Omaha Public Power District
444 South 16th Street Mall
Omaha, NE 68102-2247

Decemeber 2, 2013
LIC-13-0164

Mr. Marc L. Dapas
Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
1600 East Lamar Boulevard
Arlington, TX 76011-4511

SUBJECT: Integrated Report to Support Restart of Fort Calhoun Station and Post-Restart Commitments for Sustained Improvement

Dear Mr. Dapas:

On August 10, 2011, Omaha Public Power District (OPPD) submitted to the U.S. Nuclear Regulatory Commission (NRC) the Fort Calhoun Station (FCS) Post-Flooding Recovery Action Plan (FRP), Revision 0 documenting OPPD's commitments to take various actions to address flooding impacts at the station and other aspects of FCS performance before restart (Reference 2). FRP Revision 1 was submitted to the NRC on August 30, 2011 (Reference 3). On September 2, 2011, the NRC issued a Confirmatory Action Letter (CAL) to OPPD confirming certain of those commitments contained in the FRP (Reference 4). That September 2, 2011 CAL was updated on June 11, 2012 to include additional OPPD commitments documented in a Restart Checklist to assess and improve performance at FCS (Reference 5). That CAL was updated again on February 26, 2013 to incorporate three additional OPPD commitments to the Restart Checklist (Reference 8).

As it committed to in the June 11, 2012 CAL (Reference 5), OPPD submitted Revision 3 of the FCS Integrated Performance Improvement Plan (IPIP), including FRP, Revision 1 on July 9, 2012 (Reference 6). The FCS IPIP was a living document and OPPD submitted IPIP, Revision 4 on November 1, 2012 (Reference 7) and IPIP, Revision 5 on June 19, 2013 (Reference 9).

On July 29, 2013, as it neared completion of the FCS IPIP and began preparing for restart of the plant, OPPD submitted to the NRC its post-restart Plan for Sustained Improvement (PSI), Revision 0, including actions in ten areas indicated as Key Drivers for Achieving and Sustaining Excellence (Reference 10).

The IPIP has guided the problem discovery, analysis, and recovery activities at FCS since early 2012. Through implementation of the IPIP, OPPD identified and addressed the key underlying causes for the performance decline at FCS. This established the foundation for a safe and efficient restart. Actions taken to address those key areas include:

- Reestablished a clear vision, mission, values and goals – consistently emphasizing safety, alignment, accountability, bias for action, and healthy nuclear safety culture;

- Ensured a robust safety culture and safety conscious work environment – safety is always given priority and FCS staff feel comfortable finding and reporting issues;
- Restored the Corrective Action Program – the staff has a bias for action for continuous improvement; FCS has made substantial improvement in identifying, documenting, analyzing, and fixing issues effectively, and
- Articulated organizational expectations – the organization is aligned on clear expectations and accountability systems, effective supervisory and management oversight and independent assessment.

In addition, OPPD has identified and addressed a number of technical and programmatic deficiencies to ensure that significant safety concerns do not recur and that plant equipment supports safe and efficient plant restart.

The journey from recovery through plant restart to sustained excellence is a multi-year effort. Implementation of the PSI will continue the performance improvement momentum generated during recovery and restart within a structured and predictable management system that facilitates clear planning, implementation, and monitoring of performance improvement initiatives after restart.

In August 2012 OPPD and Exelon entered into a 20-year Operating Services Agreement by which Exelon manages day-to-day operations of the plant. The development, tracking, and management tool for the PSI is the Performance Improvement Integrated Matrix (PIIM), which is controlled under station performance improvement procedures. The PIIM is one key component in Exelon's continuous improvement process within the accountability-driven Exelon Nuclear Management Model. Every Exelon Nuclear facility utilizes the PIIM process for performance improvement. The PIIM is a strategic planning tool that facilitates a systematic approach to utilizing the full range of performance improvement tools to identify and address performance gaps. This is one element of the Exelon Nuclear Management Model that has contributed to the sustained excellent performance of the Exelon Nuclear fleet.

The key drivers for achieving and sustaining excellence within the PSI are:

- Organizational effectiveness, safety culture and safety conscious work environment
- Problem identification and resolution
- Performance improvement and learning programs
- Design and licensing basis control and use
- Site operational focus
- Procedures
- Equipment performance
- Programs
- Nuclear oversight
- Transition to the Exelon Nuclear Management Model and integration into the Exelon Nuclear fleet

The CALs included commitments to inform the NRC in writing of the completion of the FRP actions, the results of implementing the IPIP and completion of the Restart Checklist commitments. Enclosure 1 to this letter includes the "Integrated Report to Support Restart of Fort Calhoun Station." This report documents: (1) the actions taken and results achieved from implementing of the IPIP; (2) the basis for closing the Restart Checklist items; (3) the completion of the FRP commitments for restart; and (4) the actions taken to close the CALs. Enclosure 2 to this letter contains the post-restart commitments OPPD is making to continue performance improvement after restart, including the Key Drivers for Achieving and Sustaining Excellence. Enclosure 3 to this letter includes Revision 1 of the Key Drivers.

The OPPD independent Nuclear Safety Review Board regularly evaluates the effectiveness of performance improvement initiatives at FCS and reports the results of its evaluations to the OPPD Chief Executive Officer and Chief Nuclear Officer. In addition, the OPPD independent Corporate Governance and Oversight Committee and the Nuclear Oversight Department (NOS) continue to evaluate the results of FCS improvement efforts. NOS has provided a report to the OPPD Chief Nuclear Officer, concluding that FCS is ready for restart.

The FCS IPIP is now closed. OPPD completed initial heat-up of FCS using non-nuclear heat and operated many of the primary and secondary systems to demonstrate restart readiness. The key causes of the FCS prolonged performance decline have been addressed. The effectiveness of the important programs and processes at FCS has been significantly improved. Major improvements have been made in the safety and reliability of structures, systems, and components at FCS. The plant, the people, and the processes are ready to support safe and efficient restart and operation of FCS.

After restart, until such time as it is mutually agreed that it is no longer necessary, OPPD will periodically update the NRC regarding the status of the performance improvement initiatives at FCS.

If you should have any questions, please contact me at (402) 533-6821.

Sincerely,

Louis P. Cortopassi
Site Vice President and CNO

LPC/cac

Enclosure 1: Integrated Report to Support Restart of Fort Calhoun Station
Enclosure 2: Post-Restart Commitments
Enclosure 3: Key Drivers for Achieving and Sustaining Excellence, Revision 1

cc w/encl: M. R. Johnson, NRC Deputy Executive Director for Reactor and Preparedness Programs
E. J. Leeds, NRC Director of the Office of Nuclear Reactor Regulation
A. Vegel, NRC Director of Division of Nuclear Materials Safety, Region IV
M. C. Hay, NRC Chief of Branch F, Region IV
J. M. Sebrosky, NRC Senior Project Manager
L. E. Wilkins, NRC Project Manager
J. C. Kirkland, NRC Senior Resident Inspector
Document Control Desk

References

1. Docket No. 50-285
2. Letter from OPPD (J. A. Reinhart) to NRC (Document Control Desk), *Fort Calhoun Station Post-Flooding Recovery Action Plan*, dated August 10, 2011 (LIC-11-0090) (ML112231755)
3. Letter from OPPD (J. A. Reinhart) to NRC (Document Control Desk), *Fort Calhoun Station Post-Flooding Recovery Action Plan Revision 1*, dated August 30, 2011 (LIC-11-0095) (ML12012A249)
4. Letter from NRC (E. E. Collins) to OPPD (D. J. Bannister), *Confirmatory Action Letter - Fort Calhoun Station*, dated September 2, 2011 (CAL 4-11-003) (NRC-11-0109) (ML112490164)
5. Letter from NRC (E. E. Collins) to OPPD (D. J. Bannister), *Confirmatory Action Letter - Fort Calhoun Station*, dated June 11, 2012 (CAL 4-12-002) (NRC-12-0055) (ML12163A287)
6. Letter from OPPD (L. P. Cortopassi) to NRC (Document Control Desk), *Fort Calhoun Station Integrated Performance Improvement Plan Revision 3*, dated July 9, 2012 (LIC-12-0098) (ML12192A204)
7. Letter from OPPD (L. P. Cortopassi) to NRC (Document Control Desk), *Fort Calhoun Station Integrated Performance Improvement Plan, Revision 4*, dated November 1, 2012 (LIC-12-0165) (ML12311A164)
8. Letter from NRC (E. E. Collins) to OPPD (L. P. Cortopassi), *Confirmatory Action Letter - Fort Calhoun Station*, dated February 26, 2013 (EA-13-0020) (NRC-13-0018) (ML13057A287)
9. Letter from OPPD (L. P. Cortopassi) to NRC (Document Control Desk), *Fort Calhoun Station Integrated Performance Improvement Plan, Revision 5*, dated June 19, 2013 (LIC-13-0086) (ML13172A351)
10. Letter from OPPD (L. P. Cortopassi) to NRC (A. T. Howell), *Fort Calhoun Station Plan for Sustained Improvement, Revision 0*, dated July 29, 2013 (LIC-13-0099) (ML13211A358)
11. Letter from OPPD (L. P. Cortopassi) to NRC (Document Control Desk), *Status of Flood Recovery Plan Actions*, dated October 4, 2013 (LIC-13-0143)
12. Letter from OPPD (L. P. Cortopassi) to NRC (Document Control Desk), *Updated Status of Flood Recovery Plan Actions*, dated October 28, 2013 (LIC-13-0159)

bcc w/encl: W. G. Gates, President and Chief Executive Officer, Omaha Public Power District
M. J. Pacilio, Senior Vice President, Exelon Generation Company, LLC
President and Chief Nuclear Officer, Exelon Nuclear
S. R. Landahl, Senior Vice President, Operations Integration and Business Development, Exelon Generation Company, LLC
F. J. Ulrich, Chairman of the OPPD Board
A. L. McGuire, Chairman of the OPPD Nuclear Committee

Enclosure 1

Integrated Report to Support Restart of Fort Calhoun Station

Fort Calhoun Station

INTEGRATED REPORT TO SUPPORT RESTART OF FORT CALHOUN STATION

Table of Contents

Acronyms

Acronym	Definition
ACA	Apparent Cause Analysis
AE	Architect/Engineer
CAL	Confirmatory Action Letter
CAP	Corrective Action Program
CAPR	Corrective Action to Prevent Recurrence
CQE	Critical Quality Element
CD	Compact Disc
CEP	Containment Electrical Penetration
CIS	Containment Internal Structure
CLB	Current Licensing Basis
CNO	Chief Nuclear Officer
CR	Condition Report
DEN	Design Engineering Nuclear
DNC	Degraded/Nonconforming Condition
EA	Engineering Analysis
EAG	Engineering Assurance Group
EC	Engineering Change
ECP	Employee Concerns Program
EDG	Emergency Diesel Generator
EEQ	Electrical Equipment Qualification
EM	Electrical Maintenance
ENMM	Exelon Nuclear Management Model
ER	Equipment Reliability
ERO	Emergency Response Organization
ESL	Equipment Service Life
Exelon	Exelon Generation Company, LLC
FCS	Fort Calhoun Station

Acronym	Definition
FID	Functional Importance Determination
FPD	Fundamental Performance Deficiency
FRP	Flooding Recovery Action Plan
FSA	Focused Self Assessment
GAAR	Gap, Analysis, Actions, Results
GEI	GEI Consultants, Inc.
HDR	HDR Engineering, Inc.
HELB	High Energy Line Break
I&C	Instrumentation and Control
IMC	Inspection Manual Chapter
INPO	Institute of Nuclear Power Operations
IPIP	Integrated Performance Improvement Plan
IRR	Integrated Restart Report
ISFSI	Independent Spent Fuel Storage Installation
JITT	Just-In-Time-Training
KDI	Key Distress Indicator
LCO	Limiting Condition for Operation
LCQE	Limited Critical Quality Element
MRM	Management Review Meeting
MSL	Mean Sea Level
NAS	Negatively Affected Soil
NCOB	Nuclear Committee of the Board
NIEP	Nuclear Industry Evaluation Program
NLI	Nuclear Logistics Incorporated
NOS	Nuclear Oversight
NOUE	Notification of Unusual Event
NRC	U.S. Nuclear Regulatory Commission
NSRB	Nuclear Safety Review Board

Acronym	Definition
OPPD	Omaha Public Power District
OSA	Operating Services Agreement
PHC	Plant Health Committee
PI	Performance Indicator
PIIM	Performance Improvement Integrated Matrix
PI&R	Problem Identification and Resolution
PM	Preventive Maintenance
PMG	Procedure Maintenance Group
PORV	Power Operated Relief Valve
PRC	Plant Review Committee
PSI	Plan for Sustained Improvement
QA	Quality Assurance
RCA	Root Cause Analysis
RC&C	Reactor Cavity and Compartments
RCS	Reactor Coolant System
ROP	Reactor Oversight Process
RPS	Reactor Protection System
S&A	Stevenson & Associates
SARC	Safety Audit Review Committee
SCARB	Station Corrective Action Review Board
SCWE	Safety Conscious Work Environment
SGI	Safeguards Information
SHRR	System Health Readiness Review
SME	Subject Matter Expert
SSC	Systems, Structures and Components
SSFF	Safety System Functional Failure
TS	Technical Specifications
USAR	Updated Safety Analysis Report

Acronym	Definition
VIS	Vendor Information Services
WO	Work Order
ZSI	Zone Selective Interlock

Executive Summary

1. Purpose

This Integrated Restart Report (IRR) documents the basis for Omaha Public Power District's (OPPD) determination that it has taken the necessary actions to ensure that Fort Calhoun Station (FCS) can be safely and reliably returned to service. As described in this IRR, OPPD successfully implemented the FCS Integrated Performance Improvement Plan (IPIP), addressed the Restart Checklist items, and completed the commitments documented in the Flooding Recovery Action Plan (FRP) and the Confirmatory Action Letters (CAL). OPPD has concluded that FCS is ready for restart.

2. Background/Chronology

In early April 2011, OPPD shut down FCS for a scheduled refueling outage. On May 23, 2011, in response to rising water levels along the Missouri River, OPPD began implementing flood protection measures at the site to protect various safety-related structures, including the Intake Building, the Auxiliary Building, and the Containment Building. Subsequently, on June 6, 2011, OPPD declared a Notification of Unusual Event (NOUE) in anticipation that the increasing Missouri River level at the plant would reach 1,004 ft mean sea level (msl). Subsequently, based on receding river levels, OPPD exited the NOUE on August 29, 2011.

On June 7, 2011, the failure of a feeder breaker for a 480 Vac load center resulted in a fire in the station's west switchgear room. The fire caused the loss of power to six of nine safety-related 480 Vac electrical distribution buses and two of four safety-related 4,160 Vac buses. Consequently, OPPD declared an Alert. The Alert declaration was exited within four hours after sufficient electrical equipment was reenergized.

On September 2, 2011, the U.S. Nuclear Regulatory Commission (NRC) issued to OPPD a CAL, which documented certain actions OPPD committed to take prior to restarting the plant, as described in its FRP and submitted to the NRC on August 10, 2011. These actions addressed the flooding impacts on the station and other aspects of FCS performance.

Subsequently, in a letter dated December 13, 2011, the NRC notified OPPD that it had made a change in the regulatory oversight of FCS, transitioning NRC inspection and oversight from Inspection Manual Chapter (IMC) 0305, "Operating Reactor Assessment Program" (ROP), to IMC 0350, "Oversight of Reactor Facilities in a Shutdown Condition due to Significant Performance and/or Operational Concerns." The NRC basis for this action was that the plant was shutdown and in the Multiple/Repetitive Degraded Cornerstone Column of the ROP Action Matrix, and OPPD needed to accomplish significant analysis of the extent of condition and extent of cause of known performance deficiencies to understand what actions were necessary to restore acceptable performance at FCS.

In January 2012, OPPD and Exelon Generation Company, LLC (Exelon), entered into an Advisory Services Agreement in which Exelon provided advisory and other support services to OPPD focused on FCS recovery and restart. That agreement remains in effect until FCS achieves 100 percent power. In August 2012, OPPD and Exelon entered into a 20-year Operating Services Agreement, whereby Exelon is responsible for day-to-day operation of the plant while OPPD remains the owner and NRC licensee.

3. Integrated Performance Improvement Plan

The FCS recovery effort involved a large number of activities related to problem discovery and resolution, performance improvement, restart readiness, and regulatory margin recovery. After the June 2011 flood, OPPD developed several different action plans to address certain issues identified at FCS during 2011. In early 2012 these plans were in varying stages of completion and had been developed with limited coordination. Consequently, in early 2012, OPPD developed the IPIP. The purpose of the IPIP was to provide an integrated management structure and approach to fully assess and address the causes of performance deficiencies at FCS and guide the recovery and restart of FCS. The IPIP consolidated and expanded those earlier action plans and coordinated resources and recovery efforts through resource-loaded scheduling, driving accountability for recovery and restart actions. The recovery and restart activities were entered into the station's project management scheduling software.

On June 11, 2012, the NRC issued a revised CAL which included a Restart Checklist. The Revised CAL and Restart Checklist addressed expanded actions contained in the IPIP that OPPD committed to take to fully understand and resolve the underlying performance issues that resulted in the protracted performance decline at FCS. On February 26, 2013, the NRC updated that CAL and associated Restart Checklist adding several additional actions OPPD committed to take in response to the expanded discovery efforts.

The IPIP has guided the problem discovery, analysis and recovery activities at FCS since early 2012. Through implementation of the IPIP, OPPD identified and addressed the key underlying causes for the FCS performance decline and OPPD's failure to identify and resolve the performance decline on a timely basis establishing the foundation for a safe and efficient restart. Key actions taken to address those areas included:

- Reestablished a clear vision, mission, values and goals – consistently emphasizing safety, alignment, accountability, bias for action, and healthy nuclear safety culture;

- Ensured a robust safety culture and safety conscious work environment (SCWE) – safety is always given priority and FCS staff feel comfortable finding and reporting issues;

- Restored the Corrective Action Program – the staff has a bias for action for continuous improvement and consistently identifies, documents, analyzes and fixes issues effectively; and

- Articulated organizational expectations – the organization is aligned on clear expectations and accountability systems, effective supervisory and management oversight and independent assessment.

In addition, OPPD identified and addressed a number of technical and programmatic issues to ensure that significant safety concerns do not recur and that plant equipment is operable and reliable to support safe and efficient plant restart.

The IPIP is a living document that was first submitted to the NRC as Revision 3 on July 9, 2012. The IPIP was subsequently revised and Revisions 4 and 5 were submitted to the NRC on November 1, 2012, and June 19, 2013, respectively.

4. Conclusions and Readiness to Restart

In summary, OPPD has implemented the IPIP, and identified and addressed the causes of FCS's prolonged performance decline. In addition, OPPD has completed the restart-related actions described in the FRP. The improvement actions completed under the IPIP and FRP have adequately addressed the items in the CALs and Restart Checklist. Completion of these actions resulted in significant improvement in plant safety and reliability, safety culture, human performance, management and organizational effectiveness, and key processes, including CAP effectiveness. Based upon the above, OPPD has concluded that FCS can be safely and reliably returned to service and is ready to restart.

Finally, OPPD has established the FCS post-restart Plan for Sustained Improvement (PSI), including the Key Drivers for Achieving and Sustaining Excellence. The PSI and Key Drivers will continue the performance improvement momentum at FCS generated through implementation of the IPIP and guide FCS to achieving sustained excellent performance through implementation of the Exelon Nuclear Management Model (ENMM) and integration into the Exelon fleet.

Integrated Report to Support Restart of Fort Calhoun Station

A. Purpose

This IRR documents the basis for OPPD's determination that it has taken the necessary actions to ensure that FCS can be safely and reliably returned to service. As described in this IRR, OPPD successfully implemented the IPIP, addressed the Restart Checklist items, and completed the commitments documented in the FRP and the CALs. OPPD has concluded that FCS is ready for restart.

B. Background/Chronology

In early April 2011, OPPD shut down FCS for a scheduled refueling outage. On May 23, 2011, in response to rising water levels along the Missouri River, OPPD began implementing flood protection measures around the site to protect various safety-related structures, including the Intake Building, the Auxiliary Building, and the Containment Building. Subsequently, on June 6, 2011, OPPD declared an NOUE in anticipation that the Missouri River level at the plant would reach 1,004 ft msl. Subsequently, based on receding river levels, OPPD exited the NOUE on August 29, 2011.

On June 7, 2011, the failure of a feeder breaker for a 480 Vac load center resulted in a fire in the station's west switchgear room. The fire caused the loss of power to six of nine safety-related 480 Vac electrical distribution buses and two of four safety-related 4,160 Vac buses. Consequently, OPPD declared an Alert. The Alert declaration was exited within four hours after sufficient electrical equipment was reenergized.

In a letter dated August 10, 2011, OPPD submitted to the NRC the FCS FRP and a separate non-public Security Recovery Action Plan. These plans provided details on actions OPPD would take to assess and address the impact of the long-term flooding at FCS on plant systems, structures, and components and the 480Vac bus fire.

On September 2, 2011, the NRC issued to OPPD a CAL, which confirmed that OPPD would complete certain of the actions OPPD committed to take in response to the flooding conditions and switchgear fire prior to restarting the plant.

Subsequently, on December 13, 2011, the NRC removed FCS from routine inspection and oversight described in the ROP and placed FCS under special oversight described in IMC 0350, "Oversight of Reactor Facilities in a Shutdown Condition due to Significant Performance and/or Operational Concerns." The NRC described that this decision was based on the following considerations:

- The plant was in the Multiple/Repetitive Degraded Cornerstone Column of the ROP Action Matrix;

- Restart of the plant was delayed due to performance concerns associated with the flood and fire;

- The NRC issued a CAL to document actions OPPD committed to take before restart to restore the plant from the effects of the flood and fire; and

- OPPD needed to accomplish significant analysis of the extent of condition and extent of cause of known performance deficiencies to fully understand what actions were necessary to restore acceptable performance at FCS.

In January 2012, OPPD and Exelon entered into an Advisory Services Agreement in which Exelon provided advisory and other support services to OPPD for recovery and restart of FCS. That agreement remains in effect until FCS achieves 100 percent power. Under that short-term agreement, Exelon supplied OPPD with a team of full-time experts to advise and consult on the FCS recovery and restart. With Exelon support, OPPD developed the FCS Recovery Team.

C. Integrated Performance Improvement Plan

The FCS recovery effort involved a large number of activities related to problem discovery and resolution, performance improvement, restart readiness, and regulatory margin recovery. After the June 2011 flood, OPPD developed several different action plans to address known issues at FCS. These included plans to address flood recovery, engineering issues, and Corrective Action Program (CAP) effectiveness. In early 2012 these plans were in varying stages of completion and had been developed with limited coordination. Upon its formation, the FCS Recovery Team integrated those plans and filled gaps where the existing plans were not sufficiently comprehensive. This resulted in the issuance of the FCS IPIP, Revision 0, on March 6, 2012. The Recovery Team entered the refined plans and additional discovery findings and recovery actions into the station project management tool. The resulting schedule formed the core of actions contained in the IPIP.

The FCS IPIP provided the integrated management structure and approach to fully assess the performance deficiencies at FCS and guide the recovery and restart of the plant. The goals of the IPIP were to:

- Create an aligned, accountable organization with clear individual roles and responsibilities;

- Transform the culture to one that drives and rewards timely problem identification and resolution (P&IR);

- Strengthen organizational effectiveness, the CAP and human performance;

- Develop an operational focus that results in improved station performance, equipment reliability and risk reduction;

- Ensure ownership of the improvement initiatives;
- Reestablish regulatory confidence; and
- Reinforce stakeholder confidence.

The IPIP incorporated a number of recovery items, such as the FRP and the revised CAL with the Restart Checklist. The FRP is included as Appendix B to the IPIP and the Restart Checklist Implementation Strategy is included as Appendix C.

On June 11, 2012, the NRC issued a revised CAL, which included a Restart Checklist. The Revised CAL and Restart Checklist addressed expanded actions contained in the IPIP that OPPD committed to understand and resolve the underlying performance issues that resulted in the protracted performance decline at FCS. On February 26, 2013, the NRC updated that CAL and associated Restart Checklist adding several additional actions OPPD committed to take.

The IPIP was a living document that was first submitted to the NRC as Revision 3 on July 9, 2012. The IPIP was subsequently revised and Revisions 4 and 5 were submitted to the NRC on November 1, 2012, and June 19, 2013, respectively.

In August 2012, OPPD and Exelon entered into a 20-year Operating Services Agreement. Under the OSA, Exelon manages the day-to-day operations of the plant and: (1) provides OPPD with support in implementing the Exelon Nuclear Management Model (ENMM) at FCS; (2) institutes core ENMM infrastructure requirements through a transition period; (3) provides corporate support from Exelon's nuclear fleet; and (4) completes a staged transition and integration of FCS into the operational systems and processes of Exelon's nuclear fleet.

As the day-to-day manager of the station, Exelon provides a team of key experienced executives and managers who are assigned full-time to FCS and are integrated into the FCS organization. This team has the authority for management decisions relating to operational practices, including implementation of the ENMM and the ability to recommend and implement changes in the station's nuclear management, organizational structure and staffing, Nuclear Safety Review Board (NSRB) membership, budget, and procedures and processes related to safety margins and performance at the facility. FCS personnel report directly or indirectly to the Site Vice President/Chief Nuclear Officer, an Exelon employee. OPPD remains the owner of the facility and NRC licensee.

The NRC issued its Restart Checklist Basis Document on November 13, 2012. The Basis Document provides details on the actions that the NRC planned to take to verify that OPPD adequately addressed the specific items in the Restart Checklist.

The NRC issued a second revised CAL and associated Restart Checklist on February 26, 2013. The revised checklist incorporated three new OPPD commitments related to the results of its discovery activities concerning the Safety System Functional Failure

(SSFF) Performance Indicator, and the design of containment electrical penetrations and containment internal structures. On March 7, 2013, the NRC updated its Basis Document to address the changes to the Restart Checklist.

Readiness for Restart

A. Closure of Restart Checklist Commitments

1. Causes of Significant Performance Deficiencies and Assessment of Organizational Effectiveness

a. Flooding Issue — Yellow Finding (Restart Checklist Item 1.a)

In a letter dated October 6, 2010, the NRC provided OPPD with the final significance determination of the preliminary Yellow finding identified in an inspection report dated July 15, 2010. The NRC reiterated its previous finding that OPPD failed to maintain written procedures for combating a significant external flood and that FCS's written procedures did not adequately prescribe steps to mitigate external flood conditions in the Auxiliary Building and the Intake Building up to 1,014 ft msl, as documented in the Updated Safety Analysis Report (USAR). Consequently, NRC confirmed that the violation was appropriately characterized as Yellow.

In April 2011, OPPD shut down FCS for a scheduled refueling outage. In June 2011 the Missouri River flooding event began. OPPD declared a NOUE on June 6, 2011, in anticipation that the Missouri River level at the plant would reach 1,004 ft msl. During this event OPPD implemented improved removable flood barriers (flood gates) and improved procedures under actual flood conditions.

In an inspection report dated May 11, 2012, the NRC found that: (1) OPPD's procedural guidance was inadequate to mitigate the consequences of external flooding at FCS; (2) OPPD failed to classify the six Intake Building exterior sluice gates and their motor operators as Safety Class III; and (3) FCS does not meet design basis requirements for protection of the safety-related raw water system during a design basis flood for flood levels between 1,010-1,014 ft msl. NRC issued three violations regarding these deficiencies and further determined that these violations were related to the previously issued Yellow finding regarding the ability to mitigate an external flood. The significance of these findings was bounded by the Yellow finding and therefore was not characterized with separate color significance.

Finally, in a letter to the NRC dated November 6, 2012, OPPD made a commitment to install a plant modification that will eliminate the need to re-position the Intake Building sluice gates during flood levels between 1,010 and 1,014 ft msl.

Analyses

OPPD performed multiple analyses to address the flooding issues described above, including reviews of procedural guidance and removable flood barriers to ensure that systems, structures and components (SSC) required to achieve and maintain cold

shutdown are not adversely affected up to the design basis flood level of 1,014 ft msl. OPPD subsequently expanded the procedure review scope to include additional flood mitigation procedures and supporting or interfacing procedures and manuals. As a result of the procedure reviews, OPPD determined that the following attributes were satisfactory: inventory, availability, current condition, and condition sustainability of equipment, materials and disposables called for in flood mitigation procedures.

OPPD's review of SSCs associated with this Yellow finding included permanent flood barrier penetrations, removable flood barriers, and the structures that house and protect FCS systems and components required to achieve and maintain cold shutdown. Specifically, this included the Intake Building and its permanently-installed flood barrier penetrations and removable flood barriers; and the Auxiliary Building and its permanently-installed flood barrier penetrations and removable flood barriers. Major components housed in these structures that are required to achieve and maintain cold shutdown are the raw water pumps at the Intake Building, and the emergency diesel generators (EDG) and associated switchgear and controls in the Auxiliary Building. Supporting components and equipment include the component cooling water system, normal EDG fuel supply, and an alternative fuel source for the EDGs when the duration of flooding causes the normal fuel supply to be exhausted. OPPD also reviewed components that require special operation or pre-positioning during a flooding event to confirm that they were capable of performing their credited function(s) and that their physical condition and qualifications were satisfactory.

Based, in part, on causal analyses performed to address the flood-related issues, and with emphasis added by operating experience during the 2011 Missouri River flooding event, OPPD identified additional issues related to mitigating the effects of a design basis flooding event at FCS. OPPD placed these issues into the FCS CAP where they have been resolved or are being tracked to resolution.

Corrective Actions

This Restart Checklist Item encompasses several separate, but related issues. This subsection of the IRR includes the status of those issues and corrective actions taken to address them.

- External Flood Mitigation Procedures and Removable Flood Barriers. OPPD redesigned removable flood barriers with a function to provide protection for vital equipment at the Intake Building and in the Auxiliary Building. OPPD replaced the original flood barriers with improved barriers that provide protection to a design basis flood level of 1,014 ft msl. The new flood barriers are designed, fabricated, qualified, and maintained as Limited-Critical Quality Element (LCQE) (Safety Class III) equipment. OPPD reviewed, revised, validated and verified flood mitigation procedures to provide protection to vital areas and equipment required to ensure that the reactor can achieve and maintain cold shutdown for flooding events up to the design basis flood level of 1,014 ft msl.

OPPD developed a contingency action plan to provide fuel to the EDGs for postulated long-duration floods. This contingency is now included in flood mitigation procedures. OPPD determined estimated times and resources required to implement various flood mitigation actions.

OPPD also revised a number of flood mitigating procedures, including:

- AOP-01, “Acts of Nature, Section I — Flood”;
- EPIP-TSC-2, “Catastrophic Flooding Preparations”;
- PE-RR-AE-1000, “Flood Barrier Inspection and Repair”;
- PE-RR-AE-1001, “Flood Barrier and Sandbag Staging and Installation”;
- PE-RR-AE-1002, “Installation of Portable Steam Generator Makeup Pumps”;
- PE-RR-AE-1003, “Preparation of Station Non-Vital Assets for External Flooding”;
- OI-PGP-1, “Operation of Portable Gas Powered Pumps”; and
- OI-FO-1, “Fuel Receipt (FO-1, FO-10, FO-27, FO-32, FO-43A, and FO-43B).”

- Permanently Installed Flood Barrier Penetrations. OPPD evaluated the physical condition of each flood barrier penetration. OPPD identified deficiencies in those seals as a flood barrier and repaired and restored each of those deficiencies. OPPD also developed procedure SO-G-124, “Flood Barrier Impairment,” which provides a process to ensure that flood barrier degradations or impairments are properly identified, evaluated, and tracked to restoration, with appropriate compensatory actions specified if flooding conditions should occur during the time that the barrier is degraded or impaired.

  A number of FCS flood barriers use Dow Corning 3-6548 sealant; several of these flood barrier penetrations are also credited as fire barriers. Eighty-four of the fire/flood barrier penetrations are sealed with Dow Corning 3-6548 foam; Dow Corning 3-6548 has also been used in two FCS penetrations credited only for flood protection. Dow Corning 3-6548 has been rigorously qualified as a fire barrier, but had not previously been tested as a flood barrier for FCS penetration configurations below 1,014 ft msl. OPPD performed a thorough test program to qualify Dow Corning 3-6548 as a flood barrier for applicable FCS configurations. An alternate material, 3M 3000WT, was also tested for FCS applications.

- Processes and Procedures to Ensure Appropriate Tools, Equipment, Materials, and Consumables for Flood Mitigation are Readily Available. OPPD upgraded flood mitigation procedures to provide comprehensive lists of materials credited for use in the procedures. OPPD revised the applicable procedures to ensure that sufficient inventory and preventive maintenance of flood mitigation materials is periodically performed.

- OPPD developed Engineering Change (EC) 55394 to provide bypass around the sluice gates when river level is greater than 1,002 ft msl; this EC also qualified the sluice gates as LCQE and provided a means for operators to verify that the sluice gates are closed or nearly closed. OPPD developed and implemented procedure changes under EC 60330 to support the use of installed flood control valves CW-323 through CW-326 and new flood isolation valves CW-327 through CW-330 as compensatory measures pending final approval of the License Amendment Request for EC 55394.

- Update and Revise FCS Design and Licensing Basis Documents Related to External Flooding. OPPD developed engineering analysis (EA) 10-032, "External Flooding Design Basis," which describes the FCS external flood design basis and provides a basis for updates to the USAR, Technical Specifications (TS) and design basis documents. OPPD made substantial improvements to USAR Sections 2.7, "Hydrology," and 9.8, "Raw Water System," that more clearly describe the FCS design basis flood protection levels and revised TS LCO 2.16, "River Level," to more clearly state the requirements and describe FCS's capability to provide flood protection to a river level of 1,014 ft msl.

  OPPD revised design basis documents related to flooding and flood mitigation procedures, and upgraded and revised SSCs to be consistent with USAR changes and include lessons learned from the 2011 flood. This includes changes to PLDB-CS-56, "External Flooding," SDBD-AC-RW-101, "Raw Water," SDBD-AUX-502, "Auxiliary Building," and SDBD-STRUC-503, "Intake Building."

  OPPD developed additional calculations to provide a technical basis and to confirm the adequacy of flood mitigation procedures, including:

  - FC08030, "Intake Structure Cell Level Control Using the Intake Building Sluice Gates," provides a technical/analytical method for procedural actions to pre-position sluice gates to severely restrict in-flow and control intake cell level with raw water pump(s) during flood levels of 1,004 to 1,014 ft msl;

  - FC08066, "Switchgear Room Heat up During Postulated External Flooding Event," validates procedural actions to establish an

alternate method for critical switchgear room cooling if normal cooling is lost during a flood; and

- FC08034, "Diesel Fuel Usage During a Severe Flooding Event," and FC08070, "Validation Backup of Fuel Oil Transfer During Flooding Conditions," validate that adequate fuel oil can be made available to the EDGs during a prolonged flood.

- Finally, OPPD considered the impacts of a flood on the FCS Independent Spent Fuel Storage Installation (ISFSI), which has its own Safety Evaluation Report and TS that are governed by 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste." The ISFSI is cooled by natural circulation air flow and the design basis flood level of 1,014 ft msl will cover the lower vents, interrupting the cooling air flow. OPPD hired Transnuclear Incorporated, the ISFSI vendor, to perform a detailed analysis of the ISFSI, which confirmed that spent fuel storage cask temperature limits would not be exceeded during a flood that blocks air flow to the lower ISFSI vents.

b. Reactor Protection System Contactor Failure — White Finding (Restart Checklist Item 1.b)

OPPD first identified deficiencies with the Reactor Protection System (RPS) M-2 contactor during performance of a surveillance on November 3, 2008, when Instrumentation and Control (I&C) personnel noticed that the contactor was chattering. Operations determined that the contactor was "operable but degraded" based on input from Engineering that the noise did not indicate a pending failure, and that a failure could only result in a channel trip.

Three days later, Electrical Maintenance (EM) performed work on the contactor to eliminate the noise by implementing a temporary repair and reattaching the shading coils by "peening" the corners of the yoke over the shading coils. None of the personnel involved recognized that form, fit, and function had been compromised when the shading coils were reattached without a formal evaluation. The work was performed outside the guidance of the controlling procedure. I&C resumed the surveillance test and completed it satisfactorily. This was not recognized as preconditioning.

The system engineer recommended that the four contactors be replaced due to the age of the equipment. Consequently, OPPD generated EC 44745 and associated work requests on November 19, 2008, to replace the M contactors. These work requests, however, were incorrectly issued as "enhancements" and were expected to be implemented during the 2009 outage (and later deferred to the 2011 outage.)

On December 18, 2008, the Degraded/Non-Conforming Condition (DNC) Subcommittee overruled Operations' original decision that the M-2 contactor was "degraded," and

changed the status to "not degraded." As a result, OPPD completed the 2009 outage without performing an evaluation of the M-2 contactor condition.

On March 20, 2010, OPPD initiated Condition Report (CR) 2010-1378 to address the increased pitch and volume of the M-2 contactor chatter. The CR was assigned a "D" condition level, indicating a condition not adverse to quality, and was closed with "no evaluation required." Five days later during performance of the same I&C surveillance test as in 2008, however, I&C personnel again heard a loud noise emanating from the M-2 contactor; as a result, I&C aborted the test. OPPD initiated CR 2010-1460 to address the increased noise from the M-2 contactor. The contactor was screened in the CR as meeting the licensing basis (not degraded); however, the operability basis stated that the contactor was "operable but degraded" and repeated much of the same language used in the 2008 analysis.

On March 31, 2010, EM investigated the source of the noise and found one of the shading coils was loose again. Maintenance "snapped" the loose shading coil back on the yoke; the contactor chatter was still present, although at a reduced level. The I&C surveillance was completed successfully and the equipment was left in that state. Operations accepted the noise from the contactor.

On June 14, 2010, the M-2 contactor failed to open during performance of IC-ST-RPS-0042, "Quarterly Functional Test of RPS Trip Logic." Operations placed FCS in the Limiting Condition for Operation (LCO) for TS 2.15(1). Twenty-one hours later OPPD placed the channel in the tripped condition and exited the LCO. OPPD determined that this failure mode was non-conservative because with the M-2 contactor failed in the closed position, an additional failure of the M-1 contactor in the closed position would have made the RPS trip function inoperable in the event of a scram signal.

Subsequently, OPPD conducted a formal failure analysis of the contactor and concluded that a shading coil had fragmented due to wear from being hammered between the armature and yoke at 120 Hz for nearly three months. A fragment of the shading coil lodged itself in the contactor mechanism, preventing proper operation.

In an inspection conducted during the first quarter of 2011, the NRC found that:

> [B]etween November 3, 2008, and June 14, 2010, [OPPD] failed to assure that the cause of a significant condition adverse to quality was determined and corrective actions were taken to preclude repetition. Specifically, [OPPD] failed to preclude shading coils from repetitively becoming loose material in the [M-2] reactor trip contactor. [OPPD] failed to identify that the loose parts in the trip contactor represented a potential failure of the contactor if they became an obstruction; and therefore, failed to preclude repetition of this significant condition adverse to quality, that subsequently resulted in the contactor failing.

The NRC classified this deficiency as a White Finding in its Final Significance Determination EA-11-025, dated July 18, 2011.

Root Causes

OPPD conducted Root Cause Analysis (RCA) 2011-0451 to investigate the causes of the contactor deficiencies, which identified a number of inappropriate actions and/or decisions that allowed this continued operation, including:

- Stopping a surveillance to perform corrective maintenance and then resuming it without designating the test as "failed";
- Operations accepting informal and incorrect information from Engineering;
- Failing to declare the contactor inoperable and entering an LCO when the surveillance tests could not be completed because of an equipment issue;
- Failing to maintain a sufficient supply of spare parts for important equipment classified as "do not run to failure";
- EM performing unauthorized repairs and was not questioned by other personnel present;
- Preparing inadequate work packages that were accepted by working-level personnel, who then "worked through" the issue;
- Inadequate management and supervisory oversight of repair activities and resolution of a known equipment issue;
- DNC subcommittee changing the Operations determination from "degraded" to "not degraded" without new information;
- Improperly deferring the EC to replace the four contactors;
- Tolerating contactor chatter for more than two months by Operations and others visiting the control room;
- Tolerating a degraded condition within the RPS system without expediting a solution until an actual failure occurred; and
- Lacking clear guidance for applying TS requirements in the event of an M contactor failure from 2008 to 2011, despite knowing of the potential for such a failure and the gap in TS regarding these components.

Corrective Actions

OPPD took a number of corrective actions to address the causes of this deficiency, including:

- Requested and obtained from the NRC a license amendment to define operability of the RPS M Contactors.

- Implemented a comprehensive Safety Culture Improvement Plan, summarizing activities planned to improve nuclear safety culture at FCS as recommended in the report for CR 2012-08133, "95003 Fundamental Performance Deficiencies Common Factors Analysis."

- Revised FCSG-24-3, "Condition Report Screening," to state that:

    - Changes to the Operations Screening decisions may only be made by the on-duty Shift Manager at the time the change is made; and

    - Any substantial information relied upon by Operations in making an operability or functionality decision shall be provided to Operations through a formal documented means and attached to the applicable CR. Prompt operability or functionality decisions may utilize undocumented information provided an action to provide the required documentation is created in the CR with an appropriate due date.

- Revised SO-M-101, "Maintenance Work Control," to strictly define skill of the craft and establish the requirement that craft shall not perform any work activity that is not skill of the craft without authorization of an approved work document or procedure.

- Revised PED-QP-14, "Use of Engineering Judgment," to formalize the process for documenting engineering judgment in non-engineering work products. The procedure now requires that engineering judgment be documented in every case where it is used to support a DNC or operability determination.

- Revised SO-G-23, "Surveillance Test Program," to state that surveillances shall be completed once they are started unless there are extenuating circumstances. Any surveillance that is halted or paused for any reason shall be promptly reported to the Shift Manager for purposes of determining the effect of the halted surveillance on operability. In no case shall any maintenance activity that could affect the surveillance be performed on any component or system that is under surveillance testing except those activities specifically authorized and controlled within the surveillance.

- Replaced the M contactors with a newer model.

- Revised procedure FCSG-33, “FCS Issue Prioritization and Plant Health Committee Process,” to improve the Plant Health Committee (PHC) as follows:

    - Revised PHC quorum requirements to include the senior management level;

    - Revised PHC and individual responsibilities to ensure station alignment with AP-913, “Equipment Reliability,” and AP-928, “Work Management,” attributes;

    - Revised PHC agenda to direct that more focus be spent on overseeing Equipment Reliability (ER) programs and processes; and

    - Increased PHC meeting frequency to weekly to align with Exelon PHC procedure.

- Revised and issued SO-G-5 “Fort Calhoun Station Review Committee,” to prevent the Plant Review Committee (PRC) DNC subcommittee from removing the DNC classification from CRs previously screened by the DNC.

- Trained the Maintenance organization regarding form, fit, and function for SSCs covered by the Maintenance Rule.

- Trained qualified Design and System Engineers and the Operations organization regarding licensing basis DNCs.

- Informed station personnel using various communications methods of the importance and obligation to report and aggressively pursue resolution of abnormal plant conditions identified by sight, touch, sound, or smell.

- For Operations crews, reinforced the need to maintain a professional atmosphere and expectations for a low tolerance for distractions in the Control Room, including their responsibility to take prompt actions to correct out-of-specification or adverse trend readings, abnormal plant conditions, or other situations that impede plant operation.

- Trained licensed and non-licensed Operations personnel on recognition of “chattering” or degrading relays and their expected response. Station Corrective Action Review Board (SCARB) approval will now be required prior to any determination to cancel or modify this corrective action.

- Incorporated the lessons learned from this event into Institute of Nuclear Power Operations (INPO) Significant Operating Experience Reports 10-02 Training.

OPPD will also complete several other corrective actions, post-restart, including:

- Using the metrics developed for the comprehensive Safety Culture Improvement Plan, OPPD will review station safety culture performance for the period January 1, 2013 through June 30, 2013.

- Using the metrics developed for the comprehensive Safety Culture Improvement Plan, OPPD will review station safety culture performance for the period July 1, 2013 through December 31, 2013.

- Revise SO-G-87, "Non-Routine Activities Requiring Formalized Plans," to require that any formalized plan presented for PRC approval shall be incorporated in the appropriate document controlling the non-routine activity and that the activity shall be performed using the PRC-approved document.

- Train Maintenance personnel on the changes made to SO-G-23, "Surveillance Test Program."

- Train Operations personnel on the relationship between surveillance test results and equipment operability, in particular the significance of halting a surveillance test due to equipment issues and how that may affect the operability of the equipment being tested.

- Institute a cross-disciplinary team consisting of representatives from Licensing, Operations, and Design Engineering to review TS Task Force changes to determine if FCS could benefit from their adoption.

- Prepare and submit to the Business Unit Review Committee for review a revised business case, per FCSG-26, "Site Workload Management" and the Corporate Capitalization Policy, for funding a conversion to Improved Technical Specifications.

c. <u>Electrical Bus Modification and Maintenance — Red Finding (Restart Checklist Item 1.c)</u>

On June 7, 2011, with the plant in Mode 5 and reactor refueling cavity level 23 feet above the core, a fault and fire caused the destruction of safety-related load center 1B4A supply breaker compartment. During the event, both trains of safety-related DC electrical distribution continued to operate, but developed ground alarms because of extensive wire damage inside cubicle 1B4A. Accompanying the DC ground alarms were numerous control room alarms fed from the DC circuits. The event caused a

Halon discharge into the switchgear rooms and OPPD declared an alert that required non-essential personnel to leave the Protected Area.

Subsequent investigations show that the fire caused a loss of power to loads supplied from the 1B4A load center, as well as a trip of the main supply circuit breaker to load center 1B3A, which is associated with the redundant train of safety-related 480 Vac power. Three buses were lost as a direct result of the event (1B3A, 1B3A-4A, and 1B4A). Three additional buses (1B3B-4B, 1B4B, and 1B4C) were intentionally de-energized by Operations after the bus 1B3A trip as a preventative measure to aid in damage mitigation and assessment.

Analyses

After the event OPPD conducted several analyses that determined the following root causes and appropriate corrective actions:

- Design Control – RCA 2011-5414, "Breaker Cubicle 1B4A Fire," determined that the most probable direct cause of the fire was a high resistance connection that was primarily caused by cradle fingers that engaged the bus stabs in a contact area that had hardened grease and copper oxide buildup. In November 2009 OPPD changed out the original 12 GE AKD-5 480V load center feeder breakers and bus-tie breakers with Square D breakers supplied through Nuclear Logistics Incorporated (NLI). The GE AKD-5 switchgear bus stabs that connected to the NLI cradle fingers had approximately one inch of silver-plating on the stab tips, which was designed to prevent high resistance at the finger-to-stab connections. The NLI cradles had cradle finger lengths 3/8" longer than the GE AK-50 breaker fingers. Extent of condition inspections verified that some NLI cradle fingers did not contact the silver-plated area while others had minimal contact. This resulted in higher resistance connections because the cradle fingers and switchgear bus stabs engaged where there was oxidized copper and old grease instead of at the silver plating.

  A contributing cause was the failure to "normalize" the bus stabs of the GE switchgear. A "normalized" breaker compartment is a GE AKD-5 breaker compartment that has been adjusted and lubricated to the requirements of the new NLI cradle interface specifications. This assures the proper alignment of the cradle fingers to the bus stabs, which will reduce connection resistance. NLI did not require normalization in its installation procedures, noting only to "adjust as necessary." The engineer did not challenge the differences in the circuit breakers between the original GE and new NLI breakers, and did not recognize that these differences were critical characteristics. As a result, during installation, no such "normalization" was performed.

  The extent of cause evaluation determined that the causes of the 1B4A cubicle fire potentially extended to other design activities. This includes

specification of post-modification test criteria, preparation of modifications, facility changes, minor configuration changes, procurement specifications, construction work orders (WO), and field design change requests. The design process lacked a requirement to identify and compare critical characteristics when performing modifications.

Corrective Actions

To address the failure of the design process, OPPD revised FCS design procedures that incorporate guidance for identifying critical characteristics of modified equipment. Once the critical characteristics are determined, they are compared with the original with respect to fit, form, and function. Additionally, OPPD has expanded the operating experience search criteria for modifications to include INPO databases: Significant Operating Experience Reports, INPO Event Reports, Significant Event Reports, and Significant Event Notifications. This will reduce missed opportunities to prevent future modification-related events and ensure long-term sustainably.

- Inadequate Corrective Actions – OPPD found that it missed several opportunities to prevent the fire because of inadequate use of the Corrective Action and Preventive Maintenance (PM) programs. Specifically, the FCS PM procedure in use at the time of the November 2009 modification did not contain instructions to remove the switchgear bus compartment inspection covers. The EM department interpreted the lack of instructions to mean that bus compartment maintenance was not required; consequently, maintenance was performed only in easily accessible areas of the switchgear. The requirement to periodically inspect the bus compartment had not been completed.

  In May 2008, OPPD generated CR 2008-3548 to document a failure of bus tie breaker BT-1B3A to close during performance of a hot bus transfer of 480 Vac bus 1B3A. Corrective actions to address this failure, however, did not consider revising procedures to require switchgear panel removal, nor were design changes made to allow easier access to the bus compartment of the switchgear. This represented a failure of the FCS CAP to ensure 480 Vac electrical power distribution system power connections were adequately cleaned, torqued, inspected, and tested for abnormal connection temperatures.

  Another deficiency of the FCS CAP concerned the failure to properly address the acrid odor in the west switchgear room, first identified three days before the fire. The odor was not adequately communicated to Engineering, Maintenance, or management. At that time, OPPD did not consider the odor to be a significant condition adverse to quality. Also, the systematic troubleshooting guidance available at that time did not include

the level of rigor required to determine the source of acrid odors and thermography was not used to determine the source of the acrid odor.

Corrective Actions

OPPD implemented EC 53347 in January 2012. It provides better access to the switchgear bus compartments to accommodate periodic PM. OPPD revised EM-PM-EX-1200, "Inspection and Maintenance of Model AKD-5 Low Voltage Switchgear," to add instructions for verifying the condition of the silver-plated primary disconnect stab areas and to require the removal of hardened grease residue on primary disconnect stabs. In addition, a step was added to provide independent verification of the primary disconnect stabs cleanliness by the system engineer.

The untimely reporting of the acrid odor has been corrected through a revision to AOP-06, "Fire Emergency," which now instructs Operations personnel on the actions to take when an acrid odor is identified. Furthermore, an aspirating detection device was procured to aid in fire detection.

- Fire Protection Program – The bus fire resulted in a loss of power to load centers that are associated with redundant trains of safety-related 480 Vac power. This is inconsistent with the USAR requirement that no single failure of active components will inhibit necessary safety functions for safe shutdown of the plant. Further, Appendix R of 10 CFR Part 50, "Fire Protection Program for Nuclear Power Facilities," requires protection for SSCs important to safety so that a fire that is not promptly extinguished by fire suppression activities will not prevent the safe shutdown of the plant. In addition, fire protection features shall be capable of limiting fire damage so that:

  - one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station is free from fire damage, and

  - systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station can be repaired within 72 hours.

  In RCA 2011-6621, "1B3A Main Breaker Trip during Switchgear Fault on 1B4A," OPPD determined through a visual inspection of the 1B3A cradle that the Zone Selective Interlock (ZSI) wire jumpers were incorrectly installed. If Breaker 1B3A had been wired as designed, then the Electrical Distribution System would have operated properly, and would have met License Condition 3.D, "Fire Protection Program," USAR Section 9.11.1,

and commitments to the NRC regarding 10 CFR Part 50, Appendix R, Section III.G "Fire protection of safe shutdown capability."

A Factory Acceptance Test was performed during implementation of the 2009 modification that installed the NLI/Square D replacement breakers. This test should have identified the wiring error, but failed to do so because the test took the ZSI jumpers out of the circuit.

In sum, the failure to comply with the Fire Protection Program was primarily caused by inadequate implementation of a modification and inadequate post-modification testing. This gap resulted in a failure to specify a test that would ensure proper breaker performance. In addition, modification procedures did not consider the possibility that improperly configured new components could adversely affect required performance characteristics. Finally, there were no detailed standards for performing and documenting wire/continuity checks for new wiring. Instead, it was left to the test and field engineers to judge the level of detail required.

Corrective Actions

OPPD implemented several corrective actions to resolve the issues that caused the 1B3A cross-trip and implemented measures to prevent recurrence of similar events. First, OPPD verified the correct placement and continuity of ZSI jumpers in the station and verified breaker over-current coordination through primary current injection testing, as well as by using a special tool which checked continuity of the jumpers. OPPD also modified design procedures to require the design engineer to compare features of new equipment with those of the original equipment, including the potential adverse impact of new features on required performance characteristics. This is now a requirement for modifications, Substitute Replacement Items, and Facility Changes.

OPPD provided interim guidance to supervisors in Design Engineering Nuclear (DEN) and Engineering Projects until these actions were completed. Furthermore, OPPD developed a control circuit testing procedure to ensure control circuits will operate correctly. Finally, OPPD reviewed modifications for equipment provided by NLI, as well as other electrical/I&C modifications implemented during the prior five years, to determine if wiring errors could exist that testing would not identify. No such deficiencies were found.

d. Security — Greater-than-Green Findings (Restart Checklist Item 1.d)

There were five Safeguards Information (SGI) events at FCS between January 2011 and November 2012, which resulted in four NRC White Findings and three NRC violations. OPPD reviewed SGI-related CRs generated at FCS during the prior five years and used the NRC website to obtain relevant industry operating experience and standards. OPPD conducted four root cause analyses and one apparent cause analysis (ACA). These analyses addressed the SGI events both collectively, as well as individually, using applicable industry standards, operating experience and regulatory commitments. OPPD implemented corrective actions to address these issues.

Details of these events and the corrective actions to prevent recurrence are being withheld from this IRR because of their security-related nature.

e. Third-Party Safety Culture Assessment (Restart Checklist Item 1.e)

Both NRC Inspection Procedure 95003 and Inspection Manual Chapter (IMC) 0350 require the licensee to perform an independent third-party evaluation of the facility's safety culture. OPPD commissioned Conger & Elsea, Inc. to perform such an evaluation in February and March 2012. Conger & Elsea conducted the evaluation using a methodology consistent with the current NRC procedures for evaluating safety culture and focused on the following components as specified in IMC 0305:

- Human Performance
  - Decision-Making
  - Resources
  - Work Control
  - Work Practices
- Problem Identification and Resolution
  - Corrective Action Program
  - Operating Experience
  - Self and Independent Assessments
- Safety Conscious Work Environment
  - Environment for Raising Concerns
  - Preventing, Detecting, Mitigating Perceptions of Retaliation

- Other Safety Culture Components
    - Accountability
    - Continuous Learning Environment
    - Organizational Change Management
    - Safety Policies

The scope of the safety culture assessment covered each of the FCS functional areas and consisted of: (1) review of relevant documents; (2) an Organizational Safety Culture Survey that was electronically administered to OPPD and contract employees; and (3) interviews of individuals and focus groups from OPPD.

In its report issued on May 11, 2012, Conger & Elsea made a number of conclusions concerning the safety culture at FCS, including:

- Human Performance

While some examples of conservative decision-making were identified, examples of non-conservative decision-making were more prevalent in evaluating significant events. Standards and expectations with respect to work practices and work control needed to be more clearly identified, communicated, and reinforced. The majority of employees (both staff and management) did not trust senior management to be open, to make the right decisions, to be accountable for what has happened, and to lead the station back into operation. For this component, Conger & Elsea concluded that OPPD must instill "leadership behavior that demonstrates the ability to develop a strategic vision and path forward for the Station, to make decisions consistent with that vision, to engage the workforce, and clearly communicate the expectations and standards around that vision…."

- Problem Identification and Resolution

Many FCS personnel believed that the CAP was not as effective as it should be. Senior leadership provided weak oversight of the process and management engagement with the process had been very limited. The criticality and ability to self-identify issues and causes needed to be enhanced. Operating experience needed to be better integrated into a learning process and a stronger independent oversight organization was needed to help identify areas for performance improvement. Moreover, many FCS personnel felt that FCS management did not really want problems or concerns reported and that issues raised would not be addressed. Most FCS personnel did not understand or recognize the relationship of the CAP to performance improvement and the role it plays in the development of a learning organization.

For this component, Conger & Elsea concluded that Performance Improvement and the CAP must be "reassessed and realigned to ensure that employees understand its value

and priority in enhancing performance. In particular, the roles and expected behaviors of Management with respect to CAP need to be clearly communicated and reinforced."

- Safety Conscious Work Environment

The majority of employees believed that even though management says that it does not tolerate retaliation, there was still a widespread perception of fear and punishment across the station. The majority of employees believed that they could not challenge management decisions, that helpful criticism was not encouraged, and that they could not approach management with concerns. Management had not been successful in communicating and reinforcing the values and attitudes that were important for enhancing safety culture.

For this component, Conger & Elsea concluded that:

> Management needs to evaluate what behaviors can be used to create an environment where beneficial challenging, a healthy questioning attitude, and the reporting of concerns can be accepted, supported and desired. Efforts to erase the perceptions of fear around potential punishment will have to be made to provide a better foundation from which the appropriate behaviors can be effectively achieved.

- Other Safety Culture Components

Accountability was described by most of the FCS interviewees as the biggest issue for the station. Many individuals in management and supervision did not consistently exhibit desired behaviors and were not challenged by their managers or peers. Inconsistent implementation of standards and expectations in work activities were common and may have been facilitated by deficient communication around the change management process. Significant management oversight and attention was needed to communicate the standards and expectations and implement the appropriate and consistent performance management system to hold individuals accountable. A significant contributing factor to the accountability issue was the lack of senior management's ownership of many issues.

For this component, Conger & Elsea concluded that OPPD needed to ensure that any accountability model was consistently implemented against clearly communicated and prioritized standards and expectations, recognize and reinforce desired behaviors, and use effective coaching, minimizing punitive actions, for undesirable behaviors. This process needed to be formalized and clearly understood."

Analyses

Following receipt of the Conger & Elsea report, OPPD initiated CR 2012-04262 on May 18, 2012. This CR contains the following problem statement, which is the basis for the resulting RCA: "[FCS] management has been unable to create an environment where

beneficial challenging, a healthy questioning attitude, and the reporting of concerns can be accepted, supported and desired."

OPPD formed an RCA team consisting of 11 OPPD, Exelon, and contractor employees. The team interviewed station personnel and reviewed the 2012 Independent Safety Culture Assessment and other applicable documents to gain insight into the causes of the degraded SCWE. The insights were binned according to the following four pillars essential to a healthy SCWE: (1) CAP; (2) Employee Concerns Program (ECP); (3) willingness to raise concerns; and (4) ability of management to prevent retaliation.

In addition, the RCA team constructed an employee issue reporting model, developed a timeline and Event & Causal Factors chart, performed a barrier analysis, and compared the insights to NRC Regulatory Issue Summary 2005-18, "Guidance for Establishing and Maintaining a Safety Conscious Work Environment." The team also reviewed the Management Oversight and Risk Tree analysis performed for CR 2012-03986, "Organizational Ineffectiveness," and the associated root causes.

Root Causes

The team identified the following two root causes of this deficiency:

- Root Cause 1. Inadequate program oversight, and shortfalls in communicating standards for the FCS safety culture and SCWE by station leadership resulted in erosion of trust in management's ability to effectively implement the core components (CAP, ECP, willingness to raise concerns, and prevention of retaliation) of a healthy safety culture and SCWE.

- Root Cause 2. In certain cases, station leaders had exhibited inappropriate behaviors creating a chilled work environment by discouraging employees from writing CRs, minimizing discussion when dissenting opinions were raised and responding in an untimely manner to identified concerns.

OPPD developed the following corrective actions to prevent recurrence (CAPR) to address these root causes:

- CAPR-1. Use newly developed metrics during Management Review Meetings (MRM), Nuclear Safety Culture Monitoring Panel, Senior Leadership Team, and Safety Audit and Review Committee meetings to identify and correct adverse SCWE trends.

- CAPR-2. Implement facilitated small group multi-discipline employee feedback meetings to identify and prioritize site issues for management action.

- CAPR-3. Develop and conduct training as determined by a Training Needs Analysis. This training should be: (1) conducted by industry subject-matter expert(s) (SME) for the initial series. Subsequent training can be conducted by an industry or OPPD SME; (2) incorporated into annual supervisor and manager continuing training programs; and (3) part of initial supervisor and manager training and qualification programs prior to assuming a leadership role.

The conditions identified by Conger & Elsea and evaluated by the root cause team crossed organizational and functional area boundaries and extend to plant processes and departments throughout the organization.

Interim Corrective Actions

OPPD took a number of interim actions following release of the Conger & Elsea report in May 2012 and the Safety Conscious Work Environment Root Cause Analysis Report. These actions included communications from the Site Vice President to the plant staff regarding the Conger & Elsea results, NOS initiating a CR for a missed opportunity to provide effective oversight of the ECP, and a department stand-down for Security personnel.

Long-Term Corrective Actions

OPPD subsequently took a number of long-term corrective actions, including:

- Created monthly metrics to measure and monitor safety culture and SCWE program effectiveness as well as other components of a healthy nuclear safety culture. The metrics will be used by the MRM, Nuclear Safety Culture Monitoring Panel, Senior Leadership Team, and the Safety Audit and Review Committee to identify and correct adverse safety culture and SCWE trends.

- Implemented small group multi-discipline employee feedback meetings to identify and prioritize site issues for management action. Issues identified during these meetings are entered into the CAP for resolution.

- Developed and conducted training that focused on the role of supervisors and managers in establishing and maintaining a healthy nuclear safety culture and SCWE. The training was ultimately given to FCS personnel, both OPPD and contractors. The training has been incorporated into annual supervisor and manager continuing training programs.

- Changed the ECP manager, the program's organizational structure, and its reporting relationship to assure independence and accessibility to the staff.

- Implemented a site-level formal differing professional opinion program that is consistent with industry best practices.

Safety culture and SCWE survey data taken on a monthly basis at FCS indicates improvement in the site's safety culture and SCWE.

f. Integrated Organizational Effectiveness Assessment (Restart Checklist Item 1.f)

In mid-2012 a team of industry consultants and OPPD personnel performed an RCA of organizational effectiveness-related events at FCS from 2007 through May 2012. The team also reviewed the 2012 Independent Safety Culture Assessment report and Strategic Talent Solutions Executive Leadership Assessment summary. The team characterized the issue it found as:

> Senior leaders and managers are not providing the necessary leadership to improve organizational performance. Additionally, leadership failed to be intrusive, set the right priorities, and hold personnel accountable and has not understood major processes or issues affecting morale. As a result, timeliness and thoroughness of resolution of important issues has been lacking and station performance has declined significantly.

The RCA Team subsequently developed the following problem statement: The FCS organization has been deficient in meeting regulatory and industry standards, resulting in untimely and deficient resolution of issues contributing to a significant decline in station performance.

The RCA Team consisted of seven full-time members and one part-time member with over 233 person-years of industry experience in engineering, operations/plant management, training, human resources, organizational development, and regulatory/root cause analysis. The team expended more than 1,500 hours conducting the analysis, which included: nine observations involving management meetings, staff meetings, Management Review Boards, and shift manager weekend calls. The team reviewed 118 documents, including: procedures, CRs, TS, USAR, Standing Orders, internal and external Operating Experience, INPO assist visit documentation, INPO Assessment documentation, World Association of Nuclear Operators reports, Safety Audit and Review Committee (SARC) report documents, and NRC inspection documents. The RCA Team also conducted 19 interviews of key individuals within and outside the organization to gather information and to validate the team's conclusions.

The RCA Team ultimately identified the following three root causes:

- Root Cause 1. The OPPD organization failed to establish and implement the essential attributes of governance and oversight, including the key elements of individual roles, responsibilities, and accountabilities to enable

FCS to achieve and maintain high levels of operational nuclear safety and reliability.

The team found that OPPD did not have a governance and oversight plan with a set of policies, processes, and programs by which a corporation is directed and controlled, including the roles, responsibilities, and accountability of individuals in the organization. The team found that this cause was pervasive through departmental organization levels at FCS.

- Root Cause 2. Station leaders were more tactical than strategic, prioritized poorly, delegated little, surrendered oversight, rationalized low standards and hesitated to hold personnel accountable, resulting in a culture that valued harmony and loyalties over standards, accountability and performance.

  Accountability was described by most of the individuals interviewed as the biggest issue for the station. Many individuals in management and supervision did not consistently exhibit desired behaviors and were not challenged by their managers or peers. Inconsistent implementation of standards and expectations in work activities were common and were enabled by deficient communication around the change management process. Significant management oversight and attention was needed to communicate the standards and expectations and implement the appropriate and consistent performance management system to hold individuals accountable. Every organization and department at FCS exhibited this deficiency.

- Root Cause 3. FCS leaders failed to develop, implement, and hold people accountable for implementation of important policies and programs to achieve organizational effectiveness. These included, but were not limited to the Corrective Action, Operating Experience, and Observation programs.

  Key programs identified by the RCA Team important for organizational effectiveness were not implemented in accordance with their associated policies. Specifically, the corrective action, change management, accountability, observations, operational experience, and self-assessment programs were determined to be deficient.

OPPD took numerous corrective actions to address these three root causes, including:

- Established corporate governance and oversight policies, processes, and programs by which OPPD manages FCS.

- Implemented a management model that emphasizes nuclear safety and continuous improvement and that defines the FCS fundamental objectives

through the mission, vision, values, guiding principles, and fundamentals of the organization.

- Implemented an accountability model for the FCS organization.

g. Safety System Functional Failures White Performance Indicator (Restart Checklist Item 1.g)

The NRC defines its SSFF Performance Indicator (PI) as:

> The number of events or conditions that alone prevented, or could have prevented, the fulfillment of the safety function of structures or systems that are needed to:
>
> 1. Shut down the reactor and maintain it in a shutdown condition;
>
> 2. Remove residual heat;
>
> 3. Control the release of radioactive material; or
>
> 4. Mitigate the consequences of an accident.

Root Cause

OPPD determined that it failed to maintain an environment within the Engineering organization that valued maintaining the license and design basis of the station over continued operation of the facility. This led to a loss of control over the FCS design and configuration. OPPD performed an extent of condition evaluation and determined that the deficiency extends beyond the Engineering organization. The condition has been repeatedly identified as design basis/configuration control anomalies, but actions taken by management to address the dormant nature of existing design basis issues have had limited effectiveness.

Corrective Actions

To address this root cause, OPPD implemented two CAPRs:

- CAPR 1: Strengthened the function of the oversight group that performs reviews of documentation, including 50.59 reviews, modifications, operability evaluations and other documents developed that utilized design and licensing bases information. The purpose is to perform on-going evaluations of products such as modifications, 50.59 reviews, operability reviews and operations procedure changes to ensure the correct information was referenced and the appropriate changes to the license or design was made prior to implementation.
    - Conduct weekly management observations of the oversight board performance and station activities. Observations ensure behaviors

associated with recognizing the importance of and the use of design and licensing bases is understood and applied in routine activities.

- During the three years following completion of this root cause analysis, the oversight function will be performed by an independent group of dedicated personnel. At the conclusion of the three years, OPPD will determine if the independent oversight is still necessary. If it is, then OPPD will periodically reassess the need for it until it is no longer required.

- Personnel performing the design and licensing bases oversight have the necessary training and qualifications to demonstrate proficiency in the areas of review.

- CAPR 2: Define and identify the design bases and assure design bases documentation remains current, accurate, complete, and retrievable.

  - Identification includes determining the record types.

  - Identify a consistent numbering system.

  - Establish methodology for ensuring current and historical design bases records can be readily retrievable.

  - Reconstitute the design bases, including historical records required to establish the current bases.

  - If conflicts are identified during identification and location of design bases documentation, then generate a CR to document and track the resolution.

  - Establish a process for assuring design bases documentation remains current, accurate, complete and retrievable. Current processes may be retained or revised to assure needed results.

  - Closure determination: conduct an outside independent assessment to validate the completion of identifying design bases and documents are retrievable, and that the process for updates is implemented.

2. Flood Restoration and Adequacy of Structures, Systems, and Components

a. Flood Recovery Plan Actions Associated with Facility and System Restoration (Restart Checklist Item 2.a)

On May 23, 2011, with FCS shut down for a refueling outage and in response to rising water levels along the Missouri River, OPPD began implementing flood protection measures around the site to protect various safety-related structures, including the Intake Building, Auxiliary Building, and Containment Building. Subsequently, on June 6, 2011, OPPD declared a NOUE in anticipation that the Missouri River level at the plant would reach 1,004 ft msl.

In response to this flooding at FCS, OPPD undertook comprehensive, aggressive actions to fully scope, and then correct, the extent of flooding impact at FCS, beginning with comprehensive assessments of SSCs and continuing with detailed plans for repair and restoration. OPPD also developed the FCS FRP, which provides detailed plans and actions regarding the structure, content and methods to address these restart actions. The FRP identifies specific focus areas to address, provides action plans, and the associated actions required to achieve plant restart and support continued safe operation.

In developing the FRP, OPPD identified six focus areas. Each area has been assigned to a station manager as the Focus Area Owner and has one or more action plans associated with it:

1. Site Restoration. Includes activities to remove flooding protection and equipment from the site, restore facilities and equipment with known damage and restore equipment that was moved off-site for protection from flooding. Although not directly related to flooding, repairs to bus 1B4A are also included in this focus area.

   Action Plans

   - Flooding Protection and Equipment Demobilization: temporary flood protection barriers and equipment were installed prior to the flooding event. This Action Plan removed temporary flood protection barriers and equipment.

   - Plant and Facility Restoration: repaired flood-related damage to site facilities and structures

   - Bus 1B4A Restoration and Extent of Condition Actions: restored bus 1B4A, corrected any extent of condition identified in the bus fire RCA, and restored affected cables to operable condition within design basis. Also, OPPD ensured that the equipment and the switchgear room itself were returned to an acceptably clean condition.

- 13.8 kV Underground Distribution Damage Assessment and Restoration: restored FCS 13.8kV system.

2. Plant Systems and Equipment. Includes assessment of system and equipment condition to determine what, if any, damage has occurred and identify actions necessary to restore the equipment to operable or functional status.

   Action Plans

   - Station Fire Protection System Damage Assessment and Restoration: restored flood-affected fire protection systems and equipment to functional and operable status and ensured that plant areas are in compliance with applicable fire protection standing orders and program requirements.

   - System Health Assessments: identified actions required to restore system health.

   - Wetted Motor Damage Assessment and Restoration: restored and repaired wetted electric motors.

3. Long-Term Equipment Reliability. Includes assessing the condition and reliability of station equipment that may have been impacted by flooding conditions, but has not failed. This includes both short-term and long-term assessment and monitoring.

   Action Plans

   - Engineering Program Reviews: ensured site restoration issues associated with Engineering Programs are addressed.

   - Underground Cable Assessment: assessed impact of submergence on safety-related and important-to-safety/production cables within the scope of the Maintenance Rule to ensure those cables remain operable and functional.

   - Underground Piping and Tanks Assessment: restored station underground piping and tanks to functional status.

   - I&C Power Supply Service Life Assessment: ensured that safety-related (*i.e.*, Critical Quality Element (CQE)) power supplies do not fail while in service by implementing an effective equipment reliability strategy. Replaced CQE power supplies that are beyond their established service life. Developed a strong technical basis for CQE power supplies that support the equipment reliability strategies for these power supplies.

4. Design and Licensing Basis. Includes activities to verify that FCS is in compliance with the NRC-approved design and licensing basis and determine if changes to the licensing basis are required due to changes in the frequency or magnitude of an external flooding event.

   Action Plans

   - Plant and Facility Geotechnical and Structural Assessment: produced third-party geotechnical and structural assessment of the post-flood condition and functionality of buildings at FCS.

   - External Flooding Barrier Configuration: verified that the current configuration of external flood barriers is adequate to protect critical assets required to implement protective actions as described in AOP-01, “Acts of Nature.”

   - Plant Design Configuration Control: established final plant configuration following the 2011 flooding event.

   - External Flooding Design Basis Review: confirmed that the station flood design basis is adequate to maintain nuclear safety and protect the health and safety of the public. Based on the assessments, OPPD revised several design bases, processes, and procedures.

   - High Energy Line Break (HELB) Remediation: addressed analysis and configuration changes, including modifications to prevent new harsh environments.

   - Design Resolution Items: tracked the resolution of significant design issues that were not covered in other Recovery Plans.

5. Emergency Planning. Includes assessing the capabilities of both the on-site and off-site emergency response facilities and organizations in the site’s 10-mile emergency planning zone to respond to site emergencies and restoration of those facilities where required. Also includes identifying lessons learned from the external flooding event and incorporating those lessons into station procedures.

   Action Plans

   - Return Alert Notification Sirens To Functional Status: restored flood-affected sirens to functional status.

   - Field Monitoring and Post-Accident Environmental Monitoring: assessed and confirmed that Protective Action Recommendations are adequate for affected sectors.

- Assessment of Offsite Emergency Response Following a Natural Disaster: Federal Emergency Management Agency issued a letter of Reasonable Assurance to the NRC expressing no concerns about FCS going critical.

- Onsite Facility and Equipment Restoration: restored onsite emergency response facilities and equipment.

6. Security. Includes assessment of security system damage and restoration of damaged equipment. Also includes verifying that the response capability of local law enforcement and emergency response organizations for a security event has not been adversely impacted.

   Action Plan

   - Security System Damage Assessment and Restoration: restored out-of-service equipment.

Action Plans Closure

The closure of each action step in the action plans required generating a closure report using a standard closure format. The action plan owner was responsible for ensuring that the completion of the action steps was documented and prepared the closure report package. The documentation for each closure step was independently reviewed. OPPD then prepared final closure reports for each action plan, which documents justification for closure of the action plan. The completed packages were then reviewed, approved, and signed by the Action Plan Owners and Focus Area Owners.

b. System Readiness for Restart Following Extended Plant Shutdown (Restart Checklist Item 2.b)

This item addresses the readiness for restart of systems that have been shut down for an extended period. Such systems can be subject to unique conditions inherent to a long-duration shutdown, such as initial operation of equipment dormant for an extended period of time. These conditions can present the potential for emergent equipment issues as plant temperature, pressure, and operating configurations change. Consequently, OPPD evaluated the effects of the extended shutdown, and verified that the structures, systems, and components are ready for plant restart and that they conform to the licensing and design bases requirements.

1. System Health Reviews (Restart Checklist Item 2.b.1)

OPPD implemented procedure FCSG-65-6, “System Health Reviews for Restart,” to perform System Health Readiness Reviews (SHRR), which provide reasonable assurance that: (1) risk-significant systems are capable of performing their Maintenance Rule functions; and (2) other plant systems are capable of operating as designed following the 2011 flood and FCS’s extended shutdown. The reviews were performed by a multi-discipline team including staff from Engineering, Maintenance, and

Operations. The scope of the reviews included historical evaluation of system and equipment performance, maintenance activities and design changes, extensive system walkdowns and evaluation of the equipment material condition, and evaluation of the health of risk-significant components in the system. The PHC then reviewed the system health readiness reports to ensure their adequacy. OPPD performed system health reviews on the following systems:

- Auxiliary Cooling
- Auxiliary Feedwater
- Spent Fuel Pool
- Sampling
- Chemical and Volume Control
- Emergency Core Cooling
- Hoisting Equipment
- Waste Disposal
- Control Rod Drive
- Reactor Coolant
- Demineralized and Potable Water
- Circulating Water
- Emergency Diesel
- Ventilation, Heating and Air Conditioning
- Main Feedwater System
- Structures
- Steam Generator
- Steam Generator Blowdown Turbine Plant Cooling
- Instrument Air
- Turbine Generator and Support
- Auxiliary Instrumentation
- Electrical Distribution
- Engineered Safeguards
- Radiation Monitoring
- Fuel Handling
- Reactor Protective
- Fire Protection

As part of the system health review process, OPPD determined for each system: (1) its Maintenance Rule functions; (2) the most significant restart issues (3) its ability to support (or not support) FCS restart; and (4) its ability to support (or not support) continued safe and reliable operation of the plant.

Post-restart, OPPD will employ system monitoring strategies within the Plant System Health program. Each system has a health report that details the current system status, near-term actions, and longer-term actions. The health reports include assistance that is requested to support reliable performance and improvement milestones. In addition to operation rounds and Engineering's System Health Monitoring Plans, OPPD will use multi-discipline (*e.g.*, Operations, Maintenance, and Engineering) walk-downs of systems during mode ascension to identify and resolve emergent issues at the earliest point of detection.

2. Detailed Review of Alternating and Direct Current Electrical Distribution, High Pressure Safety Injection System, Emergency Diesel Generator System, and Reactor Protection System (Restart Checklist Item 2.b.2)

Methodology

To address this Restart Checklist item, OPPD performed a detailed evaluation of the capability of selected systems to fulfill their intended safety functions as defined by the licensing and design basis. OPPD selected the systems based upon several factors, including the plant Individual Plant Examination, past safety system functional inspections, and reviews of recent performance issues. The evaluations assessed the systems in the following areas: (1) design; (2) equipment performance; (3) configuration control; (4) human performance; (5) procedure quality; and (6) emergency planning.

The reviews were performed using NRC Inspection Procedure 95003 as guidance and included the following systems:

- AC and DC Electrical Distribution;
- High Pressure Injection;
- Emergency Diesel Generator; and
- Reactor Protection.

Results

- Design. OPPD evaluated the risk-significant design issues for these systems and verified their capability to perform their intended functions with a sufficient margin of safety. The focus was on system modifications rather than original system design to access the ability to maintain and operate the facility in accordance with the design basis. OPPD identified several deficiencies, including:
  - Evaluation of design characteristics was not comprehensive in the modification packages.
  - EC packages did not fully evaluate the impact and extent of the proposed changes on plant configuration.
  - The requirements of configuration change procedures were not being rigorously followed, which resulted in the EC being issued with missing, inconsistent, or incorrect documentation.
  - Calculations and EAs were issued with missing, incorrect, or inconsistent documentation, or without addressing margin management.

- Modifications, EAs, and calculations were issued with incomplete identification of affected documents.

- The CAP was deficient with respect to extent of condition, timeliness, evaluating effectiveness and applying proper classification to condition reports.

- Equipment Performance. In this area of the assessment OPPD determined if it is adequately maintaining and testing the functional capability of the selected systems and risk-significant components. The assessment included effectiveness of preventive and corrective maintenance programs to maintain equipment performance including:

  - Corrective actions for equipment deficiencies to minimize initiating events; and

  - Decision-making regarding long-standing equipment issues and the evaluation of surveillance, calibration, and post-maintenance testing.

  OPPD identified several deficiencies, including:

  - Procedural non-compliance, deficient procedural follow through, deficient implementation, and procedures with insufficient or incorrect documentation.

  - Procedural discrepancies, conflicts and inconsistencies.

  - Some maintenance activities were not performed or scheduled in a timely manner; inadequate maintenance or deficiencies in the PM program, and inadequate bases for Surveillance Test acceptance criteria.

  - Environmental Qualification programmatic issues, deficiencies, ineffectiveness (including equipment monitoring problems), procurement and material issues.

  - Non-compliances and inefficiencies with the CR program with respect to extent of condition, timeliness, metrics, proper classification, and administration.

- Configuration Control. In this area OPPD evaluated the adequacy of the configuration control process for risk-significant equipment that can initiate a reactor transient and/or compromise mitigation capability. This assessment included a review of procedures and processes used to control primary and secondary chemistry to provide assurance that the Reactor Coolant System pressure boundary is maintained intact and monitored for degradation. Configuration control of containment

penetrations and safety-related systems required to maintain containment within its design limits was also within the scope of this assessment. Findings in this area include:

- The CAP was deficient with respect to extent of condition, timeliness, evaluating effectiveness and applying proper classifications to CRs.
- Procedural and/or industry standards deviations, deficient of procedural follow-through and effective implementation.
- Environmental Qualification programmatic issues.
- PM activities not being performed and/or scheduled in a timely manner.
- Inadequate SSC configuration control.
- SSC modifications not developed and/or implemented in a timely manner.

- Human Performance. In this area, OPPD evaluated the effectiveness of the FCS Human Performance processes, programs, and procedures. OPPD identified several issues in this area, including:
  - The CAP did not consistently ensure conditions adverse to quality were fully evaluated in an effective and timely manner. These deficiencies impeded human performance improvement.
  - FCS personnel were inconsistent in planning and coordinating work activities as a result of not incorporating job site conditions that may impact human performance and contribute to long-standing equipment reliability issues.
  - FCS personnel decisions did not consistently demonstrate the use of a systematic process for decision-making, validation of underlying assumptions, or communication of a basis.
  - FCS personnel work practices did not always support human performance. The insufficient level of management oversight at FCS did not provide the coaching or reinforcement needed to ensure employees are using the appropriate human performance tools correctly.
  - OPPD did not always ensure FCS personnel, procedures, equipment and other resources are available and adequate. This resource deficit eroded the effectiveness of human performance

defenses. Engineering controls, administrative controls and oversight controls are impacted due to the lack of resources.

- Procedure Quality. In this area, OPPD evaluated the procedures associated with the selected systems. The evaluation identified several issues, including:

  - Surveillance Tests, Operating Procedures, and Operating Instructions were not of sufficient detail to ensure that the least experienced qualified person can perform the procedure.

  - A number of FCS procedures had significant gaps to excellence and did not meet nuclear industry quality standards. FCS had not provided sufficient resources, manpower or management oversight to the plant procedure process, resulting in a backlog of procedures.

  - The Procedure Maintenance Group (PMG) did not have an upper tier administrative procedure to provide direction, line authority, position descriptions or reporting requirements. The PMG itself was not recognized on station organizational charts, and the group's supervisor was not required to perform self-assessments to ensure FCS quality standards.

- Emergency Response Organizational Readiness. In this assessment, OPPD evaluated the FCS processes to staff and augment the FCS Emergency Response Organization (ERO), including corrective actions related to ERO readiness, staffing, and FCS augmentation systems and equipment. Assessment of corrective actions by the Identification, Assessment & Correcting Performance Deficiencies Team was also used as input for this evaluation. Findings in this area include:

  - The FCS processes to staff and augment the FCS ERO met minimum requirements, but needed strengthening.

  - Equipment obsolescence issues; life-cycle management program was not effective.

  - The corrective action process after identification of deficiencies was weak with incomplete actions or lack of documentation.

  - The Emergency Planning Department was not performing self-assessments. The assessments that have been performed since 2006 had been limited in scope and did not assess effectiveness of the overall program.

- ERO facilities and equipment documentation in general was weak. Document retention requirements needed to be addressed for realistic timeframes.

- In the area of staff augmentation, OPPD had not been performing the Emergency Plan annual review to ensure that the information contained in the Plan was current.

CRs were generated for the issues identified during these reviews. Each of those issues was of low safety significance. A cause analysis was not performed for the individual issues. The findings from these detailed system reviews were used as input into the collective evaluation that generated the Fundamental Performance Deficiencies. Detailed cause analyses were performed and corrective actions implemented for each Fundamental Performance Deficiency.

3. Impact of Subsurface Water on Soils and Structures (Restart Checklist Item 2.b.3)

In June 2011, Missouri River flooding affected FCS. OPPD declared an NOUE on June 6, 2011, in anticipation that the Missouri River level at the plant would reach 1,004 ft msl. The flood waters eventually receded and FCS exited the NOUE. Subsequently, the NRC raised concerns regarding the impacts of the flooding on subsurface soil and SSCs. In response, OPPD developed the FRP, which covered activities ranging from post-flood system and program reviews to underground cable assessments.

Analyses

During the 2011 flooding at FCS, OPPD employed the services of HDR Engineering, Inc. (HDR) to design an earthen berm to protect the switchyard. Subsequently, OPPD engaged HDR to assess the changes to the foundation soils supporting the structures caused by the 2011 flood and any direct impact of the floodwater on the structures. In the course of these assessments, HDR performed visual inspections, subsurface soil investigations, and reviewed plant drawings and documents. HDR documented its findings in the Plant and Facility Geotechnical and Structural Assessment report.

OPPD also engaged Stevenson & Associates (S&A) to evaluate the potential for formation of negatively-affected soil (NAS) beneath the Auxiliary Building and Containment Building, to conservatively evaluate the potential impact on the seismic floor response spectra and pile stresses for the Auxiliary Building and Containment Building, and to conservatively evaluate the impact on the pile stresses for the Turbine Building. GEI Consultants, Inc. (GEI) was a vendor to S&A and assisted it with the geotechnical issues.

In view of its earlier assessments and initial site-wide investigations, HDR identified three conditions requiring further evaluation, specifically:

1. Flow into the Turbine Building sump;

2. Damaged pavement east of the Service Building and Maintenance Shop; and

3. Column MG-15 settlement in the Maintenance Shop.

HDR referred to these conditions as key distress indicators (KDI) and designated them as KDI 1, 2, and 3, respectively. HDR performed more detailed subsurface investigations for these three conditions, including an extensive subsurface investigation to determine their causes and prepared recommendations to address them.

Turbine Building Sump

During the 2011 flood, HDR observed water flowing into the Turbine Building sump and determined that the higher than normal flow rate was due to groundwater entering breaks in the drainage piping. Groundwater flow into the breaks caused "piping" of the soil beneath the Turbine Building basement slab, which resulted in the development of NAS beneath the Turbine Building basement slab; HDR also found that the NAS extends beneath the Maintenance Shop and Service Building. GEI evaluated the lateral extent of the NAS by reviewing HDR's data from HDR's 2011 and 2012 investigations and concluded that the NAS does not extend laterally under the Auxiliary or Containment Buildings.

HDR concluded that the "piping" of soil into the drain pipe breaks and resulting spread of NAS would continue until the drainage pipes were remediated. OPPD installed temporary plugs to stop the NAS until final remedial measures can be installed.

Pavement East of the Service Building and Maintenance Shop

HDR determined that the distress to the pavement was due to normal wear-and-tear, typical for pavements subjected to heavy loading, summer expansion and contraction, winter freeze-thaw action, and exposure to de-icing agents. The distress could have been exacerbated locally by saturation of the subgrade along expansion joints by the flood and by heavy loading over subgrade softened by the flood. The single broken pavement and underlying surface void a few feet west of the Condensate Storage Tank are coincident with discharges from large pumps run continuously during the flood.

Maintenance Shop Column MG-15

In October 2011 OPPD found that Column MG-15 in the Maintenance Shop had settled 2.2 inches. HDR found the following causes for the settlement of the column and the cracking of masonry walls:

1. Poor compaction of fill during construction of the Maintenance Shop;

2. Piping and resulting spread of NAS to beneath the Maintenance Shop; and

3. Temporary overloading of the column during the 2011 flood.

During 2012, OPPD modified the column by installing helical piers into the overburden soil and jacking of the column. OPPD constructed a footing on the helical piers to support the column and filled the void space identified by HDR's subsurface investigation beneath the floor slab with flowable fill. HDR determined that the modifications will prevent further settlement of the column.

S&A and GEI performed additional analyses on the effects of the NAS for the Turbine Building, the Auxiliary Building, and Containment Building. The analyses found that piping of the soil — and therefore development of NAS — can and likely did occur even for normal non-flood river levels. The analyses also concluded that there is no indication of soil piping and therefore, no indication of NAS beneath the Auxiliary Building. Any piping of soil fines would have to start beneath the Turbine Building into the drainage pipes and progress to the Auxiliary Building though the soil beneath the gap between the Auxiliary and Turbine Buildings.

In summary, the various analyses HDR and S&A performed found:

- Site-Wide Soil Conditions Pre-2011 Flood and Post-2011 Flood: based on the pre-flood and post-flood subsurface data compiled, obtained and compared by HDR, the pre-flood and post-flood subsurface conditions for the soil are similar.

- Soil Piping and NAS:

    - There is no evidence of NAS beneath the Auxiliary Building and Containment Building;

    - Piping of the soil, and therefore development of NAS, can and likely did occur even for normal non-flood river levels; and

    - Seepage analyses for the 2011 flood river level indicate that a much larger rate of piping and development of NAS likely occurred during the 2011 flood.

- Pavement Damage: damage to the pavement east of the Service Building and the Maintenance Shop is due to normal wear-and-tear. There is no evidence of NAS east of the Service Building and the Maintenance Shop.

- Column Settlement and Influence of Soil Piping and NAS: settlement of Column MG-15 in the Maintenance Shop was caused by a combination of poor compaction during original construction of the Maintenance Shop, the extension of NAS from the Turbine Building into the Maintenance Shop in the area of Column MG15, and overloading of the column during the 2011 flood.

- Seismic Adequacy of the Auxiliary Building and Containment Building: even for the conservative extreme of a postulated 10 feet thickness of

NAS beneath the Auxiliary Building and Containment Building, the seismic response of these structures is less than the original design basis and the structural integrity of the foundation piles is maintained.

- Seismic Adequacy of Turbine Building Piles: the Turbine Building pile foundation is acceptable for the design basis seismic loads for NAS reaching a depth of 10.2 ft from the bottom of the foundation at each pile.

Corrective Actions

OPPD implemented several corrective actions:

- The damaged drainage pipes under the Turbine Building were repaired with Cured-in-Place Piping per EC 46706.

- Replaced/repaired the pavement east of the Service Building and the Maintenance Shop.

- Repaired Column MG-15's foundation per ECs 50986 and 53436.

c. Qualification of Containment Electrical Penetrations (Restart Checklist Item 2.c)

Certain Electrical Equipment Qualification (EEQ) containment electrical penetrations (CEP) at FCS, which served a containment integrity function, used Teflon for feedthrough insulated conductors and feedthrough inboard and outboard seals. In response to EEQ program requirements and testing conducted for OPPD by Wyle Laboratories, and with the exception of several penetration feedthrough assemblies in the SI-9 and SI-10 Containment Sump Outlet Valve Enclosures (Sub Hull), the EEQ CEP feedthrough subassemblies were replaced between 1984 and 1986 with feedthroughs that did not contain Teflon. Wyle found that the Teflon inner seals and the conductor insulation failed at post-design basis accident radiation levels, which led to the replacement of the EEQ CEP feedthrough subassemblies at FCS. The non-EEQ CEP feedthrough subassemblies containing Teflon were not replaced at that time because the electrical penetration manufacturer, Conax, and OPPD concluded that the outboard seals would not fail because they would be in a mild environment after a design basis Loss of Coolant Accident and consequently, containment integrity would be maintained.

In March 2012 OPPD identified discrepancies in the qualification basis of eight non-EEQ qualified CEP feedthrough subassemblies with conductors providing signals to EEQ components. OPPD subsequently declared the containment inoperable, made an eight-hour report pursuant to 10 CFR § 50.72(b)(3)(ii)(B) (unanalyzed condition), and submitted Licensee Event Report 2012-002 to the NRC.

Analyses/Root Causes

OPPD performed an RCA, "Containment Integrity Issues with Electrical Penetration Assemblies Containing Teflon," for the non-EEQ CEPs (CR 2012-01947) (and an ACA, "EEQ Equipment Connected to Non-EEQ Electrical Penetration Subassemblies," for the CEPs containing EEQ conductors (CR 2012-01655)). The RCA found that the root cause for why some of the electrical penetration Teflon feedthrough subassemblies were not replaced was a lack of technical oversight to ensure the information associated with Teflon material used in EEQ CEP subassemblies was applied to non-EEQ electrical penetrations. The RCA also determined that a contributing cause was that OPPD did not establish and implement a PI&R culture to effectively correct CEP assembly deficiencies.

Corrective Actions

The RCA identified and implemented a number of corrective actions to address these deficiencies, including three CAPRs:

- Integrated leaders into the organization that have external perspectives and broad experience as a means of raising leader performance in accountability and standards.

- Revised engineering human performance procedures to be consistent with best industry practices.

- Revised procedure FCSG-33, "FCS Issue Prioritization and Plant Health Committee Process."

The RCA identified and OPPD implemented several additional corrective actions, including:

- Designed, developed, and implemented training on revised engineering human performance procedures.

- Revised FCSG procedure on the FCS decision-making process.

- Replaced or capped containment electrical penetrations containing Teflon.

- Determined where Teflon was used in mechanical equipment located in a harsh environment that performed a containment integrity function and replaced the Teflon, where necessary.

d. Containment Internal Structure (Restart Checklist Item 2.d)

In May 2012 OPPD identified discrepancies between the FCS design calculations and design drawings for concrete beams at elevation 1049'-1 ½", steam generator bays, 1060'-0", platform elevation, and the floor slab at the 1045'-0" elevation. OPPD generated CR 2012-04392 to address these deficiencies and during the extent of

condition evaluations for this CR, OPPD discovered that Containment Internal Structure (CIS) Beam B-22, located on elevation 1013'-0", exceeded the allowable loading conditions specified in USAR Section 5.11, "Structures other than Containment,", for both working stress and No Loss of Function. This condition failed to meet the Structural Design Basis requirements specified in USAR Section 5.11, "Structures other than Containment," because the beam did not meet the requirements for Functionality or Operability.

Analyses

OPPD subsequently reviewed and assessed the drawings and calculations defining the CIS Design Basis. The initial scope of the review/assessment was to reconstitute the beam design loads and assess the condition of the calculations and drawings for six selected beams within the boundary of the CIS. In addition to evaluating the design of the six beams, the assessment also included an operability determination for any beams that did not meet the relevant acceptance criteria. The initial assessment was conducted by S&A on CIS Beams B-12, B-14, B-17, B-21, B-22 and B-57. OPPD then performed an RCA to determine the extent of condition, root causes, and associated corrective actions for the problem.

The assessment found that five of the six beams were overstressed for both working stress design and ultimate strength design for the given design loads. Four of these five beams were found to be functional, based on the use of Electric Power Research Institute NP-6041-SL, ACI 349-01 and an increased concrete compressive strength obtained from actual historical concrete break data. Beams B-22a and B-22b, however, which are two identical beams at the 1013'-0" elevation, could not be qualified as functional. In view of these results and the large number of deficiencies within the original calculations of record, OPPD decided that a reconstitution of the design calculations for the subject beams was required. OPPD also performed a similar review for the Auxiliary Building and the reactor cavity and compartments (RC&C) structures.

OPPD found several minor discrepancies during the containment analysis, which were later corrected. The structure has been qualified for Design Basis loading conditions with modifications identified to bring the CIS into conformance with the FCS Structural Design Basis. The CIS has also been validated as being operable. The reconstituted calculations for the first eight selected structural members in the Auxiliary Building found that seven meet both working stress design and ultimate strength design for the given design loads. Based on these results, OPPD decided to perform an Operability Evaluation on an increased number of members; OPPD randomly selected a population of 60 structural elements and analyzed them for Operability. The analysis found that the structural members selected were operable. No deficiencies were found in the RC&C analysis.

Root Causes

OPPD determined several root causes of this deficiency, including:

- OPPD provided inadequate ownership review of plant documents.
- Unsupported assumptions, inappropriate methods, and mathematical errors in the architect/engineer (AE) Gibbs & Hill calculations from the late 1960s. The condition of these documents and the associated poor quality indicated a design control problem within the AE.
- The problems were not identified in February 1997 when Duke Engineering Services SDBD-CONT-501 "Containment." This failure is a reflection of inadequate procedural adherence within the Engineering Design Review process.
- The program to control the design basis did not effectively respond when calculation discrepancies were identified. Design control is closely associated with the CAP in that deficiencies in design documents should have been reported through the CAP.
- OPPD design bases information was incomplete at the beginning of FCS commercial operation. This initial condition, combined with a weakness in licensing bases knowledge and a failure to internalize the importance of the design bases, resulted in OPPD missing several opportunities to correct the initial deficiencies and additional errors were created over time.
- The early FCS safety culture established standards and expectations, which improperly emphasized that the operation of the facility was more important than maintaining the licensing and design basis of the station. This early culture established long-standing, reinforced, and institutionalized behaviors that were resistant to external and internal efforts to change.

OPPD also identified a contributing cause — Engineering leadership failed to adequately implement programs to control design basis calculations. OPPD had several subsequent opportunities to identify and correct this issue, but was unsuccessful in each instance.

Corrective Actions

OPPD implemented a several corrective actions to address these deficiencies, including:

- Developed and issued Engineering review guidance for vendor/contractor design changes to ensure thorough and rigorous reviews by design engineering.

- Implemented a new Engineering organizational structure based on development of the following guidance and consistent with industry-best practices:
    - Conduct of Engineering — Principles and Expectations;
    - Engineering Division of Responsibilities; and
    - Departmental Duties and Responsibilities.

3. Adequacy of Significant Programs and Processes

The review of programs was completed in two phases. First, there were deficiencies in several programs that were key contributors to the occurrence of the safety-significant findings and the protracted performance decline at FCS. These programs are contained in the CAL and Restart Checklist, and addressed in Sections 3.a through 3.e below.

There are a number of other programs that are important to plant safety and equipment reliability that OPPD also evaluated and implemented improvement actions where necessary. OPPD verified that the station programs are ready for plant restart and that they conform to the licensing and design bases requirements.

OPPD implemented procedure FCSG-65-7, "Program Restart Readiness," to review and affirm the readiness of selected station programs prior to plant restart from the extended shutdown. The scope of the reviews included staffing, qualifications and experience of program owners and staff supporting the programs, and the breadth, adequacy and implementation of the programs and procedures. Program Challenge Boards then reviewed the program restart readiness reviews to ensure their adequacy. Consequently, OPPD performed program restart readiness reviews on the following programs:

- Boric Acid Corrosion Control
- Cables and Connections and Cable Aging
- Containment Leak Rate
- Control Room Habitability
- Electrical Equipment Qualification (EEQ)
- Reactor Coolant System (RCS) Leak Rate Monitoring
- Flow Accelerated Corrosion (FAC)
- Inservice Inspection (ISI)
- Large Motors
- Maintenance Rule
- Managing Gas Accumulation in Safety Systems
- Preventative Maintenance
- Relief Valves
- Service Water Reliability
- Steam Generators

- Structures Monitoring
- Inservice Test Program
- Vendor Manual Control
- Flooding
- Fire Protection
- Equipment Reliability Optimization Program (EROP)
- Reactor Vessel Internal Inspections

As part of the program restart readiness process, OPPD determined: (1) the most significant restart issues for each program (if applicable); (2) each program's ability to support FCS restart; and (3) each program's ability to support continued safe and reliable operation of the plant.

OPPD has begun employing program monitoring strategies within the Program Health Reports. Each program has a health report that details the current program status, near term actions, and longer term actions. The health reports include assistance that is requested to support reliable performance and improvement milestones.

a. Corrective Action Program (Restart Checklist Item 3.a)

The NRC identified organizational effectiveness issues in PI&R during inspections conducted at FCS in 2007, 2009, and 2011, as evidenced by inadequate causal analysis and deficient development of CAPRs. In addition, OPPD identified several CAP-related deficiencies, including:

- A PI&R culture of individual and organizational behaviors that precluded the effective and timely detection, evaluation, and correction of performance deficiencies.
- A negative trend in the quality of root cause analyses covering cause determination, corrective action development, and evaluation depth and breadth.
- An inconsistent establishment and reinforcement of an environment where beneficial challenging, a healthy questioning attitude, and the reporting of concerns was accepted, supported, and desired.

Analyses

OPPD performed five RCAs to address these deficiencies:

- CR 2011-10135, "Cultural Weaknesses in Problem Identification and Resolution";
- CR 2012-03495, "Poor Root Cause Analysis Quality";

- CR 2012-03986, “Organizational Ineffectiveness at FCS”;
- CR 2012-04262, “Safety Conscious Work Environment at FCS”; and
- CR 2013-08675, “Station CAP Performance.”

From these analyses OPPD identified three common gaps to a properly functioning CAP. First, FCS lacked a healthy nuclear safety culture that valued the CAP as part of a strategic process to improve plant performance. Leadership behaviors did not demonstrate a commitment to safety as it related to the identification of problems and their timely resolution. Second, OPPD failed to develop and implement the essential attributes of an effective governance and oversight policy that included the FCS CAP. Finally, station management failed to own the CAP and adequately oversee it, which caused the resolution of many important issues to be untimely and less than thorough. These failures included shortfalls in communicating standards to ensure responsibility or accountability of CAP implementation and not reinforcing CAP procedure compliance.

Root Causes

The RCAs identified a number of root causes, including:

- Flawed mental models, misguided beliefs, and misplaced values drove, influenced, and permitted the misalignment of the individual, leader, and organizational behaviors (norms) needed for effective and timely detection, evaluation, and correction of performance deficiencies.
- The FCS organizational values regarding PI&R precluded a self-improving culture and learning environment.
- Inadequate program oversight, and shortfalls in communicating standards for the FCS SCWE by station leadership resulted in erosion of trust in management’s ability to effectively implement the core components (CAP, ECP, willingness to raise concerns and prevention of retaliation) of a healthy SCWE.
- FCS management at all levels failed to establish and maintain a culture within which the RCA program is valued as a process where risk-significant issues are thoroughly evaluated and reviewed to prevent recurrence.
- OPPD failed to develop and implement an effective policy on the FCS CAP. This caused a lack of organizational alignment regarding the importance and priority of root cause analyses.
- Less than adequate governance and oversight. OPPD failed to establish and implement the essential attributes of governance and oversight, including the key elements of individual roles, responsibilities, and

accountabilities to enable FCS to achieve and maintain high levels of operational nuclear safety and reliability.

- Station leaders were more tactical than strategic, prioritize poorly, delegate little, surrender oversight, rationalize low standards and hesitate to hold personnel accountable, resulting in a culture that valued harmony and loyalties over standards, accountability and performance.

- Station management failed to establish a culture that valued constant performance improvement, thereby accepting a model that measured performance against internal standards versus industry best practices, did not proactively pursue identifying/implementing those best practices, and was infrequently receptive to constructive feedback from external sources.

- Station personnel did not consistently follow CAP procedures and station leadership had not reinforced CAP procedure compliance; as a result, improvements in CAP performance were limited.

Corrective Actions

To address these root causes, OPPD implemented numerous corrective actions, including:

- Reinforced with the staff the standards and mental models, beliefs, values, and behaviors needed for the effective and timely detection, evaluation, and correction of equipment, human, programmatic, and organizational performance deficiencies.

- Revised and implemented performance indicators for PI&R.

- Developed actions and an effective change management process that ensured the right mental model and PI&R behaviors were implemented.

- Trained Station Corrective Action Review Board, RCA, and ACA Analysts to ensure that those personnel have sufficient skills and knowledge to:

    - define corrective actions using a systematic method; and

    - develop effectiveness reviews.

- Created the CAP Coordinator position to monitor and provide feedback for expected behaviors and results related to the effective and timely detection, evaluation, and correction of performance deficiencies.

- Required the Chief Nuclear Officer (CNO) and Division Managers to conduct group meetings with managers and supervisors to facilitate alignment on implementation of the RCA process and explain the new CAP policy.

- Developed and implemented a corporate-level CAP policy that specifically includes RCAs.

- Implemented an accountability model and performance management process for FCS personnel.

- The CNO and Division Managers conducted small group, multi-discipline employee feedback meetings to identify and prioritize site issues for management action.

- Established additional oversight review of CAP evaluations and significant corrective actions.

- Developed and implemented CAP fundamentals, reinforced through an accountability model.

- Established CAP subject matter experts for each department.

- Conducted oral boards with Management Review Committee members, Department Corrective Action review Board Chairpersons, and Root Cause analysts to verify understanding of CAP requirements and training expectations.

b. Equipment Design Qualifications (Restart Checklist Item 3.b)

1. Safety-Related Parts Program (Restart Checklist Item 3.b.1)

The NRC (in its 2011 PI&R inspection) and OPPD (in CR 2011-09459) identified instances where lower-quality level classified material (*i.e.*, parts and components) was installed in CQE or into LCQE SSCs at FCS. Such instances occurred during maintenance, repair, rework, modification, or replacement of components or material associated with CQE SSCs. Additionally, during the extent of condition and root cause investigations of this issue, OPPD identified weaknesses in the programs and processes for control of replacement parts.

Analyses

OPPD performed several substantial evaluations to identify conditions where a non-safety-related component or subcomponent was improperly used in a safety-related application. These evaluations included of reviews of CQE and LCQE work activities that had been performed during the five years between February 2007 and February 2012. OPPD reviewed approximately 30,000 WOs that could have installed lower quality level parts into higher quality level equipment. The review period included multiple operating cycles during which material replacement activities were performed. OPPD thoroughly investigated evidence of lower quality level classified material usage to identify other possible applications or similar applications of material usage.

The analyses were performed in two phases. The first phase was discovery and the second phase was recovery. In Phase 1, OPPD identified 1,700 WOs that incorporated at least one material type that had a lower quality level safety classification than the associated WO. OPPD generated CRs for these deficiencies, which were initially classified as documentation inadequacies pending material evaluations. This Phase I review found that the material documentation inadequacy issues that had been identified did not compromise the functionality of the systems involved. Proper documentation, however, had not been located and must be found or generated.

The Phase II evaluation of 5,950 material types is complete with 34 specific material types found to be deficient in application and requiring rework. These 34 material types represented areas where the number of examples of inappropriate use of these specific material types warranted an expanded review. As a result, the initial five-year review period was extended back to 1998 for these specific material types.

Root Causes

OPPD identified one root cause and six contributing causes:

- Root Cause: Inadequate procedural guidance and a deficient process for training/mentoring resulted in a deficient work planning and review process with the potential for installing lower quality level parts where higher quality level parts were required.

- Contributing Cause: Lack of adequate reference documents and resources/tools for planners, engineers, and maintenance personnel.

- Contributing Cause: Station personnel unaware of who owned important resources.

- Contributing Cause: Overconfidence in station personnel's abilities to accomplish work resulted in inadequate use of Human Performance tools and a rationalization that OPPD's current expectations, standards, and performance were sufficient.

- Contributing Cause: Station personnel improperly working around station procedures using "tribal" knowledge (experience) to complete tasks which resulted in procedure use and adherence issues.

- Contributing Cause: The CAP did not fully assess and effectively resolve CQE issues.

- Contributing Cause: Gap in station personnel's knowledge regarding CQE classification boundaries and dedication requirements.

Corrective Actions

OPPD took numerous corrective actions to address these deficiencies, including:

- Corrective Actions to Prevent Recurrence:
    - Revised procedure to include adequate guidance to prevent the installation of non-CQE component/parts in CQE applications;
    - Incorporated updated procedure and process information into a lesson plan for FCS Planners; and
    - Conducted training for planners.
- Held alignment meetings with Bill of Material end-users; revised Engineering instructions; revised QA Plan; submitted USAR revision; validated/prepared System and Component Level Safety Classification Analysis Report for safety-related systems.
- Developed and trained Planners on CQE awareness and procurement; conducted CQE awareness training for Operations and Maintenance personnel; developed Asset Suite user training, focusing on navigation and use of the software to meet job requirements.

2. High Energy Line Break Program and Equipment Qualifications (Restart Checklist Item 3.b.2)

In Focused Self Assessment (FSA) 07-047, conducted in August 2007, OPPD documented numerous adverse conditions, weaknesses, potential enhancements, and areas for improvement in the FCS EEQ program. OPPD developed corrective actions to address the deficiencies identified in this assessment that ultimately eventually resulted in a corrective action plan for the EEQ and HELB Programs. Since 2007, the EEQ Program Health Report had been in "Red" Status, with the exception of one quarter that was in "Yellow" status. The programmatic breakdowns identified in FSA-07-047, as documented in CR 2007-2715, had not been corrected.

OPPD found that it had not fully implemented and/or maintained the FCS EEQ program to meet the requirements of 10 CFR § 50.49. As a consequence, the equipment included in the EEQ program, the systems included in the HELB Analysis and the environmental conditions used by the EEQ program had not been maintained current or in an auditable manner. This resulted in:

- Inoperable equipment due to a lack of Environmental Qualifications;
- Electrical equipment outside of containment being impacted by HELB; and
- The design temperature ratings for several containment valve actuators being below those required for Design Basis Accidents.

Root and Contributing Causes

To address these deficiencies, OPPD performed an analysis under CR 2013-02857, "HELB/EEQ Not in Accordance with 10 CFR 50.49," that identified two root causes and one contributing cause:

- Root Cause 1: The assumptions within the EEQ program did not have appropriate supporting documentation, affecting the validity and scope of the EEQ Program.

- Root Cause 2: The EEQ Program has unique processes that were not integrated into the EC Process, creating an unnecessary burden on the EEQ Coordinator, and affecting the sustainability of the EEQ Program.

- Contributing Cause 1: Engineering had not effectively resolved items identified in the CAP.

Corrective Actions

OPPD initiated several corrective actions to address these causes, including:

- Implement the calculations and EAs that form the basis of the EEQ Program;

- Revise EEQ procedures such that EEQ engineering activities are performed under the configuration change control process; and

- Provide a documented basis that demonstrates EEQ equipment is installed and configured in accordance with the requirements of the associated Harsh files.

OPPD also implemented a number of modifications to address HELB/EQ issues, including:

- The HELB analysis reconstitution project identified that portions of the steam supply piping the Turbine Driven Auxiliary Feedwater Pump (TDAFP), were overstressed when main steam is driving the pump. OPPD implemented a modification that replaced existing two-inch diameter socket welds with butt welds in select portions of the Chemical and Volume Control and Steam Generator Blowdown piping located in Room 13. The modification ensures that welds two-inches and larger installed between the systems' containment penetration and the outboard isolation valve are volumetrically inspectable.

- OPPD identified a potential HELB at the inlet piping attached to the Letdown Heat Exchanger (CH-7) that could cause loss of function of outboard isolation valve (HCV-204). A HELB at CH-7 concurrent with a single failure of inboard isolation could result in an unacceptable loss of

isolation outside of the containment building. To eliminate that potential condition, OPPD installed a pipe whip restraint.

- OPPD added a manually-operated, locked normally closed valve to create a pressure barrier that does not extend past the Mechanical Penetration Room (Room 13) and eliminate the possibility of a HELB outside of Room 13. This modification also added an anchor to the recirculation line piping and modified supports.

- OPPD determined that a potential flood in Room 81 caused by a HELB could allow water into vent holes in a guard pipe that protects the FW-10 TDAFW Pump steam supply lines, quenching or sufficiently cooling the steam supply for FW-10 such that the quality of steam would be insufficient to maintain proper functionality. Additionally, a steam supply line to the TDAFW Pump had the potential to flood, which could quench or cool the steam in the pipe. OPPD installed two HELB flood barriers to protect the steam line from the postulated HELB flood water.

- OPPD installed temperature switches that would monitor Room 13 Steam Generator Blowdown and isolate the line during a postulated HELB.

- OPPD installed redundant solenoids for valves YCV-1045A/B steam supply to the TDAFW Pump to eliminate a single point failure in the steam supply.

c. Design Changes and Modifications (Restart Checklist Item 3.c)

1. Vendor Modification Control (Restart Checklist Item 3.c.1)

OPPD determined that several vendor design change packages lacked the technical rigor necessary to ensure critical characteristics are identified and properly incorporated. Additionally, OPPD did not provide sufficient technical rigor and questioning attitude when reviewing vendor information. This led to an overreliance on vendor information for design changes, resulting in design change quality deficiencies.

Analyses

To address this Restart Checklist issue, OPPD first reviewed design change packages that had been performed by vendors and/or had significant vendor involvement. The goals of the review were to:

- Determine the quality and acceptability of the vendor information and involvement;

- Assess OPPD's ability to validate and incorporate vendor information at FCS; and

- Identify design change process improvements for reviewing and accepting vendor design information.

OPPD then performed a cause evaluation for the deficiencies identified in CR 2012-07279. Because the same design change process is used for vendor- and licensee-prepared design change packages, OPPD also reviewed causal analyses for recent events to identify causes applicable to this item. These causal analyses were for the design-related Fundamental Performance Deficiency (FPD) (CR 2012-08125), the 1B4A bus fire (CR 2011-5414), and the 1B3A load center de-energization (CR 2011-6621).

Root Causes

These analyses identified several root and contributing causes, including:

- Root Cause: The design process failed to identify critical parameters and interfaces.

- Root Cause: Procedures lacked requirements to provide guidance to evaluate design features.

- Root Cause: Governance and oversight (including oversight of contracted engineering services) had not been effective.

- Contributing Cause: FCS Engineering had insufficient knowledge of components, systems, design basis, and licensing basis resulting in overreliance on the vendor.

- Contributing Cause: Procedures lacked requirements to identify and evaluate critical characteristics.

- Contributing Cause: Design Engineering did not properly employ the human performance toolbox in regard to maintaining a questioning attitude.

- Simple Cause: Deficiencies in the configuration change process implementation supported by vendors resulted from FCS Design Engineering personnel not applying rigorous review and oversight of vendor products.

OPPD also identified several deficiencies in design change products involving vendor input, including:

- Lack of rigor, including preparation and review of design change packages.

- Procedures and processes did not:
    - stress importance of identifying and addressing critical characteristics;
    - address the method for acceptance of vendor products; and
    - address identifying vendor performance expectations and feedback on vendor products.
- Management did not provide adequate guidance and challenge to FCS engineering resources to ensure that they maintained adequate technical knowledge for critical vendor product review.
- Design inputs did not capture all the critical characteristics and did not necessarily provide a detailed evaluation/discussion of the characteristics.

Interim Corrective Actions

In response to these analyses, OPPD took several interim corrective actions. First, it established the Engineering Assurance Group (EAG), to review new design change documents for compliance with FCS procedures and accepted industry practices. OPPD issued letters to vendors commonly used for design change package development, summarizing discovery results, and reinforcing expectations for quality and procedural adherence. OPPD also developed guidance for vendor/contractor design change reviews to ensure that design engineers perform thorough and rigorous reviews.

Long-Term Corrective Actions

OPPD implemented a number of procedural changes to address this issue. First, it revised multiple applicable engineering procedures to incorporate guidance for critical characteristics and require the design engineer to develop a list of critical interface characteristics that must be reviewed and approved by the Design Team before the design process continues. OPPD also revised procedures to include lessons learned and also revised procedures and Interaction Checklists to require feature comparison between new and original equipment.

OPPD also plans to take a number of additional actions to address this issue. First, it will establish a process to monitor and foster improvement in contracted engineering service performance. This process will integrate governance and oversight from Exelon into FCS processes and procedures.

OPPD will also establish a Design Review Board process that will provide a comprehensive review of configuration changes so that significant aspects of design, scheduling, planning, construction, maintenance, testing, and operations are considered throughout the development of the configuration change package.

Other planned corrective actions include developing a "Conduct of Engineering — Principles and Expectations" procedure and associated implementing procedures, which will include as a critical aspect the need for FCS DEN to conduct rigorous reviews of ECs outsourced to vendors and contractors. OPPD will develop and issue Engineering review guidance for vendor/contractor design changes and benchmark FCS Engineering design procedures with industry best practices including owner acceptance of external engineering technical products.

2. 10 CFR § 50.59 Screening and Safety Evaluations (Restart Checklist Item 3.c.2)

The NRC and OPPD identified instances of inadequate 10 CFR § 50.59 evaluation documentation. Specifically, the inadequate documents did not appropriately apply licensing and design bases information and did not incorporate conservative assumptions.

Analyses

OPPD conducted several analyses to address these deficiencies. First, OPPD conducted an RCA to evaluate the process and quality issues identified in CR 2012-08177. OPPD also performed two other causal analyses concerning the 10 CFR § 50.59 process and its quality: the RCAs for the Regulatory Processes and Infrastructure FPD (CR 2012-08137) and the Engineering Design/Configuration Control FPD (CR 2012-08125).

Root and Contributing Causes

OPPD identified a number of root and contributing causes for this deficiency in several areas, including:

- Governance and Oversight
    - Root Cause: Station management had not provided sufficient direction, governance, goals, and oversight to ensure 10 CFR §§ 50.59 and 72.48 requirements were met with complete and accurate documentation.
    - Contributing Cause: Station management failed to promote a safety culture (Human Performance, PI&R, Accountability, and Continuous Learning Environment), where nuclear safety is an overriding priority to ensure 10 CFR §§ 50.59 and 72.48 requirements were met with complete and accurate documentation.
    - Contributing Cause: The NOS review of 10 CFR §§ 50.59 and 72.48 evaluations was not critical enough and in many cases did not recognize the significance of issues.

- Contributing Cause: Management failed to establish and enforce appropriate roles and responsibilities, standards, and expectations for engineers.

- Training/Knowledge
  - Root Cause: Station personnel performing 10 CFR §§ 50.59 and 72.48 activities did not always identify design functions and critical characteristics due to selection of the wrong design change process, unclear licensing basis documents, the database being inaccurate/not updated, low standards of the preparer and reviewer, and lack of knowledge of the current licensing basis (CLB) and 10 CFR §§ 50.59 and 72.48.
  - Contributing Cause: The 10 CFR §§ 50.59 and 72.48 training did not have adequate ownership, was not adequately evaluated (did not contain a practical exercise), did not require on the job mentoring and did not contain the prerequisites to ensure 10 CFR §§ 50.59 and 72.48 personnel have the right skills and knowledge to perform the task.

- Procedures/Tools
  - Root Cause: The CAP did not trend to identify performance gaps, was too narrowly focused in the cause evaluation, and did not implement effective corrective actions to resolve issues with 10 CFR §§ 50.59 and 72.48.
  - Contributing Cause: Performance Improvement processes (trending, assessments, benchmarking, and operating experience) were not used to improve and ensure 10 CFR §§ 50.59 and 72.48 requirements were met with complete and accurate documentation.
  - Contributing Cause: Procedures did not direct completion of 10 CFR § 72.48 evaluations when performing maintenance activities at the ISFSI.
  - Contributing Cause: Weaknesses in the tools that engineers used to maintain configuration and design basis requirements and configuration database information.
  - Contributing Cause: Quality and completeness of information contained in databases, software and procedures did not support accurate and timely regulatory decision making.
  - Contributing Cause: CLB documents were not always clear and up to date.

Corrective Actions

OPPD took a number of interim and long-term actions to address this deficiency, including:

- Interim Actions
    - OPPD reviewed 10 CFR §§ 50.59 and 72.48 documents and provided feedback on the results.
    - OPPD created and trended the PI for 10 CFR § 50.59 quality.
    - Established a select list of experienced personnel authorized to perform 10 CFR §§ 50.59 and 72.48 evaluations.
    - Implemented an independent EAG to review these analyses.
- Long-Term Actions
    - Updated NPM-2.01, "10 CFR 50.59 and 10 CFR 72.48 Reviews," concerning expectations for 10 CFR §§ 50.59 and 72.48 evaluations.
    - Established and communicated clear expectations for behaviors relative to accountability and standards as described in OPPD Supervisors Manual Policy 3.06, and will hold leaders accountable.
    - Established clear roles and responsibilities for the 10 CFR §§ 50.59 and 72.48 training.
    - Revised and consolidated SARC procedures and aligned procedures with Exelon standards. This includes SARC review of 10 CFR §§ 50.59 and 72.48.
    - OPPD plans on taking a number of additional actions in several areas, as described in the PSI/ Performance Improvement Integrated Matrix (PIIM).

d. Maintenance Programs (Restart Checklist Item 3.d)

1. Vendor Manuals and Vendor Informational Control Programs (Restart Checklist Item 3.d.1)

The NRC identified deficiencies concerning the controlling of updates to vendor manuals, adherence, and implementation of updated technical requirements in site procedures and WOs when servicing and replacing plant components and equipment. OPPD conducted a self-assessment that identified a number of related discrepancies, including:

- Difficulties in retrieving vendor information;
- Engineering Changes did not consistently incorporate vendor manual information;
- Engineering did not routinely verify that impacted components have vendor manuals or technical manuals;
- Vendor Manual Program failed to use the Operating Experience process to conduct reviews of vendor and technical manual changes; and
- Inadequate staffing of key positions described in program procedures.

To address these deficiencies, an OPPD team consisting of engineers and third-party consultants performed an assessment of vendor manuals tied to CQE equipment, Functional Importance Determination (FID)-1 and 2 equipment, and LCQE equipment. In addition, OPPD also reviewed selected non-CQE component manuals. In total, OPPD examined 901 manuals.

The assessment included FCS procedures, work orders, and equipment tag numbers in Vendor Manuals. The team also verified whether proper safety classifications were used for CQE equipment and components. In addition to manuals associated with CQE equipment, the team also reviewed a selection of non-CQE, but important to safety, vendor manuals to verify that they were properly classified, and to establish the accuracy of technical information that was incorporated into plant procedures and WOs.

The team reviewed associated plant procedures and WOs to verify that current vendor instructions were being applied as prescribed. These reviews included, but were not limited to, maintenance and service life requirements, calibration and test values, torque values, and other vendor recommendations when specified to insure these were translated into the plant configuration through procedures and working documents. The team's reviews also included ensuring that procedures and WOs are correctly referencing associated vendor manuals using the correct vendor manual technical document number(s). In total, the team reviewed 901 vendor manuals.

Concurrent with the reviews discussed above, OPPD engaged a third-party, Vendor Information Solutions (VIS), to update FCS vendor manuals and to determine if the FCS

CQE vendor manuals required technical changes. VIS ultimately updated 680 FCS vendor manuals (a subset of the manuals reviewed by the FCS team).

As a result of these review efforts, OPPD identified 139 vendor manuals that referenced obsolete or discontinued equipment, generated 117 CRs, and revised 400 procedures. OPPD performed a collective significance evaluation in CR 2012-09227, which identified six significant conditions and corresponding corrective actions:

Condition: Vendor Manuals were not being kept up to date. Asset Suite and FCS Controlled Documents system databases did not contain the most recent updates for these manuals.

Resolution: FCS contracted with an outside vendor, VIS, to contact vendors of CQE equipment, components and materials for updates on their manuals. In addition, VIS prepared reports detailing changes encountered in newer revisions of publications contained in these manuals and transmitted their reports and updated vendor manual documents to FCS for incorporation into their databases.

Condition: Of the 680 safety-related (*i.e.*, CQE) manuals reviewed by VIS, 52 of the changes were deemed to be potentially significant to equipment operability, based upon an engineering assessment of each change, and each had a CR written for the evaluation.

Resolution: 680 CQE vendor manuals were reviewed by VIS, which transmitted updates to OPPD. These updates were incorporated into FCS document databases. OPPD engaged VIS to perform this service in 2013 for the maintenance of vendor manual updates.

Condition: FCS procedures governing maintenance, operation, and installation were found to have outdated or incorrect references to applicable procedures, specifically, the document tracking number.

Resolution: OPPD generated CR 2012-03082 to initiate and implement a plan to review and update CQE vendor technical manuals and provide a summary of results. OPPD engaged a team of seven consultants to perform a detailed review of the CQE and non-CQE, FID-1, FID-2, and Fire Protection manuals. The team generated CRs to address identified deficiencies.

Condition: Over 200 FCS vendor manuals containing maintenance instructions were not referenced in any plant procedures. In addition, no WOs were linked to the vendor manuals, thus, requiring investigation on past preventative maintenance or servicing activities to be performed on associated equipment.

Resolution: Seven CRs were generated to address this gap. The CRs included 200 vendor manuals. Vendor manuals that exhibited this condition were reviewed against maintenance and shelf-life requirements.

Condition: OPPD performed an ACA in CR 2011-9296, "Missed Vendor Manual Update Contributed to HCV-335-O Failure," which determined that human performance issues existed prior to the vendor manual review initiative. Although the FCS program is comprehensive enough to stand on its own, implementation of vendor contacts, updating plant databases, and updating procedure references was lacking, mostly due to insufficient staffing levels at FCS.

Resolution: OPPD hired and trained additional staff to improve and expedite vendor manual control processes in an effort to meet plant requirements and procedures. The 52 vendor manual updates received from VIS are being incorporated into Asset Suite and FCS Document Control.

Condition: Information in vendor manuals was not accurately or completely detailed in associated procedures, specifically, lubrication changes, torque values for mounting, or servicing of equipment. Without proper cross-references in FCS procedures, there was no mechanism for checking back for vendor technical instruction changes prior to performing work activities on associated equipment and evaluating plant operability.

Resolution: OPPD generated CRs to address the missing cross-references, lubrication, and torquing issues.

As a result of the deficiencies identified in Collective Significance CR 2012-09227, OPPD also conducted an additional ACA, "Vendor Manual Control Information Control Issues," which was completed in November 2012.

Corrective Actions

OPPD took multiple corrective actions to resolve the deficiencies identified during these reviews, including:

- Revised FCS Engineering procedures involving vendor manual information control activities to clearly describe specific roles, responsibilities, interfaces, and applicability criteria for actions necessary to ensure vendor manual design control information is current, accurate, and complete;

- Developed and implemented an appropriate engineering organization structure and a detailed Division of Responsibilities procedure for the Engineering Division that is aligned with the roles and responsibilities developed in the "Conduct of Engineering – Principles and Expectations" procedure; and

- Developed training for vendor manuals detailing engineering responsibilities and expectations as determined by the ACA and applied the systematic approach to the training process.

2. Equipment Service Life (Restart Checklist Item 3.d.2)

Both OPPD and the NRC identified deficiencies related to equipment service life (ESL) at FCS. To address these deficiencies, OPPD performed analyses to review component history and identify those components that are beyond their recommended service life. Toward this end, OPPD:

- Identified and evaluated components installed in the plant that require an ESL activity performed;
- Updated PM databases and plant records with current ESL information;
- Assessed the PM program to identify program weaknesses; and
- Identified PM program process improvements for maintaining component integrity and preventing recurrence of the problem.

OPPD subsequently performed a root cause analyses to address these deficiencies and identified the following causes:

- Governance and Oversight
  - Leadership failed to consider the station's vulnerability to increasing failure rates when making decisions that delayed maintenance on components exceeding their ESL, despite issues presented to them by staff and regulators.
  - Engineering roles, responsibilities, and work priorities did not support component maintenance strategy development and upkeep.
  - Resources were not provided and aligned to ensure that Equipment Reliability Optimization Program PM Tasks were developed and implemented.
  - FCS leadership failed to ensure corrective actions were taken to address safety issues, adverse trends, and assessment-revealed issues that were identified in the Equipment Reliability programs and processes.
  - Management had not applied an industry-standard PHC process to ensure success of Equipment Reliability programs and processes.
  - Leadership had not demonstrated accountability nor held station personnel accountable for implementation of the engineering and work management processes in support of long-term equipment reliability.

- Procedures/Tools

  - PM program procedure and process deficiencies had contributed to a lack of awareness of how to develop and implement strategies to avoid operating equipment beyond its service life.

  - ESL tools and processes were complicated, inefficient and time-consuming; time requirements exceed resource availability. As a result, ESL maintenance strategies were incorrect or not developed.

  - Procedure and process deficiencies had contributed to the degraded equipment reliability issue.

- Training/Knowledge

  - Training programs/qualification processes had not been effective to ensure personnel have satisfactory skills and knowledge enabling them to execute work management and long-term equipment reliability functions.

Corrective Actions

OPPD took a number of corrective actions to address these causes, including:

- Replaced, refurbished, rebuilt, and overhauled various components to resolve the ESL issues;

- Performed engineering evaluations on components to resolve ESL issues as required;

- Implemented a management model that defined the OPPD fundamental objectives, through the mission, vision, values, guiding principles, and fundamentals of the organization;

- After OPPD found that EEQ program criteria do not necessarily mimic service life concerns, it evaluated equipment within the EEQ Program scope against a list of equipment identified for the ESL project and 40 items were identified as requiring action;

- Revised FCSG 24-3, “Condition Report Screening,” to include Significance Level 2 criteria for ER programmatic issues where multiple components were not maintained to protect against aging or wear-out; and

- Assigned an ER Restoration manager to address outstanding, incomplete, and not started initiatives important to high equipment reliability.

e. Operability Process (Restart Checklist Item 3.e)

OPPD initiated a CR in August 2012 to address deficiencies identified in the Collective Significance Evaluation of more than 4,000 CRs and other documents that assessed weaknesses in the identification and resolution of CLB DNC conditions and Operability Evaluations. The Collective Significance Evaluation had determined that of the of 2,049 CRs generated between 2006 through 2012 that required DNC determinations, 468 were deficient — a failure rate of approximately 23 percent. OPPD identified several deficiencies in this area, including:

- Lack of accurate identification of CLB DNC Conditions;
- Operability Determinations/functionality assessments were not sufficiently rigorous;
- Discrepancies were not always resolved in a timely manner commensurate with the safety significance of the condition; and
- Characteristics necessary for equipment to be fully qualified were not well understood or applied.

The analyses identified two root causes and four contributing causes:

- Root Cause 1. Leadership had not provided adequate governance and oversight for key regulatory required programs and activities.
- Root Cause 2. Processes to perform, and support performance of, Degraded/Non-Conforming Condition identification and Operability Determinations were not adequate to ensure consistently accurate and timely determinations.
- Contributing Cause 1. The Operating Experience Program permitted a superficial review.
- Contributing Cause 2. Operations leadership did not recognize the risk associated with failing to keep pace with the industry standard for an Operations-led organization.
- Contributing Cause 3. Knowledge and skills to perform, and support performance of DNC Condition identification and Operability Determinations were not adequate to ensure consistently accurate and timely determinations.
- Contributing Cause 4. Tools used to perform, and support performance of DNC Condition identification and Operability Determinations were not adequate to ensure consistently accurate and timely determinations.

To address these cause, OPPD implemented a number of corrective actions, including three CAPRs:

- CAPR 1. Established and communicated clear expectations for behaviors relative to accountability and standards as outlined within OPPD Supervisors Manual Policy 3.06, "Corporate Governance, Oversight, Support and Perform (GOSP) Model of Fort Calhoun Station," and holds FCS leaders personally accountable to meet those expectations using the performance management program.

- CAPR 2. Integrated leaders having external perspectives and broad experience-based insights from external organizations (*e.g.*, Exelon) as a means of raising leader performance levels in accountability and standards associated with regulatory compliance and restoration of DNC or inoperable SSCs. Execution of the OPPD/Exelon OSA in August 2012 allowed for completion of this action.

- CAPR 3. Conducted a gap analysis, using a non-FCS, DNC and Operating Experience (OE)-experienced individual, on NOD-QP-31, "Operability Determinations Process (OPD)" and FCSG-24-3, "Condition Report Screening," contents against the attributes contained in NRC Regulatory Issue Summary 2005-20, Revision 1, then revised NOD-QP-31 and FCSG-24-3 (or equivalent Exelon documents) to close identified gaps. OPPD ensured the following specific gaps were addressed:

  - Clearly identify the expectations for the screening and classification of DNC conditions under varying plant conditions and modes.

  - Clearly identify the expectations for Operability Determinations for TS components under varying plant modes and conditions.

  - Implement the requirement that applicable SSC CLB function(s) identified during the Operations CR screening be documented in the operability determination.

  - Implement the requirement that the impact of the condition on the CLB function(s) be documented in the operability determination.

  - Implement the requirement that the decision basis for CLB function DNC be documented in the operability determination.

  - Implement conservative and clear expectations for the completion of a CLB DNC determination that is clearly based upon safety significance of the component and any applicable LCO action requirement (*e.g.*, always complete within 24 hours or within one-half of any applicable LCO action time requirement for the component).

- Modify procedures to provide a more logical sequence for doing the evaluations (*e.g.*, the procedure should start with determining if the issue is degraded and/or non-conforming instead of making an operability evaluation).

- Remove the allowance to change a CLB DNC designation to a non-DNC designation if the condition is corrected prior to the end of shift.

f. Quality Assurance (Restart Checklist Item 3.f)

Significant issues were identified in the FCS Quality (Nuclear Oversight) organization beginning in 2010. Specifically, the Nuclear Industry Evaluation Program (NIEP) independent audit, conducted in October 2010, found:

> [S]everal oversight-identified conditions have gone unresolved for extended periods of time, and some issues have not been effectively escalated, including repeat findings.… [T]here is a lack of knowledge and experience of independent oversight principles and industry practices, which is likely the result of isolation and a lack of industry engagement. [T]his lack of knowledge and experience has limited the effectiveness of the assessment (*e.g.*, Quality Surveillances) program, and has adversely affected the oversight organization's independence. Also affecting the independence of the oversight staff has been the line organization assignment of line responsibilities to individuals within independent oversight.… [T]he FCS line organization was marginally effective at accepting, understanding, and acting upon the deficient conditions resulting from independent audits and assessments.

An INPO evaluation conducted in March 2011 made several findings concerning the Quality organization, including:

> The Quality organization is not consistent in identifying declining performance issues because it lacks a behavioral focus. The Quality organization's ability to drive improvements is hindered by a high number of overdue and unresolved issues, many of which have not been escalated.… Quality missed underlying problems that contributed to technical training program probation, inadequate responses to an external flooding issue, and a degraded reactor protection system. Contributing to the problem, Quality reviews have not consistently focused on important organizational behaviors. Additionally, corrective actions to address some previously identified weaknesses in Quality have not been completed or were deficient.

Analyses

Subsequently, OPPD performed a Collective Evaluation and RCA regarding the Quality organization and found that:

> Nuclear Oversight (NOS) has not identified many of the substantive issues that have resulted in the decline in station performance. NOS lacks sufficient focus on identifying adverse behaviors and conditions that, if corrected, can arrest declining performance before more significant issues occur. Issues identified by NOS are not communicated in a manner that compels site leaders to act. Site leaders do not value input from NOS.

Root Causes

OPPD performed an evaluation of these deficiencies and found one root cause and three contributing causes:

- Root Cause 1. NOS failed to effectively use trending, benchmarking, self-assessment, missed opportunity reviews, and observations which inhibited the ability to identify adverse NOS behaviors and conditions that eventually led to the decline in NOS performance and thus a decline in station performance.

- Contributing Cause 1. NOS failed to follow written guidance that resulted in deficiencies which impacted department performance.

- Contributing Cause 2. NOS lacked the requisite skills and knowledge to drive the station to improve performance.

- Contributing Cause 3. NOS failed to challenge important safety decisions and prioritization of safety-significant issues.

Corrective Actions

To address these causes, OPPD took numerous corrective actions, including:

- Established NOS expectations for using trending, benchmarking, self-assessment, missed opportunity reviews, and observations requirements to ensure NOS performance issues are identified and resolved in a timely manner. The elements of this action include:

  - revising appropriate implementing documents;

  - NOS management holding face-to-face meeting with NOS personnel on expectations;

- held monthly meetings for six months to reinforce NOS management's expectations; and

- established guidance in the FCS Corporate Governance, Oversight, Support, and Performance Model, which requires the Manager - NOS to provide the Vice President of Energy Delivery and Chief Compliance Officer with a quarterly report on NOS department improvements that resulted from trending, benchmarking, self-assessments, missed opportunity review, and observations.

- Established an NOS Policy to conduct annual NOS Self-Assessments in accordance with FCSG-4, "Performance of Self-Assessment," Section 4.2, "Scheduling of Self Assessments," to include industry peers as team members.

- Completed a benchmark for NOS Continuous Learning based on the results of the 2012 Pre-NIEP and 2012 NIEP Assessments.

- Established and published a monthly NOS Procedure Use and Adherence Key Performance Indicator based on NOS Observations and CRs.

- Completed Crucial Conversations Training for NOS personnel.

- Completed Problem Statement and Insight Development Training for NOS personnel.

- Established an NOS procedure for performing an annual evaluation of NSRB, INPO, NRC, and NIEP findings and recommendations. This evaluation included assessment of issue status, CR classification, causal analysis, resolution, trending, and common cause evaluations.

All NOS performance deficiency-related corrective actions were completed and the final effectiveness review was approved by the station Management Review Committee on November 4, 2013.

4. <u>Readiness for Restart</u>

a. <u>Operations Organization Ready for Restart (Restart Checklist Item 7.a)</u>

<u>Heatup</u>

Prior to FCS heatup, Operations personnel were trained on significant aspects of the evolution. For critical activities during testing and plant heatup, the simulator and Just-In-Time-Training (JITT) were tools used by operators. JITT supports procedure review and activity familiarization prior to critical plant system operation. Additionally, each operating crew prepared for at-power operations using the simulator. The crews participated in 12-hour, turnover to turnover, "fast cruise" exercises on the simulator.

The fast cruise took place over 48 consecutive hours and consisted of raising plant power from 30 percent to 98 percent. The fast cruise also incorporated alarming conditions, abnormal operating conditions, and real-time feedback from senior management.

FCS plant heatup began after the reactor core had been reloaded, the primary coolant system configured, filled, and vented. The FCS primary coolant system was raised in temperature and pressure from Mode 5 (less than 210 °F) to Mode 3 (greater than 515 °F). The energy to increase temperature came from the reactor coolant pumps. During the heatup, OPPD identified several components that required maintenance. During the heatup, the operators also dealt with relief valves that lifted, check valves that were slow to seat, and a penetration valve that required back-up isolation to secure the containment boundary. These issues were managed using troubleshooting plans and maintenance WOs coordinated through the Outage Control Center.

Alignment and testing of safety systems proved they were operable and ready to respond and mitigate events even with the reactor shutdown. As energy was added to the primary coolant system using the reactor coolant pumps, core protection was ensured by protecting equipment necessary to sustain key parameters, such as primary inventory, heat removal, and electrical power sources. Protection schemes and operability are process-driven and validated regularly using checks and surveillances at prescribed periods.

Operations led alignment of plant systems being readied or placed into service. Station departments were coordinated to return equipment from outage maintenance for testing. Several thousand tasks, associated work packages, and procedures were coded, sorted, and dispatched to individuals and groups to demonstrate equipment satisfied functional and operability requirements. The Operations department provided oversight of testing and licensed operators critiqued work items serving to prove systems were operable in accordance with current licensing basis.

As the primary coolant system came up in modes, the secondary side of the plant was warmed, steam formed, and energy released through atmospheric dump valves or into the main condenser after having established condenser vacuum. The operators demonstrated their understanding and ability to control the fundamentals of thermodynamics within prescribed limits. Heatup (and later cool-down) limits were monitored and maintained. Even though the primary coolant system was maintained borated at refueling concentrations, the reactivity impact of heatup and cool-down was discussed.

During mode ascension equipment challenges were identified by testing or became self-revealing. The Operations department assessed these opportunities, determined their individual and aggregate impact on the plant and TS. The station priority of having a bias to fix plant equipment was applied. Conservative decision-making was used by stopping the heatup and repairing a pressurizer relief valve that had failed surveillance testing. The Operations department engaged the station and fleet resources to troubleshoot, make repairs, and restore equipment to normal.

The station was then returned from the normal operating temperature and pressure state of 2,100 psia and 532 °F in Mode 3 to the cold shutdown conditions of less than 210 °F for Mode 5. Heat up was completed when the last reactor coolant pump was secured at 0300 on November 6, 2013.

Post-Heatup

The Operations department uses internal measures to sustain performance and alignment to the industry. At the core of the operating philosophy is the Operations Directors model of GAAR, an acronym for Gap, Analysis, Actions, Results. This model provides structure for the department to function. At the highest levels the GAAR model is born from the ENMM of governance and oversight. Behavior-based performance and equipment reliability are critiqued as part of management review meetings between the station and the executives. Operations also uses observations, both peer to peer and by supervision, to detect performance gaps. Collectively, management and the department CAP coordinator use this data and analysis techniques to detect trends and their underlying causes. As part of the accountability structure actions are applied to arrest negative trends and improve performance. Management and/or training solutions are considered as actions to correct underlying causes. Updated monthly performance is presented in narrative reports and performance indicators on the effectiveness of corrective actions taken. Recurring or significant issues are elevated to become part of the PIIM. As part of the PIIM, station and department level items are held under the closest scrutiny for effectiveness and follow- through. As a result of applying the GAAR model and the formality of actions with metrics, OPPD can ensure that FCS performance will be sustained and improved.

After the heatup and cool-down evolutions, OPPD conducted a lessons learned activity to ensure that operating experience from this first post-extended shutdown heatup/cool-down evolution were captured for application during future plant heat ups.

In sum, OPPD has concluded that the Operations department is ready to lead FCS restart.

b. Systems Ready for Restart and Mode Restraints Properly Addressed (Restart Checklist Item 7.b)

Because of the extended outage beginning in April 2011, OPPD addressed the readiness for restart of systems that have been shut down for that extended period. Such systems can be subject to unique conditions inherent to a long-duration shutdown, such as initial operation of equipment dormant for an extended period of time. These conditions can present the potential for emergent equipment issues as plant temperature, pressure, and operating configurations change. Consequently, OPPD evaluated the effects of the extended shutdown, and verified that the structures, systems, and components are ready for plant restart and that they conform to the licensing and design bases requirements. See Section 2.b of the IRR, “System Readiness for Restart Following Extended Plant Shutdown (Restart Checklist Item 2.b),”

for a detailed discussion of the actions OPPD took to ensure these systems are ready for restart.

With regard to mode restraints, see the discussion in Section 4.a above.

c. Final Review of Corrective Action Program for Restart Items (Restart Checklist Item 7.c)

Consistent with the IPIP, this item in the Checklist included final confirmation that all restart designated actions have been adequately completed or are appropriately reflected in the schedule and on the Mode Change Checklists. In addition, this item includes confirmation that post-restart designated items are appropriately categorized and confirmation that degraded but operable equipment could remain at start-up provided it meets the following criteria:

- Appropriate engineering justification;
- PRC approval; and
- A post-restart action can be readily worked online, does not affect safe and reliable operation, does not represent a significant challenge to Maintenance Rule goals or required allowed outage time, and does not impair operations necessary to perform surveillance or monitoring.

B. Closure of Flooding Recovery Action Plan Commitments

The following table provides details on how OPPD closed the various commitments in the Flooding Recovery Action Plan.

FRP No.	Action Description	Closure Date	Notes
3.2.2.01	Test or Replace 13.8KV Medium Voltage Cable for Emergency Power Feed and Met Tower Feed.	8/12/2012	3.2.2.01 was closed to 3.2.1.04 in FRP Rev. 3. Medium voltage cables for the emergency power feed and meteorological tower feed were tested with vendor support (Kinectrics). The emergency power feed cable passed the test without issues. The meteorological tower feed cable was replaced under Transmission & Distribution Work Order 425377. 3.2.2.01 and 3.2.1.04 are closed.

FRP No.	Action Description	Closure Date	Notes
3.2.2.02	Inspect Manholes and Vaults for damage and integrity of water seals at penetrations.	7/20/2012	
3.2.2.03	Contingency Cable Replacement (If identified defective cable during testing).	1/16/2013	
3.2.2.04	Testing of contingency cables installed after replacement (if needed).	1/16/2013	
3.4.2.01	Establish High Impact Team with a Charter.	8/21/2012	
3.4.2.02	Identify all CQE power supplies; priority will be on RPS CQE power supplies and then non-RPS CQE power supplies.	7/12/2012	
3.4.2.03	Determine the installation date for FCS CQE power supplies; these dates will be used to define those CQE power supplies that are beyond their service life.	7/12/2012	
3.4.2.04	Conduct an industry and FCS specific analysis of historical performance for CQE power supplies; determine the effectiveness of the current ER Strategies at the FCS component level.	7/12/2012	
3.4.2.05	Conduct an analysis of the current FCS ER Strategy for power supplies; contact vendors, review industry documentation, benchmark other plants.	7/12/2012	

FRP No.	Action Description	Closure Date	Notes
3.4.2.06	Determine the recommended service life for CQE power supplies based on analyses performed earlier in this action plan. These service lives will be based on: (1) manufacturer and model, (2) qualified life testing, (3) vendor recommendations and communication with vendors, (4) remnant life based on stress testing of removed power supplies, (5) industry and FCS specific historical performance and (6) actual duty cycle and service condition where these power supplies are installed.	7/12/2012	
3.4.2.07	Conduct a failure modes and effects analysis on each power supply to ensure the impact of failures is understood.	7/12/2012	
3.4.2.08	Document the time based replacement strategy and basis for CQE and RPS power supplies. This strategy and basis will provide the tasks to be performed and the basis for the scope and frequency of those tasks. This action is being completed before start up to ensure each power supply has been analyzed and a recommended service life defined.	7/12/2012	

FRP No.	Action Description	Closure Date	Notes
3.4.2.09	Define those power supplies that are beyond their service life. This will include power supplies that will be beyond their service life before the next planned refueling outage.	2/18/2013	
3.4.2.10	Replace RPS CQE power supplies beyond their service life.	11/6/2013	
4.2.2.01	Identify degraded flood barriers.	12/7/2012	
4.2.2.02	Repair flood barriers as required.	3/14/2012	
4.2.2.04	Prepare SO-G-124, documentation for all flood barriers which do not have adequate qualification.	3/20/2012	
4.2.2.05	Review restoration plans for each impaired flood barrier per SO-G-124 form FC-1411.	3/20/2012	
4.2.2.06	Review impaired flood barriers as identified in accordance with SO-G-124 form FC-1411.	3/19/2012	
4.2.2.07	Removal of all flood mitigation devices which have been determined to not be permanent fixtures.	10/18/2013	4.2.2.07 was closed to 4.3.2.02 in FRP Rev. 3. Walkdowns were conducted in accordance with CR 2011-8566 to verify restoration of non-permanent configuration changes. All appropriate tasks are complete. 4.2.2.07 and 4.3.2.02 are closed.
4.3.2.01	Completion of all ECs/restoration required for plant start-up.	10/18/2013	

FRP No.	Action Description	Closure Date	Notes
4.5.1.05	Complete installation of EC 53202; FW-10 Steam Line HELB Modification.	12/2/2013	4.5.1.05 (heat-up commitment) was closed to 4.5.2.05 (criticality commitment). OPPD determined this is acceptable because the affected steam line was isolated (administratively controlled) to eliminate the condition during initial heat-up. 4.5.2.05 is closed. (Note – LIC-13-0159 cover letter incorrectly indicated that the resolution of 4.5.1.05 was being tracked by 4.5.1.06. The enclosure to LIC-13-0159 contained the correct information as reflected here.)

FRP No.	Action Description	Closure Date	Notes
4.5.1.14	Perform HELB analysis of Auxiliary Steam piping in the Auxiliary Building.	2/1/2013 for 4.5.2.01 3/1/2013 for 4.5.3.05 4.5.3.06 will be completed after restart.	4.5.1.14 (heat-up commitment) was closed to 4.5.2.01 (criticality commitment). 4.5.2.01, 4.5.3.05 and 4.5.3.06 are long-term actions to develop and implement respectively, EC 53958 "Auxiliary Building-Auxiliary Steam HELB/Mitigation" to prevent harsh areas caused by cracks or breaks in the auxiliary steam system. This is acceptable because auxiliary steam to the building has been isolated (administratively controlled) to eliminate the condition until an effective resolution can be implemented. 4.5.1.14, 4.5.2.01, and 4.5.3.05 are closed. 4.5.3.06 is a post-restart item. (Note – LIC-13-0159 cover letter incorrectly indicated that the resolution of 4.5.1.14 was being tracked by 4.5.2.01. The enclosure to LIC-13-0159 contained the correct information as reflected here.)
4.5.1.15	Implement resolution of Auxiliary Steam piping in the Auxiliary Building.	3/1/2013 for 4.5.3.05 4.5.3.06 will be completed after restart.	4.5.1.15 (heat-up commitment) was closed to 4.5.3.05 and 4.5.3.06 (long-term commitments). This is acceptable because the affected steam line has been isolated (administratively controlled) to eliminate the condition until an effective resolution can be implemented. 4.5.3.05 is closed. 4.5.3.06 is a post-restart item.
5.1.2.01	Procure 10 solar charging kits for the nine affected sirens.	1/17/2013	

FRP No.	Action Description	Closure Date	Notes
5.1.2.02	Perform fly over of flood affected siren to determine status and potential condition of the equipment.	1/17/2013	
5.1.2.03	Based on siren inspection procure replacement siren heads, poles, electronic, and power supplies.	5/7/2012	
5.1.2.04	If siren damage and or infrastructure is such that timely repair of sirens is not possible, work with FEMA, state and local governments for potential exemptions or long term plan.	12/23/2011	
5.1.2.05	Replace batteries in the affected sirens.	5/7/2012	5.1.2.05 was closed to 5.1.2.03 by FRP Rev. 3. The batteries in affected sirens were replaced. 5.1.2.05 and 5.1.2.03 are closed.
5.1.2.06	Install solar charging kits on the affected sirens.	1/17/2013	
5.1.2.07	Conduct siren inspections using the Communications developed checklist.	5/7/2012	5.1.2.07 was closed to 5.1.2.03 by FRP Rev. 3. The sirens were inspected. 5.1.2.07 and 5.1.2.03 are closed.
5.1.2.08	Conduct a full siren test after sirens have been restored to functional status.	5/14/2012	
5.2.2.01	Conduct a Protective Measure table top with the states of Nebraska and Iowa.	2/9/2012	
5.3.2.01	Perform ERDS testing.	12/7/2011	
5.3.2.02	Perform normal communications testing.	5/15/2012	
5.3.2.03	Restore area radiation monitors.	No action required	5.3.2.03 was closed to no action required by FRP Rev. 3. The radiation monitors were not affected by the flood.

FRP No.	Action Description	Closure Date	Notes
5.3.2.04	Ensure effluent radiation monitors are functional.	No action required	5.3.2.04 was closed to no action required by FRP Rev. 3. The radiation monitors were not affected by the flood.
5.3.2.05	Restore equipment used for emergency classification.	9/7/2012	5.3.2.05 was closed to 5.4.2.01 by FRP Rev. 3. The equipment used for emergency classification was not affected by the flood, except for the meteorological tower. Restoration of the meteorological tower was tracked by 5.4.2.01. 5.3.2.05 and 5.4.2.01 are closed.
5.3.2.06	Perform normal facility inventories and assessments.	7/13/2012	
5.3.2.07	Conduct Meeting with FEMA, NRC, local Emergency Manager, and State Emergency Managers.	12/23/2011	
5.3.2.18	Develop a report with the supporting documentation that can be used to assist the states in writing a letter of certification to FEMA Region IV.	7/3/2012	5.3.2.18 was closed to 5.3.2.19 by FRP Rev. 3. OPPD and responsible county and state agencies for Nebraska and Iowa conducted an assessment of the state of readiness to respond to a radiological event at FCS. The results were provided to FEMA, which issued a statement of reasonable assurance to the NRC by letter dated November 22, 2011. 5.3.2.18 and 5.3.2.19 are closed.
5.4.2.01	MET tower restoration.	9/7/2012	
5.4.2.02	MET tower building restoration.	9/16/2012	
5.4.2.03	Secondary Evacuation Route restoration.	12/23/2011	
5.4.2.04	Critique Flooding event.	7/3/2012	

FRP No.	Action Description	Closure Date	Notes
6.1.2.02	Inspect Isolation zone, i.e. fence, raceway, markers.	2/28/2012	
6.1.2.03	Remove sample of Trenwa system caps and inspect.	2/28/2012	
6.1.2.04	Inspect and test south Sally Port K12 and inner gates.	2/28/2012	
6.1.2.05	Inspect and test north Sally Port K12 and inner gates.	2/28/2012	
6.1.2.06	Inspect and test EAO gates and controllers.	2/28/2012	
6.1.2.07	Inspect and test North Sally Port and Warehouse hydraulic gates and controllers.	2/28/2012	
6.1.2.08	Inspect camera towers & raceway.	2/28/2012	
6.1.2.09	Inspect Primary Access Point (PAP).	2/28/2012	
6.1.2.10	Inspect Auxiliary Access Point (AAP).	3/20/2012	
6.1.2.11	Inspect exposed Multiplexers.	2/28/2012	
6.1.2.12	Inspect Security Mast Lighting.	5/7/2012	
6.1.2.13	Inspect Security Diesel and Diesel Fuel Oil Tank.	3/20/2012	
6.1.2.14	Inspect the structural integrity of Security Structures.	6/4/2012	6.1.2.14 (criticality commitment) was closed to 4.1.1.23 (heat-up commitment) by FRP Rev. 3. Security structures were assessed as described in FRP 4.1., “Plant and Facility Geotechnical and Structural Assessment,” Rev. A, dated October 7, 2011; prepared by HDR Engineering, which concluded the flood did not affect their structural integrity. 6.1.2.14 and 4.1.1.23 are closed.
6.1.2.15	Inspect unattended opening control systems.	2/28/2012	

FRP No.	Action Description	Closure Date	Notes
6.1.2.16	Inspect Security firing range for damage and power restoration.	3/19/2012	
6.1.2.20	Replace/repair fence.	5/8/2012	
6.1.2.21	Replace/repair microwave system.	3/20/2012	
6.1.2.22	Replace/repair Intrepid system.	4/16/2012	
6.1.2.23	Replace/repair EAO K12 gates.	4/16/2012	6.1.2.23 (criticality commitment) was closed to 6.1.3.01 (long-term commitment) by FRP Rev. 3. The exclusion area operator (EAO) gates were restored to working order. 6.1.2.23 and 6.1.3.01 are closed.
6.1.2.24	Replace/repair 20 foot fence hydraulic operators.	5/7/2012	6.1.2.24 (criticality commitment) was closed to 6.1.3.02 (long-term commitment) by FRP Rev. 3. The hydraulic gate operators were replaced with new original equipment manufacturer hydraulic gate operators. 6.1.2.24 and 6.1.3.02 are closed.
6.1.2.25	Replace/repair 20 foot fence swing gates (warehouse and north sally port).	5/7/2012	6.1.2.25 (criticality commitment) was closed to 6.1.3.02 (long-term commitment) by FRP Rev. 3. The existing gate leafs were removed and replaced with new custom manufactured gate leafs with more rigorous structural design. 6.1.2.25 and 6.1.3.02 are closed.
6.1.2.26	Reinstall search train removed from PAP.	7/3/2012	6.1.2.26 was closed to 6.1.2.35 by FRP Rev. 3. The primary access portal search train equipment was tested and determined to be acceptable. 6.1.2.26 and 6.1.2.35 are closed.

FRP No.	Action Description	Closure Date	Notes
6.1.2.27	Replace/repair vehicle barrier blocks.	4/16/2012	
6.1.2.28	Replace/repair high mast lighting.	4/16/2012	
6.1.2.29	Test unattended opening detection systems.	3/20/2012	
6.1.2.30	Test PA camera system.	3/20/2012	
6.1.2.31	Test OCA camera system.	3/20/2012	
6.1.2.32	Test Microwave system.	4/16/2012	
6.1.2.33	Test Intrepid System.	4/16/2012	
6.1.2.34	Test AAP access equipment.	3/20/2012	
6.1.2.35	Test PAP access equipment.	7/3/2012	
6.1.2.36	Test as required all security system edge devices.	3/20/2012	
6.1.2.37	System is functional.	7/3/2012	

C. Closure of Confirmatory Action Letter Commitments

This section describes how OPPD closed each of the commitments in the September 2, 2011, June 11, 2012, and February 26, 2013 Confirmatory Action Letters.

September 2, 2011 CAL. The seven commitments described in this CAL and the basis for resolution of those commitments is described below.

1. "Inform the NRC of your schedule for completing the actions listed below to facilitate our timely inspection of the activities."

   Closure: Following issuance of this CAL, the OPPD Division Manager for Engineering conducted weekly telephone calls with NRC Region IV staff to discuss and update the schedule for completing the actions listed below.

2. “Prior to exceeding 210 degrees Fahrenheit in the RCS, OPPD commits to complete the following actions detailed in the Post-Flooding Recovery/Security Plan: Action Items 1.2.1.1; 1.2.1.3; 1.2.1.4; 1.3.1.1 through 1.3.1.12; 1.3.1.14 through 1.3.1.19; 1.3.1.21 through 1.3.1.24; 1.4.1.2 through 1.4.1.6; 2.1.1.1 through 2.1.1.10; 2.2.1.1 through 2.2.1.32; 2.3.1.1 through 2.3.1.16; 3.1.1.1; 3.2.1.1 through 3.2.1.3; 3.3.1.1 through 3.3.1.3; 3.4.1.1; 4.1.1.12 through 4.1.1.17; 4.1.1.20 through 4.1.1.25; 4.2.1.1 through 4.2.1.6; 4.3.1.1 through 4.3.1.4; 4.5.1.1 through 4.5.1.15; 4.6.1.1 through 4.6.1.3; and 5.2.1.1.”

   Closure: These actions were completed before FCS RCS temperature was raised above 210 °F.

3. “Inform us in writing when you have satisfactorily completed the actions listed in 2 above.”

   Closure: OPPD informed the NRC in writing regarding the completion of these actions through letters dated October 4, 2013, and October 28, 2013.

4. “Prior to reactor criticality, OPPD commits to complete the following actions detailed in the Post-Flooding Recovery/Security Plan: Action Items 3.2.2.1 through 3.2.2.4; 3.4.2.1 through 3.4.2.10; 4.2.2.1; 4.2.2.2; 4.2.2.4 through 4.2.2.7; 4.3.2.1; 5.1.2.1 through 5.1.2.8; 5.2.2.1; 5.3.2.1 through 5.3.2.7; 5.3.2.18; 5.4.2.1 through 5.4.2.4; 6.1.2.2 through 6.1.2.16; and 6.1.2.20 through 6.1.2.37.”

   Closure: As described in the Readiness for Restart section of this IRR, Subsection B, these actions are complete with following two exceptions noted:

   a. 4.5.1.14: Perform HELB analysis of Auxiliary Steam in the Auxiliary Building; and

   b. 4.5.1.15: Implement resolution of Auxiliary Steam piping in the Auxiliary Building.

      Final resolution of these two items has been deferred until after restart. OPPD determined this is acceptable because the affected steam line has been isolated (administratively controlled) to eliminate the condition until an effective resolution can be implemented.

5. “Inform us in writing when you have satisfactorily completed the actions listed in 4 above.”

   Closure: Readiness for Restart section of this IRR, Subsection B, completes this commitment.

6. "Prior to reactor criticality, OPPD will meet with the NRC to ensure there is agreement the facility is ready for restart. During that meeting, we expect you will discuss the results of your assessments performed in the plan, actions you took to address any problems identified during your assessment, and your assessment of the readiness to return the plant to power operation."

   Closure: OPPD has met publicly with NRC on progress implementing the IPIP and FCS recovery and restart readiness regularly since January 2012. Most recently, OPPD conducted a public meeting with the NRC on September 24, 2013. OPPD also met publicly with the NRC Commissioners to discuss progress on recovery and restart of FCS on January 8, 2013 and May 29, 2013. In addition, OPPD has conducted teleconferences several times per week and met onsite periodically to update the NRC staff on implementation of the IPIP. Finally, OPPD executives have conducted periodic teleconferences and met occasionally with NRC executives to update them on IPIP implementation. We believe that these series of meetings and teleconferences in the aggregate have been sufficient to fulfill this commitment.

7. "Following restart of the plant, OPPD commits to complete the following actions detailed in the Post-Flooding Recovery/Security Plan: 1.2.3.21, 1.2.3.42, 1.2.3.57, 1.2.3.58, 1.2.3.79, 1.2.3.82, 3.4.3.1 through 3.4.3.3, 4.4.3.1 through 4.4.3.3, and 5.1.3.1."

   Closure: The following items are complete and have been inspected by the NRC: 1.2.3.42, 1.2.3.57, 1.2.3.79, 3.4.3.1 through 3.4.3.3 and 5.1.3.1.

June 11, 2012 CAL. The six commitments described in this CAL and the basis for resolution of those commitments is described below.

1. "OPPD will identify the causes and implement corrective actions to address the safety significant NRC Inspection findings listed In Items 1.a through 1.d of the Restart Checklist."

   Closure: These actions are complete. Documentation of the discovery and resolution of these items is in Sections A.1.a through A.1.d of this IRR.

2. "OPPD will conduct a third-party safety culture assessment (Restart Checklist Item 1.e) and an integrated organizational effectiveness assessment (Restart Checklist Item 1.f) at Fort Calhoun Station and implement actions to address the results of these assessments."

   Closure: These actions are complete. Documentation of the discovery and resolution of these items is in Sections A.1.e and A.1.f of this IRR.

3. "OPPD will submit an updated Flooding Recovery Action Plan to the NRC (Restart Checklist Item 2). That plan will include an assessment of the long-term flooding at Fort Calhoun Station on plant systems, structures, and components and the basis for their readiness for restart."

   Closure: The FRP Revision 3 was attached to IPIP Revision 3 submitted to the NRC on July 9, 2012. The pre-restart actions in the FRP are dispositioned. Documentation of the resolution of these items is in Section A.2.a of this IRR.

4. "OPPD will assess the Fort Calhoun Station programs and processes listed in Restart Checklist Item 3 to verify that they are adequate to support safe plant operation."

   Closure: These actions are complete. Documentation of the discovery and resolution of these items is in Sections A.3.a through A.3.e of this IRR.

5. "OPPD will submit the Integrated Performance Improvement Plan to the NRC (Restart Checklist Item 4). Additionally, OPPD will implement the Integrated Performance Improvement Plan and provide a schedule for completing the plan's actions necessary for plant restart."

   Closure: The IPIP Revision 3 was submitted to NRC on July 9, 2012 and updated in Revisions 4 and 5, which were submitted on November 1, 2012 and June 19, 2013, respectively. The schedule for completing the IPIP actions was contained in the IPIP revisions through a web link and updated regularly. The IPIP has been implemented.

6. "OPPD will inform the NRC in writing of the results related to CAL actions 1 through 5 listed above."

   Closure: This IRR completes the commitment.

The February 26, 2013 CAL. The six commitments described in this CAL and the basis for resolution of those commitments is described below.

1. "OPPD will identify the causes and implement corrective actions to address the safety significant NRC inspection findings and the Safety System Functional Failures Performance Indicator listed in Items 1.a through 1.d and 1.g of the Restart Checklist."

   Closure: These actions are complete. Documentation of the discovery and resolution of these items is in Sections A.1.a through A.1.d and A.1.g of this IRR.

2. "OPPD will conduct a third-party safety culture assessment (Restart Checklist Item 1.e) and an integrated organizational effectiveness

assessment (Restart Checklist Item 1.f) at Fort Calhoun Station and implement actions to address the results of these assessments."

Closure: These actions are complete. Documentation of the discovery and resolution of these items is in Sections A.1.e and A.1.f of this IRR.

3. "OPPD will submit Flooding Recovery Action Plan updates to the NRC for items 2.a and 2.b. That plan will include an assessment of the long term flooding impact at Fort Calhoun Station on plant systems, structures, and components and the basis for their readiness for restart. Additionally, OPPD will identify the causes and address the deficiencies associated with Items 2.c and 2.d."

   Closure: The FRP Revision 3 was attached to IPIP Revision 3, which was submitted to the NRC on July 9, 2012. The pre-restart actions in the FRP are dispositioned. Documentation of the resolution of these items is in Sections A.2.a through A.2.d and the Readiness for Restart section of this IRR, Subsection B.

4. "OPPD will assess the Fort Calhoun Station programs and processes listed in Restart Checklist Item 3 to verify that they are adequate to support safe plant operation."

   Closure: These actions are complete. Documentation of the discovery and resolution of these items is in Sections A.3.a through A.3.e of this IRR.

5. "OPPD will submit Integrated Performance Improvement Plan updates to the NRC (Restart Checklist Item 4). Additionally, OPPD will implement the Integrated Performance Improvement Plan and provide a schedule for completing the plan's actions."

   Closure: The IPIP Revision 3 was submitted to NRC on July 9, 2012 and updated in Revisions 4 and 5, which were submitted on November 1, 2012 and June 19, 2013, respectively. The schedule for completing the IPIP actions was contained in the IPIP revisions through a web link and updated regularly. The implementation of the IPIP is complete.

6. "OPPD will inform the NRC in writing of the results related to CAL actions 1 through 5 listed above."

   Closure: This IRR completes the commitment.

D. Post-Restart Plan for Sustained Improvement

On June 19, 2013, OPPD submitted Revision 5 of the FCS IPIP to the NRC. In the "Transition to Plant Operation and Sustained Excellence" section of the IPIP, OPPD

committed to develop and submit to the NRC the FCS PSI. OPPD will use the PSI to continue the performance improvement momentum generated during recovery and restart within a structured and predictable management system that facilitates clear planning, implementation, and monitoring of performance improvement initiatives after restart. The development, tracking and management tool for the PSI is the PIIM, which is controlled under FCS performance improvement procedures.

The PIIM is a key component in Exelon's continuous improvement process within the ENMM. Each Exelon facility has a PIIM that is continually monitored and periodically updated to bring focus on gaps to excellence and improvement initiatives in a predictable and reliable way. The PIIM is a strategic planning tool that facilitates a systematic approach to utilizing the full range of performance improvement tools to address identified performance gaps.

The PSI is controlled under the OPPD policy and FCS program for continuous performance improvement (Nuclear Policy PI-FC-1, Revision 0, "Performance Improvement" and PI-FC-10, Revision 0, "Performance Improvement Program Description") and implemented through procedure FCSG-70, Revision 0, "Performance Improvement Integrated Matrix." The PIIM is a tool that allows the FCS organization to track performance gaps and improvement initiatives with supporting action plans that ensure clear definition of the gap, and complete analysis and documented solution(s) for each gap. Implementation of those solutions, and performance monitoring, metrics and effectiveness assessments, ensure lasting improvement.

The action plans in the PIIM will address post-restart actions generated through discovery efforts, and root and apparent cause assessments associated with the Restart Checklist items and Fundamental Performance Deficiencies. The performance monitoring and effectiveness assessments aspects of the PIIM will facilitate identification of additional necessary actions. The action plans will address multiple areas, including:

- Safety culture, SCWE, and organizational effectiveness;
- CAP effectiveness;
- Human performance;
- Learning programs effectiveness (including operating experience, training, self-assessments, and benchmarking);
- Performance Improvement program effectiveness;
- Engineering program effectiveness;
- Design and licensing basis control and implementation; and
- Procedure adequacy.

In addition, and on an ongoing basis, the PIIM action plans will address gap closure regarding any significant insights identified from other sources, such as significant insights from NRC inspections, INPO-identified Areas for Improvement, self-assessments, and fleet and industry operating experience.

The PSI is owned by FCS line managers and has been reviewed and approved by senior leaders at the site and the OPPD CNO. OPPD and Exelon senior executives have reviewed and fully support the PSI. The OPPD independent NOS Department also reviewed the Plan. Progress on implementing the PSI will be evaluated frequently by the FCS senior leadership team and periodically by OPPD and Exelon senior executives.

E. Conclusions and Readiness to Restart

OPPD concludes that it is ready to restart FCS. OPPD successfully implemented the IPIP and FRP, addressing issues referenced in the CAL and Restart Checklist. Completion of these actions resulted in significant improvement in plant safety and reliability, safety culture, human performance, management and organizational effectiveness, and key processes, including CAP effectiveness.

OPPD has identified and addressed the causes of FCS's protracted performance decline, including:

- Organizational effectiveness — leadership, accountability, governance and corporate and independent oversight;
- Safety culture — station values, leadership and SCWE; and
- Problem Identification & Resolution — a bias for action for continuous improvement and consistently identify, capture, analyze and fix issues effectively

OPPD established and aligned the FCS organization around the new safety-focused vision, mission and values. OPPD developed a safety-focused strategic plan, and established and implemented corporate governance and oversight processes/procedures. OPPD evaluated FCS leadership and put in place a blended OPPD and Exelon leadership team that is aligned with the vision, mission, and values, and accountability expectations. OPPD assessed and improved using industry-leading evaluations and metrics. The CAP was improved and is being effectively implemented allowing OPPD to find and fix its own problems at FCS. Human performance (Station Event Clock Resets) and industrial safety (Total Industrial Safety Accident Rate) improved from last in the industry in 2011 to second quartile industry-level performance. OPPD performed intrusive assessments of key systems, processes and departments, and necessary improvement actions were implemented. OPPD implemented the Exelon processes for independent oversight through the Nuclear Safety Review Board and the Nuclear Oversight Department; oversight is now intrusive and adding value.

The OPPD CNO has confirmed that the Restart Checklist issues have been addressed, the CAL actions have been completed, the FCS systems, programs and departments are ready for restart, the assessment of Operations' performance during heatup has been satisfactorily completed, independent assessments by the Nuclear Safety Review Board and Nuclear Oversight Department have been satisfactorily completed, and this IRR has been prepared and is being submitted to the NRC.

OPPD has concluded that FCS can be safely and reliably returned to service and is ready to restart.

Enclosure 2

Post-Restart Commitments

Post-Restart Commitments

1. The Plan for Sustained Improvement (Reference 10) contains action plans addressing gaps to excellence. Those action plans will continue the performance improvement momentum generated during recovery and restart of FCS within a structured and predictable management system that facilitates clear planning, implementation, and monitoring of performance improvement initiatives after restart. Certain of the actions in the action plans have been identified as Key Drivers for Achieving and Sustaining Excellence, including implementation of the Exelon Nuclear Management Model and integration of FCS into the Exelon Nuclear fleet. The Key Drivers for Achieving and Sustaining Excellence, Revision 1 is provided in Enclosure 3 to this letter.

   Commitment: Following restart of FCS, OPPD commits to implement the Key Drivers for Achieving and Sustaining Excellence, Revision 1.

2. Certain OPPD commitments contained in the September 2, 2011 Confirmatory Action Letter (CAL) (Reference 4) were long-term commitments to be completed after restart. Some of those commitments have already been completed and inspected by the NRC.

   OPPD commits to complete the remaining actions as described below.

   Commitments: Following restart of FCS, OPPD commits to complete the following actions detailed in the Flooding Recovery Action Plan: 1.2.3.21, 1.2.3.82, and 4.4.3.1 through 4.4.3.3.

3. Certain OPPD commitments contained in the September 2, 2011 CAL (Reference 4) were committed to be completed before reactor criticality. Those commitments were deferred for completion after reactor criticality with appropriate compensatory measures in place.

   Commitments: Following restart of FCS, OPPD commits to complete actions 4.5.1.14 and 4.5.1.15 (tracked through 4.5.3.06) detailed in the Flooding Recovery Action Plan, "Perform HELB analysis of Auxiliary Steam in the Auxiliary Building" and "Implement resolution of Auxiliary Steam piping in the Auxiliary Building."

4. During the course of discovery activities, OPPD identified that certain elements of the containment internal structures did not have the full structural design margin specified in the FCS licensing basis. The structures necessary to support equipment required to be operable during FCS operation have been demonstrated to be functional. Final resolution of the deficiencies for these structures will be addressed after restart. Certain structural elements inside containment support the reactor head stand. The structural support for the reactor head stand will be evaluated and assured adequate prior to the next use of the head stand.

   Commitments: OPPD will implement the following commitments regarding structures inside the containment building:
   a. **Evaluate the structural design margin for the containment internal structures, and reactor cavity and compartments, and resolve any deficiencies to restore full structural design margin as described in the Fort Calhoun Station licensing basis.**

b. **Regarding Beam 22A and Beam 22B in the containment internal structures, prior to resuming power operation following the first refueling outage after restart, OPPD will restore full structural design margin as described in the Fort Calhoun Station licensing basis.**
c. **Regarding the reactor head stand, prior to the next use of the reactor head stand, OPPD will evaluate the structural design margin for the head stand and resolve any deficiencies to restore full structural design margin as described in the Fort Calhoun Station licensing basis.**

5. **Commitment: After restart of FCS, until such time as it is mutually agreed that it is no longer necessary, OPPD commits to periodically update the NRC regarding the status of the performance improvement initiatives at FCS.**

Enclosure 3

Key Drivers for Achieving and Sustaining Excellence, Revision 1

Key Drivers for Achieving and Sustaining Excellence
Revision 1

This document summarizes the actions in the 10 Performance Improvement Integrated Matrix (PIIM) Action Plans that are critical to ensuring effective implementation of corrective actions to prevent recurrence of the Restart Checklist items, the safety-significant Fundamental Performance Deficiencies (FPD), and other important performance improvement areas necessary for achieving and sustaining excellence. Omaha Public Power District (OPPD) submitted Revision 0 of the Key Drivers to the NRC with the Plan for Sustained Improvement (PSI) on July 29, 2013 (Reference 10). Several of the actions in the PIIM Action Plans and Key Drivers have been completed since that submittal. The remaining actions captured as Key Drivers are scheduled to be completed and are included in Revision 1. The PIIM Action Plans, including the Key Drivers, are directly linked to the Corrective Action Program (CAP) and completion dates for action items are controlled under the CAP.

OPPD will evaluate the effectiveness of the actions to address performance gaps using an appropriate combination of performance metrics, assessments, and effectiveness reviews conducted by OPPD, Exelon Nuclear, and/or industry representatives. The Fort Calhoun Station (FCS) senior leadership team, OPPD, and Exelon Nuclear senior executives will periodically review progress on gap closure during Management Review Meetings, as will the OPPD independent Nuclear Oversight Department (NOS) and the Nuclear Safety Review Board (NSRB).

As action plans are completed and monitoring demonstrates that the gap has been closed, the FCS senior leadership team will evaluate the effectiveness of the actions and determine whether sustained improved performance has been achieved and the plan should be closed. Should additional gaps be identified, OPPD will implement actions to address those gaps.

Full transition to the Exelon Nuclear Management Model (ENMM) and integration into the Exelon Nuclear fleet will be concurrent with implementation of these action plans. The ENMM transition planning will include consideration of FCS-specific licensing and design characteristics in the implementation of the ENMM. The long-term actions to sustain improvement and achieve excellence included in many of the action plans are anchored in the transition to the accountability-driven ENMM. The actions to design, plan, and implement the FCS ENMM transition are centralized in one action plan addressing 27 functional areas of the plant.

OPPD commits to complete the actions described in the Key Drivers for Achieving and Sustaining Excellence, Revision 1.

The table below contains a list of acronyms used in the Key Drivers for Achieving and Sustaining Excellence document.

Acronym	Definition
ACA	Apparent Cause Analysis
ANSI/ANS	American National Standards Institute/American Nuclear Society
CAP	Corrective Action Program
CAPCO	Corrective Action Program Coordinator
CAPR	Corrective Action to Prevent Recurrence
CQE	Critical Quality Equipment
CR	Condition Report
CRC	Curriculum Review Committee
DBD	Design Basis Document
DCARB	Department Corrective Action Review Board
EAG	Engineering Assurance Group
EEQ	Electrical Equipment Qualification
ENMM	Exelon Nuclear Management Model
ERRP	Equipment Reliability Restoration Plan
FCS	Fort Calhoun Station
FPD	Fundamental Performance Deficiencies
FRP	Flood Recovery Action Plan
INPO	Institute of Nuclear Power Operations
IOD	Immediate Operability Determination
IRR	Integrated Report to Support Restart of Fort Calhoun Station
ISFSI	Independent Spent Fuel Storage Installation
ISTS	Improved Standard Technical Specifications
LCO	Limiting Condition for Operation
NLI	Nuclear Logistics, Inc.
NOS	Nuclear Oversight Department
NSRB	Nuclear Safety Review Board
ODQRB	Operability Determination Quality Review Board
OPPD	Omaha Public Power District
PHC	Plant Health Committee
PIIM	Performance Improvement Integrated Matrix
POD	Prompt Operability Determination
PRC	Plant Review Committee
PSI	Plan for Sustained Improvement
RCA	Root Cause Analysis

Acronym	Definition
SC	Safety Culture
SCARB	Station Corrective Action Review Board
SCWE	Safety Conscious Work Environment
SME	Subject Matter Expert
USAR	Updated Safety Analysis Report

1. Organizational Effectiveness, Safety Culture and Safety Conscious Work Environment

These areas for improvement are addressed on pages 22 through 29 in the Integrated Report to Support Restart of Fort Calhoun Station (IRR) and were identified through the use of an independent third-party nuclear safety culture survey. The results indicated a fundamental performance deficiency in organizational effectiveness and safety culture/safety conscious work environment (SC/SCWE). OPPD conducted root cause analyses (RCAs) and has implemented the majority of the corrective actions generated in those RCAs. The corrective actions are described in the IRR and captured within the Corrective Acton Program (CAP). The corrective actions included developing and implementing a safety-focused vision, mission and values and a governance and oversight policy incorporating an accountability model with emphasis on nuclear safety; training the station leadership and workers on SC/SCWE principles and practices; entering into an Operating Service Agreement with Exelon Generation Company, LLC (Exelon) and placing experienced Exelon personnel into key leadership positions at Fort Calhoun Station; and implementing a Corporate Nuclear Oversight Committee made up of OPPD corporate senior vice presidents. OPPD developed organizational effectiveness and safety culture monthly performance indicators and shares the status of those indicators with leadership team and station. The corrective actions have been effective and performance improvement has been sufficient to support safe and efficient restart of Fort Calhoun Station. Actions remaining include performing the effectiveness assessments described below. These actions will be completed before the end of second quarter 2016.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Organizational Effectiveness	2013-0014	Perform a self-assessment with a team comprised of station and industry personnel to determine if OPPD has established and implemented the essential attributes of governance and oversight, including the key elements of individual roles, responsibilities, and accountabilities.	2012-08132-021	Complete

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Perform a self-assessment of development and implementation the Nuclear Safety Culture Monitoring Panel and Corporate Nuclear Oversight policies and leaders are being held accountable to the policies.	2012-03986-049	Complete
		Establish initial and continuing leadership development programs that incorporate the attributes of a strong nuclear safety culture and an operationally focused organization.	2012-08132-010	Complete
		Perform a leadership skills assessment in the areas of alignment, accountability and standards.	2012-08132-025	
Station Safety Culture/Safety Conscious Work Environment	2013-0006	Perform a self-assessment of development and implementation the Nuclear Safety Culture Monitoring Panel and Corporate Nuclear Oversight policies and leaders are being held accountable to the policies.	2012-03986-049	Complete
		Perform an annual assessment by individuals independent of line management of the Fort Calhoun Safety Culture against industry standards and best practices in 2014, 2015 and 2016.	2012-04262-057; 2012-04262-068; 2012-04262-069	

2. Problem Identification and Resolution

The CAP area for improvement is addressed on pages 48 through 51 in the IRR. The areas for improvement were identified through five RCAs addressing cultural weaknesses, RCA quality, organizational effectiveness, SCWE and CAP performance. The corrective actions are described in the IRR and captured within the CAP. These corrective actions include establishing and reinforcing appropriate standards of behavior and mental models, beliefs and values for timely and effective problem identification and resolution; revision of CAP procedures and training all station leadership and workers on the new procedures, including the CAP review boards; establishing CAP performance indicators; staffing new Corrective Action Program Coordinator positions to assist with implementation and monitoring of CAP effectiveness; and establishing CAP subject matter experts (SMEs) in each department. The corrective actions have been effective and performance improvement has been sufficient to support safe and efficient restart of FCS. The majority of the corrective actions have been completed; actions remaining include performing effectiveness assessments as described below. These actions will be completed before the end of fourth quarter 2014.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
CAP Excellence Plan – Problem Identification	2013-0055	Develop and implement CAP Fundamentals, reinforced through an accountability model. The CAP behaviors managed under the accountability model will be defined in the CAP Fundamental Rules. CAP procedures will be updated to incorporate the CAP Fundamentals.	2013-08675-006	Complete
		Develop new performance measures for CAP effectiveness.	2013-08675-010	Complete
		Perform an effectiveness review of the implementation of CAP fundamentals for problem identification.	2013-08675-046	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
CAP Excellence Plan – Root Cause and Apparent Cause Quality	2013-0065	Provide DCARB and SCARB members and CAPCOs training on their responsibilities under the CAP. For SCARB, include appropriate causal analysis training.	2013-08675-034	Complete
		Require SCARB to provide RCA and ACA grading sheets that include specific success criteria prior to approval of cause analyses.	2013-08675-008	Complete
		Develop and implement CAP Fundamentals, reinforced through an accountability model. The CAP behaviors managed under the accountability model will be defined in the CAP Fundamental Rules. CAP procedures will be updated to incorporate the CAP Fundamentals.	2013-08675-006	Complete
		Develop new performance measures for CAP effectiveness.	2013-08675-010	Complete
		Perform a focused self-assessment of RCA quality.	2012-03495-033	Complete
		Perform an effectiveness review of the Management Review Committee (MRC) oversight function for CAP.	2013-08675-041	
CAP Excellence Plan – Corrective Action Closure	2013-0062	Develop and implement CAP Fundamentals, reinforced through an accountability model. The CAP behaviors managed under the accountability model will be defined in the CAP Fundamental Rules. CAP procedures will be updated to incorporate the CAP Fundamentals.	2013-08675-006	Complete
		Develop new performance measures for CAP effectiveness.	2013-08675-010	Complete

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Perform an interim effectiveness review to determine if action item closure meets timeliness goals and CAP fundamentals are effectively implemented.	2013-08675-043	Complete
		Perform an effectiveness review to determine if the corrective action to prevent recurrence was implemented timely and has been effective.	2013-08675-046	
		Perform an effectiveness review of the coding and timeliness of action item closure.	2013-08675-047	

3. Performance Improvement and Learning Programs

FCS personnel did not effectively utilize the performance improvement and learning programs to address performance gaps. RCAs were performed identifying programmatic and performance gaps utilizing industry and Exelon guidelines and practices. OPPD completed the majority of the corrective actions captured within the CAP. The corrective actions included implementing key Exelon performance improvement policies, programs and procedures at FCS; establishing performance metrics and monthly trend reports and providing them to station leadership; implementing an effective performance observation program; eliminating operating experience review backlogs; and re-establishing and implementing self-assessment and benchmarking programs. The corrective actions have been effective and performance improvement has been sufficient to support safe and efficient restart of Fort Calhoun Station. Actions remaining include continued enhancing programs and procedures and performing effectiveness assessments as described below. These actions will be completed before the end of third quarter 2014.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Performance Improvement	2013-0015	Establish tiered trending code structure for condition reports consistent with Exelon nuclear standards.	2013-08675-035	
		Revise and issue the FCS performance improvement implementing procedures to align with the Exelon procedures.	2012-08126-018	
		Develop and execute a change management plan for the leadership team regarding the newly revised performance improvement procedures and disseminate the information in related INPO documents.	2012-08126-015	Complete

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Human Performance	2013-0061	Implement the human performance strategy: a. Ensure that the Human Performance Steering Team oversees the implementation of the human performance strategy; and b. Integrate the human performance strategy into the business plan to ensure that resources are available for improvements.	2012-08135-014	Complete
		Evaluate the effectiveness of the human performance strategy.	2012-08135-015	Complete
		Develop and implement a Human Performance Strategic Plan.	2012-08135-008	
		Maintain the right picture of excellence in human performance through monitoring progress in improving human performance via the Human Performance Steering Team, monitoring operating experience and conducting regular benchmarking and self-assessment activities, updating the human performance strategic plan as needed, and using change management to guide the implementation of improvement initiatives.	2012-08135-016	
		Perform quarterly review of human performance indicators.	2012-08135-026	Complete
		Perform quarterly review of human performance indicators.	2012-08135-027	Complete
		Perform quarterly review of human performance indicators thru 4th quarter 2013.	2012-08135-028	
		Conduct a self-assessment with industry peers to ensure program meets industry best practices.	2012-08135-29	

4. Design and Licensing Basis Control and Use

OPPD discovery activities in the conduct of engineering and regulatory work processes at FCS and NRC inspections revealed that the control and use of design and licensing basis information is an area for improvement. A RCA conducted in early 2013 documented necessary corrective actions in this area. OPPD completed interim corrective actions, including providing training to engineering personnel, operators and licensing staff to ensure effective utilization of design and licensing basis information in making operability evaluations and design changes to the facility. In addition, OPPD established an Engineering Assurance Group (EAG) to review all engineering work products to ensure proper quality of the work and effective utilization of design and licensing basis information. The interim corrective actions have been effective and performance improvement has been sufficient to support safe and efficient restart of FCS. After restart, OPPD will complete a significant effort to perform a risk-focused reconstitution of the design basis, the licensing basis, and the Updated Safety Analysis Report. As part of this reconstitution, OPPD will ensure proper classification of equipment, convert to a safety-related "Q List" approach for equipment classification and complete a key calculation review. A pilot program will be completed during 2014 on a selected system to "check and adjust" the process, scheduling and resource allocation. The reconstitution project will be completed before the end of fourth quarter 2018.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Design And Licensing Basis	2013-0086	Complete Phase II of the key calculation identification and improvement process. Phase II of the process evaluates the critical calculation's defined purpose and methodology, defined acceptance criteria and appropriateness of the results and conclusions.	2013-05570-025	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Perform a technical assessment of modifications performed between January 1, 1989 and January 1, 2007 on a population of the Top 6 Risk Significant Systems that provides a 95/95 confidence level that no nuclear safety issues have been introduced into the plant.	2013-05570-091	
		Strengthen the Engineering Assurance Group to improve the oversight of engineering products that affect the design or licensing basis.	2013-05570-010	Complete
		Decide the appropriate DBD model for FCS.	2013-05570-079	
		Complete Phase 3 of the Key Calculation Project. Phase 3 consists of revising any deficient critical calculation or engineering analysis identified from Phase 2, as needed.	2013-05570-092	
		Develop performance metrics to trend and trigger action on the performance of the use, implementation, and identification of design and licensing bases issues such as, effective and ineffective 50.59 evaluations, and procedure inadequacies related to design and licensing bases.	2013-05570-057	
		Develop and implement an aggregate station performance indicator to measure the effectiveness of maintenance of and use of licensing and design bases information.	2013-05570-067	
		Modify engineering support personnel initial and continuing training addressing the design and licensing basis record types and retrieval.	2013-05570-049	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Deliver the modified training to the engineering support personnel.	2013-05570-052	
		Ensure Design Engineering performs at least one engineering self-assessment on a risk significant system in 2014.	2013-17439-003	
		Ensure Design Engineering performs at least one engineering self-assessment on a risk significant system in 2015.	2013-17439-004	
		Assign CRs to ensure Design Engineering continues to perform an engineering self-assessment on risk significant systems each year.	2013-17439-005	
		Identify and define the current licensing bases and assure licensing bases documentation remains current, accurate, complete, and retrievable.	2013-05570-026	
		Identify and define the design bases and assure design bases documentation remains current, accurate, complete, and retrievable.	2013-05570-076	
		Validate the design and licensing basis has been translated into plant operation by verifying that the operation, surveillance, and maintenance of the safety-related components do not compromise the design and licensing basis.	2013-05570-093	

5. Site Operational Focus

OPPD discovery activities disclosed weaknesses in site alignment and risk sensitivity to degraded programs, conditions, equipment and practices that challenged the site's operational focus. Operational focus is the culture and actions of site personnel to maintain and improve the safety margin and reliability of facility operation. All departments, led by operations, are accountable for their respective contribution to reach and sustain high levels of operational performance. OPPD conducted a RCA documenting necessary corrective actions in this area. OPPD completed corrective actions, including establishing a strong nuclear safety culture and Vision, Mission and Values, setting station priorities regarding safety, human performance and "fixing the plant," establishing an accountability-driven Outage Control Center, instituting safety-focused, disciplined decision making processes, and instituting regular in-field performance observation by supervisors to reinforce expected values and behaviors. Intrusive metrics were established in all areas supporting operational safety focus. The actions taken have been effective and operational focus improvement has been sufficient to support safe and efficient restart of FCS. After restart, OPPD will continue to monitor metrics and take additional actions as necessary to achieve and sustain excellence in operational focus. It is expected that three consecutive months of improving trend in the metrics with an overall performance of white or better will be achieved during 2014.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Site Operational Focus, Operational Decision Making and Anticipating System Response	2013-0037	Develop initial and continuing leadership development program for management that incorporates the attributes of a strong nuclear safety culture and an operationally focused organization.	2012-08132-010	Complete
		Monitor the Organizational Effectiveness Recovery Metric (Operational Focused) for a successful overall Green or White color with an improving trend for three consecutive months.	2013-17442-001	

6. Procedures

OPPD identified procedure quality as a contributor to several aspects of the performance decline at FCS. Several RCAs were completed identifying necessary procedure quality corrective actions. OPPD enhanced procedures across multiple programmatic areas addressed in the Restart Checklist, the Flooding Recovery Action Plan (FRP) and the FPDs. In addition, OPPD completed a targeted procedures improvement effort on operating procedures, including validation and verification of hundreds of safety-related Emergency Operating Procedures, Abnormal Operating Procedures, Alarm Response Procedures, Operating Instructions and Operating Procedures. The corrective actions have been effective and performance improvement has been sufficient to support safe and efficient restart of Fort Calhoun Station. After restart, OPPD will complete the remaining aspects of the procedures upgrade project during 2016.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Procedure Quality and Procedure Management	2013-0012	Evaluate and determine the procedures requiring upgrade.	2012-18351-001	Complete
		Institute a comprehensive Procedure Upgrade Project to ensure that FCS procedures are rigorous in support of safe, reliable plant operations and are of sufficient detail to prevent overreliance on knowledge, experience, judgment or memory.	2012-08136-014	
		Institute a validation and verification review process for corrective maintenance work order instructions.	2012-08136-022	
		Perform assessments in 2013 and 2014 by individuals independent of line management to confirm that procedure management policies meet industry standards and regulatory requirements and are effectively implemented.	2012-08136-023; 2012-08136-024	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Abnormal and Emergency Operating Procedures	2013-0031	Revise and issue all procedures identified during the abnormal and emergency operating procedures extent of condition review.	2013-09711-006	
		Complete the extent of condition upgrade of all station alarm response procedures.	2013-09711-005	Complete
		Review the corrective action system for six months and evaluate the frequency of operating procedure inadequacies.	2011-3016-048	
		Ensure adequate technical basis for abnormal operating procedures addressing acts of nature other than flooding.	2010-2387-072	
Transition to the Exelon Nuclear Management Model and Integration into the Exelon Nuclear Fleet	2013-0077	Phase V – Exelon Nuclear Management Model Transition Implementation.	2013-17434-003	

7. Equipment Performance

FCS engineering personnel did not effectively prevent, or identify and resolve equipment reliability issues in a thorough and timely manner. RCAs were performed identifying both programmatic corrective actions associated with the Plant Health Committee and engineering and maintenance activities focused on equipment reliability, and corrective actions for specific structures, systems and components. OPPD completed extensive improvement activities resulting in a safer and more reliable plant, including:

- replaced hundreds of containment electrical penetrations susceptible to damage from potential accident conditions;
- reconstituted the high energy line break/electrical equipment qualification programs including extensive plant modifications including replacement of hundreds of parts and components to enhance safety margin;
- designed and procured a new portable system to protect the reactor under a potential flood far beyond the 2011 Missouri River flood and regulatory requirements;
- restored or enhanced equipment affected by the 2011 flood;
- installed modifications to protect key plant equipment from the consequences of a severe tornado;
- upgraded the Chemical and Volume Control System piping and added piping supports;
- installed new digital turbine controls;
- replaced the emergency diesel generator voltage regulators;
- replaced hundreds of parts and components to address equipment service life;
- replaced the reactor protection system power supplies; and
- replaced or overhauled the 4160 volt circuit breakers.

The corrective actions have been effective and plant safety margin and equipment reliability is sufficient to support safe and efficient restart of Fort Calhoun Station. Actions remain in several areas as described below. These actions will be completed before the end of third quarter 2015.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Tornado Protection	2013-0041	Complete modifications to adequately protect required equipment from tornado missiles.	2013-04266-007	Complete

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Revise Updated Safety Analysis Report (USAR) and other design basis documents.	2013-04266-014	
		Verify that design and licensing basis documents have been adequately updated and reviewed under the 10 CFR 50.59 process.	2013-04266-016	Complete
Equipment Service Life	2013-0088	Establish a comprehensive Equipment Reliability Restoration Plan (ERRP) to be approved by the Plant Health Committee (PHC).	2012-08134-012	Complete
		Establish a comprehensive and sustainable system and component Performance Monitoring Program benchmarking against Exelon Nuclear practices.	2012-08134-024	
		Review Condition Reports generated during the 2nd Quarter 2013 specifically for age-related degradation of components.	2013-09658-001	Complete
		Update the preventative maintenance program basis document and procedure.	2012-15357-001	
		Establish a requirement for an annual self-assessment of station equipment reliability processes and programs for review by the Plant Health Committee.	2012-08134-019	
		Train system, program and procurement engineers on equipment condition assessment including cause and failure analysis, failure modes and effects analysis, aging management, and life cycle management.	2012-09491-020	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Review Condition Reports generated during the 3rd Quarter 2013 specifically for age-related degradation of components.	2013-09658-002	Complete
		Provide supplemental resources in preventative maintenance planning to reduce the backlog of end-of-service-life work orders and other preventative maintenance basis requirements.	2012-09491-014	
		Review Condition Reports generated during the 4th Quarter 2013 specifically for age-related degradation of components.	2013-09658-003	
		Perform a self-assessment of equipment reliability programs and PHC oversight or programs.	2012-08134-039	
		Review Condition Reports generated during the 1st Quarter 2014 specifically for age-related degradation of components.	2013-09658-004	
		Perform reviews of the approximately 10,000 PM tasks and components that must be evaluated and analyzed post-restart for End of Service Life concerns.	2013-09658-005	
		Review Condition Reports generated during the 3rd Quarter 2014 specifically for age-related degradation of components.	2012-09491-015	
		Complete implementation of the approved ERRP.	2013-09658-006	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Review Condition Reports generated during the 4th Quarter 2014 specifically for age-related degradation of components.	2012-08134-013	
		Perform final effectiveness assessment of equipment reliability, preventative maintenance and performance monitoring programs, including the Plant Health Committee oversight of equipment reliability.	2013-09491-023	
Containment Internal Structures	2013-0013	Restore the design criteria for the Internal Structure of Containment, including any needed plant modifications to beam 22A and B.	2012-04392-014	
Equipment Reliability/Equipment Performance	2013-0027	Perform interim effectiveness reviews of the Plant Health Committee process and performance.	2012-08134-039	
		Perform a final effectiveness review of the Plant Health Committee process and performance.	2012-08134-040	
Electrical Equipment Qualification/High Energy Line Break	2013-0021	Provide a documented basis that demonstrates all EEQ Equipment is installed and configured in accordance with the requirements of the associated HARSH files.	2013-02857-014	
		Revise all EEQ procedures such that all EEQ engineering activities are performed under the PED-QP-2 configuration change control process.	2013-02857-016	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Fully implement the engineering analyses that form the basis of the EEQ Program including the affected documents.	2013-02857-009	
		Perform an effectiveness review of 20 work orders for maintenance on EEQ equipment and 10 engineering changes for EEQ completed within a six-month period to verify the material used in EEQ maintenance is properly documented in maintenance work packages and all EEQ requirements are met in the engineering changes.	2013-02857-019	
		Perform an assessment by individuals independent of line management evaluating FCS against INPO EPG-02 and NRC Temporary Instruction 2515/76 to ensure compliance with 10 CFR 50.49 and industry standards.	2013-02857-015	
Safety System Functional Failures	2013-0056	Perform an effectiveness assessment of safety system performance/functional failures.	2011-2677-008	
Cables and Connections	2013-0033	Provide procedural expectations and guidance to electrical craft for handling aged electrical cables.	2012-08617-011	Complete
		Develop a change management plan to implement the cables and connections program.	2012-03544-014	
		Execute plans to recover the EEQ and cable aging management programs.	2012-08134-026	
		Perform an effectiveness review of the strategy for maintaining dry those safety-related and important-to-safety cables susceptible to wetting.	2009-4216-020	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Complete an assessment report on Cables and Connections Program.	2013-17441-001	
		Complete an assessment report on Verification of Material Condition of Medium & Low Voltage Safety Related Cables *Submerged.*	2013-17441-002	

8. Programs

OPPD identified weak implementation of multiple engineering, maintenance and regulatory programs that contributed to the performance decline at FCS. OPPD completed RCAs identifying necessary programmatic and implementation corrective actions. OPPD improved the effectiveness of the programs documented in the Restart Checklist, the Flooding Recovery Action Plan (FRP) and the Fundamental Performance Deficiencies (FPDs). OPPD completed corrective actions that included improved procedures, staffing, qualifications and training, supervision, oversight and performance metrics and monitoring. The corrective actions have been effective and performance improvement has been sufficient to support safe and efficient restart of Fort Calhoun Station. After restart, OPPD will complete the remaining aspects of the programmatic improvements noted below before the end of the third quarter of 2016.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Engineering Rigor	2013-0011	Implement a new engineering organizational structure consistent with industry best practices.	2012-08125-008	
		Develop and implement a plan to increase the depth of design and licensing basis knowledge for engineers and engineering leaders.	2012-08125-027	Complete
		Improve the engineering support personnel training regarding the design and licensing basis.	2013-05570-049	
		Maintain the Engineering Assurance Group (EAG) in accordance with FCSG-71. The complete list of documents types to be reviewed shall be updated following the identification of the document types in CAPRs 1 and 2, and FCSG-71 shall be revised if needed.	2013-05570-064	New Key Driver Action

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Equipment Safety Classification and Safety Related Equipment Maintenance	2013-0036	Evaluate Critical Quality Element boundaries against ANSI/ANS-52.1.	2013-05570-011	Complete
		Conduct an assessment by individuals independent of line management of: 1. CRs to look for on-CQE parts installed in a CQE application; and 2. Quality of work orders with respect to materials/parts classification.	2012-05615-009	Complete
		Prepare/validate system and component level safety classification analyses for safety related systems.	2012-05615-018	
		Validate/Prepare System and Component Level Safety Classification Analysis Document for non-safety related systems.	2012-05615-019	New Key Driver Action
		Create a Bill of Materials for critical equipment.	2012-05615-013	
		Submit a revision to USAR to reflect the change in nomenclature.	2012-05615-017	
		Revise the QA Plan to reflect the change in nomenclature.	2012-05615-016	
		Convert the CQE List to the QList Manual.	2012-05615-014	
		Conduct an assessment by individuals independent of line management of: 1. CRs to look for on-CQE parts installed in a CQE application; and 2. Quality of work orders with respect to materials/parts classification.	2012-05615-011	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Develop a detailed project plan for Re-Constitution of Component Safety Classification.	2013-05570-117	New key driver action added based on NRC feedback
Electrical Bus Modifications and Maintenance	2013-0016	Perform an effectiveness review of modifications created/implemented within the past 18 months to determine if new/different failure modes were introduced by features not part of original equipment.	2011-6621-038	
		Utilize the revised maintenance procedures to inspect the 480 volt switchgear during the next refueling outage.	2011-5414-045	
		Perform an effectiveness review of the completion of work requests to inspect all 480 volt NLI breakers during the next refueling outage. Inspections should include a check on resistance values, finger cluster discoloration, loose bolting, and other signs of breaker/bus stab degradation.	2011-5414-026	
Deficiencies in Design and Implementation of Fundamental Regulatory Required Processes	2013-0007	Design, develop and implement training to close knowledge and performance gaps for operators regarding the nature, scope and importance of the current licensing basis, the 10 CFR 50.59 process, the degraded/nonconforming and operability determination processes, and the reportability determination process.	2012-08137-031	Complete
		Perform a review by individuals independent of line management of station application of Technical Specifications during plant mode changes.	2012-08137-012	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Design, develop and implement training to close knowledge and performance gaps for engineers regarding the nature, scope and importance of the current licensing basis, the 10 CFR 50.59 process, the degraded/nonconforming and operability determination processes, and the reportability determination process.	2012-08137-032	
		Complete cost study of implementing Improved Standard Technical Specifications (ISTS) conversion performed by contract 192356 and present results to Budget Review Committee.	2011-1719-037	New Key Driver Action
		Perform a self-assessment of the department and station standards consistent with industry best practices for screening of degraded/non-conforming conditions, operability determinations, functionality evaluations, timely resolution of degraded/non-conforming conditions and effective operational decision making regarding degraded plant components or conditions.	2012-09494-012	
		Perform a self-assessment of screening of degraded/non-conforming conditions, operability determinations, reportability determination and Technical Specification compliance.	2012-08137-035	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Design Change 10 CFR 50.59 Practices	2013-0066	Revise the 10 CFR 72.48 training to reflect industry best practices and to include ISFSI licensing basis requirements for 10 CFR 72.48 screeners.	2012-08177-028	
		Revise the 10 CFR 50.59 training to reflect industry best practices and to include mentoring as part of the qualification process for 10 CFR 50.59 screeners.	2012-08177-027	Complete
		Develop and incorporate specific audit directions to assess 10 CFR 50.59 and 10 CFR 72.48 process and documentation quality using NRC Inspection Procedure Attachment 71111.02, “Evaluations of Changes, Test, or Experiments.”	2012-08177-020	Complete
		Develop performance metrics to trend and trigger action on the performance of the use, implementation, and identification of design and licensing bases issues such as, effective 10 CFR 50.59 evaluations, and procedure adequacy related to design and licensing bases.	2013-05570-057	
		Develop and implement performance metrics regarding 10 CFR 50.59.	2013-05570-068	
Piping Code and System Classification and Analysis	2013-0071	Review the USAS B31.7 and ASME III code reconciliation and correct any code discrepancies.	2012-07724-025	
		Provide calculations documenting thermal fatigue analysis on the Class I piping systems for primary plant sampling, reactor coolant gas vent, reactor coolant, safety injection, and waste disposal in accordance with USAS B31.7 Draft 1968.	2012-07724-023	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Review all Class I piping modifications since April 8, 1994 and document the effectiveness of the procedure for ensuring that thermal fatigue analysis was performed.	2012-07724-022	Complete
Vendor Manual and Vendor Information Control Program	2013-0060	Revise engineering procedures to reflect vendor manual control process changes.	2012-09227-010	
		Revise lists, tables and vendor supplied documents to reflect vendor manual control process changes.	2012-09227-017	
		Perform a self-assessment regarding governance, oversight and implementation of the vendor manual program.	2013-17444-002	
Safeguards Information Digital Storage Control	2013-0009	Perform an effectiveness assessment of corrective actions to prevent recurrence including ten random surveys of safeguards information qualified personnel to ensure they understand the requirements for procuring safeguards information digital storage devices, the approved use location, and the new procedures describing the process of working with safeguards information.	2012-05931-026	Complete
		Perform a drill on effective purchase of a safeguards information digital storage device.	2012-05931-034	
		Perform a self-assessment of safeguards information control.	2013-17431-001	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Operability Determination	2013-0107	As part of the quarterly training curriculum review committee (CRC) agenda, review operability determination performance indicators from the Engineering Assurance Group (EAG) and the Operability Determination Quality Review Board (ODQRB). This will be repeated action through 2014.	2013-19752-001; 2013-19752-037; 2013-19752-038; 2013-19752-039; 2013-19752-040	This is a new PIIM Action Plan
		Conduct oral boards of all operators who make immediate operability determinations (IODs) or screen condition reports.	2013-19752-002	
		Develop interim guidance for resolving unclear operability references. Include relating the use of Prompt Operability Determinations (PODs) with CAP, and current procedure direction and its level of detail.	2013-19752-005	
		Formalize the Operability Determination Quality Review Board into an FCS procedure.	2013-19752-006	
		Develop a method for ensuring that IODs which fail the minimum ODQRB acceptance criterion (<70%, unsupported operability determination) are re-performed by the On-Shift Crew.	2013-19752-007	Complete
		Institute a change to NOD-QP-31 (or equivalent Exelon document) which incorporates clear and complete directions for completion of each applicable step of supporting process forms.	2013-09494-036	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Develop specific guidance that directs personnel screening plant conditions or equipment failures to ensure actions are taken as required by the technical specifications (What to do when “this fails” procedure).	2013-19752-010	
		Screen the population of FCS surveillances and relate these to the associated LCOs they support.	2013-19752-011	
		Review existing testing criteria, direction, or methodologies against industry norms.	2013-19752-012	
		Review material previously contained in TDB VIII to ensure it resides in other documents that are clearly linked to the associated technical specification LCOs.	2013-19752-013	
		Conduct a common factors analysis of IOD determinations quarterly with results and actions approved by the MRC. Action will be on-going through 2014.	2013-19752-021; 2013-19752-022; 2013-19752-023; 2013-19752-024	
		Conduct a common factors analysis of POD determinations quarterly with results and actions approved by the MRC. Action will be on-going through 2014.	2013-19752-025; 2013-19752-026; 2013-19752-027; 2013-19752-028	

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
		Present to PRC LERs, results of operability determination performance metrics, and common factor analysis no less than semi-annually. Currently schedule for quarterly through 2014.	2013-19752-029; 2013-19752-030; 2013-19752-031; 2013-19752-032	
		Immediate Operability Determination (IOD) EAG Assessment Performance Indicator of “GREEN” with no more than 1 IOD score greater than 2.0 per month (on average) for the period of 6/1/2014 – 12/31/2014.	2013-19752-033	
		Immediate Operability Determination (IOD) EAG Failure Rate Performance Indicator of “GREEN with no more than 1 IOD failure per month (on average) for the period of 6/1/2014 – 12/31/2014.	2013-19752-034	
		ODQRB Operability Determination Performance Indicator of “GREEN” with average IOD/IFA score > 90% per month for a period of 6/1/2014 – 12/31/2014.	2013-19752-035	
		ODQRB Operability Determination Failure Rate Indicator “GREEN” with < 1 failure per month (on average) for a period of 6/1/2014 – 12/31/2014.	2013-19752-036	

9. Nuclear Oversight

The OPPD independent oversight of activities was not effective at preventing the protracted performance decline at FCS. This included the quality assurance, quality control and independent review functions. OPPD completed an RCA and identified corrective actions. OPPD adopted the Exelon Nuclear processes and structure and established a new Nuclear Oversight Department (NOS) and independent Nuclear Safety Review Board. In addition, OPPD strengthened the quality assurance and quality control functions. The implementation of these corrective actions, including the Key Drivers, is complete and the corrective actions have been effective resulting in more intrusive and effective independent oversight. This improved performance is sufficient to support safe and efficient restart of Fort Calhoun Station.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Nuclear Oversight Effectiveness	2013-0010	Perform an effectiveness review to include: 1. Actions implemented and verify that they remain active/in place by reviewing NOS procedures to ensure expectations for trending, benchmarking, self-assessment, missed opportunity reviews, and observations have been identified; verifying agenda and attendance sheets for face-to-face meetings are complete and accurate; verifying completion of scheduled monthly reinforcement of expectations by NOS management; and verifying revision of OPPD Policy No. 3.06 includes the requirement to provide a quarterly report on NOS improvements that resulted from trending, benchmarking, self-assessments, missed opportunity review, and observations; 2. NOS Manager quarterly reports to the VP of Energy Delivery and Chief Compliance Officer to verify that NOS department improvements have been realized.	2012-08142-030	Complete

10. Transition to the Exelon Nuclear Management Model and Integration into the Exelon Nuclear Fleet

OPPD established an Operating Services Agreement with Exelon. Part of this agreement includes the transition of FCS to the Exelon Nuclear Management Model and integration into the Exelon Nuclear fleet. This transition and integration is structured in five phases. Phases I, II and III include evaluation of each aspect of FCS against the Management Model and design of the new desired end state once transition is complete. These phases are complete. Phase IV involves defining the implementation process, including detailed schedules for transition of each department and functional area to the Management Model. The implementation planning phase is nearing completion. Phase V, implementation of the Exelon Nuclear Management Model at FCS and integration into the Exelon Nuclear fleet, will be completed before the end of 2016.

PIIM Title	PIIM Action Plan Number	Action Item	Action Item Number	Comments
Transition to the Exelon Nuclear Management Model and Integration into the Exelon Nuclear Fleet	2013-0077	Phase III – Exelon Nuclear Management Model Transition Implementation Design.	2013-17434-001	Complete
		Phase IV – Exelon Nuclear Management Model Transition Implementation Planning.	2013-17434-002	
		Phase V – Exelon Nuclear Management Model Transition Implementation.	2013-17434-003	
		OPPD CNO and Exelon SrVP conduct regular periodic performance challenge meetings to assure transition and integration activities are progressing and effective.	2013-17434-004	