 11/04/94
02-008294-000, MOVATS of 2-MVOP-073-040, 01/17/03
02-008292-000, MOVATS of 2-MVOP-073-016, 01/13/03
99-008592-001, MOVATS of 2-MVOP-073-016, 04/01/01
99-001012-009, MOVATS of 2-MVOP-073-036, 02/17/99
02-009769-000, MOVATS of 2-MVOP-073-036, 01/15/03
02-000354-000, MOVATS of 2-MVOP-073-002, 03/02/03
99-010316-000, MOVATS of 2-MVOP-073-002, 04/13/01
00-010237-000, MOVATS of 2-MVOP-073-003, 04/15/01
99-001012-008, MOVATS of 2-MVOP-073-026, 04/15/99
95-009768-000, MOVATS of 2-MVOP-073-027, 08/22/96
98-014200-002, MOVATS of 2-MVOP-073-035, 02/16/99
02-008539-000, MOVATS of 2-MVOP-073-038, 08/05/02

Drawings:

T-31376, HPCI Booster Pump Head Curve, 03/03/70
T-31341, HPCI Main Pump Head Curve, 03/20/70
67-M-4-47W309-1R0, Condensate Storage Tank, Rev. B
0-17W510-3, Mechanical Condensate, Demineralized Water and Misc Tunnel Piping, Rev.1
3-47E813-1, Flow Diagram RCIC System (unit 3), Rev. 45
2-47W455-4, Mechanical HPCI System (unit 2), Rev. 6
0-47W455-1, Mechanical HPCI System (unit 2), Rev. 16
2-47W455-7, Mechanical HPCI System (unit 2), Rev. 3
2-47A370-71-20, Mechanical Limit Switch and MOV Data FCV-71-02, Rev. 3
2-47B370-2, Mechanical MOV Testing Requirements, Rev. 7
2-47E812-1, Flow Diagram HPCI System (unit 2), Rev. 52
3-E20, Containment Vessel Sump Detail, Rev. 1
0-47W553-1, Mechanical Condensate Storage and Supply System, Rev. 2

0-47W455-4, Mechanical HPCI System, Rev. 4
2-47W452-2, Mechanical RHR System, Rev. 3
2-47E803-1, Mechanical Flow Diagram Reactor Feedwater, Rev. 37
2-47E803-5, Flow Diagram Reactor Feedwater System, Rev. 29
2-47E610-73-2, Mechanical Control Diagram HPCI Oil System, Rev. 14

Procedures:

0-TI-443, Condition Monitoring of Check Valves, Rev. 2
2-OI-73, HPCI System Valve Lineup Checklist attachment 1, 04/26/01
2-OI-71, RCIC System Valve Lineup Checklist attachment 1, 04/15/01
2-SR-3.5.1.7, HPCI Main and Booster Pump Set Developed Head and Flow Rate Test at Rated Reactor Pressure, Rev. 35
2-SR-3.5.3.3, RCIC System Rated Flow at Normal Operating Pressure, Rev. 30
MCI-0-073-PMP002, HPCI Booster Pump Disassembly, Inspection, Rework, and Reassembly, Rev. 13
MCI-0-071-TRB001, RCIC System Turbine Disassembly, Rework, and Reassembly, Rev. 18
MPI-0-073-TRB001, HPCI Turbine Preventative Maintenance, Rev. 35
1-SR-3.8.4.1, Surveillance Procedure, Weekly Check for 250 Volt Main Bank Number 1 Battery, Performed on 1/11/05
2-SR-3.8.4.1, Surveillance Procedure, Weekly Check for 250 Volt Main Bank Number 2 Battery, Performed on 1/5/05
1-SR-3.8.6.2, Surveillance Procedure, Quarterly Check for 250 Volt Main Bank Number 1 Battery, Performed on 12/14/04
2-SR-3.8.6.2, Surveillance Procedure, Quarterly Check for 250 Volt Main Bank Number 2 Battery, Performed on 10/20/04
WO 04-718142-000, Work order to perform annual check on main battery bank 2, completed 9/24/04
WO 04-711209-000, Bank 1 completed 8/12/04

PERs:

57087, Failure to Follow Step 7.8.26 through 7.8.28 of PMI-0-73-TRB001
57303, 2-SE-73-51 was Badly Damaged due to Contact with EGR Drive Shaft Spur Gear
47519, Several HPCI Skid Mounted Instruments were Damaged During Outage
56238, SR-2-SR-3.6.1.3.5 step 7.6.17.6 should be Revised
54528, Faulty Pressure Indicator 2-PI-71-35A
65935, HPCI Turbine Casing Elevated Temperature

Components Reviewed

RCIC Pump 2-PMP-19
RCIC Turbine 2-TRB-9
HPCI Pump 2-PMP-73-54
HPCI Booster Pump 2-PMP-73-29

HPCI Turbine 2-TRB-73-54
RCIC Vacuum Relief Check Valves:
2-CKV-597, -598, -599, -600
HPCI Vacuum Relief Check Valves:
2-CKV-633, -634, -635, -636

1R21.31a Component Degradation

Calculations:

MD-Q2073-910103, MOV-2-FCV-73-44 Operator Requirements and Capabilities, Rev. 5
MD-Q2073-910095, MOV-2-FCV-73-16 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910092, MOV-2-FCV-71-39 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910083, MOV-2-FCV-71-08 Operator Requirements and Capabilities, Rev. 6

Miscellaneous:

BFN-VTD-T147-0030, Operations and Maintenance Instructions for Terry Model CCS HPCI Turbine, Rev. 14
BFN-VTD-B260-0080, Installation, Operation, and Maintenance on Multistage Horizontal Pumps, Rev. 0
BFN-VTD-C665-0120, Crane Steel Valve Installation and Maintenance Manual, Rev. 2
BFN-VTD-B580-0030, Technical Instructions for Byron Jackson HPCI Pumps, Rev. 0
BFN-VTD-C665-0050, Crane List 900 and List 150 Gate Valves, Rev. 6
CR-78-02, Proper Lubricating Oil for Terry Turbines, 04/78
TA Job #7458, Technical Associates of Charlotte: Vibration, Modal & ODS Analysis of Unit 2 RCIC safety Injection Pump, dated 09/04
BFNP-U3-HPCI Pump, Turbine, and Booster Pump Vibration Trends, 1997 through 2004
BFNP-U2-HPCI Pump, Turbine, and Booster Pump Vibration Trends, 1997 through 2004
BFNP-U3-RCIC Pump and Turbine Vibration Trends, 1997 through 2004
BFNP-U2-RCIC Pump and Turbine Vibration Trends, 1997 through 2004
RCIC Pump Oil Analysis Trend Information (oil reservoir), 1997-2004
HPCI Pump Oil Analysis Trend Information (oil reservoir), 1997-2004
BFN-VTD-B260-0080, Gear Coupling Installation Manual, Rev. 0
BFN-VTD-W016-0010, Installation and Lubrication of Waldron Standard A Couplings, Rev. 0
Nureg/CR-5500, Reliability Study: High-Pressure Coolant Injection (HPCI) System, 1987-1993, Volume 4
Nureg/CR-5500, Reliability Study Update: High-Pressure Coolant Injection (HPCI) System, 1987-2003, Volume 4
Nureg/CR-5500, Reliability Study: Reactor Core Isolation Cooling System, 1987-1993, Volume 7
Nureg/CR-5500, Reliability Study Update: Reactor Core Isolation Cooling System, 1987-2003, Volume 7
Nureg-1715, Component Performance Studies: Turbine Driven Pumps, 1987-2003, Volume 1
0-TI-443, Condition Monitoring of Check Valves, Rev. 2
M0061, Unit 3 RXB 519' Northwest Quad Radiological Surveys, from 1/9/04-1/12/05
M0083, Unit 2 RXB 519' Northwest Quad Radiological Surveys, from 1/12/04-12/23/04

M0001, Unit 3 RXB 519' HPCI Radiological Surveys, from 1/16/04-1/11/05
M0319, Unit 2 RXB 519' HPCI Radiological Surveys, from 1/14/04-12/21/02

Drawings:

2-47A370-71-20, Mechanical Limit Switch and MOV Data FCV-71-02, Rev. 3
2-47B370-2, Mechanical MOV Testing Requirements, Rev. 7
2-47E803-1, Mechanical Flow Diagram Reactor Feedwater, Rev. 37
2-47E803-5, Flow Diagram Reactor Feedwater System, Rev. 29

PERs:

67490, Potential Trend on Fenwal Temperature Switches
68019, IST Acceptance Criteria for Safety Related Pump IN-97-90
66235, 2-PS-071-0001C Failure
70410, Failure of Surveillance Requirement
39530, 2-SR-3.3.6.1.3 (4D) Failed Acceptance Criteria
44423, 3-MVOP-71-25 Stroke Time Increased
56385, 2-FCV-71-03 Increased Motor Running Current
53719, Identified Areas for Improved Human Performance Associated with HPCI Maintenance
56397, HPCI Equipment Degradation
49698, As Found Trip Point for 2-TS-71-02K Exceeded TS Limits
42085, Multiple Steam Leaks for 2-FCV-73-16

Work Orders:

03-015064-002, RCIC lube oil cooling water valve operator, 03/23/04
02-009801-000, Replace actuator motor on 2-MOV71-3, 03/11/03
03016734-000, Replacement of high and low drain lines,12/17/03
02-008103-000, Perform preventive maintenance inspection per MPI-0-000-ACT001, 07/24/02
98-006750-000, Re-torque valve 2-FCV-73-16 and perform current verification ECI-0-000-MOV009, 06/12/9
03-024181-000, Replace packing in 2-FCV-73-16 HPCI turbine steam supply valve, 12/11/03
03-019572-000, PT-71-04 and PI-71-4B have packing leaks, 10/23/03
03-023217-001 ,PT-71-04 and PI-71-4B have packing leaks, 11/02/04
03-015440-000, Adjust 2-RTV-071 packing to stop external leakage, 1/15/03
03-001451-000, RCIC lube oil cooling water leak, 7/14/03
04-711270-000, RCIC system CNDS test MEG VLV bad green socket, 2/6/04
03-016734-000, Replace high and low side drain tubes for 2-PDT-73-1A, 12/17/03
03-002779-000, HPCI packing exhauster local switch damaged, 2/21/03
02-000851-000, HPCI booster pump - repair oil leaks, 01/15/03
01-004758-000, Auxiliary steam supply shutoff valve leaks, 3/8/03
01-011198-000, Replace 2-PDT-73-1A, 01/15/03
01-TI-443, Condition Monitoring of Check Valves, Rev. 2

Components Reviewed

Unit batteries Nos 1 & 2 (1/11 & 13/05)
2-FCV-71-2, -3, -8, -9, -10
2-FCV-71-17, -18, -19, -36, -38, -39
2-FCV-73-2, -3, -16, -18, -19
2-FCV-73-26, -27, -40, -35, -36, -44
RCIC Pump 2-PMP-19
RCIC Turbine 2-TRB-9
HPCI Pump 2-PMP-73-54
HPCI Booster Pump 2-PMP-73-29
HPCI Turbine 2-TRB-73-54]
Condensate Storage Tanks CST-1, -2, -3, -4, -5
Steam Traps TRP71-9, -10
Steam Traps TRP73-5, -8
Steam Supply Drain Pot CPOT-5
Turbine Inlet Drain Pot MCP-73-5
Feedwater Check Valves: 2-CKV-554, -558, -568, -572

1R21.32a Equipment/Environmental Qualification

EDQ0073930038, Setpoint and Scaling Calculation for 1-LS-73-56A, 1-LS-73-56B, 2-LS-73-56A, 2-LS-73-56B, 3-LS-73-56A & 3-LS-56B, Rev. 4
Farwell & Hendricks, Inc. Report No. 10153, Seismic Qualification Report on Three Modified 17002-40 Thermoswitches and Mounting Brackets, Rev.0
ED-Q0999-880554, BFN Setpoint and Scaling Calculation for Temperature Switches 2-TS-73-2A thru S
Page B28 of Binder # BFN0EQ-ITS-001, Fenwal - Temperature Switches Summary Comparison of Test Conditions To Specified Conditions, Rev. 9

Drawings:

2-47E225-100, Harsh Environmental Data Drawing Series Index, Notes and References, Rev. 1
2-47E225-103, Harsh Environmental Data Elevation 519.0, Rev. 2
2-47E225-104, Harsh Environmental Data HELB Profiles - Room No. 1 Elevation 519.0, Rev. 2

Miscellaneous:

DCN-61488, Add Fuses to Panel 9-39 to Resolve HPCI Temperatures, Rev. A
10 CFR 50.49 List, Equipment Identification Matrix Report, Rev. 01.01

PERs:

67490, Potential Trend on Fenwal Temperature Switches
47609, HPCI Components Classified as Essential Mild may not Function

1R21.34a Component Inputs/Outputs

Calculations:

MD-Q2071-910092, MOV 2-FCV-71-39 Operator Requirements and Capabilities, Rev. 6
MD-Q2071-910083, MOV 2-FCV-71-08 Operator Requirements and Capabilities, Rev. 6
MD-Q2073-910103, MOV 2-FCV-73-44 Operator Requirements and Capabilities, Rev. 5
MD-Q2073-910095, MOV 2-FCV-73-16 Operator Requirements and Capabilities, Rev. 6

Work Orders:

02-008292-000, MOVATS of 2-MVOP-073-016, 01/13/03
99-008592-001, MOVATS of 2-MVOP-073-016, 04/01/01
01-000169-001, MOVATS of 2-MVOP-071-008, 04/23/02
99-001012-004, MOVATS of 2-MVOP-071-008, 04/14/99

1R21.35a Operator Experience

HPCI system auto-initiation inhibited due to turbine exhaust drain pot faulty level switch
LER 277-03005, Loss of HPCI function as a result of less than adequate check valve condition
HPCI system test valve seat cage detached from valve body
HPCI Test return line pressure pulse results in pipe support damage
LER 352-040420, Suction air voids create potential for temporary simultaneous loss of HPCI and RCIC Suction
NRC IN 97-90, Use of non-conservative acceptance criteria in safety related pumps' Surveillance Tests
LER 341-020108-1, HPCI pump response time slower than expected
LER 260-030316-1, HPCI inoperability due to loss of turbine speed feedback signal
HPCI inoperable after performing major maintenance
Procedure NADP-3, Managing the Operating Experience Program, Rev. 4
NRC IN 90-76, Failure of turbine overspeed trip mechanism because of inadequate spring tension
Work Order (WO) 03-005859-00, Verify resistance across EGM for U2 RCIC pump
MPI-0-073-TRB001, HPCI Turbine Preventive Maintenance, Rev. 35
WO 03-005857-00, Verify resistence across U# HPCI pump MPU
WO 03-004815-00, troubleshoot 2-FIC-73-33 (HPCI flow controller)

1R21.4a Identification and Resolution of Problems

PERs:

68019, IST Acceptance Criteria for Safety Related Pump IN-97-90
55067, Equation for Raising and Rotating Stem may be Inadequate
40720, Non-conservative Error in Calculated RCIC Turbine Steam Supply Pressure Drop

41021, RCIC System Pressure/Temperature Revise Based on GE SIL
62661, HPCI Temperature Calculation Error
64592, RCIC Turbine Trip OE Review
65935, HPCI Turbine Casing Elevated Temperature
66009, OE 18127 Review
55271, Unit 2 HPCI Maintenance Rule Unavailability
68019, IST Acceptance Criteria for Safety Related Pump IN-97-90
56399, During the Performance of MOVATs Testing, 2-FCV-71-02 was Found Backseated
61753, Inadvertent Switch Manipulation
64746, 3-TI-7145 Found Out of Tolerance
70410, Failure of Surveillance Requirement
39530, 2-SR-3.3.6.1.3 (4D) Failed Acceptance Criteria
71334, RCIC Inoperable
41930, Installed Test Instrumentation did not meet Testing Requirements
44423, 3-MVOP-71-25 Stroke Time Increased
56385, 2-FCV-71-03 Increased Motor Running Current
46900, 2-SR-3.3.6.1.6 (4) Step 1.2.3 should be Deleted or Revised
49589, Adverse Trend for Robertshaw Pressure Indicator
41186, Terry Turbine NMAC Guidelines not consistent with MSI-2/3-073-GOV001
49117, FCV-73-18 Time Delay was not within 4-6 Seconds
54354, RCIC Failed Quarterly Surveillance
53719, Identified Areas for Improved Human Performance Associated with HPCI Maintenance
56397, HPCI Equipment Degradation
50162, Adverse Trend for Valve Packing Associated with FCV-71-08

Work Orders:

01-004034-000, 2-LT-3-58D out of tolerance, 4/18/01
01-003919-000, 2-LT-3-208B out of tolerance, 4/16/01
03-003273-00, 2-LT-3-208B out of tolerance, 2/26/03
04-001078-000, 2-PS-071-0001C exceeded Tech Spec allowable value, 2/9/04
02-003785-000, 2-PS-071-0001C exceeded Tech Spec allowable value, 4/8/02
98-006750-000, Re-torque valve 2-FCV-73-16 and perform current verification per ECI-0-000-MOV009, 06/12/9
03-024181-000, Replace packing in 2-FCV-73-16 HPCI turbine steam supply valve, 12/11/03
03-015440-000, Adjust 2-RTV-071 packing to stop external leakage, 1/15/03
03-001451-000, RCIC lube oil cooling water leak, 7/14/03
03-002779-000, HPCI packing exhauster local switch damaged, 2/21/03
02-000851-000, HPCI booster pump - repair oil leaks, 01/15/03
01-004758-000, Auxiliary steam supply shutoff valve leaks, 3/8/03
01-004758-000, Auxiliary steam supply shutoff valve leaks, 3/8/03
04-711707-000, Replace 2-PS-71-1C, 11/3/04

PERs initiated due to this inspection

75618, Revise calculation ED-Q0999-880554-009 to correct errors.
75497, Evaluate need for PM on Battery board filter capacitors.
75560, I&C calculation ED-Q0999-880553-009 did not contain current set point information.
75575, Calculation ED-Q0248-870041 needs clarification of bases for minimum voltage values.
75599, Voltage drop computations in ED-Q2482-0020042 for Unit 1 are not compatible with similar Unit 2 calculation ED-Q02488-70043.
75674, Re-evaluate BFN battery testing surveillances.
75494, Adequacy of battery cell sediment/debris inspections.
75471, Critical thinking to support battery set point ground alarm values not documented.
75132, HPCI pump speed element amphenol not replaced per corrective action in PER 56048
74933, Error in drawing 2-45E670-23.