



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION**

REGION III  
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LISLE, IL 60532-4352

December 27, 2012

Mr. Michael J. Pacilio  
Senior Vice President, Exelon Generation Company, LLC  
President and Chief Nuclear Officer (CNO), Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

**SUBJECT: BRAIDWOOD STATION, UNIT 2, SUPPLEMENTAL INSPECTION REPORT  
05000457/2012009 AND ASSESSMENT FOLLOW-UP LETTER**

Dear Mr. Pacilio:

On November 30, 2012, the U. S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection pursuant to Inspection Procedure 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," at your Braidwood Station, Unit 2. The enclosed report documents the inspection results, which were discussed during a Regulatory Performance Meeting on November 30, 2012, with Mr. D. Enright and other members of your staff.

In accordance with the NRC Reactor Oversight Process (ROP) Action Matrix, this supplemental inspection was performed to follow up on the White Mitigating System Performance Index (MSPI) for the Cooling Water Systems Performance Indicator (PI) which crossed the threshold from Green to White in the second quarter of 2012. We documented this issue in our Assessment Follow-Up Letter (ML12220A393) to you on August 6, 2012. The NRC staff was informed by your letter (ML12305A423) dated October 30, 2012, of your readiness for this inspection.

The objective of this supplemental inspection was to provide assurance that the root causes and contributing causes resulting in the White MSPI were understood, the extent of condition and extent of cause were identified, and that the corrective actions were sufficient to address the root causes and contributing causes and to prevent recurrence.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records and interviewed personnel.

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

We determined that your root cause evaluation was conducted to a level of detail commensurate with the significance of the problem and reached reasonable conclusions as to the root and contributing causes of the event. We also concluded that you identified the extent of condition and extent of cause of the issue, that you identified appropriate corrective actions for each root and contributing cause, and that you appropriately prioritized these actions.

As a result of our quarterly review of plant performance, which was completed on October 31, 2012, the NRC updated its assessment of Braidwood Station Unit 2. The NRC's evaluation consisted of a review of PIs and inspection results. The NRC's review of Braidwood Unit 2 identified that the MSPI for the Cooling Water Systems returned to the Green performance band in the third quarter of 2012. In accordance with NRC Inspection Manual Chapter 0305, "Operating Reactor Assessment Program," the MSPI for the Cooling Water Systems is considered a Green Action Matrix input as of July 1, 2012. Therefore, as a result of the successful completion of the supplemental inspection and a Green MSPI for the Cooling Water Systems, the NRC determined the performance at Braidwood Station, Unit 2 to be within the Licensee Response column of the ROP Action Matrix as of the date of this letter.

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 System (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Website at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

*/RA/*

Eric R. Duncan, Chief  
Branch 3  
Division of Reactor Projects

Docket No. 50-457  
License No. NPF-77

Enclosure: Inspection Report 05000457/2012009  
w/Attachment: Supplemental Information

cc w/encl: Distribution via ListServ

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No: 50-457  
License No: NPF-77

Report No: 05000457/2012009

Licensee: Exelon Generation Company, LLC

Facility: Braidwood Station, Unit 2

Location: Braceville, Illinois

Dates: November 26, 2012, through November 30, 2012

Inspector: D. Passehl, Senior Reactor Analyst, Region III

Approved by: E. Duncan, Chief  
Branch 3  
Division of Reactor Projects

Enclosure

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## SUMMARY OF FINDINGS

Inspection Report (IR) 05000457/2012009; 11/26/12 – 11/30/12; Braidwood Station, Unit 2; Supplemental Inspection – Inspection Procedure 95001.

This supplemental inspection was performed by a Region III Senior Reactor Analyst. No findings 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 4, dated December 2006.

### A. NRC-Identified and Self-Revealed Findings

#### **Cornerstone: Mitigating Systems**

This supplemental inspection was performed in accordance with Inspection Procedure 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's root cause evaluation, extent of condition and extent of cause determination, and corrective actions related to the identification of a White performance indicator (PI) with the Cooling Water Systems element of the Mitigating Systems Performance Index (MSPI). Specifically, this Cooling Water Systems MSPI was reported as White in the licensee's second quarter 2012 PI data submitted to the NRC. This MSPI was subsequently reported as Green in the third quarter 2012 PI submittal.

In preparation for the inspection, the licensee performed Root Cause Evaluation (RCE) 1390319, "Root Cause Report for 2Q2012 MSPI White Index in CWS [Cooling Water Systems]," to identify the root and contributing causes for this White MSPI.

This RCE determined that the White Cooling Water Systems MSPI was due to probabilistic risk assessment model change errors, operating restrictions on the cooling water systems, and equipment failures; and that these problems were due to organizational weaknesses with MSPI margin management, and weak organizational understanding, ownership, and challenging of the MSPI.

The inspector reviewed the licensee's RCE in addition to other evaluations conducted in support and as a result of the RCE. The inspector reviewed corrective actions that were taken or planned to address the identified causes. The inspector also held discussions with licensee personnel to ensure that the root and contributing causes and the contribution of safety culture components were understood, and corrective actions taken or planned were appropriate to address the causes and preclude repetition.

During this inspection, the inspector determined that the licensee's root cause evaluation was conducted to a level of detail commensurate with the significance of the problem and reached reasonable conclusions as to the root and contributing causes of the event. The inspector also concluded that the licensee identified appropriate corrective actions for each root and contributing cause and that these actions were appropriately prioritized.

Consistent with NRC Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program," the White Cooling Water Systems MSPI is considered a Green NRC Action Matrix input as of July 1, 2012. Therefore, since all other NRC Action Matrix

inputs are currently Green, Braidwood Station, Unit 2 has transitioned from the Regulatory Response column back to the Licensee Response column of the Reactor Oversight Process (ROP) Action Matrix as of the date of this supplemental inspection report and assessment follow-up letter.

**B. Licensee-Identified Violations**

None.

## REPORT DETAILS

### 1. 4. OTHER ACTIVITIES

#### 4OA4 Supplemental Inspection (95001)

##### .01 Inspection Scope

This inspection was conducted in accordance with Inspection Procedure 95001, "Supplemental Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluation associated with unreliability and unavailability reporting in the Cooling Water Systems element of the Mitigating Systems Performance Index (MSPI). The Cooling Water Systems MSPI was reported as White in the licensee's second quarter 2012 Performance Indicator (PI) data submitted to the NRC. The Cooling Water Systems MSPI was subsequently reported as Green in the third quarter PI submittal.

The inspection objectives were to:

- Provide assurance that the root causes and contributing causes of risk-significant performance issues were understood;
- Provide assurance that the extent of condition and extent of cause of risk-significant issues were identified; and
- Provide assurance that the licensee's corrective actions for risk-significant performance issues were or will be sufficient to address the root causes and contributing causes, and to prevent recurrence.

By letter dated August 6, 2012, the NRC communicated the results of its quarterly evaluation of plant performance, which was completed on July 31, 2012. The evaluation included an overall review of performance indicators and inspection results. The NRC's review of Braidwood Unit 2 identified that the Cooling Water Systems MSPI crossed the Green-to-White threshold in the second quarter of 2012. This was due to probabilistic risk assessment model change errors, operating restrictions on the cooling water system, and equipment failures. The NRC determined the performance at Braidwood Station Unit 2 to be in the Regulatory Response column of the ROP Action Matrix beginning in the second quarter of 2012 based on the PI data reported to the NRC.

On October 30, 2012, the licensee notified the NRC that a root cause investigation had been completed and that it was ready for the NRC to conduct this supplemental inspection to review their evaluation of the causes and the actions taken to address the White Cooling Water Systems MSPI.

In preparation for the inspection, the licensee performed Root Cause Evaluation (RCE) 1390319, "Root Cause Report for 2Q2012 MSPI White Index in CWS [Cooling Water Systems]," to identify the root and contributing causes for the White Cooling Water System MSPI. The inspector reviewed the licensee's RCE in addition to other evaluations conducted in support and as a result of the RCE. The inspector reviewed

corrective actions that were taken or planned to address the identified causes. The inspector also held discussions with licensee personnel to ensure that the root and contributing causes and the contribution of safety culture components were understood and corrective actions taken or planned were appropriate to address the causes and preclude repetition.

## .02 Evaluation of the Inspection Requirements

### 02.01 Problem Identification

- a. *Determine that the evaluation documented who identified the issue (i.e., license-identified, self-revealed, or NRC-identified) and under what conditions the issue was identified.*

The inspector determined that the licensee's RCE adequately described the conditions through which this self-revealed issue was identified.

During the entry of Cooling Water Systems data into the Consolidated Data Entry (CDE) reporting software for the second quarter 2012, it was self-revealed to the component cooling water and essential service water system managers that the Unit 2 Cooling Water Systems MSPI value had exceeded the Green-to-White threshold of 1.0E-6 with a reported MSPI value of 1.1E-06.

In the subsequent RCE, the licensee identified that organizational weaknesses with MSPI margin management, and weak organizational understanding, ownership, and challenging of the MSPI contributed to the identified White MSPI. Regarding the second quarter 2012 Cooling Water Systems MSPI, there were five key contributors that led to the Green-to-White threshold being exceeded. The licensee determined that had any one of the five contributors not occurred, the Cooling Water Systems MSPI would have remained Green. The inspector noted that from largest to smallest, the White MSPI contributors were as follows:

- Component Cooling Water Pump Pressure Switch Failures;
- Probabilistic Risk Assessment Model Changes;
- Component Cooling Water System Split Train Operation;
- Essential Service Water System Unavailability Above Baseline; and
- Removal of Credit and Use of the Auxiliary Feedwater (AF) System Cross-Tie.

- b. *Determine that the evaluation documented how long the issue existed and prior opportunities for identification.*

The inspector determined that the licensee's RCE adequately documented how long the issues leading to the second quarter 2012 Cooling Water Systems MSPI data exceeding 1.0E-6 existed and prior opportunities for identification.

#### Component Cooling Water Pump Pressure Switch Failures

Braidwood had two Component Cooling Water (CC) pump failures early in the 12 quarter MSPI monitoring period attributable to failures of the pump discharge pressure switches. The first occurred in July 2009 with the 2B CC pump and the second occurred in



January 2010 with the 2A CC pump. These switches were considered nonsafety-related and provide for an automatic start of the standby CC pump on low discharge header pressure (85 pounds per square inch gauge decreasing). These switches also provide a "CC Pump Discharge Pressure Low" alarm in the Main Control Room.

These pressure switch failures were classified as MSPI failures because actuation on low discharge pressure had not been explicitly excluded from the monitored scope in the Cooling Water Systems MSPI Basis Document. In March 2010, the licensee determined that the switch failures should not have been classified as MSPI failures because the switches were not part of the engineered safety feature start circuitry and had no impact on the safety function of the CC pumps. Even though the switches were later reclassified, the licensee could not exclude the failures from past consideration because MSPI is a forward-looking indicator.

The inspector observed that the CC pump pressure switch failures contributed the most to the second quarter 2012 Cooling Water Systems MSPI value, yet in hindsight was the easiest of the five contributors to address. Had the licensee performed a risk evaluation and removed the switches from the MSPI scope following the initial switch failure in July 2009, then the second pressure switch failure in January 2010 would not have been counted and the Cooling Water Systems MSPI would have remained Green for the second quarter of 2012.

#### Probabilistic Risk Assessment (PRA) Model Changes

The licensee determined that the process for PRA model changes did not include adequate controls to ensure that an impact to the Cooling Water Systems MSPI margin was recognized and understood in advance of these changes. Margin refers to the change in Core Damager Frequency (CDF) required for delta-CDF to exceed  $1.0E-6$ /year. Probabilistic Risk Assessment Model Change 6F in September 2011 resulted from CC split train operation (discussed below). Probabilistic Risk Assessment periodic update BB011a in March 2012 included removal of the AF cross-tie (also discussed below). The licensee had not recognized the impact of these PRA model changes sufficiently in advance of the MSPI reporting period to identify and evaluate potential conservative assumptions in the model that could have been re-examined and possibly modified to allow the MSPI to remain Green.

#### Component Cooling Water Pump Split Train Operation

For most of the life of the plant the CC system was operated as a shared train system and a semi-shared system between units. This included post-LOCA [Loss-of-Coolant-Accident] operation, during which time the system would not be split into its individual trains unless there was a leak detected in the system. In late 2008, the licensee found that this practice was not in compliance with the operating license and subsequently required the CC system to be split with the trains operated independently for emergency core cooling system recirculation during post-LOCA conditions. Related to this was an issue identified in 2010 associated with the common or "0" CC pump. The licensee found that the 0 CC pump was not a fully qualified functional spare pump for it to be aligned to replace the Unit 1 or Unit 2 'B' CC pumps due to it being isolated from the CC surge tank during post-LOCA operation. This situation increased the unreliability of the individual CC trains and core damage frequency. This issue of split train operation was

initially identified by the licensee as early as 2008 at the Byron Station during preparation for an NRC Component Design Basis Inspection.

#### Essential Service Water System Unavailability Greater Than Baseline

Braidwood essential service water (SX) system planned unavailability had been greater than its predicted baseline unavailability during the 12-quarter MSPI monitoring period. This directly contributed to a loss of MSPI margin. For the 2A SX Train, for example, the actual planned unavailability from July 2009 through June 2012 was higher than baseline with 236 hours of actual unavailability as compared to a planned unavailability of 135 hours. This was primarily due to normal preventive maintenance work, system upgrades, and degraded component repairs. At the beginning of the second quarter 2012, when the Cooling Water Systems MSPI became White, the unavailability contribution to MSPI from SX was 5E-07; half of the contribution to exceeding the Green-to-White Cooling Water Systems MSPI threshold of 1E-06. Baseline unavailability data used in MSPI was based on Braidwood data from 2002 through 2004. The licensee evaluated and revised some SX maintenance practices over the last 3 years such that activities previously counted towards system unavailability would not be considered as such going forward.

#### Removal of Credit and Use of the Auxiliary Feedwater System Cross-Tie

In October 2009 the licensee installed a cross-tie between the Unit 1 and 2 'A' (motor-driven) AF pumps. Subsequently, in October 2011 the NRC identified a finding and an associated Severity Level IV non-cited violation (NCV) of 10 CFR 50.59, "Changes, Tests, and Experiments," associated with installation of the cross-tie. Specifically, licensee personnel failed to obtain a required license amendment prior to installing the cross-tie. This issue was documented in NRC Inspection Report 05000456/2011004; 05000457/2011004. In response, the licensee removed the reference to the use of the cross-tie in the emergency operating procedures and its credit in the PRA, which increased the importance of the CC system and caused an increase in the significance of the previous CC pump pressure switch failures.

- c. *Determine that the evaluation documented the plant-specific risk consequences, as applicable, and compliance concerns associated with the issue.*

The inspector determined that the RCE adequately documented the plant-specific risk consequences and compliance concerns associated with the event.

#### Component Cooling Water Pump Pressure Switch Failures

The CC pump pressure switch failures that were identified in July 2009 and January 2010 increased the unreliability of the CC pumps. Starting in the third quarter 2012 MSPI monitoring period, the first pressure switch failure in July 2009 would no longer be considered in the reporting of Cooling Water Systems MSPI data since this failure was outside of the 3-year monitoring period. As discussed earlier, following the second pressure switch failure, the licensee reclassified the pressure switch failures as being of low safety significance. The inspector agreed with the licensee's actions and conclusions regarding reclassification of future pressure switch

failures. Therefore, any future CC pressure switch failure would not be considered in MSPI data reporting.

#### Probabilistic Risk Assessment Model Changes

The licensee's RCE identified no PRA modeling errors (i.e. modeling mistakes that caused the model to not adequately represent the as-built and as-operated plant). However, the RCE identified weaknesses with the PRA model revision process, including an absence of station reviews of pending model changes to identify losses of MSPI margin. Besides MSPI applications, the site-specific PRA was also used to support other applications, such as online work risk assessments, maintenance rule applications, risk-informed in-service inspections, and risk-informed license amendment requests.

All PRA application models, except MSPI, permitted interim changes if minor modeling assumptions or logic inputs needed to be revised. For MSPI, however, a PRA model used at the start of a quarter must be used throughout the quarter so any necessary PRA adjustments affecting MSPI cannot be made effective until the following quarter after a PRA model change has been approved. The RCE identified that there was no process to perform additional PRA model reviews or revisions sufficiently in advance to address unanticipated reductions of MSPI margin. Further, the MSPI margin management process was not well defined and relied on a single corporate expert. The corporate knowledge was not adequately captured in processes and procedures.

#### Component Cooling Water System Split Train Operation

As discussed above, the licensee revised the operation of CC during post-LOCA conditions to require the system to be split. Loss-of-Coolant-Accident events are low likelihood, passive system failure events. The impact of a CC system failure given a LOCA is of greater risk in the split train configuration due to the loss of redundancy and cross-train power supplies.

Administrative controls were implemented by the licensee as short-term corrective actions until a license amendment request (LAR) was submitted and approved. These short-term actions included reducing the CC system Technical Specification (TS) Allowed Outage Time (AOT) from 7 days to 72 hours and prohibiting the 0 CC pump from being aligned to replace either unit's "B" pump. Longer-term corrective actions included modifications to restore compliance with the current licensing basis (CLB). Because this condition applied to Byron Station due to similar CC system configurations, Byron and Braidwood were working together on a common resolution. At the end of this inspection, the issue had been entered into the licensee's corrective action program and was identified in the root cause report as Corrective Action Item 1, "Submit a LAR to not preemptively split CC trains post-LOCA in order to regain CWS [Cooling Water Systems] MSPI margin." This issue was also discussed in NRC Inspection Report 05000454/2011004; 05000455/2011004 for the Byron Station.

#### Essential Service Water System Unavailability Above Baseline

Although Braidwood SX maintenance unavailability had historically exceeded its baseline unavailability value, the overall risk significance was low. In Braidwood Unit 1

PRA model BB011a, the maintenance term for the 1A (normal standby) SX pump contributed approximately 1.5 percent to the plant core damage frequency, and for the 1B (normally running) SX pump the maintenance term was approximately 0.17 percent.

#### Removal of Credit and Use of the Auxiliary Feedwater System Cross-Tie

The compliance issues and risk significance were discussed in a previous NRC inspection report. Specifically, a violation of very low safety significance was documented in NRC Inspection Report 05000456/2011004; 05000457/2011004.

#### *d. Findings*

No findings were identified.

### 02.02 Root Cause, Extent of Condition, and Extent of Cause Evaluation

#### *a. Determine that the problem was evaluated using a systematic methodology to identify the root and contributing causes.*

The inspector determined that the root cause evaluation adequately applied systematic methods in evaluating the issue in order to identify root causes and contributing causes.

In the root cause evaluation, the licensee utilized Event and Causal Factor Charting, the TapRoot® system, Barrier Analysis, Interviewing, and Why Staircase root cause methodologies. The root cause investigation was conducted by a team of eight investigators. The systematic methodology was applied to the evaluation of plant history, operational changes, and process issues (margin assessment and PRA model changes) that led to exceeding the Cooling Water Systems MSPI Green-to-White threshold.

#### *b. Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.*

The inspector determined that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem and reached reasonable conclusions as to the root and contributing causes of the event.

As a result of the investigation into these issues the licensee identified two root causes (RCs) and five contributing causes (CCs). The identified root causes were as follows:

- RC-1: Inadequate process controls for MSPI margin management with respect to revising PRA models; and
- RC-2: Inadequate process controls for identifying, managing and communicating MSPI margin.

The identified contributing causes were as follows:

- CC-1: Component Cooling Water system alignment post-LOCA did not meet GDC [General Design Criteria] 44;
- CC-2: The process barriers in procedure ER-AA-600-1015, "FPIE [Full Power Internal Events] PRA Model Update," for review of PRA model revisions for impact on MSPI margin were not robust;
- CC-3: Failure to recognize the need for a license amendment request prior to implementing the AF cross-tie modification;
- CC-4: SX pump train unavailability was managed relative to the margin remaining in Green in the CDE margin report as opposed to unavailability over baseline; and
- CC-5: Less reliable replacement switches for the component cooling water pumps caused increased failures.

The licensee's root cause evaluation found the overall process for managing MSPI to lack robustness and allowed for a loss of MSPI margin over time. A key factor that impacted all of the identified root and contributing causes was management of the site PRA in relation to MSPI. Given the importance of the PRA model in relation to MSPI, the licensee found that more robust PRA model reviews were necessary to ensure that the status of MSPI margin is known and understood prior to model approval, and that the margin status is precisely communicated to station management.

- c. *Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.*

The inspector determined that the root cause evaluation included consideration of prior occurrences of the problem and knowledge of prior operating experience. The root cause evaluation included a search for prior occurrences and operating experience within internal and external databases, including the Exelon Corrective Action Program database.

With regard to prior occurrences, the root cause evaluation included a search of corrective action documents to identify previous events related to MSPI and PRA. This search identified several issue reports (IRs) that discussed MSPI margin management issues. However, those IRs only focused on margin recovery methods, not needed improvements in MSPI processes as identified in the licensee's root cause evaluation report. Regarding PRA, there were several human performance-related IRs in the corrective action program related to licensee personnel failing to follow established PRA-related processes and procedures. The PRA-related issues in the licensee's root cause evaluation report related to inadequate PRA-related processes and procedures, which were adequately captured in IRs.

With regard to operating experience, the root cause evaluation report discussed ten operating experience issues external to Exelon. The licensee performed an adequate review of these issues. No new corrective action documents were written as a result of the operating experience reviews since either relevant issues were already captured as part of the licensee's own root cause investigation, or the issues did not impact MSPI.

- d. *Determine that the root cause evaluation addressed the extent of condition and the extent of cause of the problem.*

The inspector concluded that the licensee adequately addressed the extent of condition and extent of cause of the problem.

The inspector's review of the extent of condition for which the root and contributing causes were identified found that each problem was evaluated against other systems or programs that may be affected. The extent of condition included assignments to review the root and contributing causes at other plants in the Exelon fleet and to implement additional reviews for Low Margin and "At-Risk" MSPI systems. The licensee's extent of cause effort included a review of each of the seven root and contributing causes and either described how the causes were being reviewed (including a reference to an action tracking item) or statements on acceptability.

- e. *Determine that the root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture components as described in Inspection Manual Chapter (IMC) 0305.*

The inspector determined that the root cause, extent of condition, and extent of cause evaluations appropriately considered the safety culture components as described in IMC 0305.

The inspector reviewed the RCE and validated the licensee had systematically considered each of the safety culture components. The safety culture components, as identified in NRC Regulatory Issue Summary 2006-13, "Information on the Changes Made to the Reactor Oversight Process to More Fully Address Safety Culture," were assessed as part of this root cause. Issues were identified in the areas of decision-making, work control, work practices, corrective action program, and continuous learning environment. Recommended actions to address these issues were properly identified in the RCE report.

- f. *Findings*

No findings were identified.

### 02.03 Corrective Actions

- a. *Determine that appropriate corrective actions are specified for each root and contributing cause or that the licensee has an adequate evaluation for why no corrective actions are necessary.*

The inspector reviewed applicable corrective actions (CAs) and corrective actions to prevent recurrence (CAPRs) and determined that the licensee specified reasonable and appropriate corrective actions for each root and contributing cause.

The root cause evaluation report identified 2 CAPRs, 13 CAs, and 12 action items (ACITs). There were also pre-existing corrective action items for the specific key factors discussed earlier. The inspector confirmed that each CAPR and CA were entered into the licensee's computerized tracking system, and sampled the other corrective action

program assignments. In those instances when it was determined that no corrective actions were necessary, the basis for those decisions were clearly documented in the RCE.

- b. *Determine that corrective actions have been prioritized with consideration of risk significance and regulatory compliance.*

The inspector concluded that the licensee adequately prioritized the corrective actions with consideration of the risk significance and regulatory compliance.

Overall, the corrective action implementation deadlines appeared reasonable and commensurate with risk significance. The licensee's immediate corrective actions appeared effective in preventing similar events until the long-term CAs and CAPRs could be completed. Time frames for actions to address the root causes and contributing causes were established commensurate with their safety significance and contribution to the event.

There were two regulatory issues referenced related to the AF cross-tie modification and splitting of the CC trains. The corrective actions identified involved submittal of LARs. For the AF cross-tie modification, the LAR had been submitted and was awaiting NRC approval. For the CC split train issue, the licensee established a due date of March 1, 2013 for submitting the LAR.

- c. *Determine that a schedule has been established for implementing and completing the corrective actions.*

The inspector determined that the licensee adequately established a schedule for implementing and completing the corrective actions. The licensee assigned completion due dates that were commensurate with the safety significance of the issues being addressed as well as the level of effort required to complete the actions. Completion dates were being tracked in the corrective action program.

- d. *Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence.*

The inspector determined that the licensee adequately developed quantitative or qualitative measures of success for determining effectiveness of the corrective actions to prevent recurrence.

Each root cause had an associated effectiveness review scheduled in the corrective action program. The effectiveness reviews were all scheduled to be completed 1 year after the associated CAPRs had been completed to allow an adequate basis to assess effectiveness. The inspector determined that the effectiveness review criteria established for the issues were appropriate.

- e. *Determine that the corrective actions planned or taken adequately address a NOV that was the basis for the supplemental inspection, if applicable.*

The White Cooling Water Systems MSPI that was the subject of this inspection was not associated with an NOV. Therefore, this inspection aspect was not applicable and, as a result, was not reviewed.

*f. Findings*

No findings were identified.

02.04 Evaluation of Inspection Manual Chapter 0305 Criteria for Treatment of Old Design Issues

The licensee did not request credit for self-identification of an old design issue; therefore, the White Cooling Water Systems MSPI was not evaluated against the IMC 0305 criteria for treatment of an old design issue.

4OA6 Management Meetings

.01 Exit Meeting Summary

The inspector presented the inspection results to Mr. D. Enright and other members of the licensee management on November 30, 2012. Proprietary material received during the inspection was returned to the licensee and was not included in this report.

.02 Regulatory Performance Meeting

On November 30, 2012, the NRC met with the licensee to discuss its performance in accordance with Section 10.02.b.4 of IMC 0305. During this meeting, the NRC and licensee discussed the issues related to the White Cooling Water Systems MSPI that resulted in Braidwood Station, Unit 2, being placed in the Regulatory Response column of the NRC's ROP Action Matrix. This discussion included the causes, corrective actions, extent of condition, extent of cause, and other planned licensee actions.

ATTACHMENT: SUPPLEMENTAL INFORMATION



## SUPPLEMENTAL INFORMATION

### KEY POINTS OF CONTACT

#### Licensee

D. Enright, Site Vice President  
M. Kanavos, Plant Manager  
M. Marchionda-Palmer, Director, Site Operations  
G. Krueger, Director, Probabilistic Risk Assessment  
P. Boyle, Director, Site Work Management  
F. Gogliotti, Senior Manager, Plant Engineering  
P. Raush, Senior Manager, Design Engineering  
R. Radulovich, Manager, Site Nuclear Oversight  
J. Kijowski, Manager, NSSS Systems  
C. VanDenburgh, Manager, Site Regulatory Assurance  
J. Odeen, Manager, Site Projects  
J. Nedza, Supervisor, Security Operations  
C. Xydis, Supervisor, Radwaste/Environmental  
D. Gullott, Corporate Licensing  
J. Bashor, Special Projects  
R. Linthicum, Risk Engineer  
H. Addis, Risk Management  
S. Falvo, Risk Management  
J. Zoeller, Nuclear Oversight  
M. Abbas, NRC Coordinator

#### Nuclear Regulatory Commission

G. Shear, Deputy Division Director, Division of Reactor Projects  
E. Duncan, Chief, Reactor Projects Branch 3  
D. Passehl, Senior Reactor Analyst  
J. Benjamin, Senior Resident Inspector  
C. Sanders, Reactor Operations Engineer

### LIST OF ITEMS OPENED, CLOSED AND DISCUSSED

#### Opened

None.

#### Closed

None.

#### Discussed

None.

## LIST OF DOCUMENTS REVIEWED

The following is a list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspector reviewed the documents in their entirety, but rather, that selected sections of portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection report.

### Documents Reviewed

BW-MSPI-001, MSPI Basis Document, Rev. 8  
AR 1390319, Braidwood Unit 2 Confirmed MSPI White Cooling Water System  
AR 1258017, 1A/2A AF Pump Discharge Crosstie Regulatory Concern  
AR 1420632, Corporate Root Cause Report Rejected by Braidwood MRC [Management Review Committee]  
AR 1391877, Unit 1 Cooling Water System MSPI is White for April 2012  
AR 1319046, BYR/BRD MSPI Lessons Learned  
AR 0841395, CDBI [Component Design Bases Inspection] FASA CC System Post-LOCA [Loss-of-Coolant-Accident] Passive Failures (Byron)  
AR 1043006, MSPI Basis Document – Enhancement Opportunity  
AR 1071578, 2PS-0673A EACE [Equipment Apparent Cause Evaluation] – Extent Of Condition Review  
AR 1412759, IP 95001 Readiness Self-Assessment  
ER-AA-600-1011, Risk Management Program, Rev. 11  
ER-AA-600-1012, Risk Management Documentation, Rev. 9  
ER-AA-600-1015, FPIE PRA Model Update, Rev. 13  
ER-AA-600-1047, Mitigating Systems Performance Index Basis Document, Rev. 7  
LS-AA-120, Issue Identification and Screening Process, Rev. 14  
LS-AA-125, Corrective Action Program (CAP) Procedure, Rev. 17  
LS-AA-126, Self-Assessment and Benchmark (SAB) PROG, Rev. 7  
LS-AA-2001, Collecting and Reporting of NRC Performance Indicators, Rev. 14  
LS-AA-2200, Mitigating System Performance Index Data Acquisition and Reporting, Rev. 5  
LS-AA-125-1001, Root Cause Analysis Manual, Rev. 10  
LS-AA-125-1002, Common Cause Analysis Manual, Rev. 7  
LS-AA-125-1003, Apparent Cause Evaluation Manual, Rev. 10  
LS-AA-125-1004, Effectiveness Review Manual, Rev. 5  
LS-AA-125-1005, Coding and Analysis Manual Rev. 8  
LS-AA-126-1001, Focused Area Self-Assessments, Rev. 7  
LS-AA-126-1005, Check-In Self-Assessments, Rev. 5  
N-BR-ENG-11C03-MSPI, MSPI Lesson Plan, Rev. 1  
RCE 1390319, Root Cause Report for 2Q2012 MSPI White Index in CWS [Cooling Water Systems]

## LIST OF ACRONYMS USED

ACIT	Action Item
ADAMS	Agencywide Documents Access and Management System
AF	Auxiliary Feedwater
AOT	Allowed Outage Time
CA	Corrective Action
CAPR	Corrective Action to Prevent Recurrence
CC	Component Cooling
CC	Contributing Cause
CDE	Consolidated Data Entry
CDF	Core Damage Frequency
CLB	Current Licensing Basis
CWS	Cooling Water Systems
FPIE	Full Power Internal Events
GDC	General Design Criteria
IMC	Inspection Manual Chapter
IP	Inspection Procedure
IR	Issue Report
LAR	License Amendment Request
LOCA	Loss-of-Coolant-Accident
MSPI	Mitigating Systems Performance Index
NCV	Non-Cited Violation
NOV	Notice of Violation
NRC	Nuclear Regulatory Commission
PARS	Publically Available Records System
PI	Performance Indicator
PRA	Probabilistic Risk Assessment
RC	Root Cause
RCE	Root Cause Evaluation
ROP	Reactor Oversight Process
SX	Essential Service Water
TS	Technical Specification

We determined that your root cause evaluation was conducted to a level of detail commensurate with the significance of the problem and reached reasonable conclusions as to the root and contributing causes of the event. We also concluded that you identified the extent of condition and extent of cause of the issue, that you identified appropriate corrective actions for each root and contributing cause, and that you appropriately prioritized these actions.

As a result of our quarterly review of plant performance, which was completed on October 31, 2012, the NRC updated its assessment of Braidwood Station Unit 2. The NRC's evaluation consisted of a review of PIs and inspection results. The NRC's review of Braidwood Unit 2 identified that the MSPI for the Cooling Water Systems returned to the Green performance band in the third quarter of 2012. In accordance with NRC Inspection Manual Chapter 0305, "Operating Reactor Assessment Program," the MSPI for the Cooling Water Systems is considered a Green Action Matrix input as of July 1, 2012. Therefore, as a result of the successful completion of the supplemental inspection and a Green MSPI for the Cooling Water Systems, the NRC determined the performance at Braidwood Station, Unit 2 to be within the Licensee Response column of the ROP Action Matrix as of the date of this letter.

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 System (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Website at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

*/RA/*

Eric R. Duncan, Chief  
Branch 3  
Division of Reactor Projects

Docket No. 50-457  
License No. NPF-77

Enclosure: Inspection Report 05000457/2012009  
w/Attachment: Supplemental Information

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Letter to M. Pacilio from E. Duncan dated December 27, 2012.

SUBJECT: BRAIDWOOD STATION, UNIT 2, SUPPLEMENTAL INSPECTION REPORT  
05000457/2012009 AND ASSESSMENT FOLLOW-UP LETTER

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