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December 21, 1989

Nuclear Regulatory Commission
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Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
LICENSEE EVENT REPORT 89-025 - PORV OPENING AND SAFEGUARDS EQUIPMENT ACTUATION

Licensee Event Report (LER) 89-025 (PORV Opening and Safeguards Equipment Actuation) is attached. This event is reportable to the NRC per 10CFR50.73(a)(2)(iv).

Brian D Johnson
Staff Licensing Engineer

CC Administrator, Region III, USNRC
NRC Resident Inspector - Palisades

Attachment

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A CMS ENERGY COMPANY

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) PALISADES NUCLEAR PLANT DOCKET NUMBER (2) 0500021551 OF 8

TITLE (4) PORV OPENING AND SAFEGUARDS EQUIPMENT ACTUATION

| EVENT DATE (5) | | | LER NUMBER (6) | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|----------------|-----|------|-------------------|-----------------|-----------------|-----|------|-------------------------------|-------------------|
| MONTH | DAY | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER (8) |
| 11 | 21 | 89 | 025 | 001 | 12 | 21 | 89 | N/A | 05000 |
| | | | | | | | | N/A | 05000 |

OPERATING MODE (9) N

POWER LEVEL (10) 0.00

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

| | | | | |
|-----------------|----------------|-------------------------------------|--------------------|--|
| 20.402(b) | 20.402(d) | <input checked="" type="checkbox"/> | 60.73a(2)(iv) | 73.71(b) |
| 20.402a(1)(i) | 60.20a(1) | <input type="checkbox"/> | 60.73a(2)(v) | 73.71(c) |
| 20.402a(1)(ii) | 60.20a(2) | <input type="checkbox"/> | 60.73a(2)(vi) | OTHER (Specify in Abstract below and in Text, NRC Form 205A) |
| 20.402a(1)(iii) | 60.73a(2)(i) | <input type="checkbox"/> | 60.73a(2)(vii)(A) | |
| 20.402a(1)(iv) | 60.73a(2)(ii) | <input type="checkbox"/> | 60.73a(2)(viii)(B) | |
| 20.402a(1)(v) | 60.73a(2)(iii) | <input type="checkbox"/> | 60.73a(2)(ix) | |

LICENSEE CONTACT FOR THIS LER (12)

NAME: C S Kozup, Technical Engineer, Palisades Plant

TELEPHONE NUMBER: 611 6716 4-189 113

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

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NRC | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NRC |
|-------|--------|-----------|--------------|-------------------|-------|--------|-----------|--------------|-------------------|
| | AB | RV | | | | | | | |
| | AB | ISV | | | | | | | |

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If you complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15)

| MONTH | DAY | YEAR |
|-------|-----|------|
| | | |

ABSTRACT (Limit to 1400 letters, i.e., approximately 11/2000 single space typewritten lines) (16)

On November 21, 1989 at 0225 Power Operated Relief Valve (PORV), PRV-1042B [AB;RV] instantaneously opened following the manual opening of its associated motor operated block valve (MOV), MO-1042A [AB;ISV]. Both the MOV and PORV, and the redundant valves MO-1043A and PRV-1043B, had recently been replaced during the ongoing maintenance outage. The MOV was opened with the reactor subcritical and the primary coolant system (PCS) at 2154 psia to permit ASME Section XI leak testing of the welds made during valve installation.

Approximately 24 seconds following the opening of the PORV, the reactor. Automatically tripped due to the receipt of all four Thermal Margin Low Pressure (TMLP) signals. Approximately three minutes later a Safety Injection Actuation Signal (SIAS) was received when PCS pressure dropped to the safety injection system actuation pressure of 1605 psia. All safety injection equipment then started or otherwise performed its design function. Both diesel generators started on low bus voltage, but no equipment was automatically loaded onto the diesel generators. With the PCS at 1565 psia the PORV closed and the MOV fully closed. An Unusual Event was declared due to the PORV opening at 0256. The PORV and the MOV which opened were removed from the Plant and inspected and tested. The valve operating characteristics were determined and the Plant operators trained and operating procedures modified to reflect those characteristics.

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TEXT: If more space is required, use additional NRC Form 388A's (17)

Description

On November 21, 1989 at 0225 (event time:0), Power Operated Relief Valve (PORV), PRV-1042B [AB;RV] instantaneously opened following the manual (via Control Room handswitch) opening of its associated motor operated block valve (MOV), MO-1042A [AB;ISV]. Both the MOV and PORV, and the redundant valves MO-1043A and PRV-1043B, had recently been replaced during the ongoing maintenance outage. The MOV was opened with the reactor subcritical and the primary coolant system (PCS) at 2154 psia to permit ASME Section XI leak testing of the welds made during valve installation.

Approximately 24 seconds following the opening of the PORV, the reactor, with its protection system [JC] enabled for the performance of control rod sequencing tests, automatically tripped due to the receipt of all four Thermal Margin Low Pressure (TMLP) signals. The PORV was open at this time and remained opened for approximately nine additional seconds (event time: 33 seconds) before closure with the PCS at 1670 psia. At 0228 (event time: 2 minutes, 46 seconds), with the PCS at 1738 psia, the PORV reopened. Approximately six seconds later (event time: 2 minutes, 52 seconds), Control Room Operators identified that the MOV was not indicating full closed. At 0228 (event time: 2 minutes, 58 seconds), a Safety Injection Actuation Signal (SIAS) was received when PCS pressure dropped to the safety injection system actuation pressure of 1605 psia. All safety injection equipment then started or otherwise performed its design function. Consequently, both diesel generators 1-1 and 1-2 started per design on low bus voltage (approximately 92 percent for greater than one second). The low voltage condition recovered within the designed six second recovery time and consequently no equipment was automatically loaded onto the diesel generators.

With the PCS at 1565 psia the PORV closed and at 0229 (event time: 3 minutes, 26 seconds) indication was received that the MOV was fully closed. Subsequently, the SIAS was reset and the diesel generator secured. An Unusual Event was declared due to the PORV challenge and secured from at 0256 and 0334 respectively.

The following provides a chronological listing and description of the event. Included are descriptions of operator actions derived from post event reviews of primary data logger and critical functions monitor output, and operator interviews:

| EST | Event Time | Description |
|----------|------------|--|
| 02:25:52 | 0 | In support of testing, Control Room Operators manually opened MOV, MO-1042A using Control Room handswitch. The PORV, PRV-1042B, opened almost immediately. In response to indication of PORV opening, the Control Room operator took action to close |

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TEXT (If more space is required, use additional NRC Form 388A's) (17)

MOV MO-1042A with the handswitch. However, due to the seal in feature in the control circuit, the valve had to stroke full open prior to responding to the close signal.

02:26:02 10 Seconds Control Room Operator observed MOV green light go out and come back on; red light remains on. Operator continued to hold control switch in the closed position. (Note: For the MOV, green indicates full closed, red/green indicates intermediate position and red indicates full open.)

02:26:12 20 Seconds Control Room Operator releases Control Room switch. Green light goes out (red light still on) indicating MO-1042A is full open. Operator takes control switch to closed position. Operator releases switch. Operator observes MO-1042A green light comes back on, indicating MO-1042A is closing.

02:26:16 24 Seconds Reactor trip comes in due to trip actuation on all four TMLP channels. Operator leaves control switch to perform EOP actions.

02:26:25 33 Seconds PRV-1042B closed. PCS pressure is at approximately 1670 psia.

02:28:38 2 Minutes
46 Seconds PCS pressure is at approximately 1738 psia. PRV-1042B reopens. MOV-1042A is not closed. PORV "Full open" limit switch cycles 6 times (open/closed) within approximately one second.

02:28:44 2 Minutes
52 Seconds Acoustic monitor for PORV discharge line alarms. Operator acknowledges alarm and observes both red and green PORV lights on. Operator observes both lights on (red and green) for MO-1042A and takes control switch to close position.

02:28:50 2 Minutes
58 Seconds Safety Injection Actuation Signal (SIAS) received when PCS pressure goes to 1605 psia. All required safety injection equipment functions as designed. Diesel generator 1-1 and 1-2 start on low voltage (92 percent) due to SIAS loading per design. Voltage drop recovers as expected. No equipment is automatically loaded onto diesel generator.

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TEXT (If more space is required, use additional NRC Form 388A's) (17)

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|----------|-------------------------|--|
| 02:28:52 | 3 Minutes 00 Seconds | PORV PRV-1042B closes PCS pressure is 1565 psia. |
| 02:29:18 | 3 Minutes 26 Seconds | MO-1042A fully closed. PCS pressure is 1584 psia. |
| 02:56:00 | 30 Minutes 8 Seconds | Unusual Event declared due to PORV challenge. |
| 03:05:00 | 39 Minutes 8 Seconds | SIAS reset and diesel generators secured. |
| 03:34:00 | 68 Minutes 8 Seconds | Secured from Unusual Event. PCS at normal operating pressure and temperature. |

Cause Of The Event

The initial opening of the PORV, was not anticipated. After discussions with vendor personnel, consultants and testing performed at an independent laboratory the opening was determined to be an expected result of rapid pressurization of the PORV upon MOV opening with a pressurized PCS. When the primary system pressure is significantly greater than that between the isolated MOV and the downstream PORV, rapid pressurization by opening the MOV will cause the PORV to open.

When the inlet pressure rises rapidly, the control chamber pressure will lag behind inlet pressure. This may cause the PORV to open due to the pressure differential between the inlet piping and the PORV control chamber. Normally, the PORV will be closed by deenergizing the coil. When the coil is deenergized, the control chamber is pressurized from the inlet piping through two small valve ports.

During the Plant heatup on November 21, 1989, the MOV was full open with the pressurizer at about 500 psi with a steam bubble when it was shut isolating the PORV. The PORV was isolated for several hours before the MOV was reopened with the pressurizer at 2154 psia with a saturated steam bubble. During the time the PORV was isolated, the steam trapped in the valve internals and in the piping condensed, significantly reducing the pressure in the spool piece between the valves and in the PORV internals. During valve tests under similar conditions, the pressure between the valves with the MOV shut dropped from 571 psig to 73 psig in only 10 minutes.

The cause of the second opening of the PORV has not been absolutely determined, however, the following two scenarios have been postulated as credible.

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TEXT (If more space is required, use additional NRC Form 308A's) (17)

The first scenario is that the MOV stopped on overtorque about 0.375 inch from full shut and subsequent pilot and/or main disc leakage caused the PORV to reopen. The MOV closure is stopped based on tripping of the motor when a preset torque measured from the operator spring pack is exceeded. The MOV remained in this position until another close signal was given to the valve and it went completely closed at 3 minutes 26 seconds. If there was no pilot leakage, the PORV would not be expected to reopen under this condition. During closure when the MOV torques out, the inlet pressure should be near the PCS pressure depending on PORV main disc leakage. Under these conditions the only way to reduce the control pressure enough to reopen the PORV (with no movement of the MOV) is for the pilot to be leaking. For a 0.375 inch MOV position, a pilot lift of 0.027 inch is required to create enough leakage to reopen the PORV. The PORV opening and reclosing times are highly dependent on the position of the MOV and the leak rate of the main disc or pilot.

The second scenario is the MOV closed completely and then reopened. In this scenario it is assumed that the MOV closes completely but that the closed limit switch was not activated. The MOV then reopens at about 2 minutes 46 seconds. For the time that the PORV is closed before reopening, the volume between the PORV and the block valve can depressurize either due to pilot leakage or main disc leakage. The second opening would be expected to be a repeat of the first. In fact, the second time the PORV closed within 12 seconds. This reduction of time to close could have occurred due to the PORV control chamber being at a higher initial temperature.

Corrective Actions

Numerous actions were taken to evaluate the performance of MO-104?A and PRV-104 B and to determine what further corrective actions were needed. These actions included:

1. An independent electrical checkout of the PORVs and MOVs valves was conducted to verify the control circuitry. No problems were found.
2. The VOTES diagnostic testing was reperformed on MO-1042A and MO-1043A and spring packs were inspected in both valves. No significant changes in thrust settings of Limitorque operators were found from previous settings.
3. The operator actions were simulated for MO-1042A to check for coupling during the event and to check instrumented control circuits for voltage and current. No electrical coupling or control circuit problems were seen for the valves.
4. The nitrogen test was reperformed and no significant difference in PORV opening times from previous nitrogen tests was noted.

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TEXT IF MORE SPACE IS REQUIRED. USE ADDITIONAL NRC Form 306A's (17)

5. PRV-1042B was electrically actuated open and close during testing at Wyle Laboratories and was found to operate within its design basis of two seconds.
6. The MOVs were tested for proper response by jogging them open and by full stroking them.
7. MO-1042A was opened and inspected and the valve internal clearances were measured. A non-linear analysis was performed of the valve internals to predict the affect the thermal and hydraulic forces would have on valve guide clearances. No physical damage noted in the internals, although the sliding function surfaces were rough from hand machining by the manufacturer.
8. Opened and inspected MO-1043A. Obtained clearances among valve internals. No physical damage noted in the internals. Clearances on MO-1043A were noted to be less than MO-1042A. The clearances on MO-1043A were opened up to match those of MO-1042A.
9. Removed, opened and inspected PRV-1042B. Small amounts of foreign materials were noted in valve internals. Nickel plating on disc rings was also seen to have flaked off. The nickel plating was removed and the valve was cleaned and reassembled.
10. Removed, opened and inspected PRV-1043B. No unusual indications were noted.
11. PRV-1042B and MO-1042A were removed from the Plant and tested at an independent laboratory. Testing indicated that the PORV will open when the MOV is opened. The opening duration is a function of PORV position, temperature, water in the control chamber and the rate of MOV opening. The PORV would reseal as pressure forces increased in the control chamber.

Based on the investigation, it was determined that the initial PORV opening was expected per the design. The Operating Procedures were revised to reflect this information and to document the PORV and MOV operating practices. The Operators were trained on the design of the new PORVs and the procedure changes involving the PORV and MOV operation. These actions were completed prior to Plant startup.

Additional actions were undertaken to evaluate the modification process with respect to the shortcomings seen in this event. This evaluation is planned for completion in April 1990.

Following the initial opening of the PORV, the valve closing time of 33 seconds was thought to be excessive. However, following testing at an independent laboratory this closure time was confirmed to be reasonable.

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TEXT (if more space is required, use additional NRC Form 308A's) (17)

Because no root cause of the second opening of the PORV could be conclusively determined, the safety objectives of the PORV's and MOVs were reviewed to provide assurance the objectives would be met. The three objectives are:

1. Prevent inadvertent depressurization of PCS.
 - a. Assure adequate subcooling margin maintained
 - b. Assure primary coolant pump NPSH is maintained.
2. Assure once through cooling flow path is maintained
 - a. Provide core cooling during DBA
3. PORVs and block valves are available and operable for Low T Over Pressure (LTOP) protection
 - a. Prevent brittle fracture of reactor vessel.

In addition to the actions stated above, the following actions were taken to assure these objectives would be met.

1. The MOVs were opened and closed while at 2500 psi for 100 percent, 60 percent and 25 percent of full stroke.
2. The closing thrust was calculated and it was determined that margin existed.
3. The seal in feature for the opening of the MOVs was removed to allow bumping of the MOVs.
4. The new method of opening of the MOVs was demonstrated at normal operating pressure.
5. The MOV was demonstrated to open against 575, 1800 and 2500 psi.
6. The PORV was demonstrated to open against 575 and 2500 psi.
7. The PORV was operated in a variety of steam conditions. It electrically operated within design limits, did not inadvertently open, and reclosed when forced open due to pressure.
8. The MO-1043A internal tolerances were increased to be more in the nominal range of the valve manufacture's recommendations.
9. All the sliding function surfaces were polished on MO-1042A and MO-1043A.
10. VOTES diagnostic testing of the MOVs was conducted after reinstallation to verify the proper thrust settings.

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TEXT: If more space is required, use additional NRC Form 388A's (17)

11. Post maintenance testing of the PORVs and the MOVs were conducted to verify operability for the valves.

All of the above corrective actions were conducted prior to taking the reactor critical with the exception of the review of the modification process. The review of the modification process will be completed by April 1990.

Analysis Of The Event

During the event, all safety systems and their associated equipment functioned as designed in response to PCS depressurization event. All PCS inventory was maintained, as designed, in the quench tank downstream of the PORVs. Therefore, no unusual increases in containment pressure or radiation level were noted and no threat to the health and safety of the public was presented. The primary system pressure and level transients should not have presented any deleterious effects on the fuel, however, the PCS radioactivity levels will be monitored during power operation to verify that no fuel damage occurred.

This event is being reported per 10CFR50.73(a)(2)(iv) due to the automatic actuations of engineered safety features.

Additional Information

MO-1042A is a four inch Edwards Valve equi-wedge gate valve (model number: 17011(CF8M) FJMNPQTYZ with a Limitorque SMB-00-25 actuator.

PRV-1042B is a 4 inch by 4 inch Target Rock Solenoid operated relief valve (model number: 88RR-001)