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 1 6

TITLE (4) Inoperable Motor-operated Valves in Multiple Systems due to Various Deficiencies Found During Generic Letter 89-10 Testing

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 NUMBER(S)
1 1	0 5	9 3	9 3	0 1 0	0 1	0 1	2 6	9 4	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): 5

POWER LEVEL (10): 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

	20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
	20.405(a)(1)(i)		50.36(c)(1)		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 (AREA CODE)
Burton A. Grabo, Supervisor, Nuclear Regulatory Affairs	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

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 fifteen single-space typewritten lines) (16)

On November 5, 1993, at approximately 1200 MST, Palo Verde Unit 1 was in Mode 5 (COLD SHUTDOWN), Palo Verde Unit 2 was in Mode 1 (POWER OPERATION) operating at approximately 85 percent power, and Palo Verde Unit 3 was in Mode 3 (HOT STANDBY) at normal operating temperature and pressure when, following data analysis of testing performed in accordance with the recommendations of Generic Letter (GL) 89-10, "Safety Related Motor-Operated Valve Testing and Surveillance," APS Engineering personnel determined that, in the past, the capability of a number of motor-operated valves (MOVs) to perform their intended safety function under design basis conditions was questionable. Therefore, the MOVs and/or their associated safety systems may have been inoperable at certain times in the past and applicable Technical Specifications Limiting Condition for Operation ACTION statements may not have been met. The MOVs did not meet the new performance criteria established in accordance with GL 89-10 recommendations (i.e., the as-found MOV switch settings were non-conservative compared to those established by the PVNGS MOV Program). The MOVs had been set up and tested under pre-existing testing programs. Following identification of the MOV deficiencies, the MOV switch settings were adjusted and verified to be in full compliance with the provisions of the current PVNGS MOV Program prior to return to service.

There have been no previous similar events reported pursuant to 10CFR50.73.

[NOTE: The entire LER has been revised.]

TEXT

I. DESCRIPTION OF WHAT OCCURRED:

A. Initial Conditions:

At 1200 MST on November 5, 1993, Palo Verde Unit 1 was in Mode 5 (COLD SHUTDOWN) during its fourth refueling outage with the Reactor Coolant System (RCS) (AB) at approximately 97 degrees Fahrenheit and at atmospheric pressure, Palo Verde Unit 2 was in Mode 1 (POWER OPERATION) operating at approximately 85 percent power, and Palo Verde Unit 3 was in Mode 3 (HOT STANDBY) at normal operating temperature and pressure following a manual reactor (AC) trip which occurred on November 3, 1993 (LER 530/93-004).

B. Reportable Event Description (Including Dates and Approximate Times of Major Occurrences):

Event Classification: Actual and potential conditions prohibited by the plant's Technical Specifications (TS).

On November 5, 1993, at approximately 1200 MST, following data analysis of testing performed in accordance with the recommendations of Generic Letter (GL) 89-10, "Safety Related Motor-Operated Valve Testing and Surveillance," APS Engineering personnel determined that, in the past, the capability of a number of motor-operated valves (MOVs) to perform their intended safety function under design basis conditions was questionable. Therefore, the MOVs and/or their associated safety systems may have been inoperable at certain times in the past and applicable TS Limiting Condition for Operation (LCO) ACTION statements may not have been met. The MOVs did not meet the new performance criteria established in accordance with GL 89-10 recommendations (i.e., the as-found MOV switch settings were non-conservative compared to those established by the PVNGS MOV Program). The MOVs had been set up and tested under pre-existing testing programs. Following identification of the MOV deficiencies, the MOV switch settings were adjusted and verified to be in full compliance with the provisions of the current PVNGS MOV Program prior to return to service.

When Palo Verde Units 1, 2, and 3 were originally designed and constructed, MOVs were selected for their torque and thrust capabilities and MOV switch setpoints were adjusted consistent with the manufacturer's recommendations to ensure the MOVs would operate as required. In 1985, the NRC issued Bulletin (IEB) 85-03, "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Setting," which requested licensees to include additional conservatism in the MOV switch

settings for safety-related Auxiliary Feedwater (BA) and High Pressure Safety Injection (HPSI) (BQ) MOVs. IEB 85-03 required the documentation of the MOVs' maximum differential pressures and the implementation of an MOV testing program to assure MOV operability. For these MOVs, new MOV switch setpoints were calculated and the MOV switch setpoint adjustments were performed.

The MOV program scope was expanded in 1989, when the NRC issued GL 89-10 requesting licensees to ensure that safety-related MOVs would perform their intended functions under design basis conditions. The PVNGS MOV Program to implement the GL 89-10 recommendations was to include plans and procedures to review and verify design parameters for each safety-related MOV, perform calculations to determine the MOV's torque/thrust requirements and switch settings, and to ensure that MOV switch setpoints for the safety-related MOVs were selected, set, and maintained properly. The MOV switch setpoint calculation program for thrust, torque, and actuator sizing was revised to incorporate the additional required conservatism. In response to GL 89-10 recommendations, PVNGS has been validating the design basis MOV operating conditions, determining the torque/thrust capabilities of the as-installed MOVs, recalculating the required switch setpoints, performing static baseline tests, and where practicable, performing tests under actual design basis flow and pressure conditions to verify operability.

Following an engineering design basis review and evaluation for each GL 89-10 program MOV, calculations were performed to establish switch setpoints. The switch setpoints are currently documented and maintained in an interim controlled motor operator data base (ICMODB). The ICMODB switch setpoints are recalculated as a result of ongoing diagnostic test data and MOV switch settings are adjusted accordingly.

Following diagnostic testing, an evaluation was performed to assess the as-found condition of the MOV. If the as-found MOV switch setting fell outside the ICMODB switch setpoint band, an initial engineering evaluation and operability determination was performed. The initial evaluation may have determined that the MOV may not have been capable of performing its intended safety function during a postulated design basis accident in the as-found condition. Because the ICMODB switch setpoints are interim and considered conservative, the initial evaluations for questionable MOVs were being tracked under the APS Commitment Action Tracking System for future operability review. Following identification of the MOV deficiencies, the MOV switch settings were adjusted and verified to be in full compliance with the provisions of the PVNGS MOV Program prior to return to service.

Following the completion of the GL 89-10 MOV dynamic testing, the MOV switch setpoint calculations could then be validated. If lower setpoint values resulted, the questionable MOVs would be re-evaluated and the evaluation may determine that the MOVs would have been capable of performing their intended safety functions in the initial as-found conditions. The intention was that a final operability review would be performed following the GL 89-10 MOV switch setpoint calculation validation.

During Phase 2, "Verification of Program Implementation" of the NRC inspections of PVNGS activities implementing the commitments to GL 89-10, performed during the period of October 18 through 22, 1993, the NRC inspector noted that APS had not submitted any LERs related to the GL 89-10 MOV testing program. In response to the NRC inspector's concern, APS committed to complete an operability review by November 5, 1993, of the as-found MOV switch settings which had been found to be outside of their associated switch setpoint bands.

Following data analysis of testing performed in accordance with GL 89-10 recommendations, APS Engineering personnel determined that, in the past, the capability of a number of MOVs to perform their intended safety function under design basis conditions was questionable. Therefore, the MOVs and/or their associated safety systems may have been inoperable at certain times in the past and applicable TS LCO ACTION statements may not have been met. The MOVs did not meet the new performance criteria established in accordance with GL 89-10 recommendations (i.e., the as-found MOV switch settings were non-conservative compared to those established by the PVNGS MOV Program). The purpose of this LER is to provide information (i.e, the specific valves, cause of inoperability, corrective actions, and safety significance) for MOVs that may not have been capable of performing their intended safety functions under design basis conditions. In all cases listed below, the cause of inoperability involved previous MOV switch settings not being within allowable switch setpoint bands. As corrective action, the appropriate MOV switch settings were adjusted to within allowable values.

<u>AUXILIARY FEEDWATER SYSTEM (AF):</u>

DEFICIENT MOV INFORMATION:
Train A Auxiliary Feedwater Regulating Globe MOV.
1JAFAHV0032, 1JAFCHV0033,
2JAFAHV0032, 2JAFCHV0033, and
3JAFAHV0032
Normally closed six-inch globe MOV designed to cycle open and close in response to an Auxiliary Feedwater Actuation Signal

(AFAS) (JE) to provide makeup to Steam Generator 1 (AB) and Steam Generator 2.

Engineering evaluation report (EER) 91-MO-154, EER 92-MO-015, EER 91-MO-152, and EER 91-MO-320 determined that 1JAFAHV0032, 1JAFCHV0033, 2JAFAHV0032, and 2JAFAHV0032 as-left close torque switch settings were high when compared with the ICMODB. The evaluations did not identify a problem with the MOVs' capability to open or close, and as-found diagnostic testing and signature analysis did not detect motor damage or motor stall when operated at the nominal voltage. However, the evaluations predicted that if the MOVs were stroked closed with the as-left close torque switch settings and with reduced voltage, the MOVs would have stalled, potentially resulting in motor burnout and subsequent loss of electrical opening and closing capability. The inoperability determinations were based on a motor stall capability evaluation that conservatively assumed minimum available voltage at the motor considering locked rotor current cable loss, elevated cable and motor temperature, and maximum cable length. Additionally, EER 92-MO-201 determined that the close torque switch setting of 3JAFAHV0032 was low when compared with the ICMODB and the MOV was not capable of completely closing under design basis conditions. Electrical opening and closing capability is considered a safety function for these MOVs.

Safety Significance: AFAHV0032 and AFCHV0033 are physically located outside of Containment (NH) in the Main Steam Support Structure (NM). These MOVs automatically open and close in response to an AFAS to provide makeup to Steam Generator 1 and Steam Generator 2. In the event of either or both MOV failures to electrically open, auxiliary feedwater would be provided by the redundant train. In the event of either or both MOV failures to electrically close completely, auxiliary feedwater would be interrupted by the redundant automatic closure of the downstream isolation gate MOVs, AFCUV0036 and AFAUV0037.

DEFICIENT MOV INFORMATION:
Turbine Driven Auxiliary Feedpump Trip and Throttle Globe MOV.
1JAFAHV0054 and 3JAFAHV0054
Normally latched open four-inch globe MOV designed to spring closed to prevent turbine overspeed and electrically open after an inadvertent pump trip.

EER 91-MO-154 determined that 1JAFAHV0054 as-left close torque switch setting was high when compared with the ICMODB. The evaluation did not identify a problem with the MOV's capability to open, and as-found diagnostic testing and signature analysis did not detect motor damage or motor stall when operated at the

nominal voltage. However, the evaluation predicted that if the MOV was stroked closed with the as-left close torque switch setting and with reduced voltage, the MOV would have stalled, potentially resulting in motor burnout and subsequent loss of electrical opening and closing capability. The inoperability determination was based on a motor stall capability evaluation that conservatively assumed minimum available voltage at the motor considering locked rotor current cable loss, elevated cable and motor temperature, and maximum cable length. Another evaluation (CRDR 320337) determined that 3JAFAHV0054 as-left open torque switch settings were low when compared with the ICMODB and the MOV may not have been capable of opening. For these MOVs, electrical opening capability is considered a safety function.

Safety Significance: AFAHV0054 is physically located outside of Containment in the Main Steam Support Structure. The MOV is normally latched open and is designed to spring closed to prevent turbine overspeed. The MOV does not automatically respond to any ESFAS (JE) signal and is designed to open under manual/electrical control from the Control Room following inadvertent closure. Since the closing safety function is accomplished with the stored energy of a spring and not the electric actuator, the MOV was operable in the close direction under design basis conditions. In the event of the MOV's failure to electrically reopen following inadvertent closure and subsequent loss of Train A Auxiliary Feedwater operability, auxiliary feedwater would be provided by the redundant train. Also, Train A Auxiliary Feedwater operability could be restored by manual operation of the MOV using the handwheel.

<u>CHEMICAL AND VOLUME CONTROL SYSTEM (CH) (CA/CB):</u>

DEFICIENT MOV INFORMATION:
Refueling Water Tank (RWT) (BQ) Outlet Isolation Gate MOV.
2JCHBHV0530
Normally open 20-inch gate MOV designed to close under manual control from the Control Room during a transfer to Containment sump recirculation flowpath.

EER 91-MO-152 determined that 2JCHBHV0530 as-left close torque switch settings were low when compared with the ICMODB and the MOV may not have been able to close under design basis conditions. For the MOV, closure is a safety function.

Safety Significance: CHBHV0530 is located outside of Containment. The MOV does not automatically respond to any ESFAS signal. The MOV is designed to close upon demand following a Recirculation Actuation Signal (RAS) (JE) and/or to close for hot leg makeup

during a loss of shutdown cooling (BP) reduced inventory scenario. Closure is required to prevent backflow from a pressurized Containment sump into the RWT. In the event of the MOV's failure to electrically close, isolation would be accomplished automatically by the in-line safety related check valve CHBV305 and/or by manual operation of the MOV using the handwheel.

CONDENSATE TRANSFER SYSTEM (CT) (KA):

DEFICIENT MOV INFORMATION:
Condensate Storage Tank (CST) (KA) Isolation Butterfly MOV.
2JCTAHV001
Normally closed ten-inch butterfly MOV designed to close under manual control from the Control Room to protect CST inventory when the essential auxiliary feedwater trains are activated, and also if pipebreak occurs downstream of the MOV in the non-class piping. The MOV does not automatically respond to any ESFAS signal.

EER 91-MO-209 determined that 2JCTAHV001 would not have opened or closed completely under design basis conditions with the as-found torque switch settings. Although the butterfly valve is normally closed and is required to open on Control Room demand prior to initiating auxiliary feedwater flow using the non-safety auxiliary feedwater pump, valve opening is not a safety function. The safety function of the valve is to close in order to isolate the CST in the event of rupture of downstream non-seismic piping.

Safety Significance: CTAHV001 is physically located outside of Containment at the CST. CTAHV001 is designed to close under manual control from the Control Room to protect CST inventory when the essential auxiliary feedwater trains are activated, and also if pipebreak occurs downstream of the MOV in the non-class piping. The MOV does not automatically respond to any ESFAS signal. In the event of the MOV's failure to electrically close, the affected line would be isolated by actuation of the redundant train MOV, or manual operation of the MOV using the handwheel.

HYDROGEN PURGE SYSTEM (HP) (BB):

DEFICIENT MOV INFORMATION:
Containment Hydrogen Control System Isolation MOV.
2JHPBUV0004
Normally closed two-inch globe MOV designed to close automatically upon receipt of Containment Isolation Actuation Signal (CIAS) (JE).

EER 91-MO-152 determined that 2JHPBUV0004 as-left close torque switch settings were low when compared with the ICMODB and the MOV

may not have been able to close under design basis conditions. Closure of the MOV is a safety function in order to accomplish Containment isolation.

Safety Significance: HPBUV0004 is physically located outside of Containment. The MOV is normally closed and is opened post-Loss of Coolant Accident (LOCA) to establish a flowpath to the hydrogen recombiner (BB). If the MOV was open during normal power operation and was required to close during a plant transient in response to a CIAS, the as-left close torque switch setting may have prevented complete closure of the valve. The affected penetration is provided with component redundancy to accomplish Containment isolation, including a second automatic isolation MOV HPBUV0002 and downstream manual isolation valves, HPBV011 and HPBV006. In the event of the MOV's failure to completely close during a plant transient, the penetration would be isolated by the redundant automatic MOV and, if required, could be isolated by Control Room operator manual operation of the MOV or downstream isolation valves, all located outside of Containment.

NUCLEAR COOLING WATER SYSTEM (NCWS) (CC):

DEFICIENT MOV INFORMATION:
Nuclear Cooling Water Containment Isolation Butterfly MOV.
1JNCAUV0402, 2JNCAUV0402, and 3JNCAUV0402
Normally open ten-inch butterfly MOVs designed to close automatically upon receipt of a Containment Spray Actuation Signal (CSAS) (JE).

An evaluation (MNCR 91-NC-1003) determined that 1JNCAUV0402 was not capable of closing with the as-found torque switch settings when operated at design basis conditions because the measured closing torque at torque switch trip was less than the design basis calculation's minimum requirement. EER 93-MO-033 and EER 91-MO-007 determined that 2JNCAUV0402 and 3JNCAUV0402 would not have opened or closed under design basis conditions with the as-found torque switch settings. For all of these MOVs, closure is a safety function.

Safety Significance: NCAUV0402 is required to close automatically in response to CSAS to provide Containment isolation. The affected penetration is provided with component redundancy to accomplish Containment isolation, including a second automatic isolation MOV NCBUV0403 and a downstream manual isolation butterfly valve NCNHCV0489. In the event of the MOV's failure to completely close during a plant transient, the penetration would be isolated by the redundant automatic MOV and, if required, could be isolated by Control Room operator manual operation of the MOV

or downstream isolation valve, both located outside of Containment. Although the NCWS penetrates primary reactor Containment, the system is neither part of the reactor coolant pressure boundary nor connected directly to the Containment atmosphere. In addition, the NCWS is provided with a continuously operating radiation monitor which alarms in the Control Room on detection of high radiation.

NCAUV0402 is also required to close electrically in response to Control Room operator command for mitigation of the consequences of a reactor coolant pump high pressure seal cooler (HPSC) passive failure. The design basis requirement was identified during a separate evaluation performed in response to NRC Information Notice 89-54, "Potential Overpressurization of the Component Cooling Water System." The evaluation determined that the MOV in the as-found configuration was not sized to close and remain closed against the system pressures associated with HPSC failure. As a result, the safety significance of the MOV's inability to close completely when operated under this design basis requirement was addressed by a Justification for Continued Operation, "Potential for Small Break Loss of Coolant Accident Due to Tube Rupture in the Reactor Coolant Pump Seal Cooler," filed with the NRC on January 18, 1991.

STEAM GENERATOR SYSTEM (SG):

DEFICIENT MOV INFORMATION:
Turbine Driven Auxiliary Feedpump Steam Isolation Gate MOV.
1JSGAUV0134, 1JSGAUV0138,
2JSGAUV0134,
3JSGAUV0134, and 3JSGAUV0138
Normally closed six-inch gate MOV designed to open automatically in response to an AFAS to provide steam to the essential auxiliary feedwater pump turbine.

EER 91-MO-154 determined that 1JSGAUV0134 and 1JSGAUV0138 as-left close torque switch settings were high when compared with the ICMODB. The evaluation did not identify a problem with the MOVs' capability to open, and as-found diagnostic testing and signature analysis did not detect motor damage or motor stall when operated at the nominal voltage. However, the evaluation predicted that if the MOVs were stroked closed with the as-left close torque switch settings and with reduced voltage, the MOVs would have stalled, potentially resulting in motor burnout and subsequent loss of electrical opening and closing capability. The inoperability determinations were based on a motor stall capability evaluation that conservatively assumed minimum available voltage at the motor considering locked rotor current cable loss, elevated cable and

motor temperature, and maximum cable length. EER 92-MO-040, EER 92-MO-182, and EER 91-MO-031 determined that 1JSGAUV0138 and 3JSGAUV0138 as-found close torque switch settings were low when compared with the ICMODB and the MOVs may not have been able to close completely under design basis conditions. EER 92-MO-179 determined that 3JSGAUV0134 as-found open and close available thrust measurements were low compared with the ICMODB and the MOV may not have been able to open or close completely under design basis conditions. EER 91-MO-152 and EER 91-MO-271 determined that 2JSGAUV0134 as-left close torque switch settings were low when compared with the ICMODB and the MOV may not have been able to close completely under design basis conditions. Electrical opening and closing capabilities are considered safety functions for these MOVs.

Safety Significance: SGAUV0134 and SGAUV0138 are physically located outside of Containment in the Main Steam Support Structure. A safety function of the MOVs is to open automatically in response to AFAS to provide steam to the essential auxiliary feedwater pump turbine. A second safety function of the MOVs is to close to isolate a faulted steam generator. The closure function is accomplished manually from the Control Room in accordance with excessive steam demand emergency operating procedure requirements. In the event that SGAUV0134 failed to electrically close completely in response to Control Room actuation to isolate the faulted Steam Generator 1, the isolation would automatically be accomplished by the in-line safety related check valve SGEV043, and additionally by manual operation of the MOV using the handwheel. In the event that SGAUV0138 failed to electrically close completely in response to Control Room actuation to isolate the faulted Steam Generator 2, the isolation would automatically be accomplished by the in-line safety related check valve SGEV044, and additionally by manual operation of the MOV using the handwheel. In the event that either/both SGAUV0134 and SGAUV0138 failed to electrically open completely in response to AFAS, auxiliary feedwater would be automatically initiated by the redundant auxiliary feedwater train.

<u>SAFETY INJECTION SYSTEM (SI) (BP/BQ):</u>

DEFICIENT MOV INFORMATION:
HPSI Hot Leg Injection Isolation Gate MOV.
2JSIAHV0604
Normally closed three-inch gate MOV designed to be opened approximately one and one-half hours to three hours following a design basis event requiring safety injection flow.

TEXT

EER 91-MO-152 determined that 2JSIAHV0604 as-left open and close torque switch settings were low when compared with the ICMODB and the MOV may not have been able to open or close under design basis conditions. The safety function for the valve is to open under manual control from the Control Room to establish long term high pressure safety injection (HPSI) and/or emergency boration flow to the Reactor Coolant System hot leg(s). Valve closure is required upon completion of these evolutions, does not occur during flow, and is not considered a safety function.

Safety Significance: SIAHV0604 is physically located outside of Containment in the HPSI pump room and is required to be opened approximately one and one-half hours to three hours following a design basis event requiring safety injection flow. The MOV does not automatically respond to any ESFAS signal and is designed to open under manual control from the Control Room. In the event of the MOV's failure to electrically open, Hot Leg Injection could be established by either manual operation of the MOV using the handwheel, or use of the redundant HPSI train.

DEFICIENT MOV INFORMATION:
Safety Injection Tank (BP) Outlet Isolation Gate MOV.
3JSIAUV0644
Normally locked open 14-inch gate MOV in Modes 1 through 3, and in Mode 4 with pressurizer pressure more than 430 psia. The MOV is procedurally closed during shutdown when pressurizer pressure is below 430 psia and is designed to open automatically in the event of a LOCA upon receipt of a Safety Injection Actuation Signal (SIAS) (JE).

EER 91-MO-019 determined that 3JSIAUV0644 as-left close torque switch settings were high when compared with the ICMODB. The evaluation did not identify a problem with the MOV's capability to open, and as-found diagnostic testing and signature analysis did not detect motor damage or motor stall when operated at the nominal voltage. However, the evaluation predicted that if the MOV was stroked closed with the as-left close torque switch setting and with reduced voltage, the MOV would have stalled, potentially resulting in motor burnout and subsequent loss of electrical opening and closing capability. The inoperability determination was based on a motor stall capability evaluation that conservatively assumed minimum available voltage at the motor considering locked rotor current cable loss, elevated cable and motor temperature, and maximum cable length. For the MOV, electrical opening capability is considered a safety function.

Safety Significance: SIAUV0644 is physically located inside of Containment. In Modes 1 thru 3, and in Mode 4 with pressurizer

TEXT

pressure more than 430 psia, the MOV is locked open and is not required to change position to accomplish any safety function. When closed during Mode 4, the MOV is designed to open automatically in response to a SIAS. In the event of a LOCA during Mode 4 with the pressurizer (AB) pressure less than 430 psia and the MOV's failure to electrically open in response to a SIAS, safety injection to the affected Cold Leg would be accomplished by the HPSI and/or low pressure safety injection (LPSI) (BP) systems.

DEFICIENT MOV INFORMATION:
Shutdown Cooling Suction Isolation Gate MOV.
3JSIAUV0655
Normally closed twelve-inch gate MOV which is not designed to reposition automatically in response to any safety signal (JE).

EER 91-MO-030 determined that 3JSIAUV0655 as-found close torque switch setting was high when compared with the ICMODB. The evaluation did not identify a problem with the MOV's capability to open, and as-found diagnostic testing and signature analysis did not detect motor damage or motor stall when operated at the nominal voltage. However, the evaluation predicted that if the MOV was stroked closed with the as-found close torque switch setting and with reduced voltage, the MOV would have stalled, potentially resulting in motor burnout and loss of subsequent operability. The inoperability determination was based on a motor stall capability evaluation that conservatively assumed minimum available voltage at the motor considering locked rotor current cable loss, elevated cable and motor temperature conditions, and maximum cable length. The MOV is normally closed and does not automatically respond to any safety signal. Opening capability is a safety function for the MOV.

Safety Significance: SIAUV0655 is physically located outside of Containment. The MOV provides shutdown cooling suction isolation when shutdown cooling is not in service or when emergency borating using an inservice shutdown cooling train. The MOV is opened manually from the Control Room to establish system alignment required to initiate shutdown cooling. In the event of the MOV's failure to electrically open, shutdown cooling could be initiated by using the redundant train or by manual operation of the MOV using the handwheel.

DEFICIENT MOV INFORMATION:
Containment Spray Isolation Gate MOV.
1JSIAUV0672 and 2JSIAUV0672
Normally closed eight-inch gate MOV designed to open automatically upon receipt of a CSAS.

TEXT

EER 91-MO-152 determined that 2JSIAUV0672 as-left open torque switch settings were low when compared with the ICMODB and the MOV may not have been able to open completely under design basis conditions. EER 92-MO-024 determined that 1JSIAUV0672 as-found close torque switch setting was high when compared with the ICMODB. The evaluation did not identify a problem with the MOV's capability to open, and as-found diagnostic testing and signature analysis did not detect motor damage or motor stall when operated at the nominal voltage. However, the evaluation predicted that if the MOV was stroked closed with the as-found close torque switch setting and with reduced voltage, the MOV would have stalled, potentially resulting in motor burnout and loss of subsequent operability. The inoperability determination was based on a motor stall capability evaluation that conservatively assumed minimum available voltage at the motor considering locked rotor current cable loss, elevated cable and motor temperature conditions, and maximum cable length. The MOV is normally closed and designed to open automatically in response to a CSAS. Opening is a safety function for the MOV.

Safety Significance: SIAUV0672 is physically located outside of Containment. The MOV is normally closed and designed to open automatically in response to a CSAS. In the event of the MOV's failure to electrically open, Containment Spray would be initiated by actuation of the redundant train or manual operation of the MOV using the handwheel.

DEFICIENT MOV INFORMATION:
Containment Sump Suction Isolation Butterfly MOV.
1JSIAUV0674
Normally closed 24-inch butterfly MOV designed to automatically open in response to a RAS.

EER 92-MO-045 determined that 1JSIAUV0674 would not have opened under design basis conditions with the as-found torque switch and torque switch bypass (i.e., limit) settings. The butterfly valve is normally closed and remains closed to provide Containment isolation. Following a LOCA, when the water in the RWT reaches a predetermined low level, the sump RAS is automatically initiated and the MOV opens to establish the recirculation flowpath. The safety function of the MOV is to open.

Safety Significance: SIAUV0674 is physically located outside of Containment. The MOV remains closed to provide Containment isolation until a RAS at which time the valve opens to provide flow from the Containment sump. In the event of the MOV's failure to electrically open, the recirculation flowpath would be

established by automatic actuation of the redundant train, or manual operation of the MOV using the handwheel.

C. Status of structures, systems, or components that were inoperable at the start of the event that contributed to the event:

The MOVs which may have been inoperable at the start of the event which contributed to this event are discussed in Section I.B.

D. Cause of each component or system failure, if known:

The cause of each MOV deficiency is discussed in Section I.B.

E. Failure mode, mechanism, and effect of each failed component, if known:

The failure mode, mechanism, and effect of each MOV deficiency is discussed in Section 1.B.

F. For failures of components with multiple functions, list of systems or secondary functions that were also affected:

MOV deficiencies with multiple functions are discussed in Section I.B.

G. For a failure that rendered a train of a safety system inoperable, estimated time elapsed from the discovery of the failure until the train was returned to service:

MOV deficiencies which may have rendered a train of a safety system inoperable are discussed in Section I.B.

H. Method of discovery of each component or system failure or procedural error:

The MOV deficiencies were discovered during the implementation of the PVNGS MOV Program. There were no procedural errors which contributed to this event.

I. Cause of Event:

An evaluation of this event was conducted in accordance with the APS Incident Investigation Program. As part of the evaluation, a root cause of failure analysis of the GL 89-10 program MOVs was performed by APS Engineering personnel for each program MOV that was previously determined not to meet the performance criteria established in accordance with the GL 89-10 recommendations.

The MOVs had previously been configured to the generally accepted methodology and regulatory criteria existing at each stage of MOV switch setpoint evolution from initial construction, through IEB 85-03, and including the initial testing and setup in accordance with the GL 89-10 recommendations. Changes to the MOV switch setpoints occurred as new information from industry operating experience and further advances in MOV diagnostic equipment and technology resulted in more precise evaluations of the operating characteristics of MOVs. The MOVs met the acceptance criteria established by the plant's previous testing programs. The cause of this event has been determined to be the result of inadequate industry testing methodologies and non-conservative calculation assumptions used for MOVs installed in accordance with manufacturer specifications (SALP Cause Code B: Design, Manufacturing, Installation Error). No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event. There were no procedural or personnel errors which contributed to this event.

J. Safety System Response:

Not applicable - there were no safety system responses and none were necessary.

K. Failed Component Information:

A description of each MOV is discussed in Section I.B.

II. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

Engineering evaluations to assess the safety significance of each deficient MOV are discussed in Section I.B. The evaluations were performed to address the safety concerns that certain MOVs in their safety-related systems may not have been capable of performing their intended safety-related function under design basis conditions, and to provide the technical basis to conclude whether the identified MOV inoperability would have adversely affected safe plant operation during past cycles. The evaluations concluded that the potential inoperability of each of the deficient MOVs would have insignificant effects on the design basis analysis results had a postulated design basis accident occurred during the time period in which the specific MOV was inoperable. Therefore, there were no adverse safety consequences or implications as a result of this event. This event did not affect the safe operation of the plant or the health and safety of the public. The event did not result in any challenges to the fission product barriers or result in any releases of radioactive materials.

TEXT

III. CORRECTIVE ACTION:

A. Immediate:

The deficient MOV switch settings were adjusted and verified to be in full compliance with the provisions of the PVNGS MOV Program prior to return to service.

B. Action to Prevent Recurrence:

Planned testing of MOVs to meet GL 89-10 performance criteria is expected to continue for one more refueling outage per unit: 1R5 is scheduled for March 1995, 2R5 is scheduled for Spring 1995, and 3R4 is scheduled for March 1994. If additional significant PVNGS MOV program deficiencies are discovered, a supplement will be submitted within 60 days of completion of each outage.

During the implementation of GL 89-10 recommendations, MOV switch setpoint bands have been recalculated on several occasions as a result of new diagnostic test data and MOVs switch settings have been adjusted accordingly. As a result of multiple switch setpoint band changes in the ICMODB, some of the original as-found or as-left MOV switch settings would no longer meet the new performance criteria established by the most recent version of the ICMODB. In other words, MOV switch settings which were acceptable based on original versions of the ICMODB would not be acceptable based on the current version of the ICMODB or the final version of the setpoint bands established at the completion of the PVNGS MOV Program testing. APS recognizes that MOV deficiencies that may have occurred as a result of revising the ICMODB switch setpoint band have not been evaluated and may be reportable. However, a backend review of all original as-found or subsequent as-left MOV switch settings against the final version of the setpoint bands will not be performed. Significant resources are necessary to evaluate the effect of each revision of the ICMODB for operability. No further reportability evaluations for previous MOV settings are planned and the resources are being used to ensure that the MOV switch settings for the safety-related MOVs are selected, set, and maintained properly. To date, there are no MOVs that have been identified as incapable of performing their intended safety functions under design basis conditions.

IV. PREVIOUS SIMILAR EVENTS:

No other previous events have been reported pursuant to 10CFR50.73.