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SUBJECT: LER 90-002-01:on 900223,reactor trip w/pressurizer safety valve opening resulting from MSIS actuation.

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October 31, 1990

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Docket No. 50-362
Supplemental Report
Licensee Event Report No. 90-002, Revision 1
San Onofre Nuclear Generating Station, Unit 3

Reference: Letter, H. E. Morgan (SCE) to USNRC Document Control Desk, dated March 26, 1990

The referenced letter provided Licensee Event Report (LER) No. 90-002, (Revision 0), for an occurrence involving a reactor trip resulting from a spurious main steam isolation actuation. The enclosed supplemental LER provides additional information concerning the cause and corrective actions. Neither the health and safety of plant personnel or the public was affected by this occurrence.

If you require any additional information, please so advise.

Sincerely,

R. W. Krieger

Enclosure: LER No. 90-002, Rev. 1

cc: C. W. Caldwell (USNRC Senior Resident Inspector, Units 1, 2 and 3)
J. B. Martin (Regional Administrator, USNRC Region V)
Institute of Nuclear Power Operations (INPO)

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LICENSEE EVENT REPORT (LER)

Facility Name (1)	Docket Number (2)	Page (3)
SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 3	0 5 0 0 0 3 6 2	1 of 1 2

Title (4)
REACTOR TRIP WITH PRESSURIZER SAFETY VALVE OPENING RESULTING FROM SPURIOUS MAIN STEAM ISOLATION SYSTEM ACTUATION (MSIS) CAUSED BY DEGRADED ACTUATION PUSHBUTTON

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)
0 2	2 3	9 0	9 0	0 0 2	0 1	1 0	3 1	9 0	UNIT 2	0 5 0 0 0 3 6 1

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

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

___ 20.402(b)	___ 20.405(c)	X 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)
___ 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)	
R. W. Krieger, Station Manager	7 1 4	3 6 8 - 6 2 5 5

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
X	J B	H S	H 2 6 0	YES	X	I P	R L Y	N 0 9 6	NO
X	S B	X C V	B 0 4 0	YES					

SUPPLEMENTAL REPORT EXPECTED (14)

___ Yes (If yes, complete EXPECTED SUBMISSION DATE) XX NO

Expected Submission Date (15): Month ___ Day ___ Year ___

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

At 2257 on February 23, 1990, with Unit 3 at 100% power, during the performance of Main Steam Isolation System (MSIS) subgroup relay testing, a spurious MSIS actuation occurred. This MSIS actuation initiated closure of the main steam isolation valves (MSIVs) and resulted in a reactor trip on high pressurizer pressure. The plant transient included: 1) Lifting of the Main Steam Safety Valves (MSSVs); 2) initiation of the Emergency Feedwater Actuation System (EFAS); and 3) the brief opening of a pressurizer safety valve (PSV). However, during the transient, RCS pressure never exceeded the minimum PSV set point value allowed by Technical Specification (TS) 3.4.2. Operators stabilized the plant in Mode 3. Following this event, it was determined that the lift set points for the Units 2 and 3 PSVs were outside the TS requirements. There is no safety significance to this event since: 1) all reactor protection system, MSIS, and EFAS components were verified to actuate in accordance with design; and 2) the plant response with the as-found PSV lift set points was determined to be acceptable.

Contacts on the MSIS manual actuation pushbutton (PB) were found to be degraded such that one trip leg of MSIS did not reset during the subgroup relay testing. MSIS actuation occurred upon initiation of testing of the other trip leg. The PSV temperature profiles present during power operation were different than the profiles specified for setting the PSV lift set points at Wyle Labs. The cause of set point deviation is attributed to the use of a temperature profile during the calibration process which was different than that which exists during power operation.

Corrective actions included: 1) Replacement of the MSIS actuation PB; 2) examination/replacement of all Unit 3 MSIS actuation PBs; 3) enhancement of the MSIS subgroup relay testing procedure; 4) resetting of the Units 2 and 3 PSVs to within the TS required band; and, 5) performance of a Human Performance Enhancement System (HPES) evaluation. Similar PBs in Units 2 and 3 will be replaced by the end of the next refueling outage for each unit. Additionally, a design change to eliminate the need for the MSIS cycling subgroup relay is under consideration.

Plant: San Onofre Nuclear Generating Station
Unit: Three
Reactor Vendor: Combustion Engineering
Event Date: 02-23-90
Time: 2257

A. CONDITIONS AT TIME OF THE EVENT:

Mode: 1, 100% Power Operation

B. BACKGROUND INFORMATION:

1. Main Steam Isolation System (MSIS) Testing:

Subgroup relay testing of Main Steam Isolation System (MSIS) [JB] circuitry is required to be performed on a semi-annual basis in accordance with Technical Specification (TS) 4.3.2.1. MSIS testing is performed on each of two trip legs, one at a time.

An MSIS cycling-subgroup relay [RLY] in the selected trip leg and the components (valves and a pump in one trip leg) actuated by the trip leg are tested by depressing the associated MSIS manual actuation pushbutton switch (PB) [HS]. Depressing the PB opens switch contacts which de-energize the MSIS cycling-subgroup relay, causing associated relay contacts to open, resulting in actuating the components to their required conditions. The components are then verified to have actuated. Verification of component actuation also verifies proper operation of the MSIS cycling-subgroup relay. The trip leg is reset by releasing the PB. A red indicating light on the auxiliary cabinet above the PB is extinguished when the trip leg is actuated and re-illuminates when it is reset. Since both trip legs of one train are required to be actuated at the same time to initiate MSIS, testing one leg at a time should not result in MSIS actuation.

2. Atmospheric Dump Valves HV-8419 and HV-8421:

Each of two main steam [SB] lines contains an Atmospheric Dump Valve (ADV) [PCV] located upstream of the associated Main Steam Isolation Valve (MSIV) [ISV]. The ADVs can be utilized to provide an easily controlled path from the steam generators (SG) [AB,SG] to atmosphere following an event involving closure of the MSIVs to facilitate a controlled cooldown by releasing steam to the atmosphere when necessary.

3. Pressurizer Safety Valves

TS 3.4.2 specifies that in Modes 1-3, both Pressurizer Safety Valves (PSV) [RV] shall be operable with a lift set point of 2500 psia +/- 1%.

TS 3.3.3.6, "Accident Monitoring Instrumentation," Table 3.3-10, specifies that in Modes 1-3, that each PSV have operable position indication. This position indication is provided by acoustic monitors [IP] on each PSV.

C. DESCRIPTION OF THE EVENT:

1. Event:

At 2257 on February 23, 1990, with Unit 3 at 100% power, during the performance of MSIS subgroup relay testing, a spurious MSIS actuation occurred, causing closure of the MSIVs and a reactor trip upon reactor coolant system (RCS) pressure increasing to the core protection calculator (CPC) [JC] auxiliary trip set point of 2375 psia. The MSIS actuation occurred upon initiation of testing of the second trip leg of MSIS Train B (by depressing the manual actuation PB).

Following the trip, the increase in secondary plant pressure was limited by the lifting of the Main Steam Safety Valves (MSSVs); maximum secondary plant pressure during the transient was approximately 1170 psia. As expected, steam generator level "shrink" in response to the rapid power decrease resulted in an Emergency Feedwater Actuation System (EFAS) initiation to both SGs. Although maximum RCS pressure during the transient was below the minimum PSV lift set point value (2475 psia) specified by TS 3.4.2, one PSV opened briefly and then tightly reseated. For a further discussion of the opening of the PSV, refer to section G.4.a.

Operators promptly took action to open the Atmospheric Dump Valves (ADVs) and reduced pressure in the secondary plant to cause closure of the MSSVs. The plant was stabilized in Mode 3 using ADVs and four operating Reactor Coolant Pumps (RCPs) [AB,P]. For a further discussion of the ADV operation during the event, refer to section G.4.b.

2. Inoperable Structures, Systems or Components that Contributed to the Event:

None.

3. Sequence of Events:

TIME	ACTION
2250	Commenced MSIS Train B subgroup relay test.
2257	Spurious MSIS occurred. MSIVs closed, resulting in RCS pressure increase and reactor trip on CPC auxiliary trip. Operators opened ADVs to reduce secondary plant pressure.
2312	Plant stabilized in Mode 3 using ADVs and RCPs.

4. Method of Discovery:

Control room alarms and indications alerted the operators of the MSIS actuation and reactor trip.

5. Personnel Actions and Analysis of Actions:

Operator actions were proper and in accordance with applicable procedures. The control room operators (utility, licensed) immediately realized that the MSIS actuation was spurious by noting high SG pressure indications (MSIS automatically actuates on low SG pressure) and promptly opened the ADVs (plant computer records indicate that both valves were in the "not closed" position within 27 seconds after the trip) to reduce secondary plant pressure and cause the MSSVs to reseat. This action was proper and minimized the time that the MSSVs were open.

6. System Response:

All MSIS and EFAS components were verified to actuate in accordance with design.

The operation of the Steam Bypass Control System (SBCS) [SB], ADVs, and the PSV Acoustic Monitor and Tailpipe Temperature indication, is discussed in section G.4.

Channel 1 of EFAS-1 (EFAS for SG E-089) actuated approximately 2.4 seconds after the other 3 channels. This response was determined to be acceptable and was the result of a hydrodynamic phenomenon previously described in LERs 89-001 (Docket No. 50-362) and 87-004 (Docket No. 50-361).

D. CAUSE OF THE EVENT:

1. Immediate Cause:

The first MSIS trip leg did not reset following testing. Therefore, during testing of the second MSIS trip leg, a MSIS actuation occurred.

2. Root Cause:

The MSIS Train B manual actuation PB (in the first trip leg tested) was removed and evaluated by an independent laboratory. The contacts on the PB were determined to be in a degraded condition which caused intermittent and variable high resistance (50 to 75 ohms) connections in the switch contacts. One set of contacts in the non-sealed switch was found to have melt sites and contamination. These contact conditions provide the most likely cause of the above mentioned high resistance connection and thus, the most likely cause of the trip. It has been concluded that this high resistance PB switch connection prevented the first MSIS trip leg from resetting following the release of the PB.

In addition, the associated cycling-subgroup relay was evaluated by an independent testing laboratory and found to be satisfactory. Further, plant protection system (PPS) [JB] circuitry associated with the first MSIS trip leg was inspected for loose connections; none were identified which could have contributed to the event.

3. Contributing Cause:

The procedure which governs the performance of subgroup relay testing was inadequate in that it did not provide for verification (by indicating light status) that one trip leg is reset prior to initiating testing (i.e., introducing a trip condition) in the other trip leg.

E. CORRECTIVE ACTIONS:

1. Corrective Actions Taken:

a. The MSIS manual actuation PB was replaced with an in-kind part.

b. In order to determine the root cause of the MSIS, an extensive investigation was performed which included in part: 1) Testing of the MSIS manual actuation PB and the cycling-subgroup relay in the first trip leg by an independent testing laboratory as described above, 2) performing a review of applicable procedures and personnel actions, and 3) inspecting PPS circuitry.

c. The remaining Unit 3 MSIS actuation PBs were replaced with in-kind parts. The PBs which were removed were examined by an independent testing laboratory and found to also have contamination on the contacts, similar to what was observed on the MSIS Train B manual actuation PB. These MSIS actuation PBs had performed correctly prior to their removal.

d. The MSIS subgroup relay testing procedure has been enhanced to provide verification via the indicating light that one trip leg is reset prior to initiating testing in the other trip leg. This verifies that the actuation PB has functioned correctly and that the trip leg is reset.

e. A Human Performance Enhancement System (HPES) evaluation was performed. For a discussion of the results, refer to section G.4.f.

2. Planned Corrective Actions:

a. All the Unit 2 MSIS actuation PBs will be replaced at the next refueling outage with new in-kind parts.

b. All similar actuation PBs in both Units 2 and 3 will be replaced by the end of the next refueling outage for each unit.

c. A design change is under consideration which reconfigures the MSIS testing circuitry by eliminating the MSIS cycling-subgroup relay. This change allows testing of the MSIS circuitry at power without the possibility of a MSIS actuation similar to the one being reported herein.

F. SAFETY SIGNIFICANCE OF THE EVENT:

There is no safety significance to the MSIS actuation and reactor trip since all MSIS and EFAS components and the PPS actuated in accordance with design.

An evaluation was performed to determine the effect of the as-evaluated set points on the Unit 3 PSVs (at both 2427 psia and 2461 psia for 3PSV-0200 and 2544 psia for 3PSV-0201) on both the Loss Of Condenser Vacuum (LOCV) event and the Feedwater Line Break (FWLB) event analyzed in the UFSAR. (Refer to section G.4.a for a discussion of the PSV findings.) SCE has concluded that utilizing conservative FSAR assumptions, the PSV opening pressures indicated above would not have resulted in plant design basis parameters being exceeded during either the LOCV or the FWLB event. The LOCV and the LOCV plus a single failure are the limiting peak RCS pressure events for the Moderate Frequency and Infrequent events, respectively. Since it has been demonstrated that of the two events, the LOCV plus a single failure yields the highest peak RCS pressure, only this event was re-analyzed. The FWLB event was re-analyzed since it is the limiting peak RCS pressure event for the Limiting Fault events.

As discussed in the following section G.4.a, the Unit 2 PSV lift set points were checked and found to be 2533 and 2461 psia. Since the above described evaluation of the Unit 3 PSV set point pressures bounds the conditions found for the Unit 2 PSVs, there is no safety significance to the as-found set points of the Unit 2 PSVs being outside the range specified by TS 3.4.2.

G. ADDITIONAL INFORMATION:

1. Component Failure Information:

The MSIS manual actuation PB switch is manufactured by Micro Switch Division of Honeywell, part no. PK 8302 9.

The SBCS positioner [XCV] that failed is a model AP2 positioner manufactured by Bailey. (Refer to section G.4.c.)

The failed relay in the acoustic monitor annunciation circuitry is a class 101 relay manufactured by Magnecraft, P/N W101MIP-4, NEWARK # 23F5580. (Refer to section G.4.d.)

2. Previous LERs for Similar Events:

LER 86-022 (Docket No 50-361) describes a spurious MSIS actuation which occurred with Unit 2 at 100% power during the performance of PPS matrix relay testing. Although the event discussed above and the event reported by LER 86-022 both involve a failure of pushbutton switches, the switches are of a different design and function in the circuitry. Additionally, the portions of the MSIS circuitry being tested at the time of the spurious actuation were different. Thus, the corrective actions implemented could not have prevented recurrence.

3. Results of NPRDS Search:

A NPRDS search of the failed components found no similar failures.

4. Additional Information:

a. PSV Response:

1) Description of Findings:

Background

The lift set points for PSVs installed at San Onofre Units 2 and 3 are set at Wyle Laboratories using a standard temperature profile which had been provided by the valve vendor. Use of this temperature profile was intended to ensure repeatability for the installed valves during plant operation. The lift set point of a PSV is sensitive to temperature and temperature distribution in a complex manner which is not predictable from one valve to another. Typically, a lower valve bonnet temperature will tend to result in a higher lift set point. The PSV temperature profile (degrees F) is defined by temperatures taken at the inlet flange, bonnet flange, and upper bonnet of the valve.

Unit 3 Findings

The 3PSV-0200 lift set point was checked in Mode 4 using a hydraulic assist testing device (Dresser Hydroset). The as-found lift set point of 3PSV-0200 was 2461 psia. At the time the lift set point was checked, the concern about valve temperature was not yet clear and the temperatures taken on this valve were not taken in the standard locations. Based on those temperatures taken, it is clear that the valve was significantly cooler than when it was set at Wyle and somewhat cooler than it would normally be during power operation. This valve was set at Wyle at 2476 psia. It was found in Mode 4 to be set at 2461 psia with the valve bonnet about 80 degrees cooler than the temperature at which it was set by Wyle. This implies that the set point dropped by about 0.19 psi per degree F. Although the lift set point typically rises as bonnet temperature falls, the above performance has been seen on another similar valve and is within the expected statistical variation seen on such valves. A review of plant historical data taken during the transient shows RCS pressure at no more than 2406 psia. The resolution of data points was once each two seconds and a lag in pressure indication due to instrument response is expected. A calibration check of the pressurizer pressure transmitter which indicated 2406 psia and our evaluation of plant data would suggest that RCS pressure reached a maximum of 2427 psia. Although some uncertainty exists about the actual lift set point of this valve during the trip transient, it was reset in the plant with a

temperature profile close to that seen in normal operation and, as such, was set properly.

Testing was also performed in Mode 4 using a Hydroset device on 3PSV-0201 that demonstrated its as-found opening pressure to be 2604 psia. Since this pressure was observed at valve surface metal temperatures which were less than normal operating temperature, SCE has inferred the lift set point to be about 2544 psia at normal operating temperature (as described in the above PSV background discussion, lift pressure decreases with increasing valve temperature).

Complete temperature profiles were taken for both valves. Using a Hydroset device, the lift set points for both Unit 3 PSVs were reset in place while the Unit was in Mode 4 to meet TS requirements. Since the upper bonnet containing the actuating spring of 3PSV-0201 had cooled over a prolonged period prior to its being reset, it was rechecked in Mode 3 at normal operating temperature and was found to be within the required pressure range. It was deemed unnecessary to check the 3PSV-0200 lift set point in Mode 3 since it: 1) Showed a low temperature sensitivity, 2) had not been allowed to cool significantly, and 3) was reset while near its normal operating temperature.

Unit 2 Findings

As a result of the Unit 3 PSV problem, the possibility of having incorrect set points for the Unit 2 PSVs was evaluated. A Unit 2 containment entry was performed during power operations on March 9, 1990, to survey existing temperature profiles for the Unit 2 PSVs. These temperature profiles were found to be less than those found at Unit 3 and were also below the test specification temperatures used to set the Units 2 and 3 PSVs at Wyle Laboratories. Due to these temperature differences, the lift set point pressures of the Unit 2 PSVs became suspect, and a normal shutdown of Unit 2 was performed to verify operability of the PSVs.

As performed on Unit 3, a Hydroset device was used to determine the actual lift set points of the Unit 2 PSVs. This activity was performed with Unit 2 in Mode 3 at normal operating temperature and pressure. The as-found set points for 2PSV-0200 and 2PSV-0201 were demonstrated to be 2533 psia and 2461 psia (initially), respectively. 2PSV-0201 subsequently lifted at 2544 prior to being reset. The lift set points for both Unit 2 PSVs were reset in place to meet TS requirements. The lift pressures were set at 2518 psia for 2PSV-0200, and at 2521 psia for 2PSV-0201.

2) Cause:

As described above, the temperature profile used at Wyle Laboratories to set PSV lift set points was provided by the valve vendor. This temperature profile was believed to be representative of the ambient conditions of all the Unit 2 and Unit 3 PSVs. As a result of the recent surveys, it is clear that this data was not correct for all the PSVs.

The temperature profile of a valve is affected by the ambient temperature of the surrounding area. An evaluation was performed to determine if modifications to the pressurizer spray line, which had been performed subsequent to the establishment of the base PSV temperature profile, had resulted in changes in the surrounding area temperature. The evaluation concluded that the PSV ambient temperature was not significantly changed by the modifications to the pressurizer spray line.

In both units, one valve lifted higher than its maximum allowable set point and one valve initially lifted low. The variations in the as-found lift set points were within the variations we would expect to see for the different temperature profiles and the known variability of individual valve temperature responses.

Revision 0 of this LER referred to data obtained at Units 2 and 3 and some industry experience which indicates that the presence of non-condensable gases at the top of the pressurizer could affect the PSV lift set points. Our investigation has concluded that the information available is insufficient to provide any meaningful conclusions. Accordingly, that effort has been discontinued.

Revision 0 of this LER also referred to an evaluation of time-dependent PSV lift set point drift beyond the allowable limits of the ASME code during the 5-year surveillance period. Information available to date does not identify a mechanism which would cause such drift, and the results of this activity are not expected to substantially affect the maintenance or surveillance frequencies currently governing the PSVs. The study is therefore long-term in nature and will not be completed until the latter part of 1991. If the results of this study impact the conclusions or corrective actions indicated in the LER, a supplemental report will be submitted.

The effects of thermal and mechanical stress on the valve, possibly affecting valve geometry, were evaluated and concluded not to have contributed to this event.

The above discussed variability observed in the PSVs results in their having variations in their lift set points which is greater than the +/- 1% permitted by the present TS 3.4.2.

3) Corrective Actions:

SCE will evaluate submitting a TS change request to increase the PSV opening tolerance specified in TS 3.4.2.

Other corrective actions will be determined and implemented based on the evaluations being performed as described in Section G.4.a.2 above.

Both Unit 3 PSVs were removed from the plant during the last refueling outage. Replacement PSVs were set in accordance with the recently measured Unit 3 temperature profiles.

A temperature profile which encompasses the ambient conditions of the Unit 2 and Unit 3 PSVs has been developed and incorporated into our valve testing program.

b. ADV Operation

Immediately following the MSIS actuation and reactor trip, operators took action to open the ADVs; however, based on parameter trends during the event, it was subsequently determined that HV-8419 may not have initially functioned properly. Nevertheless, adequate RCS cooling was provided since all RCPs were running and ADV 3HV-8421 operated properly.

Approximately 3 1/2 hours after the event initiation, operators attempted to open the ADVs to reduce pressure on the upstream side of the MSIVs to establish prerequisite conditions for opening the MSIVs. At this point, 3HV-8419 initially did not open past its pilot valve. An operator locally opened the 3HV-8419 bonnet drain valve to bleed off condensate from the bonnet, after which the ADV was satisfactorily operated from the control room. This mode of failure of the ADVs had been previously recognized and results from anticipated steam condensation which collects in the bonnet cavity area.

As discussed in NRC Inspection Reports (IR) 50-206/89-07, 50-361/89-07 and 50-362/89-07, interim compensatory actions were established which included opening the bonnet drain valve as required and exercising the ADV bi-weekly to maintain the ADVs in an operable condition. The frequency of ADV exercising was subsequently decreased to monthly with the vendors concurrence. As a result of the ADV failure during this event, the frequency of exercising the Unit 3 ADVs had been increased to weekly, since valve reliability is increased as the exercising frequency is increased. This exercising frequency was continued until the Unit 3 ADVs were modified during the refueling outage which concluded in July 1990. This modification, which had earlier been installed in Unit 2, improved condensate removal from the bonnet area by enlarging the pilot valves thus reducing the potential for a similar ADV failure.

Condensate which accumulates in the ADV bonnet cavity is also removed by the periodic opening of the manual bonnet drain valve. The frequency of this activity was established based on experience. It was originally performed daily and was changed in June 1988 to weekly. As a further result of the ADV failure, the ADV bonnets are now drained of condensate shiftly. The vendor has stated that the decreased bonnet drainage frequency did not contribute to the ADVs failure to operate correctly in this event. A design change to preclude accumulation of condensate in the ADV bonnet will be implemented.

The actions described above provide assurance that the ADVs will remain responsive to demands from the remote-manual controller.

c. Steam Bypass Control System (SBCS) Valve Failure

The SBCS [SB] regulates steam dumping to the condenser from a point downstream from the MSIVs. Therefore, steam bypass to the condenser does not occur following MSIS actuation, even though the SBCS does provide an open signal to the four air-operated SBCS valves [PCV].

After the MSIVs closed in response to the MSIS, three of the four SBCS valves opened properly. Valve HV-8424 failed to open due to a malfunction of its pneumatic positioner [XCV]. The positioner has been replaced and the valve tested satisfactorily. An evaluation of the cause of the failure of the positioner revealed that the pneumatic relay was not functioning properly due to improper assembly by the manufacturer. A search of NPRDS revealed no similar failures.

d. PSV Acoustic Monitor

Two acoustic monitors [IP] are installed for each PSV to provide opening indication. Signals from these monitors are routed to relays which, when energized, open associated contacts in the annunciation circuit to provide a control room alarm that indicates that a PSV has opened. The monitoring system is also provided with indicating lights to indicate that a PSV is open. Since the indicating lights remained operable and are periodically checked, these monitors are considered to have been operable.

Following this event, it was noted that the control room annunciation for 3PSV-0200 opening had not actuated. An investigation determined that the problem was due to the malfunction of a relay in the annunciation circuitry. The investigation also determined that the same problem existed in the other Unit 3 and both Unit 2 acoustic monitoring channels' annunciation circuitry.

The faulty relays have been replaced. In an attempt to determine the cause of the relay malfunction, two of the relays were sent to an independent testing laboratory for examination. Neither relay exhibited anomalous conditions during electrical testing. During destructive testing, arc sites were found on one of the relay's contacts. However, since electrical testing had been previously completed satisfactorily, the effect of the arc sites on relay operation could not be determined.

e. Reversed Temperature Indications

Following the event, a review of plant data indicated that 3PSV-0201 had opened briefly during the transient. This was based on tailpipe temperature indication. Subsequent testing of the valves, however, demonstrated that indicators for the temperature of the two identical Unit 3 PSVs were reversed and that 3PSV-0200 was the safety valve which briefly opened during the transient. This condition has been corrected.

An investigation into the cause of this error did not identify any plant design changes or maintenance activities that might have resulted in the error; therefore, this condition most likely has existed since original construction.

During the performance of the Unit 2 PSV testing, the proper alignment of (Unit 2) tailpipe indications was verified, indicating that the Unit 3 error is an isolated occurrence. Further, the reversed identification does not affect the safety function of the temperature indication. For these reasons, no further corrective action is planned regarding the reversed temperature indications.

f. Human Performance Enhancement System (HPES) Evaluation

The HPES evaluation concluded that the procedure which governs the performance of subgroup relay testing could have provided for verification (by indicating light status) that one trip leg is reset prior to initiating testing (i.e., introducing a trip condition) in the other trip leg. For corrective action, procedural and human factors considerations have been included in the review process for surveillance testing procedures which could result in a reactor trip at power.

Additionally, the evaluation concluded that the design function of the initiate actuation PB (a different PB switch than the manual actuation PB described previously), which is maintained depressed for the duration of the subgroup relay testing to enable the test initiation sequence, may make it difficult for an operator to maintain an appropriate level of awareness of those assisting with the test. In addition, this design feature may also adversely affect the operators awareness of the status of the illuminating light associated with the trip leg in test. Based on these conclusions, the design of the initiate actuation PB will be evaluated to determine if another type of control would be appropriate for this application.