



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-4005

November 17, 2006

Charles D. Naslund, Senior Vice
President and Chief Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT- NRC SUPPLEMENTAL INSPECTION REPORT
05000483/2006013

Dear Mr. Naslund,

On October 13, 2006, the US Nuclear Regulatory Commission (NRC) completed a supplemental inspection pursuant to Inspection Procedure 95001 at your Callaway Plant. The purpose of the inspection was to evaluate the auxiliary feedwater system performance which had resulted in a White system indication. Performance in the White region indicates that system health is outside of the nominal, expected range. The enclosed report documents the results of the inspection, which were discussed on October 12, 2006, with Mr. T. Moser and other members of your staff.

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

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

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

Sincerely,

/RA/

Geoffrey B. Miller, Chief
Project Branch B
Division of Reactor Projects

Docket: 50-483
License: NPF-30

Union Electric Company

-2-

Enclosure:
Inspection Report 05000483/2006013
w/Attachment: Supplemental Information

cc w/enclosure:
Professional Nuclear Consulting, Inc.
19041 Raines Drive
Derwood, MD 20855

John O'Neill, Esq.
Pillsbury Winthrop Shaw Pittman LLP
2300 N. Street, N.W.
Washington, DC 20037

Keith A. Mills, Supervising Engineer,
Regional Regulatory Affairs/
Safety Analysis
AmerenUE
P.O. Box 620
Fulton, MO 65251

Missouri Public Service Commission
Governor's Office Building
200 Madison Street
P.O. Box 360
Jefferson City, MO 65102

H. Floyd Gilzow
Deputy Director for Policy
Missouri Department of Natural Resources
P. O. Box 176
Jefferson City, MO 65102-0176

Rick A. Muench, President and
Chief Executive Officer
Wolf Creek Nuclear Operating Corporation
P.O. Box 411
Burlington, KS 66839

Dan I. Bolef, President
Kay Drey, Representative
Board of Directors Coalition
for the Environment
6267 Delmar Boulevard
University City, MO 63130

Union Electric Company

-3-

Les H. Kanuckel, Manager
Quality Assurance
AmerenUE
P.O. Box 620
Fulton, MO 65251

Director, Missouri State Emergency
Management Agency
P.O. Box 116
Jefferson City, MO 65102-0116

Manager
Regulatory Affairs
AmerenUE
P.O. Box 620
Fulton, MO 65251

David E. Shafer
Superintendent, Licensing
Regulatory Affairs
AmerenUE
P.O. Box 66149, MC 470
St. Louis, MO 63166-6149

Certrec Corporation
4200 South Hulen, Suite 630
Fort Worth, TX 76109

Keith G. Henke, Planner
Division of Community and Public Health
Office of Emergency Coordination
930 Wildwood, P.O. Box 570
Jefferson City, MO 65102

Electronic distribution by RIV:
 Regional Administrator (**BSM1**)
 DRP Director (**ATH**)
 DRS Director (**DDC**)
 DRS Deputy Director (**RJC1**)
 Senior Resident Inspector (**MSP**)
 Branch Chief, DRP/B (**GBM**)
 Senior Project Engineer, DRP/B (**FLB2**)
 Team Leader, DRP/TSS (**RVA**)
 RITS Coordinator (**KEG**)
 DRS STA (**DAP**)
 J. Lamb, OEDO RIV Coordinator (**JGL1**)
ROPreports
 CWY Site Secretary (**DVY**)

SUNSI Review Completed: __gbm__ ADAMS: Yes No Initials: __gbm__
 Publicly Available Non-Publicly Available Sensitive Non-Sensitive

R:\ REACTORS\ CWY\2006\CW2006-13RP-TAM.wpd

RIV:RI	C:DRP/B			
TAMcConnell	GBMiller			
E - GBMiller	/RA/			
11/17/06	11/17/06			

U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Dockets: 50-483
Licenses: NPF-30
Report No.: 05000483/2006013
Licensee: Union Electric Company
Facility: Callaway Plant
Location: Junction Highway CC and Highway O
Fulton, Missouri
Dates: October 10-13, 2006
Inspector: T. McConnell, Resident Inspector
Approved By: G. Miller, Chief
Project Branch B
Division of Reactor Projects

SUMMARY OF FINDINGS

IR 05000483/2006013; 10/10/06 - 10/13/06; Callaway Plant. Inspection Procedure 95001 Supplemental Inspection.

The report covered a one week period of inspection by a resident inspector. No violations were identified. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

Cornerstone: Mitigating Systems

The U.S. Nuclear Regulatory Commission performed this supplemental inspection to assess the licensee's evaluation associated with a performance indicator (Mitigating Systems Performance Index Heat Removal System) that became White with the initial implementation of the Mitigating Systems Performance Index performance indicators during the second quarter of 2006. The primary reason for this performance indicator being characterized as White was system reliability for the auxiliary feedwater system. The licensee performed a comprehensive evaluation that identified three primary root causes for the degraded reliability of the auxiliary feedwater system: poor implementation of maintenance programs to improve quality; a lack of training for maintenance personnel; and poor coordination of personnel and resources. During this supplemental inspection, performed in accordance with Inspection Procedure 95001, the inspector determined that the licensee, in general, adequately determined the root and contributing causes of the White performance indicator and established appropriate corrective actions. In addition, the licensee conducted an extent of cause review, which included a performance assessment of the remaining mitigating systems.

REPORT DETAILS

01 INSPECTION SCOPE

The U.S. Nuclear Regulatory Commission (NRC) performed this supplemental inspection to assess the licensee's evaluation associated with a performance indicator (PI) (Mitigating Systems Performance Index (MSPI) heat removal system) that crossed the Green-White threshold in the second quarter of 2006. The primary reason for this PI being characterized as White was excessive unavailability of the auxiliary feedwater (AFW) system. To address this issue, the licensee performed a root cause evaluation focused on the factors that contributed to the unavailability of the AFW system. The inspector used the guidance in NRC Inspection Procedure 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," to assess the licensee's evaluation and corrective actions.

02 EVALUATION OF INSPECTION REQUIREMENTS

02.01 Problem Identification

- a. Determination of who (i.e., licensee, self-revealing, or NRC) identified the issue and under what conditions

The licensee identified the condition prior to the transition to the current MSPI methodology. The licensee conducted a root cause evaluation, Callaway Action Request (CAR) 2005005859, "Emergency AC Power and Auxiliary Feedwater Systems Likely to Produce 'White' MSPI," to evaluate those systems likely to result in a White PI following the implementation of MSPI. This assessment was completed on November 10, 2005, and identified several aspects of work control, training, and ineffective organizational components that had contributed to excessive AFW system unavailability and reduced system reliability.

- b. Determination of how long the issue existed and prior opportunities for identification

The licensee documented AFW system performance in the industry's worst quartile since the first quarter of 2001. The AFW pump system performance was adversely affected by unavailability due to monthly tests for troubleshooting, operator errors, and work planning errors. Performance was also adversely affected by five operational events directly associated with the turbine-driven AFW pump. Three of these events involved human performance errors; the other two events involved digital control system component failures. The inspector concurred with the licensee's evaluation that there were no common threads linking the five AFW failures.

The root cause assessment identified prior opportunities to identify the adverse work control practices. Specifically, for outages with documented completion times, unplanned unavailability hours had occurred on all of the maintenance outages since April 23, 2002.

- c. Determination of the plant-specific risk consequences (as applicable) and compliance concerns associated with the issue

The licensee's evaluation included a qualitative risk assessment that acknowledged that the work done on the AFW system was being performed primarily during online periods which contributed to system unavailability and increased the overall plant risk. Consequently, the evaluation determined, as a corrective action, that maintenance should be scheduled for periods when the AFW system is not required in order to reduce the plant risk. The inspector concluded that the licensee properly classified the risk consequences of the maintenance periods.

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

- a. Evaluation of method(s) used to identify root cause(s) and contributing cause(s)

The licensee used Procedure APA-ZZ-00500, "Corrective Action Program," Revision 42, to evaluate these issues. This procedure included such analysis tools as the "Why Staircase Tree," root cause analysis, root cause investigations, apparent cause evaluations, and Pareto chart analysis. The inspector evaluated the root cause evaluation report against the requirements of the licensee's procedures and determined that the evaluations performed followed the administrative procedure requirements. The inspector also concluded that the evaluations were performed with adequate detail and rigor to provide assurance that a significant condition adverse to quality would not recur.

- b. Level of detail of the root cause evaluation

Overall, the inspector concluded that the root cause evaluation was thorough and identified and assessed the potential contributors to the decrease in performance in sufficient detail to identify appropriate corrective actions.

The licensee identified three root causes and four contributing causes for the decrease in performance:

Root Causes

- The licensee identified that optimal work practices and continuous improvement preventive maintenance programs had not been fully incorporated into station programs. The licensee determined that earlier implementation of these programs would have identified declining system performance. Corrective actions were implemented to limit the organizational tolerance for long-standing equipment issues.
- Personnel working on newly installed equipment would proceed with tasks in the face of uncertainty. Several instances of knowledge based weaknesses were identified and corrective actions were established. Training had been implemented for the system engineers on the digital control system. Training for maintenance technicians was scheduled to be completed the week of November 6, 2006.

- A lack of resources (personnel and parts) and poor work coordination resulted in planned unavailability estimations being routinely exceeded. The licensee identified several aspects to improve the execution of maintenance and troubleshooting. Specific examples include: requiring additional work planners for work package reviews; the inclusion of technicians in the work planning processes; strengthening the work package review by the assigned work group; and keeping system engineers apprised of maintenance outages that exceed estimations.

Contributing Causes

- Although processes were in place to continuously improve preventive maintenance practices and procedures, full implementation had not improved the system reliability until prompted by a potentially degraded system PI. Interviews with licensee staff revealed that corrective actions have been implemented to review and strengthen the processes for maintenance improvement.
 - Unplanned equipment outages and resource coordination contributed to the adverse system health indicator. Specifically, work sequencing, scaffolding requirements, and personnel resources were not well managed to effectively complete the required maintenance. The staff indicated that management of maintenance outages of risk significant equipment has since improved through better management oversight.
 - Internal operating experience, industry standards and expectations for mitigating system performance with regard to the improvement of maintenance procedures and work practices had not been implemented with sufficient rigor to reduce the trend of excessive unavailability hours prior to the root cause assessment. The inspector determined that additional training for the licensee staff had been effective in producing an increased sensitivity to unplanned outages and outages that resulted in additional system unavailability.
 - Troubleshooting plans lacked detail and formality. This condition was exacerbated by the lack of maintenance personnel training on digital control systems. As corrective action, the licensee scheduled training for maintenance personnel during the week of November 6, 2006. Discussions with licensee staff regarding troubleshooting risk significant systems indicated that a systematic and formal approach had been implemented by Procedure MDP-ZZ-TR001, "Planning and Execution of Troubleshooting Activities," Revision 2.
- c. Consideration of prior occurrences of the problem and knowledge of prior operating experience

The inspector concluded that, in general, the licensee's root cause evaluation appropriately considered both internal and external operating experience. The evaluation assessed the licensee's previous inability to address the symptoms and

evidence of personnel, procedural, and communications weaknesses apparent in the licensee's operating experience and its failure to adequately address declining PIs.

While reviewing quarterly inservice testing for turbine-driven pump discharge pressure from December 2002, the inspector did identify one instance where an adverse trend existed without a concurrent CAR to evaluate the trend. The inspector also identified one instance where work procedures had not been updated to reflect improper outside vendor work controls that resulted in improper reassembly of the shaft coupling on the motor-driven AFW pump. The pump and motor subsequently experienced high vibration during postmaintenance testing. To address these issues, the licensee initiated CARs 200608454 and 200608480, respectively.

d. Consideration of potential common cause(s) and extent of condition of the problem

The licensee's evaluation considered the potential for common cause and extent of condition for each of the identified root causes. The licensee formed a panel to identify other potentially affected systems. The licensee also performed a root cause assessment of the emergency ac power system as a system that could potentially exceed PIs, though this system ultimately resulted in a Green PI.

To address extent of condition, the licensee issued action reports to assess other PIs. The licensee included assessments of high pressure safety injection, low pressure safety injection, closed cycle cooling water, and emergency service water. The assessment of these systems resulted in Green PIs.

The inspector concluded that the extent of condition and extent of cause reviews performed by the licensee were adequate.

02.03 Corrective Actions

a. Appropriateness of corrective action(s)

The root cause evaluation clearly identified corrective actions to address each root and contributing cause. The inspector determined that the corrective actions specified in the root cause evaluation were appropriate for the associated causes. The root and contributing causes and the associated corrective actions are discussed further in Section 02.02(b).

b. Prioritization of corrective actions

The licensee completed interim corrective actions, and subsequent corrective actions were on track for completion as scheduled. Several corrective actions were immediately implemented to improve system performance and reduce unavailability hours. Human performance and work planning improvements had been identified as areas requiring continuous improvement. Programs implementing continuous improvement were revisited and improved to incorporate lessons learned. The inspector considered the prioritization of the established corrective actions to be appropriate.

- c. Establishment of schedule for implementing and completing the corrective actions

The licensee established adequate schedules for the completion of the specified corrective actions. The majority of the corrective actions have been completed or are on track for completion. The inspector reviewed the completed corrective actions and concluded that they had been generally implemented in a timely and effective manner. The inspector did not identify any concerns with the scheduling or completion of corrective actions.

- d. Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence

The inspector concluded that measures identified in the root cause analysis would provide a means to determine the effectiveness of the corrective actions toward preventing a recurrence. Qualitative improvements in human performance and level of knowledge was affirmed during staff interviews. Several of the corrective action measures implemented had quantitative success in reducing the system unavailability hours. The most recent performance indicator for the AFW system has improved and the system now has an index of 1.19E-6. The inspector identified no concerns in this area.

03 **MANAGEMENT MEETINGS**

Exit Meeting Summary

On October 12, 2006, the inspector presented the inspection results to Mr. T. Moser, Manager, Plant Engineering, and other members of the staff who acknowledged the findings. The inspector confirmed that proprietary information was not provided or examined during this inspection.

Attachment: Supplemental Information

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee

T. Antweiler, Engineer, Maintenance Rule
K. Barbour, Engineer, Electrical and I&C Systems
L. Beaty, Engineer, Control Systems
D. Busker, Mechanical Maintenance
W. Claspill, Engineer, Performance
J. Center, Engineer, Maintenance Rule/EPIX
J. Engelbrecht, Engineer, NSSS
W. Griffith, Regulatory Affairs
D. Heinlein, Troubleshooting Procedure Owner
B. Huhman, Supervisor, NSSS
J. Imhoff, System Engineer, Auxiliary Feedwater
S. Maglio, Superintendent, Nuclear Engineering
K. Mills, Supervisor, Regulatory Affairs
T. Moser, Manager, Plant Engineering
W. O'Neil, I&C Maintenance
M. Smart, I&C Maintenance
E. Smith, Engineer, Performance and Inservice Test
C. Wood, Engineer, Pump and Valve

NRC personnel

M. Peck, Senior Resident Inspector
D. Dumbacher, Resident Inspector

LIST OF DOCUMENTS REVIEWED

Procedures

APA-ZZ-00500, "Corrective Action Program," Revision 42
MDP-ZZ-TR001, "Planning and Execution of Troubleshooting Activities," Revision 2
MDP-ZZ-RW001, "Rework Program," Revision 1
MP 04-1019, "Replace Terry Turbine Terminal Box," Revision A
MP 02-1018, "Installation of MDAFWP's Discharge Automatic Recirculation Control Check Valve," Revision A
MTT-ZZ-I0004, "Termination Procedure for Cables 600 Volts or Less," Revision 9
OSP-AL-P001A, "Motor Driven Aux. Feedwater Pump A Inservice Test- Group A," Revision 43

OSP-AL-P002, "Turbine Driven Aux. Feedwater Pump Inservice Test," Revision 51

Work Orders

06524838/450
06524838/460
06524838/500
06524838/525
06524838/550
06524838/560
06526187/460
06526187/500
06526187/530
06526187/560

Work Requests

C529210
C529211
C529212
C529213
C529214
C529216
C529217
R529210A

Request for Resolution (RFR)

019548A

Callaway Action Request (CARs)

200200455
200201430
200302861
200400798
200400884
200401143
200401167
200403988
200404334
200404494
200405236
200405894
200406231
200407557
200407982
200408693
200503397
200505807
200505859

200600806
200604360
200605314
200608454
200608480

Calculations

A170.0165/C090, "Uninsulated Steam Trap FCST0002; for Condition 4: Loss of Offsite Power M-GF-415," Addenda 1

A170.0165/C090, "Uninsulated Steam Trap FCST0002; for Condition 2: Turbine Driven Pump Operational Testing M-GF-415," Addenda 2

A170.0167/C090,AL-30, "Acceptance Criteria for PAL02 and PAL01A and PAL01B," Revision 2

A170.0167/C090,AL-30, "ARC Valve Modification to MDAFWP," Revision 2, Addenda 1

A170.0167/C090,AL-30, "Leakage Through 'C' FWIV," AEFV0041, Revision 2, Addenda 2

A170.0167/C090,AL-30, "AFW Flow Model Using KYPIPE2000, MDAFW and TDAFW," Revision 2, Addenda 3

GF-415, "Temperature of Auxiliary Feedwater Turbine Driven Pumphouse During 4 Operating Conditions," Revision 0

Miscellaneous Documentation

6355559, Summary of Material Item, Sealant, dated October 11, 2006

6371359, Summary of Material Item, Adhesive, dated October 11, 2006

71381-FMEN-1, "Failure Mode & Effects Analysis for 505/PG/PL Turbine Control Modification for Ameren Services Company," Revision 0

85017V1, "Woodward 505 Digital Governor Manual"

AL System Health Report, dated October 11, 2006

Callaway Second Quarter Performance Report, printed October 11, 2006

Callaway Plant Rework Tracking, dated October 11, 2006

Callaway Root Cause Analysis Report, "Emergency AC Power and Auxiliary Feedwater Systems Likely to Produce 'White' MSPI," November 10, 2005

DIR 96-1026, "Terry Turbine Controls Upgrade," Revision 0

FC219, Equipment Qualification Report, "Control Panel for TDAFWP Turbine (KFC02)," dated October 11, 2006

IWO 71381/ J-1070-00001, "Qualification Plan of Woodward 505/PG/PL Turbine Control Modification for Ameren Services Company," Revision 0

J-1070, "Technical Specification for Terry Turbine Controls Upgrade," Revision 0

J-1070-00036, "505 Configuration List," Revision 3

M-2Y007, "Conduit Seals and T-Drains for MOV's," Revision 6

PAL02, Equipment Qualification Report, "Turbine Driven Aux Feed Pump," dated October 11, 2006