



James R. Becker
Site Vice President

Diablo Canyon Power Plant
Mail Code 104/5/601
P. O. Box 56
Avila Beach, CA 93424

December 23, 2009

805.545.3462
Internal: 691.3462
Fax: 805.545.6445

PG&E Letter DCL-09-094

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2
Licensee Event Report 2-2009-003-00
Containment Sump Recirculation Valve Position Interlock Failure
Due to Inadequate Testing

Dear Commissioners and Staff:

In accordance with 10 CFR Parts 50.73(a)(2)(i)(B), 50.73(a)(2)(ii)(B), 50.73(a)(2)(v)(D), and 50.73(a)(2)(ix)(A), Pacific Gas and Electric Company is submitting the enclosed licensee event report regarding degradation of the Loss of Coolant Accident recirculation flow path that would have prevented the Residual Heat Removal flow from reaching the containment spray, high head and intermediated head safety injection pumps following alignment to long term recirculation from the containment sump without additional operator actions.

There are no new or revised regulatory commitments in this report.

This event did not adversely affect the health and safety of the public.

Sincerely,

James R. Becker

ddm/2246/50277252

Enclosure

cc/enc: Elmo E. Collins, NRC Region IV
Michael S. Peck, NRC Senior Resident Inspector
Alan B. Wang, NRR Project Manager
Megan Williams, NRC Region IV
INPO
Diablo Distribution

JE22
NRC08

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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4. TITLE
Containment Sump Recirculation Valve Position Interlock Failure Due to Inadequate Testing

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	23	2009	2009	003	00	12	23	2009	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE 6	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFRs: (Check all that apply)			
10. POWER LEVEL 0	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input checked="" type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input checked="" type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME Steven W. Hamilton – Senior Regulatory Services Engineer	TELEPHONE NUMBER (Include Area Code) (805) 545-3449
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE MONTH: DAY: YEAR:
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On October 23, 2009, with Unit 2 in Mode 6 (Refueling) and the reactor core offloaded to the spent fuel pool, plant operators identified failures of containment sump recirculation valves to activate their open interlock. This condition would have prevented the residual heat removal (RHR) flow from reaching the containment spray, high head and intermediate head safety injection pumps following alignment to long term recirculation in accordance with Emergency Operating Procedures (EOP) via the control room manual remote switches.

On October 23, 2009, the Unit 1 sump valves interlock condition was satisfactorily verified based upon a review of testing previously performed. Plant operators made a non-emergency notification in accordance with 10 CFR 50.72(b)(3)(ii)(B) at 14:44 PDT (EN45461).

This event was the result of inappropriate maintenance and testing performed during the Unit 2 fourteenth refueling outage (2R14) that resulted in the valve position interlock switches for the containment sump unable to perform their safety function without local manual operator action.

Unit 2 Cycle 15 specific analysis performed for a range of loss of coolant conditions found that the time to perform local manual operator actions was available. The analysis also verified that radiological conditions at the local manual actuation locations would allow operator action.

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TEXT

I. Plant Conditions

Unit 2 was in Mode 6 (Refueling) with the reactor vessel defueled.

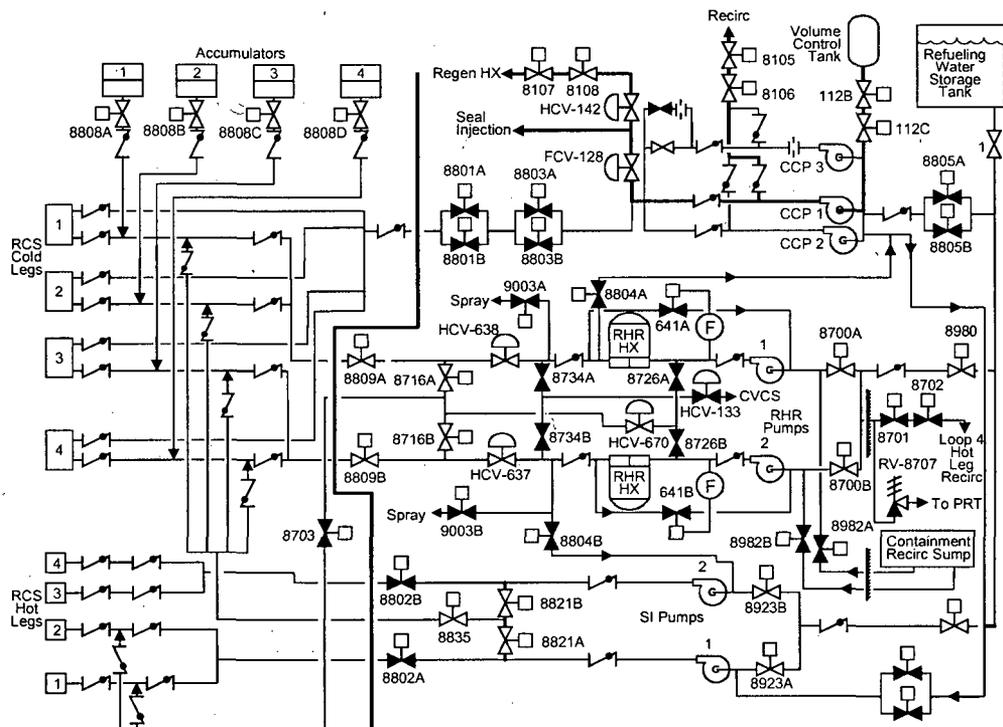
Unit 1 was in Mode 1 (Power Operation) at approximately 100 percent reactor power at nominal full power operating temperature and pressure.

II. Description of Problem

A. Background

The Diablo Canyon Power Plants (DCPP) Units 1 and 2 are Pressurized Water Reactors (PWR) with four Reactor Coolant Loops (RCL)[AB] to circulate reactor coolant to each of the four steam generators (SG)[SG].

The Emergency Core Cooling System (ECCS)[BQ] is depicted below.



Emergency Core Cooling System (ECCS) Flow Paths

The ECCS is designed to cool the reactor core as well as provide additional reactor shutdown capability by injection of borated water following initiation of accident conditions for:

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TEXT

1. A pipe break or spurious valve lifting in the Reactor Coolant System (RCS) that causes a discharge larger than that which can be made up by the normal makeup system, up to and including the circumferential rupture of the largest pipe in the RCS.
2. Rupture of a control rod drive mechanism (CRDM) causing a rod cluster control assembly (RCCA) ejection accident.
3. A pipe break or spurious valve lifting in the steam system, up to and including the instantaneous circumferential rupture of the largest pipe in the steam system.
4. A steam generator tube rupture.

The residual heat removal (RHR)[BP] function, including the long term recirculation from the containment sump, was not adversely affected by this condition. Also, containment spray [BE], high head [BQ] and intermediate head [BP] safety injection from the refueling water storage tank (RWST) was not adversely affected by this condition.

However, in the event of a Loss of Coolant Accident, (LOCA) this condition would have prevented RHR flow from reaching containment spray, high head and intermediate head safety injection pumps following realignment to long term recirculation from the containment sump without additional operator action. The realignment to the long term recirculation is required to provide continued core cooling after the RWST is exhausted.

To accomplish this licensed plant operators at the remote manual control switches in the control room perform the flow path realignment in accordance with the Emergency Operating Procedures (EOP) as described in Final Safety Analysis Report (FSAR) Update, Section 6.3.1.4.4.2, "Changeover from Injection Mode to Recirculation After Loss of Primary Coolant," and Table 6.3-5, "Safety Injection to Recirculation Mode: Sequence and Timing of Manual Changeover." Technical Specification 3.5.2, "ECCS – Operating," Bases states, in part:

"During the recirculation phase of LOCA recovery, RHR pump suction is transferred to the containment recirculation sump. The RHR pumps then supply the other ECCS pumps. Initially, recirculation discharge is through the same paths as the injection phase to the cold legs. Subsequently, recirculation provides injection to both the hot and cold legs." And "The ECCS suction is manually transferred to the

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TEXT

containment recirculation sump to place the system in the recirculation mode of operation to supply its flow to the RCS hot and cold legs. During the recirculation operation, the RHR pumps provide suction to the charging and SI pumps.”

The containment recirculation sump suction valves 8982A and 8982B, utilize a geared limit switch that has multiple rotors, contacts, and gear boxes. Those rotors are driven directly by gearing that drives the valve stem, and can be set to operate independently at any specific number of turns of the actuator gear train. The specific number of turns corresponds to a specific valve position. The limit switch contacts, which are actuated by the rotors, can be electrically connected to other valves so that the valves can be opened and closed depending on the specific position of the rotors.

The open limit function for SI-2-8982A and SI-2-8982B is controlled by Rotor 1. The interlock function for SI-2-8804A, SI-2-8804B, CS-2-9003A and CS-2-9003B is controlled by Rotor 3 in the 8982A and B limit switch. For proper function of the interlock with 8804A and B and 9003A and B, Rotor 3 must be set to actuate with or before Rotor 1.

Maintenance Procedure (MP) E-53.10V1 allows switch adjustments without specifying rotor coordination because it relies on the skill of the craft to perform switch adjustment and rotor coordination. That was the result of a legacy issue from Revision 0 of MP E-53.10V1. MP E-53.10V1 and its predecessors had always contained this potential deficiency.

B. Event Description

During July 2005 DCPD received INPO Operating Event, OE20893 (Catawba small break LOCA), for evaluation. DCPD Engineering Calculation STA-220 determined that the resulting Δp for SI-2-8982A and B could be much greater than specified in the original design. Therefore, Action Request (AR) A0643107, "Evaluate OE20893, Possible Concerns with Delta-P in SBLOCA", was entered into the DCPD CAP.

On November 22, 2005, a preliminary Engineering Calculation V-07 for a revised gear train identified a stroke time of 24.3 seconds that increased the valve Δp design margin to 20 percent. The increased stroke time reduced design margin but remained within the 25 second limit. The 24.3 second stroke time met the design requirement of 35 seconds and was therefore considered an acceptable modification.

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The valves were modified on Unit 2 in refueling outage 2R14 during February 2006. The modified valves were found to take greater than 25 seconds to stroke. The valve stroke length was subsequently adjusted to assure the 25 second stroke requirement was met. Adjustment of valve position switches was not performed following adjustment of the stroke length, leaving the system configured such that the permissive interlocks to stroke valves SI-2-8804A, SI-2-8804B, CS-2-9003A and CS-2-9003B would not function. No testing of the interlock functions was performed following the stroke length adjustment. As a result, operators had no ability to operate these valves from the control room between 2R14 and 2R15.

The same problem did not occur during modification in refueling outage 1R15 because the unit 1 valve position switches were adjusted following stroke length adjustment.

On February 8, 2006, AR A0659468, "Evaluate V-7B Test Optimization to Reduce Draindown Window," was initiated. This September 13, 2006, entry states, in part:

"PEP V-7B will now perform the RHR valve interlocks. This test will be sectionalized to allow partial interlock testing. This provides flexibility in this procedure in that the whole test need not be performed, this will help reduce the outage hours."

On July 26, 2006, the Safety Injection (SI) System Engineer requested a design change for new gear ratio in SI-2-8982A and B. AR A0674066, "SI-2-8982A/B motor operated valve (MOV) gear change to improve design margin," was initiated.

On November 9, 2006, SI System Engineer requested a design change for a new gear ratio in SI-1-8982A/B (same actuator design). AR A0682070, "SI-1-8982A/B MOV gear change to improve design margin (Unit 1)," was entered into the DCPD corrective action program (CAP).

On April 19, 2007, Plant Engineering Procedure (PEP) V-7B, Revision 0 was issued and used in 1R14 (04/30/07 –05/29/07).

On August 20, 2007, AT MM A0702739 Revision A, "Design Change to improve design margin of SI-2-8982A/B (U2)," concluded that SI-2-8982A and B stroke time would be less than 25 seconds.

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TEXT

On August 23, 2007, AT MM AR A0702739 was approved for SI-2-8982A and B gear change anticipating less than 25 second stroke time.

On August 23, 2007, AT MM AR A0702739, Action Evaluation (AE) 15 specified Surveillance Test Procedure (STP) V-3L7 (Stroke Time Test) and Viper Static Test as the required Post Modification Test (PMT).

On August 30, 2007, the maintenance planner initiated a PMT request to the PMT Coordinator.

On September 19, 2007, Valve Sizing Calculation V-07 for SI-1/2-8982A and B was approved.

On October 16, 2007, AR A0702739, AE 17 specified a Design Verification Test (DVT) consisting of the STP V-3 valve timing test for SI-2-8982A and B.

On October 18, 2007, work orders (WOs) C0214725 and C0214751 were updated to identify PEP V-7B as a contingency PMT.

On November 29, 2007, AT MM AR A0707169, "Design Change to improve design margin of SI-1-8982A/B (U1)," was approved anticipating a less than 25 second valve stroke time.

On February 16, 2008, SI-2-8982A and B Viper PMT stroke time was found to be greater than 25 seconds (WOs C0214725 & C0214751).

On February 16, 2008, Engineering revised the open limit (Rotor 1) setting specification to eliminate travel beyond what is necessary to fully open seat port.

On February 16, 2008, MOV Engineer E-mail on 2R14 MOV Dayshift Turnover, which stated, in part, "... We do not have to do the STP V-7B interlock test..."

On February 16, 2008, AR A0674066, AE 06, "Documentation of new open limit setpoint basis," was taken to "COMPLT."

On February 17, 2008, SI-2-8982B open limit switch (Rotor 1) was reset using MP E-53.10V1 (C0214751-02). The As-left Viper test and Instrument and Controls Evaluation (ICE)-12 evaluation was noted as satisfactory (C0214751-03).

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TEXT

On February 18, 2008, SI-2-8982A open limit switch (Rotor 1) was reset using MP E-53.10V1 (C0214725-02). The As-left Viper test and ICE-12 evaluation was noted as satisfactory (SAT per C0214725-03).

On February 19, 2008, an E-mail from the MOV Subject Matter Expert (SME) to the Test Team MOV Engineering Team states that the interlock limit switches have not been adjusted for SI-2-8982A and B.

On February 21, 2008, the Engineering PMT Coordinator rejects PEP V-7B for SI-2-8982A and B (PMT module for C0214725 & C0214751). Therefore, SI-2-8982A and B were inadvertently returned to service with the interlocks disabled.

On March 6, 2008, operation of the interlock between the stem mounted position switch on SI-2-8982A and B and RHR Pumps 2-1 & 2-2 was verified satisfactory per STP P-RHR-ST.

On April 8, 2008, Unit 2 enters Mode 4 with 8982A and 8982B containment recirculation interlocks for 8804A, 8804B, 9003A and 9003B inoperable, a violation of TS 3.5.2, "ECCS – Operating."

On October 23, 2009, with Unit 2 in Mode 6 (Refueling) and the reactor core offloaded to the spent fuel pool, plant operators identified failures of containment sump recirculation valves to activate their open interlock.

On October 23, 2009, at 14:44 PDT licensed plant operators notified the NRC via the Emergency Notification System (ENS) of the condition in accordance with 10 CFR 50.72(b)(3)(ii)(B) as an unanalyzed condition.

C. Status of Inoperable Structures, Systems, or Components that Contributed to the Event

Containment sump recirculation valves 8982A and 8982B were degraded in that the valve open position interlock switches would not activate their open interlock, and thus would have prevented RHR flow from reaching the containment spray rings, high head and intermediate head safety injection pumps following alignment to long term recirculation from the containment sump without additional operator action from outside the control room.

D. Other Systems or Secondary Functions Affected

No additional safety systems were adversely affected by this event.

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TEXT

E. Method of Discovery

During scheduled surveillance testing performed during 2R15 the failure of the 8982A and 8982B interlocks was identified.

F. Operator Actions

Plant operators were informed of the discovery and the details of the surveillance test failure documented in the DCPD CAP.

G. Safety System Responses

None required.

III. Cause of the Problem

A. Immediate Cause

MP E-53.10V1, "MOV Diagnostic Testing with the Viper System," was used to set the stroke of valves 8982A and 8982B that did not contain adequate guidance regarding coordination of MOV limit switches.

No additional testing was performed, other than MP E-53.10V1.

B. Cause

1. A legacy issue from 1991 resulted in MP E-53.10V1, not including adequate guidance for rotor coordination if a limit switch is reset.
2. Maintenance Procedure MP E-53.10V1 and MP E-53.10S did not identify that performance of specific steps requires implementation of MMD M-000073-1. That resulted in MMD M-000073-1 not being properly implemented.
3. Engineering Calculation V-07 did not provide adequate precautions and limitations regarding the potential uncertainty in the final value when calculating stroke time. That resulted in the design change development group relying on the results of the calculation and not considering alternatives to meet the 25 seconds stroke time specified in the licensing basis.

C. Contributory Cause

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TEXT

1. Conversion of STP V-7B, "Test of Engineered Safeguards, Valve Interlocks and RHR Pump Trip from RWST Level Channels," to PEP V-7B, "Test of ECCS Valve Interlocks," facilitated an organizational decision to not perform V-7B in its entirety every outage in order to reduce critical path time and/or outage duration.

2. There was no rigorous method of evaluating, documenting, and communicating information regarding work performed that would be needed to make decisions about conditional PMT. Informal and incomplete communication between the MOV engineer and the PMT coordinator led to the rejection of PEP V-7B as a post maintenance test.

3. A legacy issue from 1998 in Calculation V-07, Appendix K, resulted in narrative information not being formatted for ready retrieval or use. That led to a human error by the Engineer having to remember the need to coordinate Rotor 3 with Rotor 1.

IV. Assessment of Safety Consequences

There were safety consequences as a result of this event.

The Unit 1 reactor was maintained in Mode 1, with TS-required equipment operable, as confirmed by a review of the successful surveillance testing performed during the Unit 1 fourteenth and fifteenth refueling outages.

Pacific Gas and Electric Company and the Nuclear Steam Supply System (NSSS) vendor, Westinghouse, performed a limited scope best estimate analysis of the effect of the described condition. From those analyses, it was determined that for a large break LOCA; no significant adverse affects occur as the RCS pressure decreases rapidly, the accumulators inject, and SI system operates to keep the core in a coolable geometry with the RHR pumps alone providing the required SI flow necessary. Therefore, with the availability of the RHR pumps and flow path throughout Cycle 15, there is reasonable assurance that there were no significant adverse consequences resulting from a postulated large break LOCA.

For the small break LOCA conditions a range of breaks were investigated that concluded for five (5) inch and smaller diameter piping breaks the containment spray pumps were not automatically actuated during the injection phase of the accident. Therefore, there is sufficient time from the RWST low level alarm and RHR pump trip point to effectively manually transfer the containment recirculation flow path to the reactor core, with greater than one hour of total time available for

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TEXT

remote manual and local manual valve operation. A review of the anticipated Unit 2 Cycle 15 radiological conditions at the local manual valve locations found no significant radiological "turn back" condition that would preclude successful operator actions.

Additionally, from the analysis, it was confirmed that for breaks larger than approximately five (5) inch diameter that the containment spray could be actuated, drawing the RWST inventory more quickly. However, the RCS pressure dropped significantly allowing the RHR alone to satisfy the long term recirculation cooling.

Therefore, this event did not adversely affect the health and safety of the public.

PG&E considers this event a Safety System Functional Failure (SSFF). Since it does not result in crossing an NRC PI threshold DCPD will include it with the next routine quarterly PI data submittal.

V. Corrective Actions

A. Immediate Corrective Actions

1. Engineering confirmed that appropriate testing was performed for all ECCS interlocks prior to Mode 4 entry for Unit 2 following 2R15.
2. Engineering confirmed that appropriate tests were performed for all ECCS interlocks for the Unit 1 fifteenth refueling outage.
3. An operations summary of the event was published and given to all crews. Included in the summary was a discussion of the importance of knowing the locations of valves identified in the EOPs that might be required to be manually operated and the actuation of MOVs using the contactors at the Motor Control Centers (MCC).

B. Corrective Actions to Prevent Recurrence (CAPR)

1. MP E-53.10V1 has been revised (11/12/09) to include guidance for limit switch setting and rotor coordination.
2. Revise MOV maintenance procedures to identify that performance of specific steps requires implementation of MMD M-000073-1.
3. Revise Calculation V-07 to specify limitations for the use of stroke time calculation in design applications.

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TEXT

C. Administrative Actions

1. Revise PEP V-7B to:
 - Have a full performance of the test of every refueling outage,
 - Include in the "Discussion" section a statement that the test is not only performed as PMT but also as a test to verify the design function of the interlocks even when no maintenance was performed on the specific tested components.
 - Reference this event and order 60020753, and
 - Reference AR A0551483, "Evaluate Deferral of STP V-7B Scope."

2. Revise AD8.DC58, "Outage Scope Control," and AD8.DC60, "Outage Schedule Preparation," to require that deletions of non-TS driven STPs or PEPs that have been routinely performed during multiple outages be collectively evaluated and reviewed by Engineering, Maintenance, Operations, and Outage Management; and the basis documented prior to deletion from an outage schedule.

3. Revise AD13.ID4, "Post Maintenance Testing," to require that any proposed PMT changes due to work scope change be documented in SAP, evaluated and independently reviewed by individuals with adequate technical knowledge, and approved by a supervisor or higher prior to the PMT being rejected.

4. Revise AD13.ID4 to include PEP V-7B as PMT for ECCS interlock MOVs.

5. Revise Engineering Calculation V-07, Appendix K, to include, specific reference to rotor coordination and to make narrative information easily usable.

VI. Additional Information

A. Failed Components

None, this condition involved individual switch settings that were capable of functioning but were not properly coordinated to ensure operability.

B. Previous Similar Events

None were identified at DCPD.

C. Industry Reports

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TEXT

390-061026-1, "Licensee Event Report 390-06009 – Containment Spray Valve Interlock," reported an industry condition similar to this event. The Watts Bar event was similar in that a mis-coordinated rotor resulted in a required function being inoperable. In the Watts Bar event, the function was containment spray during recirculation. The corrective actions at Watts Bar are similar to those taken for this event.

PG&E was not previously aware of this industry event was not previously identified because Watts Bar, INPO and NRC did not publish an operating experience report (e.g. OE, SEN, IN) regarding the issue.