UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
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ARLINGTON, TEXAS 76011-4125

November 17, 2009

Mr. Adam C. Heflin, Senior Vice
President and Chief Nuclear Officer
AmerenUE
P.O. Box 620
Fulton, MO 65251

SUBJECT: SUMMARY OF REGULATORY CONFERENCE WITH AMEREN UE REGARDING CALLAWAY PLANT

Dear Mr. Heflin:

This refers to the public meeting conducted at the U.S. Nuclear Regulatory Commission Region IV office on November 9, 2009 during which a regulatory conference was held.

Topics discussed during the meeting included the significance, cause, and corrective action associated with an apparent violation involving the inoperability of the turbine driven auxiliary feedwater pump. The apparent violation is discussed in NRC Inspection Report 05000483/2009009 (ADAMS ML092730656). Members of the public present at the meeting were allowed to ask questions and comment on the proceedings.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be made 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).

Should you have any questions concerning this matter, I will be pleased to discuss them with you.

Sincerely,

/RA/

Geoffrey Miller, Chief
Project Branch B
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Docket: 50-483
License: NPF-30

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1. Attendance List
2. Presentation Slides

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Publicly Avail	☑ Yes ☐ No	Sensitive	☐ Yes ☑ No	Sens. Type Initials	GM

SPE:DRP/PBB	BC:DRP/PBB		
PAJayroe	GBMiller		
/RA/	**/RA/ JClark for**		
11/12/2009	11/12/2009		

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REGULATORY CONFERENCE
AMEREN UE
CALLAWAY PLANT
November 5, 9, 2009

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NRC Regulatory Conference

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Callaway Plant
TDAFP Failure to Start 5/25/09

November 9, 2009

Regulatory Conference Presentation Outline

▪ Introduction	Fadi Diya
▪ Risk Assessment	Dave Shafer
▪ Qualitative Evaluations	Fred Bianco
▪ Risk Assessment Quantification	Dave Shafer
▪ Summary	Greg Bradley
▪ Corrective Actions	Les Kanuckel
▪ Closing	Fadi Diya

Introduction

- Circumstances leading up to the event are unacceptable
- May 25, 2009 failure of the Turbine Driven Auxiliary Feedwater Pump (TDAFP) to start
  - The valve actuator was manually operated in the as found condition
  - Following lubrication the valve tested satisfactorily
- The performance deficiencies constitute violations of Federal Regulations (September 30, 2009 Special Inspection Report)
- Ameren is not contesting the violations
- We will provide information relative to the risk assessment
- We will describe our extensive corrective actions

Risk Assessment

Areas of Agreement:

- Quantification of unrecovered internal events risk
- Quantification of external events risk (fires & flooding)
- Trip throttle valve can be locally operated manually

Risk Assessment

We will provide additional information in the following areas:

- Ergonomics
- Available Time
  - o Diagnosis phase
  - o Action phase

Narrative

May 25, 2009 at 1141, Operations commenced Surveillance Testing

- Auxiliary Feedwater Actuation Signal (AFAS) relays actuated as expected
- Main Steam supply valves opened as expected
- The TDAFP failed to start
- Initial investigation determined the actuator had stopped just prior to latching the valve
  - o Main Control Board (MCB) indications
  - o Local observations
  - o Review of drawings

Narrative (Cont)

Investigation and Repair

- Torque switch stopped valve movement
  - Manually operated actuator (as found condition)
  - It would have taken 2-3 turns to latch valve and make-up limit switch. The actuator would then have opened the valve (in an actual station blackout event)
- Lubricated the trip throttle valve spindle and sliding nut and stroked the valve actuator several times

Successfully performed post maintenance testing and the TDAFP was declared operable 5/25/09 at 2056

Ergonomics

Factors Important to Ergonomics:

- Equipment displays & controls
- Instrumentation information (quality, quantity and diversity)
- Interaction of the operator with the equipment
- Equipment layout
- Environmental conditions

Ergonomics - Qualitative Evaluation

Actions for recovery of the TDAFP with a station blackout (SBO) place additional challenges on the Operations crew

- **Training**
- **The use of diverse indications**
- **Procedures**

We will restore auxiliary feedwater flow from the TDAFP prior to Steam Generator (S/G) dryout

Ergonomics - Training

Licensed Operator

Auxiliary Feedwater

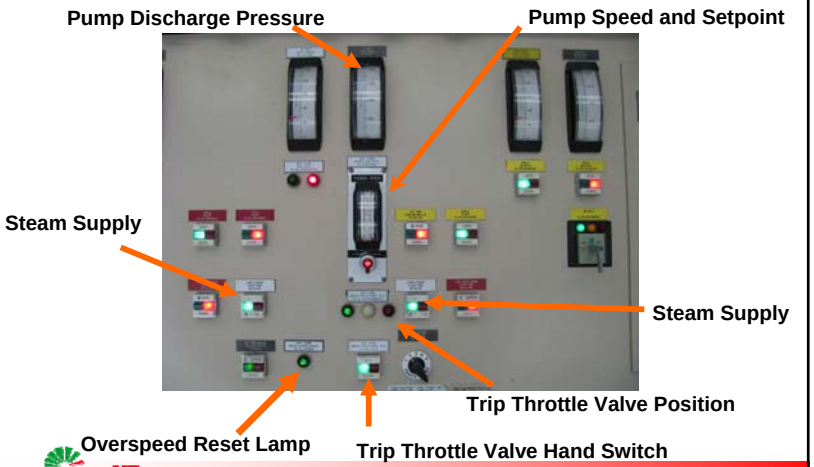
- Initial Licensed Training
- Continuing Training
  - ECA 0.0, Loss of All Alternating Current (AC) Power – 24 month frequency
  - Critical Safety Function (CSF) – 12 month frequency

Non Licensed Operator – Operations Technician (OT)

Auxiliary Feedwater

- Initial Training – Secondary Classroom
- Continuing Training – 36 month frequency
- On the Job Training

Ergonomics - Control Room Indication - Normal Operation

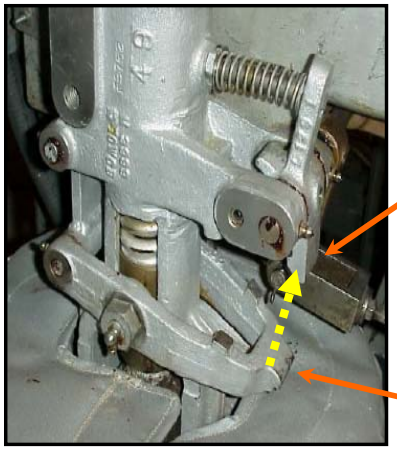


Ergonomics - Control Room Indication - SBO No TDAFP

Ergonomics - Training

- **Trip throttle valve is a unique valve, the only one like it in the plant**
- **Actuator must go in the closed direction to latch the valve, then will reverse direction and open the valve**
  - Operators are trained specifically on this valve
  - Manually operate the trip throttle valve to start the TDAFP

Ergonomics - Indication - Trip Throttle Valve



Ergonomics - Governing Procedures - SBO

ECA 0.0, Loss of All Alternating Current (AC) Power

- Directs the operator to check AFW flow
- Gives the guidance for restoring the TDAFP

CSF-1, Critical Safety Functions

- Red Path on Heat Sink – maintains the priority of the control room staff to restore flow from the TDAFP to restore a heat sink

Ergonomics - Governing Procedures

Multiple priorities during a SBO:

- Loss of AFW flow – Failure of TDAFP to start
- Loss of Offsite Power
- Two Emergency Diesel Generators (EDG) failure to start

LOSS of ALL AC Power (ECA 0.0) MANAGES these priorities

- Step 4 Response Not Obtained (RNO) ECA 0.0 dispatch secondary Operations Technician (OT) to the TDAFP
- Step 5 ECA 0.0 Reactor Operator will start process of Restoration of Offsite Power, then Step 7 will dispatch OTs to EDGs
- Step 13 RNO requires MAINTAIN AFW flow
- Step 16 requires CHECK of SG level above 7% and MAINTAIN AFW flow
- Step 23 requires CHECK AC emergency buses and RNO loops back to Step 11

Procedure use drives priorities

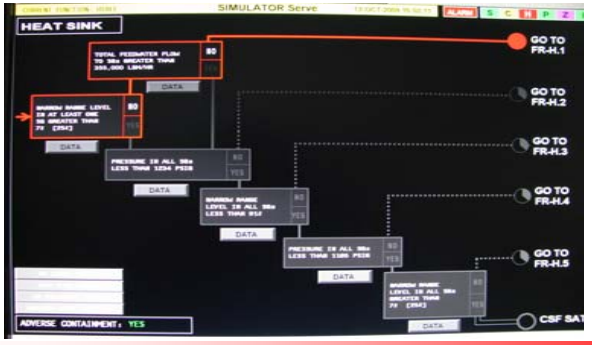
Ergonomics - Governing Procedures (cont)

Loss of all AC Power procedure

Ergonomics - Governing Procedures (cont)

CSF-1, Critical Safety Functions

- Continuously monitored when in Emergency Procedure
- Red Path on Heat Sink – maintains the priority of the control room staff to restore flow from the TDAFP to restore a heat sink



Ergonomics - Staffing Available for Recovery

Assumptions for response time:

- Operations normal shift complement for back shifts and weekends
  - o Normal Control Room Staffing 6
  - o Normal Field Staffing 7
- One OT would be dispatched to the TDAFP
- Two OTs would be dispatched to the EDGs

Staffing allows for additional OTs and a Field Supervisor that would be dispatched to assist at the TDAFP and EDGs

Ergonomics - Multiple Priorities

There would be multiple priorities during a Station Blackout (SBO) with failure of TDAFP to start:

- TDAFP failure to start
- Loss of Offsite Power
- Two Emergency Diesel Generators (EDG) failure to start

ECA 0.0 is designed and written to manage these priorities

Ergonomics – Pump Room

Conditions:

- Room temperature averages 90 -110 deg F
- No Emergency Lighting in the room - only Emergency Lighting was in the hallway
- Trip throttle valve accessibility

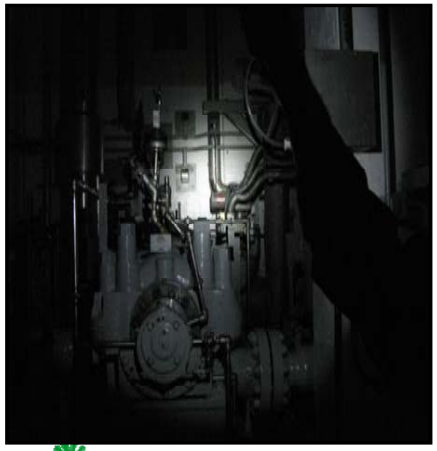
OTs:

- Tour the room at least once per shift
- All carry and routinely use flashlights on rounds
- Are very familiar with the room layout
- Know how to access all areas of the room
- Inspect mechanical overspeed trip linkage each shift

Ergonomics - Plant West

Ergonomics - Plant East

Ergonomics - SBO - Lighting



Ergonomics - Summary

- **Equipment displays & controls**
  - Control Room indications and displays allow for quick and accurate diagnosis
  - Procedures and displays maintain focus on priorities
- **Equipment layout**
  - OTs are familiar with room
  - Trip Throttle Valve can be accessed from either side of the pump
- **Instrumentation information (quality, quantity and diversity)**
  - Control Room information provides direct indication of trip throttle valve position (high quality)
  - Allows for timely diagnosis
- **Interaction of the operator with the equipment**
  - OTs are familiar with the room
  - OTs are trained on valve operation
  - Valve actuator was manually operated with near normal effort
- **Environmental conditions**
  - OTs carry a flashlight
  - Flashlight provides adequate lighting to access and operate
  - Room is hot, but this is the normal condition and not unlike other plant areas
  - OTs have trained in more severe conditions

Ergonomics - Risk Assessment

PSFs	PSF Levels	NRC	CALLAWAY	Multiplier
Ergonomics/ HMI	Missing/Misleading	**X**		50
	Poor		**X**	10
	Nominal			1
	Good			0.5

Poor *– the design of the plant negatively impacts task performance (e.g. poor labeling, instrumentation, computer interfaces)*

- Control room indications are clear **GOOD**
- Spindle not properly lubricated, but operated with near normal effort **POOR**
- Thermal overloads – Not relevant, SBO scenario **--------**
- Unique valve design, however training addresses **POOR**
- Access (design) not ideal **POOR**
- Control room priorities & focus is on heat sink restoration **GOOD**

Available Time - Risk Assessment

Factors Important to Available Time:

- Time to S/G dryout (before core damage)
- Time for the crew/operator to diagnose the fail-to-start condition
- Time available to act and manually start the TDAFP
- Time available for repeat actions

Available Time - Operator Response Timing

Callaway Revised SPAR-H Timeline
Following EOPs: 6 min **[Total 6 min]**
Contact OT: 5 min Brief OT and Travel to the Pump Room: 5 min OT Assesses Condition: 5 min Contact MCR for Instructions and receive second direction to open valve: 5 min **[Total 20 min]**
Manipulation Time: **5 min** **[Total 5 min]**
(Total Time: 31 min) **[49 Minutes remain for repeated attempts to open the trip throttle valve]**

Total Time Available:
80 min

Three different crews response time tested for SBO w/loss of TDAFP

- All 3 crews took less than 5 minutes to reach step 4 of ECA 0.0
- Dispatch an OT to the TDAFP

Three different OTs were response time tested

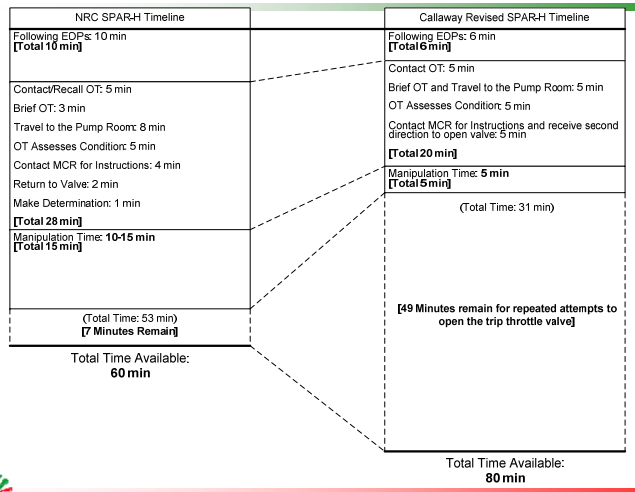
- From the time they were contacted, given a brief of conditions, to the time they entered the room was less than 5 min

These response tests validate the times used in the Callaway Timeline

Available Time - Risk Assessment

- **Time to S/G dryout is 80 minutes**
  - o Based on thermodynamic heat balance for Callaway
    - Actual S/G secondary inventory
    - Decay heat based on Cycle 17 burnup conditions
  - o Conservative assumptions
    - Decay heat uncertainty added
    - RCS is instantly in thermal equilibrium with S/Gs
    - Cycling of the Atmospheric Steam Dumps was not credited
  - o A significant portion of the RCS must boil away after S/G dryout for actual core damage to occur

Available Time - Timeline Comparison



Available Time - Summary

- **Time to S/G dryout (before core damage)**
  - S/G dryout is conservatively determined to be 80 minutes
- **Time for the crew/operator to diagnose the fail-to-start condition**
  - Control Room diagnosis performed within 6 minutes
- **Time available to act and manually start the TDAFP**
  - Communication and transit (10)
    - Contact and brief
    - Transit
  - Assess and manipulate (15)
    - Assess and communicate
    - Manipulation
- **Time available for repeat actions**

Available Time - Risk Assessment - Diagnoses

PSFs	PSF Levels	NRC	CALLAWAY	Multiplier
Available Time - Diagnoses	Inadequate Time			P(failure) = 1.0
	Barely adequate time (~ 2/3 x nominal)			10
	Nominal time			1
	Extra time (between 1 and 2 x nominal and > 30 min)	**X**		0.1
	Expansive time (> 2 x nominal and > 30 min)		**X**	0.01

Based on Callaway's timeline, which includes an elapsed time of 6 minutes for control room diagnosis and 5 minutes to assess valve conditions, leads to a diagnosis of EXPANSIVE TIME

Available Time - Risk Assessment - Action

PSFs	PSF Levels	NRC	CALLAWAY	Multiplier
Available Time - Action	Inadequate Time			P(failure) = 1.0
	Time available is ~ the time required			10
	Nominal time	X		1
	Time available >= 5x the time required		X	0.1
	Time available >= 50x the time required			0.01

Based on Callaway's timeline, which includes an elapsed time of 31 minutes for the action and 5 minutes per valve manipulation, leads to a diagnosis of TIME AVAILABLE >= 5x

Risk Assessment Summary

We have discussed:

- Procedures that establish our priorities
- Indications that maintain our focus
- Training (CR and field personnel) that shape how we react to events
- Staffing that allow us to handle multiple priorities
- Timing that allows multiple attempts to open the trip throttle valve
- Room conditions that with a flashlight are suitable for opening the valve

We have provided basis for:

- Ergonomics shaping factor
- Available Time shaping factor

These performance shaping factors lead to the risk being <1.0E-6 Very Low Risk Significance (Green)

Our operating crews would open the trip throttle valve in these postulated conditions prior to the onset of core damage

Hardware Corrective Actions

- Approved use of a more effective high temperature grease for the trip throttle valve
- Correct valve stem lubrication type and preventive maintenance frequency for other important motor operated valves are being verified
- Installed emergency lighting in TDAFP room
- Installed an access platform for the trip throttle valve
- Adequate emergency lighting, access, and tooling to support other critical operator recovery actions are being verified

Process Corrective Actions

- Revised work instructions for trip throttle valve replacement to verify lubrication as a critical step and made numerous other work instruction improvements
- Developed a stand alone preventive maintenance document for trip throttle valve lubrication and changed lubrication frequency
- Developed a more rigorous review process for preventive maintenance basis changes

Organizational Corrective Actions

- **Continue to reinforce written instruction use and adherence**
- **Communicated expectations and providing training to personnel who establish lubrication preventive maintenance bases and frequency intervals**
- **Dedicated work coordinators will be assigned for major Auxiliary Feedwater System activities during refueling outages**
- **Lowered threshold for use of Event Review Teams to investigate issues**
- **Strengthened management support for root cause analyses and associated teams**

Closing

- **Failure of TDAFP to start is NOT ACCEPTABLE**
- **Implemented extensive corrective actions with broad extent of cause/condition resulted in**:
  - Hardware changes
  - Process changes
  - Organizational behavior changes
- **We have a high confidence that we would have opened the trip throttle valve when needed**
- **We ask that you consider the information we have provided today**