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

May 8, 2007

Mr. R. T. Ridenoure
Vice President
Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
P.O. Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: FORT CALHOUN STATION - NRC SPECIAL INSPECTION REPORT 05000285/2007006

Dear Mr. Ridenoure:

On April 9, 2007, the U.S. Nuclear Regulatory Commission (NRC) completed a special inspection at your Fort Calhoun Station. The inspection examined your activities and root cause evaluation following the failure of two safety related ABB circuit breakers. The enclosed special inspection report documents the inspection findings which were discussed on April 9, 2007, with Mr. David Bannister, Plant Manager, and other members of your staff.

The enclosed special inspection report documents 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. 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 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/

William B. Jones, Chief
Engineering Branch 1
Division of Reactor Projects

Docket: 50-285
License: DPR-40

Enclosure:
NRC Inspection Report 05000285/2007006
w/Attachment 1: Supplemental Information
Attachment 2: Special Inspection Charter

cc w/Enclosure:
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Resident Inspector **(LMW1)**
Branch Chief, DRP/E **(JAC)**
Senior Project Engineer, DRP/E **(JCK3)**
Team Leader, DRP/TSS **(FLB2)**
RITS Coordinator **(MSH3)**
FCS Site Secretary **(BMM)**

SUNSI Review Completed: ____Y___ ADAMS: √ Yes ☐ No Initials: _WBJ_____
√ Publicly Available ☐ Non-Publicly Available ☐ Sensitive √ Non-Sensitive

R:_REACTORS_FCS\2006\FC2007006RP-MSP.wpd **ML**

RIV:SRI:DRP/B	RI:DRP/E	RI:DRS/EB2	C: DRS/EB1
MSPeck	LMWilloughby	BKCorrell	WBJones
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U.S. NUCLEAR REGULATORY COMMISSION

REGION IV

Docket:	50-285
License:	DPR-40
Report:	05000285/2007006
Licensee:	Omaha Public Power District
Facility:	Fort Calhoun Station
Location:	Fort Calhoun Station FC-2-4 Adm. P.O. Box 399, Highway 75 - North of Fort Calhoun Fort Calhoun, Nebraska
Dates:	February 20 through April 9, 2007
Inspectors:	M. Peck, Senior Resident Inspector L. Willoughby, Resident Inspector
Accompanied By:	B. Correll, Reactor Inspector
Approved By:	William B. Jones , Branch Chief, Engineering Branch 1 Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000285/2007006; 02/20-04/09/2007; Fort Calhoun Station, Special inspection to evaluate ABB circuit breaker failures.

This report documents special inspection activities conducted by a special inspection team consisting of one senior resident inspector, one resident inspector and one region-based reactor inspector. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process." Findings for which the significance determination process does not apply may be Green or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

No findings of significance were identified.

Enclosure

REPORT DETAILS

4. OTHER ACTIVITIES

4OA5 Other Activities

1. Special Inspection Scope

The NRC conducted a special inspection to evaluate the risk significance and corrective actions associated with two safety-related ABB circuit breaker failures at the Fort Calhoun Station (FCS). On January 25, 2007, the raw water Pump AC-10B power supply breaker failed during the start sequence. The licensee determined the apparent cause of the failure was a broken linkage arm connecting the circuit breaker to the mechanism operated contact switch. The licensee replaced the linkage arm and returned the pump to service. On February 8, 2007 the raw water Pump AC-10C supply breaker failed during the start sequence. The second breaker failure was also the result of a broken linkage arm. Both linkage arms failed at the same location. Due to the common cause aspect of these failures, the licensee declared the two remaining raw water pumps inoperable. The licensee replaced the failed linkage arm and the linkage arms on the two remaining raw water pumps. Failure of two linkage arms raised a concern for a potential common mode failure of safety-related applications powered from 4160 volt ABB circuit breakers. Other potentially affected FCS safety-related components included the low pressure safety injection pumps, the motor-driven auxiliary feedwater pump, the normal and alternate feeder breakers to the 4160 volt busses, and bus feeder breakers. Non-safety related buses and components, supplied by 4160 volt ABB circuit breakers, may also have been affected.

The NRC determined that this event met several of the deterministic criteria described in Management Directive 8.3, "NRC Incident Investigation Program," and represented sufficient risk significance to warrant a special inspection. The special inspection team reviewed the circumstances related to the ABB circuit breaker failures and assessed the effectiveness of the licensee's actions for resolving these issues. The team also assessed the effectiveness of the immediate actions taken and the notifications made by the licensee in response to the January 25, and February 8, 2007 breaker failures. The team used NRC Inspection Procedure 93812, "Special Inspection Procedure," to conduct the inspection. The special inspection team reviewed procedures, corrective action documents, and design and maintenance records for the equipment of concern. The team interviewed key station personnel regarding the event, reviewed the root cause analysis, and assessed the adequacy of corrective actions. A list of specific documents reviewed is provided in Attachment 1. The charter for the special inspection effort is provided as Attachment 2.

2. Overview of ABB Circuit Breaker Design, Degraded Conditions, and Failures

Omaha Public Power District (OPPD) modified the FCS safety and non-safety related 4160 volt electrical distribution breakers in 1995. This modification involved adapting replacement ABB circuit breakers for use in existing General Electric bus cubicles. OPPD contracted with ABB Combustion Engineering Nuclear Power, Windsor,

Connecticut, to modify the existing General Electric breaker trucks to accommodate the replacement ABB breakers. The replacement breakers were expected to last 20 years and perform 10,000 open/close cycles. OPPD purchased the modification and replacement ABB breakers as Class 1E, safety-related components. The modification included replacement of the existing General Electric Mechanism operated contact switch linkage arms with a 0.3125-inch nominal diameter, 12-inch long off-set cold rolled carbon steel rod.

The team concluded that the January 25 and February 8, 2007, raw water pump breaker failures were due to inadequate design of the mechanism operated contact switch linkage arm used to adapt the ABB circuit breakers to the General Electric cubicles during the 1995 period. Both linkage arms failed at the same location (Figure 1) due to reverse bending fatigue. The number of operating cycles on the failed breakers were 1222 cycles, for raw water Pump AC-10B, and 1728 cycles for raw water Pump AC-10C. Replacement arms, manufactured to the same design specifications, also failed during laboratory testing due to reverse bending fatigue. The replacement arms, however, underwent additional stress cycles prior to failure. The inspectors concluded that the failure could have been predicted based on the linkage arm geometry, the static and cyclic stress induced on the component by the breaker and mechanism operated contact switch spring, and material used in the construction.

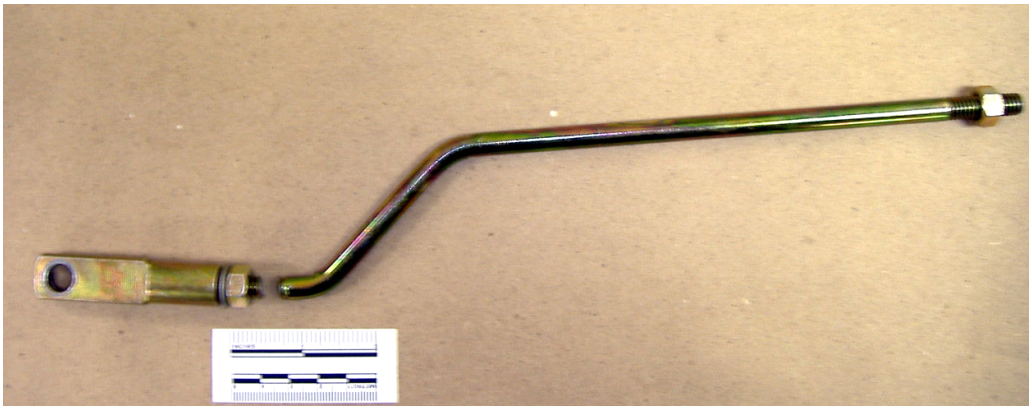

Figure 1 - Failed Mechanism Operated Contact Linkage Arm

The mechanism operated contact switch is aligned with the breaker by a mechanical linkage arm and changes position as the breaker either opens or closes. The mechanism operated contact switch is located in the breaker cubicle and is not physically part of the breaker (Figure 2). The broken linkage arms resulted in failure of the raw water pump discharge valves to open during the pump starting sequence on January 25 and February 8, 2007. The normally-closed discharge valve receives an open signal after the pump breaker closes. The valve open-signal is generated when the mechanism operated contact switch changes position. The broken linkage arm resulted in the failure to complete the circuit.

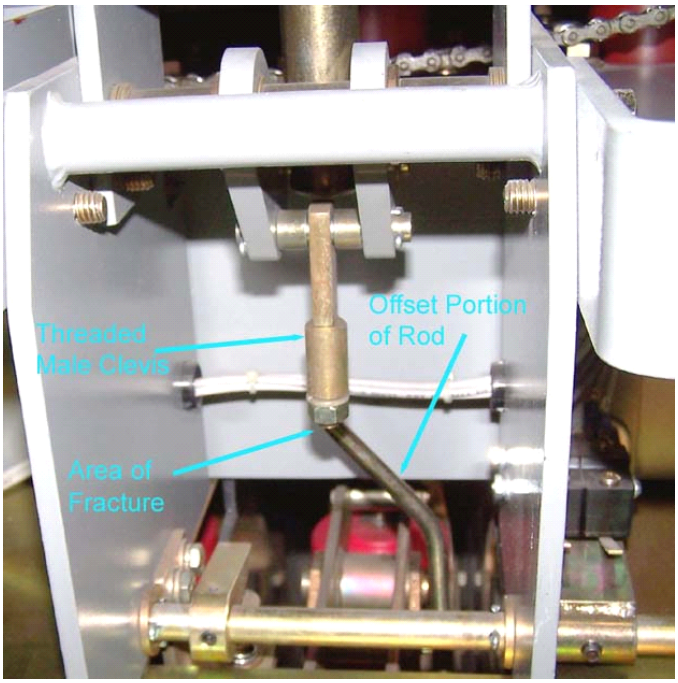

Figure 2 - Linkage Arm Installed in Modified 4160 Volt Breaker

3. Effectiveness of ABB Breaker Maintenance and Monitoring Programs

The team concluded OPPD maintenance and monitoring programs were sufficient to maintain the ABB breakers within their designed configuration and operating parameters. No linkage arm failures occurred at FCS prior to January 25, 2007.

The modification vendor completed prototype qualification testing of the modified breaker in accordance with ANSI C37.59 prior to installation. Mechanically aged breakers were cycled 2000 times while housed in a switchgear cell. The vendor chose the 2000 cycle test scope to demonstrate mechanical endurance based on the recommended service interval. ABB concluded this testing demonstrated satisfactory performance of the mechanism operated contact switch linkage. The qualification testing did not include operation of the breaker in the "test" configuration.

When the breaker is racked vertically into the switchgear and in the "open" position, the top of the breaker mechanism operated contact switch plunger is spaced about 0.125-inch from the end of the linkage arm. The breaker may be test cycled without engaging 4160 volt power to the load. In this "test" configuration, the breaker is racked down and partially withdrawn from the cubicle. An offset metal "test flag" is installed to bridge the vertical gap between the mechanism operated contact switch plunger bolt on the top of the breaker and the end of the switchgear mechanism operated contact switch linkage arm. Testing conducted by OPPD revealed higher than normal radial and inertial loads on the plunger bolt on top of the breaker when the breaker was cycled when the "test flag" was installed. The radial load, caused by the horizontal offset between the mchanism operated contact switch and the breaker plunger, resulted in

frictional loading of the plunger bolt as it was driven through the metal guide bushing at the top of the breaker. The mass of the “test flag,” which is about the same as that of the moving parts in the mechanism operated contact switch linkage system during normal operation, doubled the normal inertial load. Breaker timing tests demonstrated closure times of about 30 milliseconds and opening times of about 15 milliseconds. These breaker cycle durations resulted in between 10 and 100 gram acceleration on the breaker plunger, "test flag," and mechanism operated contact switch plunger. The licensee concluded that these inertial loads were significant contributors to the fatigue failure of the linkage arms.

Improperly adjusted “test flag” linkage may have also contributed to the cycle fatigue of the linkage arms during breaker cycling. Insufficient clearance could result in the “test flag” exerting excessive force against the mechanism operated contact switch housing and too great of a gap could increase the number of linkage arm stress cycles each time the breaker position was changed. OPPD personnel observed a "jack hammer" affect on the original General Electric "test flags” resulting in very noisy operation. The licensee's measurements of the static mechanism operated contact switch spring force supported the conclusion that minor variations in the travel of the mechanism operated contact switch plunger would result in large changes in the compression forces of the mechanism operated contact switch plunger spring and linkage arms. The team concluded that no other breaker maintenance issues were precursors to the failed linkage arms.

After the February 8, 2007, failure, OPPD began informally tracking the operating data (number of cycles) when transferring linkage arms from one breaker to another. The licensee plans to establish a formal tracking method which will be incorporated into station procedures.

4. Root Cause and Extent of Condition Review

On February 24, 2007, OPPD completed a revised operability determination concluding that ABB breaker linkage arms with less than 1000 breaker cycles were operable. The licensee concluded that between 335 and 579 stress cycles had occurred prior to fracture failure of the two broken linkage arms following the onset of initial surface cracking. The licensee based this conclusion on an evaluation of scanning electron microscope images of the fracture surface. Based on an estimated 10 stress cycles per breaker cycle, the licensee concluded that a linkage arm failure would not be expected to occur before 34 breaker cycles following the onset of a surface crack. OPPD examined the linkage arms that had been removed from the remaining two raw water pumps, with 1671 and 1688 breaker cycles each, the auxiliary feedwater breaker linkage arm, with 759 breaker cycles, and the low pressure coolant injection breaker linkage arm, with 755 breaker cycles. Nondestructive examination of these linkage arms indicated that no initial crack formation had occurred at any of the high stress points.

On March 15, 2007, RSI Materials Engineering completed laboratory testing and evaluation of old and newly manufactured linkage arms. The test scope included mechanical fatigue, metallurgical failure analysis, a comparative analysis of replacement rods with existing rods, and Weibull Analysis using existing operational data. The

testing confirmed that the failure mechanism was reverse bending fatigue. Based on the Weibull Analysis, OPPD concluded that no linkage arm failures were likely to occur prior to 1000 breaker cycles (97.5 percent confidence).

OPPD concluded the root cause of the linkage arm failures was a less than adequate process for identification of critical interface/operating configurations when specifying the replacement breaker procurement requirements. Specifically, OPPD failed to identify the usage of the "test flag" as a critical constraint during the 1994 breaker modification procurement. The OPPD purchase contract for the breaker modifications required "the circuit breakers, with interrupter, are otherwise identical to and interchangeable with the existing General Electric Magna-Blast air-magnetic circuit breakers." The purchase specification did not include use of the "test flag" or a requirement to perform production testing with the "test flag." Use of the “test flag” increased the linkage arm stress, aggravating the reverse bending fatigue.

Contributing Causes:

- The linkage arm fabrication process used die-cut rather than machine rolled threads. Use of the die-cut fabrication process increased the effect of high stress loading on the linkage arms

- Use of the "test flags" at FCS was not adequately controlled to ensure that critical gaps are maintained

Corrective Actions:

- Evaluation of material change for mechanism operated contact switch linkage arms to obtain reliable operation

- Develop replacement schedule or strategy to address rod replacement needs

- Revise procedure for "test flag" installation

- Provide administrative control for tracking mechanism operated contact switch linkage arms

The team concluded OPPD's corrective actions were adequate.

The inspectors evaluated the consequences of a linkage arm failure on other safety-related loads power by the 4160 volt ABB breakers. The mechanism operated contact switch linkage arm was common to all twenty-three 4160 volt ABB safety-related breakers. The raw water pumps were adversely affected because the mechanism operated contact switch was required to open the discharge valve during the start sequence. Failure of the mechanism operated contact switches on the breakers supplying the 4160 volt/480 volt in-house transformers (T1B-3A, T1B-3B, T1B-3C, T1B-4A, T1B-4B and T1B-4C) would trip and lock-out the 480 volt bus feeder breaker. A reset of the mechanism operated contact switch contacts would then be required to close any of these breakers. The licensee determined the breaker cycle count for each

of the six 4160 volt/480 volt in-house transformer breakers was less than 225 cycles. A mechanism operated contact switch failure in the breakers suppling reactor coolant pump motors could result in the failure of the associated undervoltage relays. This could result in a diesel generator overload during a loss of off-site power event. The licensee determined the breaker cycle count for each of the reactor coolant pump motors was 253 cycles or less.

The team verified that OPPD correctly applied Technical Specification requirements associated with the linkage arm failures. The licensee applied the Raw Water Pump Technical Specification Action requirements following the January 25 and February 8, 2007 failures during the pump start sequence. OPPD also declared the two remaining raw water pumps inoperable on February 8, 2007 after discovering the potential for a common mode failure of the breaker linkage arms. The licensee appropriately recognized this as a condition outside of the Technical Specifications, requiring a six-hour reactor shutdown (as described in NRC Event 43157). OPPD subsequently retracted the Event Notification after nondestructive examination of remaining raw water pump breaker linkage arms did not show crack initiation.

The team performed a review of pertinent industry operating experience and potential precursors to the FCS breaker failures, including the effectiveness of licensee actions taken in response to any operating experience. The team concluded no nuclear operating experience related to ABB circuit breaker linkage arm failures was available. When contacted, ABB responded that no technical bulletins on the modification had been issued. The team has confirmed that no generic issues exist related to the ABB circuit breakers/mechanism operated contact switches. The team has not identified any other safety related uses of the ABB modification or other linkage arm failures.

4OA6 Meetings, Including Exit

On April 9, 2007, the results of this inspection were presented to Mr. David Bannister, Plant Manager, and other members of his staff who acknowledged the findings. The inspectors confirmed that the supporting details in this report contained no proprietary information.

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

G. Cavanaugh, Supervisor Regulatory Compliance
H. Faulhaber, Division Manager, Nuclear Engineering
J. Herman, Manager, Engineering Programs
E. Matski, Compliance
S. Miller, Superintendent, Systems Engineering

LIST OF DOCUMENTS REVIEWED

Drawings

161F597, Sheet 1, File 9801, Elementary Diagram AI-30A, Revision 16

161F597, Sheet 2, File 9802, Elementary Diagram AI-30A, Revision 11

161F597, Sheet 4, File 9804, Elementary Diagram AI-30A, Revision 17

161F597, Sheet 8, File 9808, Elementary Diagram AI-30A, Revision 17

0223R0454, Sheet 3, File 9922, Bus Number 1A1 Power & Control Circuit for Unit 1A1-7 Breaker Number 1A11-T1A-1 Inc., Revision 9

0223R0454, Sheet 12, File 9931, Bus Number 1A1 Power & Control Circuit Unit 1A1-4 Circulating Water Pump Number CW-1A Feeder, Revision 6

0223R0455, Sheet 10, File 9953, Bus Number 1A3 Power & Control Circuit for Unit 1A3-20 Breaker Number 1AD1 Inc. Diesel Generator DG-1, Revision 6

0223R0455, Sheet 11, File 9954, Bus Number 1A3 Unit-1A3-20 Breaker Number 1AD1 Inc. Diesel Generator DG-1 Functional List of Contacts, Revision 6

0223R0455, Sheet 12, File 9955, Bus Number 1A3 Power & Control Circuit Unit 1A3-7 L.P. Safety Injection Pump SI-1A, Revision 9

0223R0455, Sheet 15, File 9958, Bus Number 1A3 Power & Control Circuit Unit 1A3-9 Raw Water Pump Number AC-10A, Revision 14

0223R0455, Sheet 19, File 9962, Bus Number 1A3 Power & Control Circuit Unit 1A3-16 Auxiliary Feed Pump FW-6, Revision 14

11205-E-19, Sheet 2, File 57310, 480V Transfer Sec Breaker 1B3A (Unit 101B), Revision 0

11405-E-326, Sheet 3, File 42987, Exciter Field Breaker, Revision 16

11405-E-327, Sheet 1, File 12589, Motor Operated Disconnect Switch DS-T1, Revision 12

11405-E-262, Sheet 1, File 12529, Steam Generator Feed Pump, Lube Oil Pumps and Motor Operated Discharge Valves, Revision 21

11405-E-262, Sheet 3, File 41743, PSOV - Heater Drain Pump Recirculation and Steam Generator Feed Pump Recirculation and Suction Valves, Revision 18

B-4102, Sheet 3, File 37452, Emergency Response Facilities Computer System Input/Output List, Revision 3

B-4102, Sheet 5, File 37454, Emergency Response Facilities Computer System Input/Output List, Revision 3

Figure 8.1-1, File 12234, Simplified One Line Diagram Plant Electrical P&ID, Revision 128

Quality Control Inspection Reports

20070031, Informational Penetrant Test for AC-10D Breaker, February 9, 2007
20070032, Informational PT for AC-10A, February 9, 2007

Condition Reports

200700618
200700620

Procedures

Functional Test Procedure EM-FT-EX-0200, Functional Test of Auto Start Prohibit of 480 and 4160 Volt Breakers

Preventive Maintenance Procedure EM-PM-EX-0200A, 4160 Volt Circuit Breaker Inspection, Revision 13

Preventive Maintenance Procedure EM-PM-EX-0200B, Spare 4160 Volt Circuit Breaker Inspection, Revision 1

Preventive Maintenance Procedure EM-PM-EX-1400, 4160 Volt Switchgear Inspection, Revision 23

Preventive Maintenance Procedure SE-PM-EX-1600, Infrared Thermographic Surveys Operating Instruction OI-EE-1A, 4160 Volt Circuit Breaker and Control Switch Operation, Revision 16

NOD-QP-31, Operability Determinations Process, November 25, 2006

Functional Scoping Data Sheet 0810 ECC LPSIPU - Low Pressure Safety Injection Pump, Revision 5a, March 28, 2006

Functional Scoping Data Sheet 1004 EDS 022XFM - 4160 VAC Bus Supply from 22KV, Revision 4, January 31, 2006

Functional Scoping Data Sheet 1002 EDS - Electrical Distribution System, Revision 2a, January 31, 2006

Functional Scoping Data Sheet 1014 EDS 161XFM - 4160 VAC Bus Supply from 161KV, Revision 3a, February 22, 2006

Functional Scoping Data Sheet 0204 AFWPMP - Auxiliary Feedwater Pumps, Revision 8a, August 23, 2005

Functional Scoping Data Sheet 1015 EDS 416BUS - 4160 VAC Electrical Bus, Revision 2a, January 31, 2006

Functional Scoping Data Sheet 0112 ACS RWPUMP - Raw Water Pumps, Revision 6a, December 13, 2005

Functional Scoping Data Sheet 0902, EDG - Emergency Diesel Generator, Revision 3a, August 23, 2005

Work Orders

00263362-01, Replace mechanism operated contact Offset Rod for FW-6 Breaker
00263517-01, Do 52STA Force Testing at this Location

ABB Documents

Proposal 1053-240-012-A, Fort Calhoun Safety Related 4160 Volt AC Circuit Breakers, July 29, 1994

Certificate of Conformance, 4160 Volt, 2000 Amp and 1200 Amp Circuit Breakers

L-111463, Instruction Manual for ABB Combustion Engineering Vacuum Replacement Breakers, Revision 0 (FCS TD C490.0370)

Memo dated May 11, 1995, Information Regarding NRC Notice 95-22

PDG 55001, Instructions for Installation, Operation and Maintenance; ABB Vacuum Replacement Breaker for GE AM 4.16 250MVA 1200/2000A, Revision 1, February 17, 1995 (FCS TD C490.0370)

Miscellaneous

Design of Machine Elements, M. F. Spotts, Mechanical Engineering Department, The Technological Institute Northwestern University

OPPD Material Procurement Plan Report, November 15, 1994, ABB Combustion Engineering, ABB CE Vacuum Replacement Breaker AM4.16 Type 8H 200A 1E

Plant Review Committee Minutes, February 21, 2007

Event Notification Worksheet, EN# 43157 Sandin, February 8, 2007

FCS Corrective Action Program Root Cause Analysis Report, 4160VAC Breaker Offset Rod Failure

QCP-311, Liquid Penetrant Examination (Water Washable), Revision 7

Failure Analysis of 4160 VAC Breaker Offset Rods, Prepared for Dr. Bob Lisowyj, Director Materials Analysis Omaha Public Power Company, Fort Calhoun Nuclear Station Fort Calhoun, NE, Prepared by, Hans C. Iwand, PE, VP Laboratory Operations RSI-Materials Engineering

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

February 20, 2007

MEMORANDUM TO: Michael S. Peck, Senior Resident Inspector, Callaway

FROM: Dwight D. Chamberlain, Director, Division of Reactor Safety /RA/

SUBJECT: SPECIAL INSPECTION CHARTER TO EVALUATE THE FORT CALHOUN STATION ABB CIRCUIT BREAKER FAILURES

A Special Inspection Team is being chartered in response to the Fort Calhoun Station safety-significant ABB circuit breaker failures. An ABB breaker failed during the starting sequence for the 'B' raw water pump on January 25, 2007. The apparent cause was determined to be a broken linkage/connector arm in the ABB circuit breaker mechanism operated cell (MOC). On Feb. 8, a second of their four (4) raw water pumps failed due to breakage of the same linkage arm. Because of the common cause aspect of this failure, the licensee declared 3 of the 4 pumps (all except 'B,' which was repaired and returned to service on January 31) inoperable, which placed them in a 6-hour shutdown action (see NRC Event 43157) due to operation outside their technical specifications. This represented a potential common-mode failure concern for the raw water pump circuit breakers, as well as other 4160 volt breakers in safety-related applications at Fort Calhoun Station. The other potentially affected breakers include those for both low pressure safety injection pumps, the motor-driven auxiliary feedwater pump, the normal and alternate feeder breakers to the 4160 volt busses, and the feeder breakers from the 4160 volt busses to the 480 volt safety busses. Nonsafety-related buses and components may be affected as well (e.g., the feeder breakers to the nonsafety-related 4160 buses). The assigned Senior Reactor Analyst to support the team is Russ Bywater.

A. Basis

On both January 25 and February 8, 2007, identical ABB circuit breakers for Fort Calhoun Station raw water pumps failed due to the same apparent cause. As stated previously, there are also other Fort Calhoun Station safety-significant breakers that may have this problem. This represents the potential of a significant common mode concern, as well as a potential generic issue. The combined deterministic criteria and risk evaluation, conducted under NRC MD 8.3, indicate supplemental inspection of this issue is warranted.

A Region IV Senior Reactor Analyst completed a preliminary estimate of the incremental conditional core damage probability for this condition using the SPAR model for Fort

Calhoun Station, Revision 3.31, and methods identified in the Risk Assessment Standardization Project (RASP) Handbook for performing Management Directive 8.3 assessments. Accounting for the plant conditions and configurations resulted in an incremental conditional core damage probability of 1.17E-6.

The licensee believes the cause of the ABB circuit breaker/MOC failures is most likely high-cycle fatigue of the linkage/connector arm. They also believe the potential adverse condition of the component only occurs after more than 1,000 cycles of the breaker. However, this is yet to be substantiated. The licensee has sent the two failed components to labs for analysis. Additionally, high-cycle fatigue may only be the failure mechanism, not the root cause of the problem. Additional factors, such as breaker alignment and adjustment, may significantly alter the expected number of cycles before failure. This is evidenced by one of the breakers failing at 1,200 cycles when the other three raw water pump breakers did not fail with 1,600 cycles. Therefore, additional inspection is important to gain a more comprehensive understanding of this issue and the underlying cause(s).

This Special Inspection Team is chartered to review the circumstances related to the licensee's ABB circuit breaker and MOC problems, and assess the effectiveness of the actions for resolving these problems. The team will also assess the potential for impact on other plant systems in addition to the raw water pumps and the potential for generic implications. The team will also assess the effectiveness of the immediate actions taken and the notifications made by the licensee in response to the pump failures that occurred on January 25 and February 8, 2007.

B. Scope

The team is expected to address the following:

1. Develop an understanding of the ABB circuit breaker original design, the degraded conditions, and failures related to the raw water pump failures.

2. Determine if the licensee's maintenance and monitoring programs were sufficient to maintain the ABB breakers/MOCs in their designed configuration and operating parameters.

3. Assess licensee effectiveness in identifying previous ABB circuit breaker problems, evaluating the cause of these problems, and implementation of corrective actions to resolve identified problems.

4. Review plant equipment records to verify a complete listing of the potentially affected breakers at the facility, the number of cycles of the components, and record keeping regarding transfer of operating data (cycles) when transferring parts from other breakers.

5. Identify and assess additional actions planned by the licensee for other similar safety-significant ABB circuit breakers at the facility.

6. Assess the licensee's root cause evaluation, the extent of condition, and the licensee's common mode evaluation and assess the adequacy of corrective actions including immediate and long-term actions.

7. Evaluate pertinent industry operating experience and potential precursors to the January 25 and February 8 breaker/MOC failures, including the effectiveness of licensee actions taken in response to any operating experience.

8. Determine if there are any potential generic issues related to the failures of the ABB circuit breakers/MOCs. Promptly communicate any potential generic issues to Region IV management.

9. Determine if the technical specifications were met during the periods of each of the raw water pump failures.

10. Collect data as necessary to support a risk analysis of the degraded conditions and failures as appropriate.

C. Guidance

Inspection Procedure 93812, "Special Inspection," provides additional guidance to be used by the Special Inspection Team. Your duties will be as described in Inspection Procedure 93812. The inspection should emphasize fact-finding in its review of the circumstances surrounding the event. It is not the responsibility of the team to examine the regulatory process. Safety concerns identified that are not directly related to the event should be reported to the Region IV office for appropriate action.

The Team will report to the site, conduct an entrance, and begin inspection no later than February 20, 2007. While on site, you will provide daily status briefings to Region IV management, who will coordinate with the Office of Nuclear Reactor Regulation, to ensure that all other parties are kept informed. A report documenting the results of the inspection should be issued within 30 days of the completion of the inspection.

This Charter may be modified should the team develop significant new information that warrants review. Should you have any questions concerning this Charter, contact me at (817) 860-8180.

cc:
J. Clark, C:DRP/E
W. Jones, C:DRS/EB1