LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Palo Verde Unit 1	0 5 0 0 0 5 2 8	1 OF 0 8

TITLE (4)

Misalignment of Limitorque Torque Switch Contact Bar Prevented Remote Operation of MOVs

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBERS
0 4	0 9	9 3	9 4	- 0 1 0	- 0 1	0 6	2 8	9 5	Palo Verde Unit 2	0 5 0 0 0 5 2 9
									Palo Verde Unit 3	0 5 0 0 0 5 3 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL(10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Burton A. Grabo, Section Leader, Nuclear Regulatory Affairs	AREA CODE 6 0 2 3 9 3 - 6 4 9 2

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	B P	2 0	L 2 0 0	Y					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-space typewritten lines) (16)

At approximately 1900 MST on April 9, 1993, Palo Verde Unit 2 was DEFUELED, when it was identified by Valve Services personnel that the close torque switch contact bar for Shutdown Cooling suction isolation valve 2JSIAUV0655, was misaligned. The evaluation at the time determined the misalignment of the close torque switch contact bar to be an isolated incident.

Similar events happened on January 27, 1994 (Unit 1), and June 7, 1994 (Unit 3). Based upon further evaluation, the above events were determined to have a common-mode failure. On January 10, 1995, the above events were determined to be reportable per 10CFR 50.73.

There have been no previously similar events reported pursuant to 10CFR 50.73.

The purpose of this supplement is solely for the inclusion of the appropriate EIIS codes and the correction of minor typographical errors.

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TEXT

1. REPORTING REQUIREMENT:

This LER 528/529/530/94-010 is being written to report events that resulted in a condition prohibited by the plant's Technical Specifications (TS) as specified in 10 CFR 50.73(a)(2)(i)(B). Also, these events identified a condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to: (B) Remove residual heat, and (D) Mitigate the consequences of an accident as specified in 10 CFR 50.73(a)(2)(v).

Specifically, at approximately 1900 MST on April 9, 1993, APS Valve Services personnel (utility, nonlicensed) identified that during the performance of a preventive maintenance (PM) task for Train A Shutdown Cooling (SDC)(BP) suction isolation valve (ISV) 2JSIAUV0655, the close torque switch contact bar (CNTR) was found to be misaligned.

On January 27, 1994, at approximately 0500 MST, it was identified by Operations personnel, that Unit 1 Train A Containment Spray (BE) valve (ISV) 1JSIAUV0672 would not close after being opened for Surveillance Testing (ST). Troubleshooting of the valve identified that the contact bar was found to be on its side between the contact spring and bracket at a 90 degree angle. No indication of degradation to the torque switch other than the flipped contact bar was identified.

On June 6, 1994, Unit 3 Operations was performing procedure 43OP-3SI02 "Recovery from Shutdown Cooling to Normal Operating Lineup". During performance of step 4.3.4.3, Train A Shutdown Cooling suction isolation valve 3JSIAUV0655 was given a closing signal by the control room hand switch in an effort to lineup Safety Injection (SI) (BP)(BQ) Train A for power operation. The valve stroked partially closed and then stopped. Troubleshooting of the valve identified that the contact bar was found to be on its side between the contact spring and bracket at a 90 degree angle. No visible signs of damage or degradation were noted other than the spread retaining bracket.

Upon further investigation and evaluating the above events as a whole, a common-mode failure existed. Also, on June 6, 1994, Unit 3 changed from Mode 5 (COLD SHUTDOWN) to Mode 4 (HOT SHUTDOWN) with valve 3JSIAUV0655 inoperable as determined by post event analysis. This condition is in violation of TS 3.0.4.

2. EVENT DESCRIPTION:

On April 9, 1993, Unit 2 was DEFUELED, when it was identified by Valve Services personnel that the close torque switch contact bar for valve 2JSIAUV0655 was misaligned.

The functional requirement of 2JSIAUV0655 is to provide containment isolation in Modes 1-4 (POWER OPERATION - HOT SHUTDOWN) and tertiary isolation between the Reactor Coolant System (RCS) (AB) and Shutdown Cooling suction line during Modes 1-3 (HOT STANDBY). During power operation, the valve is normally closed (passive) and must remain in its closed position for these functions.

As part of the evaluation, queries of the national Nuclear Plant Reliability Data System (NPRDS) and Palo Verde's Failure Data Trending were performed. Neither of the two queries produced any evidence that the problem had occurred before at PVNGS or nationwide. Also, Limitorque Corporation had no prior knowledge of the problem occurring before with any other Limitorque torque switch.

The investigation concluded that the misalignment of the close torque switch contact bar was an isolated incident. Because the problem has never before been encountered, and since the condition could not be duplicated during testing. The apparent cause of the misalignment of the close torque switch contact bar was its impact against the close torque switch contact posts during unseating.

On January 27, 1994, Unit 1 was in Mode 1 (POWER OPERATIONS) at approximately 85 percent power, when it was identified by Operations personnel, that 1JSIAUV0672 would not close after being opened for Surveillance Testing (ST). Troubleshooting of the valve identified that the contact bar was found to be on its side between the contact spring and bracket at a 90 degree angle. No indication of degradation to the torque switch other than the flipped contact bar was identified.

The functional requirement of 1JSIAUV0672 is to provide Train A containment spray header isolation during power operation and shutdown cooling. The valve is normally closed (passive) and must remain in its closed position for these functions. The valve must open on receipt of a containment spray actuation signal (CSAS)(BE)(JE) and must close on control room demand to terminate containment spray.

TEXT

Procedure 36ST-9SA01, "ESFAS Train A Subgroup Relay Monthly Functional Test", has been performed seven times during the course of the year prior to the motor operated valve's (MOV) (20) latest static diagnostic test.

Because this valve is required to be left in the closed position following completion of this relay tests, and the closing valve stroke is controlled remotely via control room handswitch, it can be concluded that the close torque switch contact bar must have flipped on its side during the opening stroke just prior to the closing stroke on January 27, 1994. If it had done so during any relay test prior to January 27, 1994, the valve would not have been able to close. Thus, MOV 1JSIAUV0672 was fully operational prior to the relay test during which the failure occurred.

On June 6, 1994, Unit 3 Operations was performing procedure 43OP-3SI02 "Recovery from Shutdown Cooling to Normal Operating Lineup." During performance of step 4.3.4.3, valve 3JSIAUV0655 was given a closing signal by the control room hand switch in an effort to lineup Safety Injection (SI) Train A for power operation. The valve stroked partially closed and then stopped. Troubleshooting of the valve identified that the contact bar was found to be on its side between the contact spring and bracket at a 90 degree angle. No visible signs of damage or degradation were noted other than the spread retaining bracket.

The functional requirement of 3JSIAUV0655 is to provide Train A containment isolation in Modes 1-4 and tertiary isolation between the RCS and Shutdown Cooling suction line during Modes 1-3. During power operation, the valve is normally closed (passive) and must remain in its closed position for these functions.

Because the torque switch failure occurs during unseating of the valve, the torque switch failure happened during the last open stroke prior to the failure discovery. The last open stroke prior to the failure discovery must have occurred when 3JSIAUV0655 was cycled open to lineup Train A SDC for service because 3JSIAUV0655 cannot be cycled with Train A SDC in service.

It is therefore, determined that 3JSIAUV0655 was not capable of remote manual closure from the time at which the valve was opened to place Train A SDC in service to the time that the failure was discovered and corrected. Therefore, 3JSIAUV0655 was inoperable from May 31, 1994 (last time Train A SDC was placed in service), to June 6, 1994 (the discovery date).

TEXT

Unit 3 entered Mode 4 at 2036 MST on June 6, 1994. The valve was discovered inoperable at 2253 MST and Limiting Condition of Operations (LCO) 3.6.3 Action b was met at 0118 MST on June 7, 1994. The Operations staff was timely in complying with TS, however, according to the above evaluation 3JSIAUV0655 was inoperable prior to going into Mode 4. Therefore, TS 3.0.4 was not satisfied unbeknown to the Unit 3 Operations staff.

3. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATION OF THIS EVENT:

An Equipment Root Cause of Failure Analysis (ERCFA) was performed on 1JSIAUV0672 and 3JSIAUV0655. As part of this evaluation test data on the torque switch springs from 1JSIAUV0672 and 3JSIAUV0655 were compared to the springs removed from 2JAFBUV0035 and new springs from the warehouse. The springs from 1JSIAUV0672 and 3JSIAUV0655 were determined not to be in a degraded or out of design condition. Further, it is reasonable to assume that the same springs are present in other PVNGS MOVs and may be susceptible to the same failure.

A Probabilistic Risk Assessment (PRA) was performed to determine if a known deficient condition has a significant impact on the reliability of certain motor operated gate valves (MOVs). This study calculated the fail to close (FTC) probability for all MOVs susceptible to this condition in addition to a smaller grouping of MOVs whose static diagnostic displacement measuring transducer (DMT)(TD) signature may indicate a higher susceptibility to this type of failure.

Of the 52 valves identified only 2 are currently credited in the PVNGS PRA for any type of FTC function. Valves that are included in the PRA are 1) SIA/BHV0699/698 (High Pressure Safety Injection cold leg injection isolation valves)(BQ) and 2) CHA/BHV0531/530 (Refueling Water Tank (RWT) to SI isolation valves)(BP/BQ). SIA/BHV0699/698 are credited in the PRA to reduce the HPSI flow via the cold legs to allow for HPSI flow via the hot legs (hot leg injection) within 2-3 hours following a Loss of Coolant Accident (LOCA). CHA/BHV0531/530 are credited to isolate the RWT post LOCA once a RWT(BQ) low level is reached and containment recirculation occurs.

There are a number of additional valves however, that due to operational concerns or due to postulated events which may require a need for valve closure. The calculated FTC probabilities from industry data, which range from 1.08 E-03 to 1.91 E-02, for all susceptible MOVs with a weighted average value of 7.69 E-03.

TEXT

The calculated FTC probabilities for PVNGS specific failures (flipped torque switch bar) range from 1.71 E-04 to 5.41 E-04, with the 1.71 E-04 value representing all susceptible MOVs and 5.41 E-04 representing MOVs whose static diagnostic DMT signatures indicate a potentially higher susceptibility.

The results indicate that the failures associated with the failed torque switches are bounded and represent a small increase (FTC mean demand rate value) to the total MOV estimated failure probabilities. However, the study recommended that corrective action for SGA/BUV0134/138 (AB)(ISV) not be deferred until the next unit outage since the calculated FTC probability shows an additional 50 percent increase in that valve's FTC probability along with the valve's safety related function to close on a steam line break. Corrective action to replace the torque switch contact bar springs on select MOVs may be prudent from an operational or deterministic standpoint, however, based upon examining the FTC demand failure probability, justification exists from a probabilistic standpoint to defer corrective action until the next refueling outage.

This event did not result in any challenges to the fission product barriers or result in any releases of radioactive materials. Therefore, there were no adverse safety consequences or implications as a result of this event. This event did not adversely affect the safe operation of the plant or the health and safety of the public.

4. CAUSE OF THE EVENT:

An evaluation for each event was performed in accordance with the APS Incident Investigation Program. The evaluation for the second and third events determined that the root cause of the torque switch contact flipping on its side is attributed to a combination of torque loads experienced by the operator during the unseating of the valve disk, the resiliency of the spring pack dampening those loads, and the sudden release of those loads as the disk unseats. During unseating, the torque switch relaxes towards the open direction from its closed rotation and remains in its relaxed state until the valve stem starts to pull on the disk.

Once the stem starts to pull on the disk, the torque switch rotates in the open direction until the disk breaks its static friction with the valve seat and starts to move in the open direction.

TEXT

At the instant that the disk breaks its static friction with the guides, the open torque switch contacts snap closed and the shock from this action rapidly rotates open the closing contacts which then snap back closed. It is possible that the rotational acceleration of the close torque switch contact block assembly from this rapid oscillatory action caused the torque switch contact bar to become misaligned (SALP Cause Code B Design, Manufacturing or Installation Error). As a result of this misalignment, continuity is broken across the close torque switch contact posts and the surface of the contact bar, therefore, the valve cannot be cycled closed.

5. STRUCTURES, SYSTEMS, OR COMPONENTS INFORMATION:

MOV 1JSIAUV0672 is comprised of a Limitorque SB-0 actuator mounted on an eight inch Borg Warner flex wedge gate valve. The actuator and the valve are oriented vertically to the piping through which flow is controlled. The MOV is driven by a 25 FT-LB, 3400 RPM AC motor.

MOVs 2JSIAUV0655 and 3JSIAUV0655 are comprised of a Limitorque SMB-1 actuator mounted on a Borg Warner flex wedge gate valve. The actuator and the valve are oriented horizontally to the piping through which flow is controlled. The MOVs are driven by a 40 FT-LB, 1800 RPM AC motor.

6. CORRECTIVE ACTIONS TO PREVENT RECURRENCE:

As part of the evaluation for the torque switch failures, an evaluation of all flex wedge gate valves and SB type MOVs was performed and identified valves that were susceptible to this type of failure. To prevent reccurrence of the torque switch failure, the contact bar compression springs will be replaced in all of the identified valves. These replacements are to be done no later than their next scheduled maintenance.

To date all of the contact bar compression springs for valves identified in Unit 3 have been replaced. The majority of valves identified for Units 1 and 2 will be replaced in their up coming refueling outages (April and February, 1995, respectively). These actions are being tracked under the APS Commitment Action Tracking System.

TEXT

7. PREVIOUS SIMILAR EVENTS:

There have been no similar events to this type of failure reported pursuant to 10CFR50.73 where misalignment of the torque switch contact bar have affected MOV operability in the past three years. LER 1-93-010 was submitted on January 26, 1994, however, this LER dealt with performance criteria established in Generic Letter 89-10.