October 5, 2007

Mr. Christopher M. Crane
President and Chief Nuclear Officer
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BRAIDWOOD STATION, UNITS 1 AND 2
NRC COMPONENT DESIGN BASES INSPECTION (CDBI)
REPORT 05000456/2007009; 05000457/2007009(DRS)

Dear Mr. Crane:

On August 24, 2007, the U.S. Nuclear Regulatory Commission (NRC) completed a baseline inspection at your Braidwood Station. The enclosed report documents the inspection findings which were discussed on August 24, 2007, with Mr. T. Coutu and other members of your staff.

The inspection examined activities conducted under your license, as they relate to safety, and to compliance with the Commission's rules and regulations, and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel. Specifically, this inspection focused on the design of components that are risk significant and have low design margin.

Based on the results of this inspection, three findings of very low safety significance, which involved violations of NRC requirements were identified. However, because these violations were of very low safety significance, and because they were entered into your corrective action program, the NRC is treating the issues as Non-Cited Violations (NCVs) in accordance with Section VI.A.1 of the NRC's Enforcement Policy.

If you contest the subject or severity of an NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, U.S. Nuclear Regulatory Commission - Region III, 2443 Warrenville Road, Suite 210, Lisle, IL 60532-4352; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the Resident Inspector Office at the Braidwood Station.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any), 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), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Ann Marie Stone, Chief
Engineering Branch 2
Division of Reactor Safety

Docket Nos. 50-456; 50-457
License Nos. NPF-72; NPF-77

Enclosure: Inspection Report 05000456/2007009; 05000457/2007009(DRS)
w/Attachment: Supplemental Information

cc w/encl: Site Vice President - Braidwood Station
Plant Manager - Braidwood Station
Regulatory Assurance Manager - Braidwood Station
Chief Operating Officer
Senior Vice President - Nuclear Services
Vice President - Operations Support
Vice President - Licensing and Regulatory Affairs
Director Licensing
Manager Licensing - Braidwood and Byron
Senior Counsel, Nuclear, Mid-West Regional
Operating Group
Document Control Desk - Licensing
Assistant Attorney General
Illinois Emergency Management Agency
State Liaison Officer
Chairman, Illinois Commerce Commission

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Vice President - Operations Support
Vice President - Licensing and Regulatory Affairs
Director Licensing
Manager Licensing - Braidwood and Byron
Senior Counsel, Nuclear, Mid-West Regional Operating Group
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Letter to Mr. Christopher M. Crane from Ms. Ann Marie Stone dated October 2007

SUBJECT: Braidwood STATION, UNITS 1 AND 2
NRC COMPONENT DESIGN BASES INSPECTION (CDBI)
REPORT 05000456/2007009; 05000457/2007009(DRS)

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REGION III

Docket Nos:	50-456; 50-457
License Nos.	NPF-72; NPF-77
Report No:	05000456/2007009; 05000457/2007009(DRS)
Licensee:	Exelon Nuclear
Facility:	Braidwood Station, Units 1 and 2
Location:	Braceville, IL
Dates:	July 23, 2007 through August 24, 2007
Inspectors:	J. Jacobson, Senior Reactor Engineer, Lead Inspector T. Bilik, Reactor Engineer B. Jose, Reactor Engineer D. Schrum, Reactor Engineer L. Kozak, Senior Reactor Analyst C. Brown, Reactor Engineer J. Chiloyan, Electrical Contractor S. Traiforos, Mechanical Contractor
Approved by:	Ann Marie Stone, Chief Engineering Branch 2 Division of Reactor Safety

SUMMARY OF FINDINGS

IR 05000456/2007009; 05000457/2007009(DRS); 7/23/07 - 8/24/07; Braidwood Station; Component Design Bases Inspection.

The inspection was a 3-week onsite baseline inspection that focused on the design of components that are risk significant and have low design margin. The inspection was conducted by five regional inspectors and two consultants. Three Green Non-Cited Violations (NCVs) were identified. The significance of most findings are indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process (SDP)." Findings for which the SDP does not apply may be Green, or be assigned a severity level after NRC management review. 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. Inspector-Identified and Self-Revealed Findings

Cornerstone: Mitigating Systems

- Green. The inspectors identified a finding having very low significance and an associated NCV of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," related to the failure to establish a formal heat exchanger testing program capable of identifying an unacceptable condition of the safety related cubicle coolers. Specifically, prior to 2003, the licensee's program lacked formalized acceptance criteria. The current program did not provide guidance on how to translate design information into acceptance criteria or guidance on quantifying the results of the examinations.

  This issue was more than minor because if left uncorrected could result in an unacceptable evaluation of heat exchanger performance and would become a more significant safety concern. The issue was of very low safety significance because the results of recent inspections of cubical coolers showed that the coolers were operable. This finding has a cross-cutting aspect in the area of problem identification and resolution associated with the self and independent assessments (P.3(a)) because the licensee self-assessments were not comprehensive and of sufficient depth to identify the procedural/program deficiencies. (Section 1R21.3.b.1)

- Green. The inspectors identified a finding of very low safety significance involving a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," with regard to the licensee's heat exchanger examination procedure. Specifically, the procedure was inappropriate to ensure that the safety-related heat exchangers were satisfactorily inspected and evaluated. Upon discovery, the licensee initiated an evaluation to determine the operability of the affected heat exchangers.

  This issue was more than minor because if left uncorrected an inadequate testing program could result in a failure to identify inoperable room coolers and would become a more significant safety concern. The issue was of very low safety significance because an evaluation demonstrated continued operability of the heat exchangers. This finding

has a cross-cutting aspect in the area of human performance associated with work practices (H.4(c)) because the licensee did not provide adequate oversight of work activities, specifically, the licensee's process did not require verification by an independent individual. The program owner established the acceptance criteria and directly translated these onto the Inspection Forms. (Section 1R21.3.b.2)

- Green. The inspectors identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," having very low safety significance. Specifically, the inspectors determined that the licensee failed to identify that operability of the AFW pump room coolers would not be supported above 100°F and subsequently correct the condition when the allowable heat sink temperature was raised. The licensee performed a preliminary calculation and determined the coolers remained operable.

  The issue was more than minor because the inability to remove heat from the room could impact the functionality of instrumentation and components within the AFW system. The issue was of very low safety significance because the licensee performed a new calculation using a higher cubicle maximum temperature and demonstrated operability. The inspectors did not identify a cross-cutting aspect to this finding.(Section 1R21 3.b.3)

B. Licensee-Identified Violations

None.

REPORT DETAILS

1. REACTOR SAFETY

Cornerstone: Initiating Events, Mitigating Systems, and Barrier Integrity

1R21 Component Design Bases Inspection (71111.21)

.1 Introduction

The objective of the component design bases inspection is to verify that design bases have been correctly implemented for the selected risk significant components and that operating procedures and operator actions are consistent with design and licensing bases. As plants age, their design bases may be difficult to determine, and an important design feature may be altered or disabled during a modification. The Probabilistic Risk Assessment (PRA) model assumes the capability of safety systems and components to perform their intended safety function successfully. This inspectible area verifies aspects of the initiating events, mitigating systems, and barrier integrity cornerstones, for which there are no indicators to measure performance. Specific documents reviewed during the inspection are listed in the attachment to the report.

.2 Inspection Sample Selection Process

The inspectors selected risk significant components and operator actions for review using information contained in the licensee's PRA. The operator actions selected for review included actions taken by operators both inside and outside of the control room during postulated accident scenarios.

The inspectors performed a margin assessment and detailed review of the selected risk-significant components to verify that the design bases have been correctly implemented and maintained. This assessment considered operational, maintenance, and calculated design margin. Recent operations procedure changes as well as manual operator actions were considered for operational margin. Equipment reliability issues were also considered in the selection of components for detailed review. These included items such as failed performance test results, significant corrective action, repeated maintenance activities, maintenance rule (a)(1) status, components requiring an operability evaluation, NRC resident inspector input of problem equipment, system health reports, and the potential margin issues list. Consideration was also given to the uniqueness and complexity of the design, operating experience, and the available defense in depth margins. As practical, the inspectors performed walkdowns of the components to evaluate the as-built design and material condition. A summary of the reviews performed and the specific inspection findings identified are included in this report.

.3 Component Design

a. Inspection Scope

The inspectors reviewed the Final Safety Analysis Report (FSAR), Technical Specifications (TS), component/system design basis documents, drawings, and other available design basis information, to determine the performance requirements of the selected components. The inspectors used applicable industry standards, such as the American Society of Mechanical Engineers (ASME) Code, and the Institute of Electrical and Electronics Engineers (IEEE) Standards, to evaluate acceptability of the systems' design. The review was to verify that the selected components would function as required and support proper operation of the associated systems. The attributes that were needed for a component to perform its required function included process medium, energy sources, control systems, operator actions, and heat removal. The attributes to verify that the component condition and tested capability were consistent with the design bases and were appropriate included installed configuration, system operation, detailed design, system testing, equipment/environmental qualification, equipment protection, component inputs/outputs, operating experience, and component degradation.

For the components selected, the inspectors reviewed the maintenance history, system health report, and corrective action process documents. Walkdowns were conducted for accessible components to assess material condition and to verify the as-built condition was consistent with the design. Other attributes reviewed were included as part of the scope for each individual component.

The components (18 samples) listed below were reviewed as part of this inspection effort:

- 125 V Battery and Charger: The inspectors reviewed various electrical documents including battery load and sizing calculations, voltage drop calculations for the 4160V and 480V switchgear breaker control components, battery float and equalizing voltages, overall battery capacity, battery service test, modified performance discharge test , weekly battery surveillance tests, quarterly battery surveillance tests, electrical maintenance procedures, short circuit calculation for distribution panel, breaker interrupting ratings and electrical coordination.

  The inspectors also reviewed battery charger sizing calculation, testing data, and preventative maintenance documents.

- Component Cooling Water (CCW) Pump: The inspectors reviewed the CCW mechanical calculations, including the heat exchanger plugging limit analysis to ensure that design basis requirements were properly translated into testing and surveillance procedures. Following this assessment, the inspectors reviewed a sample of CCW pump work orders with an emphasis on the ASME/IST test performance results. The temperature analysis performed as part of the Power Uprate Project was also reviewed to ensure adequate heat removal. The inspectors also reviewed associated electrical calculations to confirm that the

design basis minimum voltage at the motor terminals would be adequate for starting and running the motor under design basis condition.

- Safety Injection Sump Suction Valve: The inspectors reviewed electrical calculations, drawings and equipment specifications to determine whether adequate voltage and current would be available at the pump motor terminals for starting and running under worst case design basis loading and grid voltage conditions and whether the motor capacity was adequate for the loading requirements.

- Charging Pump Discharge to Cold Legs Valve: The inspectors reviewed electrical calculations, drawings and equipment specifications to determine whether adequate voltage and current would be available at the pump motor terminals for starting and running under worst case design basis loading and grid voltage conditions and whether the motor capacity was adequate for the loading requirements.

- Transformer 131 and Bus 131X: The inspectors reviewed calculations, design basis descriptions, and drawings to verify that the loading of the Unit Substation Transformer (UST), the UST power supply breaker and the 480 Vac Bus was within the corresponding transformer and switchgear ratings. The inspectors reviewed design assumptions and calculations related to short circuit currents, voltage drop and protective relay settings associated with UST 131 and breaker trip settings associated with Bus 131X to verify that they were appropriate. The inspectors also reviewed operating procedures and design drawings to assess the adequacy of the ground detection design. The inspectors reviewed a sample of completed maintenance and functional verification testing results to verify that the power supply breaker associated with UST 131 and the cabling to Bus 131X were capable of supplying the power requirement of the 480 Vac Bus 131X during normal and postulated accident conditions. The inspectors performed a sample of independent short circuit and voltage drop calculations to verify that the values stated in the design bases documents were appropriate. The inspectors interviewed system engineers, and conducted a field walkdown of the 4160/480 Vac UST 131 and 480Vac Bus 131X to verify that equipment alignment and nameplate data was consistent with design drawings and to assess the material condition of the 4160/480 Vac UST 131 and the 480 Vac Bus 131X switchgear.

- 125 V Bus 111: The inspectors reviewed short circuit calculation for the distribution panel, breaker interrupting ratings and electrical coordination to ensure that coordination existed between the downstream and the upstream breakers.

- 4160 V Bus 141: The inspectors reviewed vendor specifications, nameplate data, one-line diagrams, calculations, design basis descriptions, drawings, calculations of short circuit, voltage drop, protective relay trip setpoints and ESF loading requirements to evaluate the capability of the 4160 Vac ESF Bus 141 and that of its power supply 345000/6900/4160 Vac System Auxiliary Transformer (SAT) 142-1 to supply the voltage and current requirements to one

train of ESF loads. The inspectors performed independent transformer and bus protective relay setpoint calculations to verify that the applied protective relay settings calculations had adequately accommodated for transformer being energized, through-faults, and maximum loading conditions. The inspectors also reviewed the rating of the transformer neutral grounding resistor to verify that is was adequate. The inspectors reviewed the results of completed 4160 Vac Bus 141 preventive maintenance and relay setpoint calibrations to verify that the test results were within their acceptable limits. The loss of voltage and degraded voltage relay settings were also reviewed to verify that they satisfied the requirements of Technical Specifications (TS) 3.8.1. Records of system voltage profiles were reviewed to verify that they were consistent with the design basis assumptions. The inspectors performed a visual inspection of the observable portions of the SAT and the associated neutral grounding resistors to assess the installation configuration and material condition. The inspectors also performed walkdowns of the 4160 Vac ESF Bus 141 to verify equipment alignment, that the installed local and remote circuit breaker control switches and breaker position indicating lights were consistent with design drawings and to assess the observable material condition.

- Emergency Diesel Generator (1A): The inspectors reviewed the Emergency Diesel Generator (EDG) loading calculations including voltage, frequency, current, and loading sequences during postulated loss of offsite power and loss of coolant accidents to verify the capability of the EDGs to perform their intended safety function. Short circuit calculations were reviewed to ensure that the ratings of the generator output breaker was adequate. The inspectors also performed independent calculations of available phase and ground short circuit currents to ensure that the maximum system short circuit duty was within equipment rating. Protective relay setpoint calculations and setpoint calibration test results were reviewed to assess the adequacy of protection during testing and emergency operations and to assure that excessive setpoint drift had not taken place. The generator grounding scheme was also reviewed to determine the adequacy of ground overcurrent relay coordination, grounding transformer and grounding transformer secondary resistor ratings. The electrical drawings and calculations that describe the generator output breaker control logic, the permissive and interlocks were reviewed to determine whether the breaker opening and closing control circuits were consistent with design basis documents. The inspectors also reviewed surveillance test results to verify that applicable test acceptance criteria and test frequency requirements for the EDGs were satisfied. The inspectors conducted a field walkdown of the electrical relay cabinets, output breaker control switches and breaker position indicating lights to assess material conditions and to verify that the installed configuration was consistent with system drawings. The inspectors also visited the control room to observe meter readings, switch positions, indicating lights and annunciator alarm panels associated with EDGs to verify that they were consistent with design basis documents and operating procedures. The inspectors also interviewed system engineers and discussed system performance and recent Issue Reports. The inspectors also reviewed ventilation requirements for the EDG room.

- Reactor Trip Breakers: The inspectors selectively reviewed the calculations supporting the trip settings and protection coordination as well as the licensee's preventive maintenance template for the circuit breakers, results of the latest trip testing, and related preventive maintenance and surveillance activities.

- Diesel Driven Auxiliary Feedwater (AFW) Pump Cubical Coolers: The inspectors reviewed calculations which was used as input to the cubicle cooler specifications and essential water requirements for the cubicle coolers. The inspectors also reviewed the calculation that determined the maximum number of tube circuits that could be plugged in the ESF Cubicle Coolers while maintaining the ability to remove the design basis cooling load from the affected cubicles. The inspectors also reviewed Engineering Change (EC) 343817, which listed the Visual Inspection Acceptance Criteria (VIAC) on the maximum number tube circuit blockage, for the Generic Letter (GL) 89-13 program. The inspectors reviewed the procedural and programmatic aspects of GL 89-13 program related to AFW cubicle coolers and reviewed the inspection and cleaning results.

- Motor Driven and Diesel Driven AFW Pumps: The primary review prompted parallel review and examination of the electrical support systems, such as power, instrumentation and controls. The inspectors reviewed electrical calculations, drawings and equipment specifications to determine whether adequate voltage and current would be available at the pump motor terminals for starting and running under worst case design basis loading and grid voltage conditions and whether the motor capacity was adequate for the loading requirements. Protective relay settings, motor feeder cable ampacity and cable short circuit current capability were also reviewed as part of the electrical review to determine whether appropriate electrical protection coordination margins had been applied and whether the feeder cable had been properly sized for the maximum available short circuit current capability requirements.

  The inspectors also reviewed piping and instrumentation diagrams and pump capacities for both the diesel driven and motor driven AFW pumps. Also, the inspectors reviewed various analysis and procedures, and associated with operation of the AFW pumps under transient, accident, and station blackout conditions. The analyses included hydraulic performance, net positive suction head (NPSH), minimum flow and deadheading calculations. Also Reviewed auxiliary feedwater pump suction pressure setpoint error analysis. Health reports and design change history was reviewed, to assess potential component degradation and impact on design margins. Inservice testing (IST) results were reviewed to verify acceptance criteria were met and performance degradation would be identified.

- Safety Injection Pumps: The primary review prompted parallel review and examination of the electrical support systems, such as power, instrumentation and controls. The inspectors reviewed electrical calculations, drawings and equipment specifications to determine whether adequate voltage and current would be available at the pump motor terminals for starting and running under worst case design basis loading and grid voltage conditions and whether the motor capacity was adequate for the loading requirements. Protective relay

settings, motor feeder cable ampacity and cable short circuit current capability were also reviewed as part of the electrical review to determine whether appropriate electrical protection coordination margins had been applied and whether the feeder cable had been properly sized for the maximum available short circuit current capability requirements.

The inspectors also reviewed piping and instrumentation diagrams and various analysis, including hydraulic performance under accident conditions during the ECCS injection mode; NPSH; minimum flow; and deadheading calculations. System health reports and IST results were reviewed to verify acceptance criteria were met and performance degradation would be identified.

- Residual Heat Removal Pump: The primary review prompted parallel review and examination of the electrical support systems, such as power, instrumentation and controls. The inspectors reviewed electrical calculations, drawings and equipment specifications to determine whether adequate voltage and current would be available at the pump motor terminals for starting and running under worst case design basis loading and grid voltage conditions and whether the motor capacity was adequate for the loading requirements. Protective relay settings, motor feeder cable ampacity and cable short circuit current capability were also reviewed as part of the electrical review to determine whether appropriate electrical protection coordination margins had been applied and whether the feeder cable had been properly sized for the maximum available short circuit current capability requirements.

  The inspectors also reviewed the NPSH calculation during the ECCS injection mode and during post-LOCA recirculation. The inspectors also reviewed surveillances to ensure instrument accuracy was considered, design basis requirements were properly translated, and results met acceptance criteria.

- Residual Heat Removal Pump Cubical Coolers: The inspectors reviewed calculations was used as input to the cubicle cooler specifications and essential water requirements for the cubicle coolers. The inspectors also reviewed the calculation that determined the maximum number of tube circuits that can be plugged in the ESF Cubicle Coolers while maintaining the ability to remove the design basis cooling load from the affected cubicles. The inspectors also reviewed Engineering Change (EC) 343817, which listed the Visual Inspection Acceptance Criteria (VIAC) on the maximum number tube circuit blockage, for the GL 89-13 program. The inspectors reviewed the procedural and programmatic aspects of GL 89-13 program related to AFW cubicle coolers and reviewed the inspection and cleaning results.

- Condensate Storage Tank (CST): The inspectors reviewed the calculations which supported the increased design basis for the CST usable volume and corresponding level. Consideration was given to the minimum height of the CST level required to avoid essential service water (SX) system switchover during a dual AFW pump start up. Increase of condensate storage volume to accommodate power uprate requirements was also considered.

- Essential Service Water Pump: The inspectors reviewed analyses, operating procedures, test procedures, and test results associated with operation of the SX pumps. The evaluation considered both test and accident conditions. The analyses included hydraulic performance, refueling water storage tank vortex limits, transfer to sump recirculation mode, NPSH, and minimum flow to the pumps. The inspectors reviewed completed tests to ensure that design basis requirements were correctly translated into test acceptance criteria and that the tests demonstrated the pump's capacity to perform its design basis required functions. Design change history and IST results were reviewed to assess potential component degradation and impact on design margins. The inspectors reviewed IRs related to these SX pump problems. In addition, the inspectors reviewed calculations demonstrating that adequate room cooling existed for the SX pumps.

  The inspectors reviewed the preventive maintenance tasks, corrective maintenance history, problem history, and operating history of SX Strainers to ensure that they were capable of performing their required functions under required condition. The inspectors reviewed strainer design requirements to ensure debris loading assumptions were consistent with industry guidance. The inspectors reviewed NPSH calculations for SX Pumps to ensure that the hydraulic pressure drop through the strainers was considered for design basis strainer debris loading. The inspectors reviewed periodic inspection program to ensure strainers were maintained in a clean condition. The inspectors reviewed operating and maintenance procedures associated with the service water strainers. In addition, the inspectors reviewed the IRs relating to the service water strainers.

- Component Cooling Water Heat Exchanger: The inspectors reviewed the history and physical condition and testing of the CCW Heat Exchangers. The surveillance test thermal performance requirements were reviewed to determine if they were consistent with design requirements. Calculations addressing the Byron/Braidwood Uprate project and tube plugging evaluations were also reviewed. The inspectors ensured that the design basis requirements were properly translated into operating procedures. The inspectors reviewed the IRs and calculations related to the incorrect installation of lube oil coolers for the 1A SX Pump and the 2A SX Pump.

- Refueling Water Storage Tank: The inspectors reviewed calculations and the licensee's recent mock-up testing results to determine the allowance for vortexing. The inspectors assessed the adequacy of pump suction respect to vortex limits and air entrainment and adequacy of pump suction with respect to the vortex limits.

  The inspectors reviewed calculations, drawings, and procedures associated with RWST Vacuum Breaker. The inspectors reviewed condition reports regarding vacuum breaker material condition and decisions made for this non-safety related component. The Inspectors reviewed radiological concerns, tank collapse from vacuum breaker failure, and NPSH for safety-related pumps during vacuum conditions in the RWST.

b. Findings

Three findings of very low safety significance with associated non-cited violations were identified by the inspectors. One unresolved item was also identified.

b.1 Inadequate Test Control for Safety Related Heat Exchangers

Introduction: The inspectors identified an NCV of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," having very low safety significance (Green) for failure to implement a Generic Letter 89-13 heat exchanger (HX) inspection program capable of identifying an unacceptable conditions with safety related cubicle coolers.

Description: The inspectors reviewed the licensee's program for maintaining and inspecting heat exchangers and identified the following concerns:

- In response to Generic Letter (GL) 89-13,"Service Water System Problems Affecting Safety-Related Equipment," the licensee committed to conduct performance test or inspection on safety related heat exchangers cooled by open cycle service water to ensure that each heat exchanger was capable of performing its required safety function. The inspectors noted that in the mid-1990s, the licensee modified the program from conducting performance tests to inspection and cleaning; however, the licensee could not locate the justification to support the transition for the 22 cubicle coolers in the GL 89-13 program.

- Prior to 2003, the licensee did not establish visual inspection acceptance criteria for safety related HX inspections. A review of previous inspection documentation showed that in 1998, four safety related HXs were fouled beyond the current visual inspection acceptance criteria. It appears that at the time of the HX inspections, operability of the HX was based on translating the ratio between the required thermal acceptance criteria and the manufacturer's rating into a "clean" percentage. The heat exchangers have since been inspected and therefore, no current operability concerns exist.

- The inspectors noted that EC 343817 "Heat Exchanger Visual Inspection Acceptance Criteria," listed the number of "circuits" (group of heat exchanger tubes) that were permitted to be plugged for a given cubicle cooler heat exchanger and that the licensee translated this information onto Inspection Forms. However, the inspectors identified that the licensee's program did not provide guidance on how to translate the number of tubes plugged (observed during the heat exchanger inspection) into the number of circuits allowed to be plugged (VIAC). The inspectors identified discrepancies in determining the number of tubes vs. circuits that could be plugged, in the calculation of percentage of tubes or circuits plugged, or writing the wrong acceptance criteria on several Inspection Forms.

- The inspectors also noted that the heat exchanger program owner relied on personal judgement in quantifying the results of the examinations and had not translated this knowledge into the procedure. In addition, the inspectors noted that the training program used to certify an examiner of the heat exchangers

(ENANPG18CG) did not include training on how to determine the extent of fouling of a heat exchanger or a plugged circuit.

The licensee issued IR 0063670 to address these issues. The licensee performed a review of those cubical coolers that used the wrong VIAC and concluded that the coolers were operable.

Analysis: The inspectors determined that the failure to establish a formal heat exchanger testing program capable of identifying an unacceptable condition of the safety related cubicle coolers was a performance deficiency and a finding. The inspectors further determined that the issue was within the licensee's ability to foresee and correct, and that it could have been prevented. The inspectors concluded that the finding was more than minor in accordance with IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," because the finding affected the Mitigating Systems Cornerstone and if left uncorrected, could result in an incorrect evaluation of heat exchanger performance, thus, operability and would become a more significant safety concern.

The inspectors performed a IMC 0609, Appendix A, Phase 1 screening. The finding screened as as having very low safety significance (Green) because the results of recent inspections of cubical coolers showed that the coolers were operable, therefore, did not represent an actual loss of function; did not result in exceeding a TS allowed outage time; and did not affect external event mitigation.

This finding has a cross-cutting aspect in the area of problem identification and resolution associated with the self and independent assessments because the licensee self-assessments were not comprehensive and of sufficient depth to identify the procedural/program deficiencies. Specifically, during a self-assessment (FASA 441886-02 "Generic Letter 89-13 Program: NRC Heat Sink Inspection") conducted in September 2006, the licensee did not identify this issue. (P.3(a))

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion XI, "Test Control," requires, in part, that a test program shall be established to assure that all testing required to demonstrate that components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents.

Contrary to the above, as of August 24, 2007, the licensee failed to establish an HX testing or inspection program capable of identifying an unacceptable condition of the safety related cubicle coolers. Specifically, (1) prior to 2003, the licensee did not establish visual inspection acceptance criteria for safety related HX inspections; and (2) the current program did not provide guidance on how to translate design information into acceptance criteria or guidance on quantifying the results of the examinations. Because this violation was not willful, was of very low safety significance, and was entered into the licensee's corrective action program (IR 0063670), this violation is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy (NCV 05000456/2007009-01(DRS) 05000457/2007009-01(DRS))

b.2 Inadequate Procedures to Implement Generic Letter 89-13 Program

Introduction: The inspectors identified an NCV of 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," having very low significance (Green) related to an inadequate safety-related heat exchanger examination procedure. Specifically, a review of cubicle cooler test/inspection documents identified errors in the application of visual inspection acceptance criteria (VIAC).

Description: The inspectors reviewed documents related to the maintenance and inspection of heat exchangers. The inspectors determined that the licensee used heat exchanger tube sheet drawings to determine the number of circuits/tubes (water paths) in each specific cubical cooler. The inspectors noted that EC 343817 "Heat Exchanger Visual Inspection Acceptance Criteria," listed the number of "circuits" (group of heat exchanger tubes) that were permitted to be plugged for a given cubicle cooler heat exchanger to ensure the design basis function. Cubicle cooling tube plugging had been evaluated in EC 336446, "Cubical Cooler Tube Plugging." The licensee evaluated this data and documented the visual inspection acceptance criteria (VIAC) for each heat exchanger inspection in BwVP 859-15 "Generic Letter 89-13 Heat Exchanger As-Found Inspection and Work Report," Revision 4.

The inspectors identified through a records review that the licensee had incorrectly translated the performance acceptance criteria listed in EC 343817 into BwVP 859-15 for several heat exchangers. For example, the VIAC for the 1B core spray pump cubicle cooler was incorrectly translated into the BwVP 859-15 Inspection Form resulting in a non-conservative acceptance criteria. The inspectors also noted that for cubicle coolers, the VIAC was expressed in terms of blocked circuits whereas other heat exchanger's VIACs were expressed in number of tubes. This resulted in discrepancies in determining the number of circuits which were plugged in several other heat exchangers.

As a result of the inspectors' discovery of the errors, the licensee re-evaluated the results of the examinations of all of the affected heat exchangers. While several additional errors, including those noted above, were discovered, none of the results exceeded the allowable plugging limit criteria. The inspectors determined that procedure BwVP 859-15 did not contain appropriate quantitative or qualitative acceptance criteria to determine operability of the safety-related heat exchangers. The licensee initiated AR 663664 to revise the examination procedure to prevent the reoccurrence of these errors.

Analysis: The inspectors determined that the failure to correctly translate the performance acceptance criteria into the inspection plan for several safety related cubicle coolers was a performance deficiency warranting a significance evaluation. This inadequacy led to the licensee incorrectly listing the acceptance criteria for several heat exchanger examinations and incorrectly determining the number of plugged circuits in several others. The finding was not similar to any of the examples in Appendix E in IMC 0612. The inspector concluded that the finding was more than minor in accordance with IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," because the finding affected the Mitigating Systems Cornerstone and if left uncorrected, could result in an incorrect evaluation of heat

exchanger performance, thus, operability and would become a more significant safety concern.

The inspectors completed a significance determination of this finding using IMC 0609, Appendix A, "Significance Determination of Reactor Inspection Findings for At - Power Situations." The inspectors answered "no" to all five screening questions in the Phase 1 Screening Worksheet under the Mitigating Systems column. The inspectors concluded that the safety-related room coolers remained operable based on the licensee's re-evaluation. Therefore, the finding screened out as having very low safety significance or (Green).

This finding has a cross-cutting aspect in the area of human performance associated with work practices because the licensee did not provide adequate oversight of work activities. Specifically, the acceptance criteria for several safety related cubicle coolers was not correctly documented into procedures because the licensee's process did not require verification by an independent individual. The program owner established the acceptance criteria and directly translated these onto the Inspection Forms. (H.4(c))

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," requires that activities affecting quality be prescribed by documented procedures and shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

Contrary to the above, prior to August 24, 2007, BwVP 859-15 "Generic Letter 89-13 Heat Exchanger As-Found Inspection and Work Report," Revision 4 did not contain appropriate quantitative or qualitative acceptance criteria to determine operability of the safety-related heat exchangers. Once identified, the licensee entered the finding into their corrective action program and re-evaluated operability. Because this violation was of very low safety significance and it was entered into the licensee's corrective action program, this violation is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy (05000456/2007009-02(DRS); 05000457/2007009-02(DRS)).

b.3 Failure to Take Corrective Action

Introduction: The inspectors identified a Non-Cited Violation of 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," having very low safety significance (Green). Specifically, in an approved calculation, the licensee concluded that the diesel driven auxiliary feedwater pumps cubicle coolers would not be capable of removing the design cooling loads if the maximum allowable ultimate heat sink temperature was raised to 100 degrees Fahrenheit (°F). The ultimate heat sink temperature was subsequently raised to 100 °F and this calculation was used to establish the plugging limits of the various pump cubicle coolers, including the diesel driven AFW pumps cubicle coolers.

Description: Calculation BRW-00-0030-M, Revision 0, dated February 11, 2000 determined the maximum number of tube circuits that could be plugged in the ESF cubicle coolers while maintaining the ability to remove the design basis cooling load from the affected cubicles. This determination was performed for two values of SX inlet temperatures of 99.3 °F and 100.3 °F corresponding to maximum Ultimate Heat Sink

(UHS) temperatures following a Loss-of-Coolant Accident (LOCA). The assumed fouling factor was 0.0025, a more realistic value as compared to the originally assumed design fouling of 0.0015. The calculation was also used to determine the allowable loss of tube wall thickness.

The calculation concluded that in case of SX inlet temperature of 100.3 °F, which corresponded to a maximum UHS temperature of 100°F, the two AFW cubicle coolers, 1VA08S and 2VA08S, for the two diesel driven AFW pumps, and the two containment spray (CS) cubicle coolers, 1VA03SB and 2VA03SB, were not capable of removing the design cooling load from the affected pump room, with all tube circuits functional, no tubes plugged. At the time the calculation was prepared, the maximum allowable UHS temperature had not been raised to 100°F. However, in July 2000, the maximum allowable UHS temperature was raised to 100°F. The licensee failed to realize the significance of the above conclusions and take required actions. When the licensee established the visual inspection acceptance criteria, the licensee misinterpreted the results of the calculation and established an acceptance criteria of 0 tubes plugged. The licensee should have recognized that the heat exchangers would not be operable regardless of the number of tubes plugged.

In December 2002, the licensee performed a subsequent minor revision 000B to BRW-00-0030-M and raised the maximum CS cubical room temperature from 122°F to 130°F. The calculated allowable number of tubes/circuits that could be plugged in the CS pump cubicle coolers was modified to three. A similar calculation for the diesel driven AF Pump cubicle coolers was not performed at that time.

To address the above concerns, the licensee initiated IR 00662453, “Calculation Enhancement Required to Support CDBI.” Upon identification and during the inspection, the licensee performed a calculation using a higher cubicle maximum temperature and demonstrated operability.

Analysis: The inspectors determined that the failure to identify that operability of the AFW pump room coolers would not be supported above 100°F was a performance deficiency and was contrary to 10 CFR Part 50, Appendix B, Criterion XVI, “Corrective Actions.” Furthermore, the inspectors determined that the licensee had many opportunities to address this issue, specifically in December 2002 when the licensee addressed a similar issue for two CS cubicle coolers.

The inspectors determined that the performance deficiency was more than minor in accordance with IMC 0612, Appendix B, “Issue Screening,” because the finding was affected the Mitigating Systems cornerstone objective and attribute of equipment performance of ensuring the availability, reliability, and capability of the AFW system. Specifically, the inability to remove heat from the room could impact the functionality of instrumentation and components within the AFW system. The inspectors evaluated the finding using IMC 0609, “Significance Determination Process,” Appendix A, Phase 1 screening. The finding screened as Green because it was not a design issue, did not represent an actual loss of a system safety function, did not result in exceeding a technical specification allowed outage time, was not an actual loss of non-safety-related equipment and did not affect external event mitigation. Specifically, the licensee

performed a calculation using a higher cubicle maximum temperature and demonstrated operability of the coolers.

The inspectors did not identify a cross-cutting aspect for this finding because the failure to identify the condition occurred in 2000 and in 2002.

Enforcement: Title 10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action" requires in part that the licensee establish measures to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and non-conformances are promptly identified and corrected, for those systems, structures and components covered under 10 CFR Part 50, Appendix B.

Contrary to the above from July 2000 to August 2007, a condition adverse to quality was not identified and corrected by the licensee. Specifically, the inspectors determined that in February 2000, the licensee failed to identify that the diesel driven AFW pump cubicle coolers, 1/2VA08S, were not capable of removing the design cooling load if the UHS temperature was raised to 100°F and failed to take corrective actions in July 2000 when the maximum allowable UHS temperature was raised to 100°F. Furthermore, the inspectors determined that the licensee had many opportunities to address this issue considering that in December 2002, the licensee addressed a similar issue for two containment spray cubicle coolers.

Because the issue was determined to be of very low safety significance, and because the licensee subsequently entered this issue in its corrective action program as AR 00662453, this violation is being treated as an NCV, consistent with Section VI.A of the NRC Enforcement Policy (NCV 05000456/2007009-03(DRS); 05000457/2007009-03(DRS))

b.4 Non-Conservative Pump Power Supply Cables Short Circuit Current Capability

Introduction: The inspectors identified an unresolved item related to the residual heat removal (RHR) and safety injection (SI) pump motor power supply cables short circuit current capabilities. Specifically, the licensee did not have formal documentation to demonstrate that cable damage resulting from maximum available short circuit currents will not compromise the integrity of other cables in common raceways.

Description: The power supply cables for the RHR and SI motors consist of 3C/No. 2 insulated copper conductors and share a common raceway. The magnitude and duration of the calculated maximum short circuit currents during postulated electrical faults at the motor terminals were compared with the cable time versus current damage curve to assess the short circuit current capability of the cable. This examination identified that the cable short circuit current capability was lower then the required capability to assure cable damage would not take place for faults at the motor terminals. Specifically, the review of the short circuit current capability curves indicated that the safe short circuit withstand time of the No. 2 copper cables for the calculated available fault currents is between 1 and 2 cycles. Review of the applied protective relaying and breaker tripping indicated that it would take between 5 and 6 cycles to isolate a postulated electrical fault at the RHR or at the SI motor terminals. The inspectors concluded that the fault clearing time exceeded the cable short circuit current carrying

capability. The inspectors learned that the licensee had recognized that the RHR and SI cables were undersized for the short circuit current capability requirements and had adapted the practice of replacing these cables following electrical faults either the RHR or SI motor terminals.

The inspectors reviewed the Sargent and Lundy (S&L) cable sizing acceptance criteria, Standard ESC-193 the licensee had used, and determined that the RHR and SI motor power supply cables were sized in accordance with the stated cable sizing acceptance criteria. The S&L cable sizing criteria required that the No. 2 cables of certain lengths be replaced in the event they carry short circuit currents during electrical faults at the motor terminals. The S&L Standard ESC-193 made reference to test results to support the acceptability of the licensee's use of No. 2 size cables for the 4160 Vac power supplies to the RHR and SI pump motors. However, the S&L test data was not available for review. The licensee provided a preliminary calculation results which indicated that the No. 2 cables could withstand electrical faults for up to 90 seconds before compromising the functional capability of other cables in common raceways. This issue is considered an Unresolved Item (URI 05000456/2007009-04(DRS); 05000457/2007009-04(DRS)) pending the inspectors' review of the test data or final licensee calculation.

.4 Operating Experience

a. Inspection Scope

The inspectors reviewed five operating experience issues (5 samples) to ensure these issues, either NRC generic concerns or identified at other facilities, had been adequately evaluated and addressed by the licensee. The following Information Notices (IN) were reviewed as part of this inspection effort:

- IN 2006-03 Motor Starter Failures;
- IN 2006-05 Possible Defect in Bussmann KWN-R and KTN-R;
- IN 2005-18 Forsmark Loss of External Power and Loss of Power Supply from 2 of 4 EDGs;
- IN 2005-21 Plant Trip and Loss of Preferred AC Power from Inadequate Switchyard Maintenance; and
- IN 2006-18 Forsmark 1, Loss of External Power and Loss of Power Supply from 2 and 4 Diesel Generators; AR 520869.

b. Findings

No findings of significance were identified.

.5 Modifications

a. Inspection Scope

The inspectors reviewed three permanent plant modifications related to selected risk significant components to verify that the design bases, licensing bases, and performance capability of the components have not been degraded through modifications. The modifications listed below were reviewed as part of this inspection effort:

- EC 41447, “Change to the DC Busses to Facilitate Battery Testing”;
- EC363874, “Change to Ultra Low Sulfer Diesel Fuel (ULSD)”; and
- EC354365, “Permanently Remove Valve 1SX101A Which is Currently Failed Open” With Internals Removed Per TCCP EC 351271.”

b. Findings

No findings of significance were identified.

.6 Risk Significant Operator Actions

a. Inspection Scope

The inspectors performed a detailed review of six risk significant, time critical operator actions (six samples). These actions were selected from the licensee’s PRA rankings of human action importance based on risk achievement worth (RAW) values. Where possible, operator response time criteria were determined by the review of the assumed design basis and UFSAR response times and performance times documented by job performance measures results. For the selected operator actions, the inspectors observed simulator performance of associated procedures with plant operator’s to assess operator’s knowledge level, adequacy of procedures, and use of any special equipment required. The following operator actions were reviewed:

- Actions to realign charging system suction from the volume control tank to the refueling water storage tank;
- Actions to open the pressurizer power-operated relief valves, bleed and feed the primary system, and initiate safety-injection;
- Actions to establish steam generator feed with the start-up pump;
- Actions associated with the failure to identify and isolate a steam generator tube rupture, also were observed in the simulator and in the plant;
- Actions to establish reactor coolant system cooldown post steam generator tube rupture; and

- Actions to establish high-head ECCS recirculation, observed in the simulator and in the plant.

b. Findings

No findings of significance were identified.

4. OTHER ACTIVITIES (OA)

4OA2 Problem Identification and Resolution

.1 Review of Condition Reports

a. Inspection Scope

The inspectors reviewed a sample of the selected component problems that were identified by the licensee and entered into the corrective action program. The inspectors reviewed these issues to verify an appropriate threshold for identifying issues and to evaluate the effectiveness of corrective actions related to design issues. The specific corrective action documents that were sampled and reviewed by the inspectors are listed in the attachment to this report.

b. Findings

No findings of significance were identified.

4OA6 Meeting(s)

.1 Exit Meeting Summary

The inspectors presented the inspection results to Mr.T. Coutu and other members of licensee management at the conclusion of the inspection on August 24, 2007. Proprietary information was reviewed during the inspection and was handled in accordance with NRC policy.

ATTACHMENT: SUPPLEMENTAL INFORMATION

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee
T. Coutu, Site Vice President
P. Summers, Work Control Manager
C. Ingold, Shift Manager
D. Gullott, Regulatory Assurance Manager
G. Golwitzer, Site CAP Manager
M. Smith, System Engineering
D. Riedinger, Electrical and I&C Design Manager
R. Wolen, Design Engineering Manager
C. Furlow, Design Engineering
R. Koenig, Design Engineering
S. Matthews, Design Engineering
R. Clemens, Programs Engineering
R. Geslor, Corporate Engineering
B. Perchiazz, Design Engineering (Byron)
R. Larsen, Maintenance
M. Perry, IEMA Inspector

NRC
L. Kozak, Senior Reactor Analyst
S. Ray, Senior Resident Inspector
G. Roach, Resident Inspector
A. Stone, Chief, Engineering Branch 2

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

05000456/2007009-01; 05000457/2007009-01	NCV	Inadequate Test Control for Safety-Related Heat Exchangers (Section 1R21.3.b.1)
05000456/2007009-02; 05000457/2007009-02	NCV	Inadequate Safety-Related Heat Exchanger Examination Procedure(Section 1R21.3.b.2)
05000456/2007009-03; 05000457/2007009-03	NCV	Failure to Take Corrective Action (Section 1R21.3.b.3)

Opened

05000456/2007009-04; 05000457/2007009-04	URI	(Section 1R21.3.b.4)

LIST OF DOCUMENTS REVIEWED

The following is a list of licensee documents reviewed during the inspection, including documents prepared by others for the licensee. Inclusion on this list does not imply that NRC inspectors reviewed the documents in their entirety, but rather that selected sections or portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document in this list does not imply NRC acceptance of the document, unless specifically stated in the inspection report.

CALCULATIONS

Number	Description or Title	Date or Revision
19-AQ-68	Division Specific Degraded Voltage Analysis	Revision. 6
19-AU-15	Modeling Transformers for AC-ELMS	Revision. 0
19-AN-3	Protective Relay Settings for 4.16 KV ESF Switchgear	Revision.16
19-AN-29	Second Level Undervoltage Relay Setpoint	Revision. 2
19-AN-5	Diesel Generator Protective Relay Settings	Revision. 3
19-T-1	Edg Neutral Grounding Resistor	Revision. 1
19-T-6	Diesel Generator Loading During LOOP/LOCA	Revision. 6
19-AQ-24	Voltage Drop on 480-120VAC Control Transformer Circuits	Revision. 7
19-AU-4	480 V Unit Substation Breaker and Relay Settings	Revision. 18D
BRW-96-348-E	Ampacity Analysis for Specific Fire Wrapped Raceway/Cable Tray Routing Points	Revision. 6
BRW-97-0472-E	125 Vdc Voltage Drop Calculation	Revision. 0
BRW-97-0474-E	125 V DC System Short Circuit Calculation	Revision. 2
BRW-98-0644-E	Ampacity Analysis of Additional Fire Wrapped Cable Tray Routing Points	Revision. 0
BRW-98-0719-E	Motor Operated Valves (MOV) Actuator Motor Terminal Voltage and Thermal Overload Sizing Calculation–Containment Spray (CS) System	Revision. 0
BRW-98-0723-E	Motor Operated Valves Actuator Motor Terminal Voltage and TOL Sizing Calculation-Safety Injection System	Revision. 0

CALCULATIONS

Number	Description or Title	Date or Revision
VA-102	Auxiliary Building Energy Load Calculation for Elevations 330', 346', 364', 383', 401', and 426' in Abnormal Condition	Revision 0
VA-100	ESF Pump Cubicle Energy Calculation	Revision 4
CQD-040092	Demonstrating Functionality of Non-Safety-Related Vacuum Relief Device on RWST	Revision 00
BRW-04-0005-M	RHR, SI, CV, and CS Pump NPSH During ECCS Injection Mode	Revision 1
PMDF-SX-01	Reduction in Design Pressure; SX Lines	Revision 0
PMDF-SX-02	SX System Over-pressure (NCR 8371)	Revision 0
SX2-85	SX Pump Head Check	Revision 0
BRW-97-1072-M	Component Cooling Heat Exchanger Tube Plugging Evaluation	Revision 0
BRW-95-218	Evaluation of Essential Service Water Pump Operation with Degraded Lube Oil Coolers	11/10/1995
BYR95-074	SI Pump Bearing Oil Cooler Evaluation	10/19/1995
BRW-07-0085	Determination of the Correlation for the Critical Submergence Height (Vortexing) for the RWST	Revision 0
BRW-97-0665-M	ECCS Pumps NPSH Verification Following a Failure of the RWST Vent Line	7/07/1997
NED-H-MSD-9	Heat Exchanger Effectiveness Curves for Auxiliary Building Cubicle Coolers	Revision 5
BRW-00-0030-M	Cubicle Cooler Tube Plugging Evaluation	Revision 0C
SX 1-85	Essential Service Water Pumps Net Positive Suction Head Available	Revision 1
BRW-96-037	Endurance Evaluation of SX Pumps	Revision 1
88-0169	Fuel Pool Storage Tank and NPSH	Revision 000
BRW-96-036	Essential Service Water Pump Suction and Discharge Pressure Gauge Accuracy	3/16/1996

CALCULATIONS

Number	Description or Title	Date or Revision
BRW-00-0017-M	Byron/Braidwood Uprate Project - Post LOCA Component Cooling Water System Temperature Analysis	Revision 1
Calc. No. 8.1.163	RWST Design for Differential Pressure	1/9/1988
UHS-03	Effects of 110F SX Temperature on Various Equipment	Revision 0
Calc. No. 8.1.163	RWST Design for Differential Pressure	1/9/1988
BRW-97-1072	Component Cooling Heat Exchanger Tube Plugging Evaluation	7/28/2004
NED-M-MSD-042	Essential Service Water Pump NPSH Check – Two Forebay Operation	10/30/1992

ENGINEERING DOCUMENTS

Number	Description or Title	Date or Revision
EC350195	Determine NPSH Requirements are Met for the ECCS and CS Pumps Taking Suction From the RWST During the ECCS Injection Phase	
EC 344306	1B Auxiliary Feedwater Pump Monitoring System	
EC 344318	Seismic Evaluation for the Relocation of the AF Diesel Governor Oil Reservoir	
EC 42652	Revise RSO for Installation of Amptector 1A Trip Units	
EC347340	Revise ECCS Pump NPSH and Boron Dilution Calculations	
EC 354365	Permanently Remove Valve 1SX101A Which is Currently Failed “Open” With Internals Removed Per TCCP EC 351271	8/31/05
EC 339308	Acceptance Criteria for As-Found Heat Exchanger Tube Blockage	Revision 0

CORRECTIVE ACTION DOCUMENTS

Number	Description or Title	Date or Revision
IR 505454	OpEval 06-005, Potential Degradation od EQ Seals on Barton Level and Pressure Transmitters	10/2/2006
IR 545318	OpEval 06-007, 2S18948C, 2C Safety Injection Accumulator Outlet to 2C RCS Loop 3 Cold Leg	11/1/2006
IR 579766	OpEval 07-001, 2DG01KB-Z, 2B Diesel Generator Engine Driven Lube Oil Pump	1/19/2007
IR 589225	OpEval 07-002, N0n-Safety Related Ventilation Filters in Safety Related Systems	2/14/2007
IR 606909	OpEval 07-003, Main Control Room AST Calculation Prefilter Efficiency Misapplied	3/26/2007
IR 618449	OpEval 07-004, Incomplete Bolting on Unit 2 ECCS Sump Trash Rack	4/23/2007
IR 628474	OpEval 07-005, Through Wall Leakage of Line 2SX27DA -10"	5/16/2007
IR 627912	OpEval 07-006, Incorrect Pressurizer Heater Contactor Bolt Torque Values	5/17/2007
AR 662874	Potential Issue With Westinghouse Modeling of SG PORV Relief	9/20/2007
AR00631244	Vortex Input Assumption Non-Conservative for DSOTS	5/18/2007
AR00651337	Typographical Eror in EDG Fuel Consumption Calc	2/5/2007
AR00585956	U1, U2 DO Storage Tanks - Instrument Error Calc Error	1/31/2007
AR00654046	CDBI-Calc Methodology not Correctly Stated	7/26/2007
AR00654675	CDBI-DOST Calc Has Unused Invalid Assumption	7/27/2007
AR 00204227	1B CV Pump Lube Oil Cooler (1CV03SB) As-Found Data	2/26/2004
IR00653664	CDBI: Take Calculation BRW-95-218 to History Status	7/25/2007
AR 00659208	Calculated SX Temperature Exceeds Pipe Design Temperature (CDBI);	8/10/2007

CORRECTIVE ACTION DOCUMENTS

Number	Description or Title	Date or Revision
AR 00562375	Update Calculation BYR04-016 (Confirm NPSH ECCS Pumps)	3/27/2007
AR 00562375	CDBI Calculation BRY04-016 Assumptions (NPSH Injection Mode)	6/23/2005
AR 00204227	1B CV Pump Lube Oil Cooler (1CV03SB) As-Found Data (Lake Precipitation Event)	2/25/2004
AR 00367473	Potential Enhancements to Strainer Backwash Response	8/27/2007
AR 00169943	Low SX Pressure Due to High 2A Strainer DP	8/1/2003
AR 00584642	PI&R FASA – Concern With Response to SX Strainer Finding	1/26/2007
AR 00629907	Simulator does not depict the 1/2A AF Pump in LOOP	5/15/2007
AR 00629903	Documenting 1/2A AF Pumps Response Time in LOOP	5/15/2007
AR 00629371	CDBI FASA Comments on VD System Calcs	5/14/2007
AR 00647391	1LI-CD051A - Unit 1 CST Level Questionable	7/5/2007
AR 00663664	"CDBI, Result of NRC Review of Cubicle Cooler Visual Inspection	08/23/2007
AR 01094082	CDBI - 2007; 11 safeguards battery discharge test results	05/25/2007
AR 01098038	CDBI07 - Charging Spring Motor Operation at Reduced Voltage	06/20/2007
IR 595516	BUS 141 SAT 142-1 UV Relay Control PWR Failure	2/24/2007
IR 613791	Intermittent Trip on Spare 480V DS Breaker (1AP10EN)	4/5/2007
IR 629351	CBBI FASA-DG Frequency Variation Not addressed	5/11/2007
IR 638023	Some Difficulty With Secondary Contacts, ACB 1411	6/7/2007
IR 659213	Calculation 19-AN-3 Should Cover Cable Protection	8/10/2007

DRAWINGS

Number	Description or Title	Date or Revision
Vendor Drawing	62601 Drawing 1	Revision 2
Vendor Drawing	62601 Drawing 4	Revision 3
Vendor Drawing	62601 Drawing 7	Revision 1
Vendor Drawing	62601 Drawing 8	Revision 3
Vendor Drawing	62602 Drawing 1	Revision 4
Vendor Drawing	62602 Drawing 3	Revision 5
Vendor Drawing	62602 Drawing 7	Revision 2
Vendor Drawing	62602 Drawing 8	Revision 2
M-900	Outdoor Piping Arrangement	Revision K
M-42-1A	Diagram of Essential Service Water Units 1 & 2	Revision BH
M-42-6	Diagram of Essential Service Water	Revision T
SX-210	Essential Service Water Lake Screen House	Revision E
M-61	Diagram of Safety Injection Unit 1	Revision BD
M-62	Diagram of Residual Heat Removal	Revision BD
20E-1-4002E	Single Line Diagram:125 VDC ESF Distribution Center 111	Revision K
20E-2-4002E	Single Line Diagram:125 VDC ESF Distribution Center 211	Revision G
NE-40006 SH.52	Unit 1 train A component cooling pump breaker control schematic	Revision NR
NE-40006 SH.48	Unit 1 train A SI pump breaker control schematic	Revision AG
NE-40006 SH.56	Unit 1 train A containment spray pump breaker control schematic	Revision LP
NE-40006 SH.51	Uni1 train A RHR pump breaker control schematic	Revision QU
20E-0-4001	Station One Line Diagram	Revision X
20E-4001C	Station Key Diagram	Revision N
20E-1-4016C	Relaying and Metering Diagram System Auxiliary Transformer 142-1 and Transformer 142-2	Revision J

DRAWINGS

Number	Description or Title	Date or Revision
20E-1-4016D	Relaying & Metering Diagram Differential Relay Transfer Scheme System Auxiliary Transformer 142-1 and Transformer 142-2	Revision E
20E-1-4018A	Relaying & Metering Diagram 4160 V ESF Switchgear Bus 141	
20E-1-4019A	Relaying & Metering Diagram 480V ESF Switchgear Bus 131X	Revision K
20E-1-4020A	Relaying & Metering Diagram Diesel Generator 1A-1DG01KA Generator Control Part 1	Revision U
20E-1-4030P01	Schematic Diagram System Auxiliary Transformer 142-1 Tripping Relays	Revision L
20E-1-4030AP23	Schematic Diagram System Aux. Transformer 142-1 Feed to 4.16KV ESF Switchgear Bus 141-ACB 1412	Revision Y
20E-1-4030AP25	Schematic Diagram Reserve Feed from 4.16KV ESF SWGR 241 to 4.16KV ESF SWGR Bus141-ACB 1414	Revision AA
20E-1-4030AP27	Schematic Diagram 4.16KV ESF SWGR Bus 141 Feed to 480 V Aux. Transformer 131X-ACB1415X	Revision J
20E-1-4030AP30	Schematic Diagram 4160 V ESF SWGR Bus 141 Undervoltage Relays	Revision T
20E-1-4030AF01	Schematic Diagram Aux. Feedwater Pump 1A 1AF01PA	Revision AF
20E-1-4030DG01	Schematic Diagram Diesel Generator 1A Feed to 4.16 KV ESF SWGR Bus 1413	Revision AA
20E-1-4030DG40	Schematic Diagram Diesel Generator 1A Shutdown & Alarm System	Revision U
20E-1-4030RH01	Schematic Diagram Residual Heat Removal Pump 1A 1RH01PA	Revision Q
20E-2-4016C	Relaying & Metering Diagram System Auxiliary Transformers 242-1 & 242-2	Revision H
20E-2-4030AP25	Schematic Diagram Reserve Feed from 4.16 KV ESF SWGR Bus 141 to 4.16 KV ESF SWGR Bus 241	Revision Y

PROCEDURES

Number	Description or Title	Date or Revisionision
BwAP 380-1	Green Board Concept - Control Panels	Revision 5
1BwEP-0	Reactor Trip or Safety Injection Unit 1	Revision 103
1BwEP-3	Steam Generator Tube Rupture - Unit 1	Revision 101
1BwFR-H.1	Response to Loss of Secondary Heat Sink Unit 1	Revision 104
1BwEP ES-1.3	Transfer to Cold Leg Recirculation - Unit 1	Revision 104
1Bw0A SEC-B	Steam Generator Tube Leak Unit 1	Revision 103
CY-BR-120-412	Braidwood Station Lake Chemistry Control	Revision 5
CY-BR-120-4120	Braidwood Station Lake Chemistry Strategic Plan	Revision 4
CY-AA-120-4110	Raw Water Chemistry Strategic Plan	Revision 1
ER-AA-340-1002	Service Water Heat Exchanger and Component Inspection Guide	Revision 3
MA-AP-725-104	PRevisionentive Maintenance on Westinghouse Reactor Trip and Bypass Breakers	Revision 3
OP-AA-100	Description of the Exelon Nuclear Conduct of Operations Manual	Revision 0
OP-AA-106-101	Significant Event Reporting	Revision 7
OP-AA-106-101-1001	Event Response Guidelines	Revision 11
OP-AA-106-101-1002	Exelon Nuclear Issues Management	Revision 5
OP-AA-106-101-1004	Station Duty Teams OCC Activation Management Observations	Revision 2
OP-AA-106-101-1005	Quarantine of Areas Equipment and Records	Revision 0
OP-AA-106-101-1006	Operational and Technical Decision Making Process	Revision 4
OP-AA-108-106	Equipment Return to Service	Revision 1
OP-AA-108-115	Operability Determinations	Revision 3
OP-AA-108-101-1001	Component Position Determination	Revision 1

PROCEDURES

Number	Description or Title	Date or Revisionision
ER-AA-340-1002	Service Water Heat Exchanger and Component Inspection Guide	Revision 3
ER-AA-302-1006	Generic Letter 96-05 Program Motor-Operated Valve Maintenance and Testing Guidelines	Revision 4
ATD-0196	Useable Volume in Diesel Oil Storage tanks and Day tanks	Revision 3
ATD-0196	Useable Volume in Diesel Oil Storage tanks and Day tanks	Revision 3a
MA-AA-725-562	PRevisionentive Maintenance on Westinghouse Type DS 480V Circuit Breakers	Revision 4
TP 1617B	480 V breaker 111M functional test	Revision 3
OP-AA-112-101	Shift Turnover and Relief	Revision 3
0BwOS TRM 3.7.d.1	UO, U1 and U2 All Modes/at All Times Area Temperature Monitoring Shiftly Surveillance	Revision 1
0BWOA-ELEC-1	Abnormal Grid Conditions Unit 0	Revision 6
BwVS 900-35	Diesel Generator Governor Set-UP Following Governor Replacement	Revision 6
MA-BR-773-300	Diesel Generator Relay Routine	Revision 4
MA-AA-725-562	PRevisionentive Maintenance on Westinghouse Type DS 480V Circuit Breakers	Revision 4
MA-MW-772-701	Calibration of Overcurrent Protective Relays EID No. 1AP05E-U-PR38	4/22/2006

REFERENCES

Number	Description or Title	Date or Revisionision
BB PRA-017.57A	Risk Significant Time-Critical Operator Actions	Revision 0
OE 19150	Emergency Diesel Generator Governor Oil Sample Indicates Low Viscosity	9/22/2004
MOV-DB-BRW-SI	MOV Design Basis Document	1/28/1998

REFERENCES

Number	Description or Title	Date or Revisionision
2097-DB-BRW-SX	MOV Design Basis Document	Revision 1
ENANPG18CG	Exelon Nuclear Engineering Training Certification Guide for SW Heat Exchange/Comp. Inspector	Revision 00
BwVP 850-15	Essential Service Water System Performance Monitoring Program	Revision 6
NT13	[Nuclear Generation Group] Engineering Support Training Certification Guide GL 89-13 Program Manager	Revision 00
FASA 561255-04	Readiness Revisioniew for 2007 NRC Component Design Basis Inspection	5/4/2007
IN 90-64	Potential for Common-Mode Failure of High Pressure Safety Injection Pumps or Release of Reactor Coolant Outside Containment During a Loss-of-Coolant Accident	10/4/1990
FASA 287798-02	Safety System Design and Performance Capability Assessment	7/12/2005
FASA 441886-02	Generic Letter 89-13 Program: NRC Heat Sink Inspection	9/2006
Drawing M-77	Auxiliary Building Equipment Vents (Filtered)Units 1 and 2	Revision AX
	List of Cubicle Coolers That Failed VIAC in 1998	8/10/2007
IN 86-60	Unanalyzed Post-LOCA Release Paths	7/28/1986
Memo BW040016	Regulatory Commitment Change Summary Report	2/6/2004
BwVP 859-15	GL 89-13 Heat Exchange As-Found Inspection and Work Report	7/7/2004
BwOP SX-6	Essential Service Water Strainer Manual Operation	Revision 7
BwMP 3300-103	SX Strainer Manual Backwash Operation on Loss of Power	Revision 1
BwVP 850-15	Essential Service Water System Performance Monitoring Program	Revision 5
	Cubicle Cooler Tube Sheet Drawing	8/10/2007
ER-AA-340	GL 89-13 Program Implementing Procedure	Revision 4

REFERENCES

Number	Description or Title	Date or Revisionision
ER-AA-340-1001	GL 89-13 Program Implementation Instructional Guide	Revision 6
ER-AA-340-1002	Service Water Heat Exchanger and Component Inspection Guide	Revision 3
ER-AA-340-1003	GL 89-13 Program Performance Indicators	Revision 1
BwVP 850-15	Essential Service Water System Performance Monitoring Program	Revision 6
NDIT 970144	AFW Design Conditions Required for Safety Analysis	11/25/1997
NDIT BRW-DIT-97-173	Auxiliary Feedwater Pump Performance (Head vs. Flow) at Braidwood Station	5/28/1997
FASA	Readiness Review for 2007 NRC Component Design Basis Inspection (CDBI)	5/04/2007
	White Paper on implementation of GL 89-13 at Braidwood	8/21/2007
Service Request 00024821	PM Change 1VA01SB: 1B SX PP CUB CLR PMS 44218-01 02 03 04	12/19/2003
Service Request 00024918	PM Change 1VA02SA: 1A RH PP CUB CLR PMS 44232-01 02 03 04	12/19/2003
Service Request 00024921	PM Change 1VA02SB: 1B RH PP CUB CLR PMS 44233-01 02 03 04	12/19/2003
Service Request 00024922	PM Change 2VA02SA & B: 2A/2B RH PP CUB CLR PMS 48342 and 48343	12/19/2003
AR00381794	Braidwood's review of IN 2006-05 related to Bussmann KWN-R and KTN-R fuses	5/15/2006
AR00456209	Braidwood's review of IN 2006-03 related to Cutler Hammer starter mechanical interlock binding	2/20/2006

SURVEILLANCES (completed)

Number	Description or Title	Date or Revision
1BwVSR 3.3.1.15-2	Reactor Trip Breaker and Gripper Coil Response Time Measurement	Revision 2

SURVEILLANCES (completed)

Number	Description or Title	Date or Revision
2Bw0A PRI-8	Essential Service Water Malfunction	Revision 103
BwVS 900-18	Heat Exchanger Test Procedure for Containment Spray Pump Room Cubicle Coolers -VA03S	Revision 5
1BwVSR 5.5.8.SX.1	ASME Surveillance Requirements for 1A Essential Service Water Pump	Revision 7
2BwVSR 5.5.8.SX.2	ASME Surveillance Requirements for 2B Essential Service Water Pump	2/22/2007
BwVS 900-17	Heat Exchanger Test Procedure for Essential Service Water Pump Room Cubicle Coolers	2/07/1994
1BwOSR 3.7.8.1	Essential Service Water System Surveillance	Revision 13
1BwOSR 3.7.8.1	Essential Service Water System Surveillance	10/05/2006
	Trended Cubicle Cooler Performance Tests and Performance Criteria	8/20/2007
BwVS 900-17	Heat Exchanger Test Procedure for SX Pump Room Cubicle Cooler	6/27/1995
1BwVSR 3.8.6.6-111	Unit 1 125V ESF Battery Bank 111 Modified Performance Test	
1BwVSR 3.8.4.3-111	Unit 1 125V ESF Battery Bank 111 Service Test	04/23/2006
1BwOSR 3.8.6.1-1	Unit 1 125 VDC ESF Battery Bank and Charger 111 Operability Surveillance (Weekly)	07/21/2007
1BwOSR 3.8.6.5-1	Unit 1 125 VDC ESF Battery Bank 111 Operability Surveillance	
1BwVSR3.8.4.2-111	Unit 1 125 V ESF Battery Charger Capacity Test	
1BwHSTRM3.8.c4	125 V ESF Battery Bank and Rack Surveillance	Revision 2
BwHS 4002-075	4160 TO 480 Volt Unit Substation Transformer Inspection and Testing Revision. 3E1	4/20/2003
1BwVSR 3.8.1.19-1	1A Diesel Gen 24 Hr Load Test and ECCS SRV	10/9/2004

SURVEILLANCES (completed)

Number	Description or Title	Date or Revision
1BwOSR 3.8.1.19-1	1A Diesel Gen ECCS Sequencer Surveillance	Revision 2
BwHSR 3.3.5.2S2	Periodic Protective Relay Calibration for Reactor Trip System Instrumentation and Engineered Safety Features Actuation System Instrumentation. EID No. 1AP05E-E-PR9A and C, 1AP05E-E-PRA3A and C	4/22/2006

WORK DOCUMENTS

Number	Description	Revision/Date
00750910 01	Reactor Trip Breaker and Gripper Coil Response Time Measurement	5/01/2006
00776901 01	Swap/Install UTC No. 1354666 for PM per Task 2	10/16/2006
WO 978742	IST for 1/2 CC9463 A/B	2/8/2007
WO 1020851	IST for 1CC9463 A / B	7/12/2007
WO 695341-01	1SI8811B Diagnostic Test	5/17/2006
WO 559482-01	1SI8801B Diagnostic Test	10/14/2004

LIST OF ACRONYMS USED

ADAMS	Agency-Wide Document Access and Management System
AFW	Auxiliary Feedwater
ASME	American Society of Mechanical Engineers
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CST	Condensate Storage Tank
EC	Engineering Change
EC	Engineering Change
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EPU	Extended Power Uprate
GL	Generic Letter
HX	Heat Exchanger
IMC	Inspection Manual Chapter
IST	Inservice Testing
LOCA	Loss of Coolant Accident
NCV	Non-Cited Violation
NPSH	Net Positive Suction Head
NRC	U. S. Nuclear Regulatory Commission
OE	Operating Experience
PRA	Probalistic Risk Assessment
RWST	Refueling Water Storage Tank
SDP	Significance Determination Process
SX	Essential Service Water
TS	Technical Specifications
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate Heat Sink
UST	Unit Substation Transformer
VIAC	Visual Inspection Acceptance Criteria