GPU NUCLEAR

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March 14, 1999
1920-99-20126

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

Dear Ladies and Gentlemen:

Subject: Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
LER 99-002-00, "Potential Failure of Multiple Containment Monitoring System (CM) Containment Isolation Valves (CM-V-1, 2, 3, and 4) due to Inappropriate Use of Vendor Information"

This letter transmits Licensee Event Report (LER) No. 99-002-00 concerning a condition which was evaluated and determined to be reportable on February 12, 1999.

This LER is being submitted pursuant to 10 CFR 50.73, using the required NRC forms (attached). NRC Form 366 contains an abstract that provides a brief description of the evaluated condition. For a complete description of the evaluated condition, refer to the text of the report provided on Form 366A.

This condition did not adversely affect the health and safety of the public. For additional information regarding this LER, contact Bob Knight of the TMI Nuclear Safety & Licensing Department at (717) 948-8554.

Sincerely,

James W. Langenbach
Vice President and Director, TMI

MRK

cc: TMI Senior Resident Inspector
Administrator, Region I
TMI-1 Senior Project Manager
File No. 99062

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NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

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TITLE (4)

Potential Failure of Multiple Containment Monitoring System (CM) Containment Isolation Valves (CM-V-1, 2, 3, and 4) due to Inappropriate Use of Vendor Information

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 NAME	DOCKET NUMBER
										05000
02	12	99	99	-- 002 --	0	03	14	99	FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
POWER LEVEL (10)	100	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)		
		20.2203(a)(1)	20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)		
		20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71		
		20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER		
		20.2203(a)(2)(iii)	50.36(c)(1)	X 50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A		
		20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)			

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Bob Knight, TMI Licensing Engineer	(717) 948-8554

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
A	JM	V	C684	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-spaced typewritten lines) (16)

On February 12, 1999, after it was discovered that Containment Post Accident Sampling System (CATPASS) Containment Isolation Valves (CIVs) CM-V-1 and 3 exceeded Local Leak Rate Testing (LLRT) limits, it was determined that a condition existed that could have prevented the fulfillment of the safety function needed to control the release of radioactive material. The NRC was notified in accordance with 10CFR50.72(b)(2)(iii)(c). The root cause of this event was inappropriate use of vendor information in that a packing torque was taken from a vendor manual without the evaluation required by administrative procedures. Contributing to this event was lack of periodic maintenance (PM) for this component and inadequate post maintenance testing (PMT). CM-V1, 2, 3, and 4 were declared operable after repairs and leakage tests were completed. Additional repair work is planned for the next refueling outage. Personnel will be trained on management expectations regarding the vendor manual program; periodic maintenance for these valves will be developed; and PMT procedures will be revised. There were no adverse safety consequences from this event, and the event did not affect the health and safety of the public.

Potential Failure Of Multiple Containment Monitoring System (CM) Containment Isolation Valves (CM-V-1, 2, 3, And 4) Due To Inappropriate Use Of Vendor Information

I. Plant Operating Conditions before Event:

TMI-1 was operating at 100% reactor power.

II. Status of Structures, Components, or Systems that were Inoperable at the Start of the Event and that Contributed to the Event:

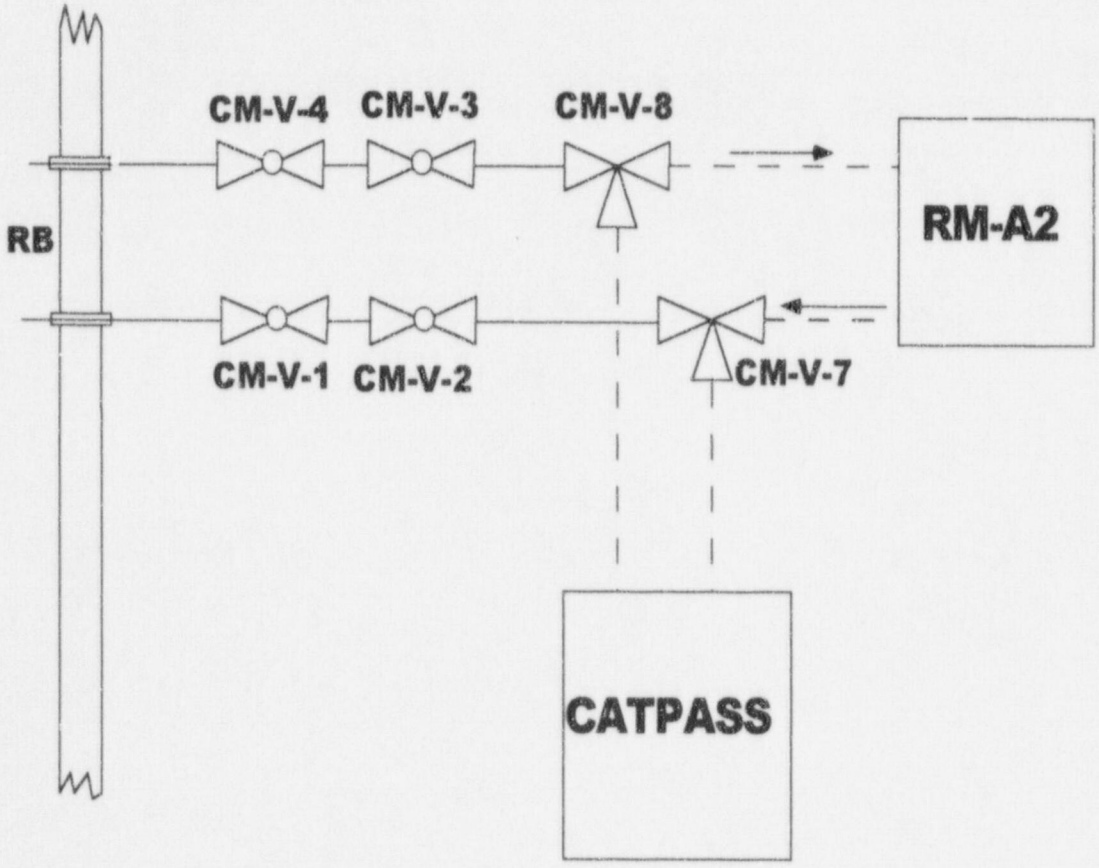
This event involves the containment isolation valves (CM-V-1, 2, 3, and 4) in the Containment Monitoring System. There were no other structures, components, or system operability concerns related to this event.

III. Event Description:

Containment isolation valves (CIVs) CM-V-1, 2, 3, and 4 are 1 inch pneumatic ball valves manufactured by Crane-Flomatics (now owned by the Hi-Gear Valve Company). As shown in Figure 1 below, the Reactor Building (RB) Radiation Monitor (RM-A-2) is also located in the IB and taps into the same process piping that is isolated from the RB by these CIVs. The direction of RB air flow is normally out of the RB through CM-V-4 and 3 respectively to RM-A-2, returning through CM-V-2 and 1 respectively; samples can either be drawn out of the RB through CM-V-1 and 2, or through CM-V-4and 3, respectively.

The Containment Atmospheric Post Accident Sample System (CATPASS) was installed in 1986 to satisfy NUREG-0737, Item II.B.3, "Post Accident Sampling." On February 11, 1999, during a leak check of the CATPASS in accordance with Preventative Maintenance (PM) Procedure IC-132, "CATPAS System Leak Check and Functional Test," leakage was detected through Containment Isolation Valves CM-V-3 and 4. The purpose of IC-132 is to ensure that leakage out of the CATPASS into the IB will not prevent taking a post accident RB air sample using the CATPASS. However, during IC 132, pressure is applied to the CIVs in the opposite direction from accident conditions. Since the section of tubing outside of the CIVs is pressurized during IC-132, the outer CIVs, CM-V-2 and 3, are pressurized during the CATPASS leak check and the leakage detected was from the CATPASS into the RB.

Figure 1



Prior to any knowledge of CIV leakage, on February 4, 1999, a functional test of the CATPASS was being performed using Procedure N1831, "Post Accident Atmospheric Sampling." The test could not be completed because system leakage exceeded the test acceptance criteria of 5 psig pressure drop over 2 minutes when the system was pressurized to Instrument Air pressure of 104 psig. In response to this deficiency, Corrective Action Process (CAP) item T1999-0113 was initiated at 0800 on February 4, 1999 to document that the CATPASS failed the N1831 leak check; the Control Room was informed, and Work Request (WR) 794377 was submitted to trouble shoot and make any necessary repairs. PM IC-132 was successfully performed, however it only requires the system to be tested at 60 psig while N1831 uses full Instrument Air System pressure of 100 psig. It was determined that the testing performed at 60 psig by IC-132 was adequate for identifying system leakage

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

and verifying the CATPASS operablility. However, direction was given to locate the source of the leakage found when CATPASS had been pressurized to 100 psig.

Troubleshooting resumed on February 10, 1999. The CATPASS was pressurized to 100 psig per N1831 and the valve stems of CM-V1, 2, 3, and 4 and CM-V-7 and 8 were "snoop" tested for leakage. Air leakage through the CM-V-2 valve stem was found and the packing nut was determined to be only hand tight. In response, engineering contacted the vendor. It was learned that the seals are not pressure sensitive, that the reverse pressure will seat the upstream seat, and that the valve should be leak tight at 100 psig internal piping pressure. An engineering assessment established that the operability of CM-V-2 was not affected. It was concluded that the appropriate packing load for CM-V-2 was 100 inch-pounds based on a torque value listed in vendor manual VM-TM-1042. The decision to tighten the packing to 100 inch-pounds was accepted, and preparations were initiated to tighten the CM-V-2 packing.

On February 11, 1999, the packing on CM-V-2 was tightened and the valve was successfully stroke time tested in accordance with Survaillance Procedure (SP) 1300-3Q, "Quarterly Inservice Testing of Valves During Normal Plant Operation," for Post Maintenance Testing. After the packing on CM-V2 was tightened, it was found that the other valves also appeared to have less than 100 inch-pound on the valve packing, and the packing glands on containment isolation valves CM-V-1, 3, and 4 were also tightened to the 100 inch-pounds torque value. Each valve was successfully stroke time tested in accordance with SP 1300-3Q for Post Maintenance Testing prior to adjusting the packing on the next valve. (Note: The valve stroke confirmation is based on changes to the valve position indications in the Control Room. In retrospect, it is possible that during these stroke tests only CM-V-2 was completing its full stroke. Later stroke test failures at 100 inch-pounds were based on direct observations of the valves in the plant.) IC-132 leak check was repeated at 60 psig, and the CATPASS exceeded the leak check limit. At this time, the leakage was not coming from any of the valve stems. After several valve manipulations with the CATPASS pressurized, GPU Nuclear was able to eliminate the CM-V-1 and 2 line as the leakage path.

Later that day, on February 11, 1999, a RB entry was made to check for air flow on the containment side of the CM-V-3 and 4 line. This confirmed the leakage was through CM-V-3 and 4 into the containment. The technicians reported to the Control Room that "CM-V-3 and 4 were not holding pressure and leaking by their seats even when both were closed." Based on the leakage through CM-V-3 and 4, a 6 hour time clock was entered in accordance with TS 3.6.6 with inline CIVs potentially inoperable.

At this time the packing adjustment was suspected as a possible cause of the observed leakage as this was the only alteration to CM-V-3 and 4 since the valves passed LLRT during the previous refueling outage in 1997. After the packing load (torque) on both CM-V-3 and 4 was relaxed, PM IC-132 was performed again the acceptance criteria was met. The containment penetration was then observed inside the RB with the line pressurized; and there was no leakage. Based on at least one valve per containment line having passed the IC-132 acceptance criteria and no leakage being observed in the RB, the 6 hour time clock

per TS 3.6.6 was exited prior to expiration. However, in accordance with an interpretation of TS 3.6.6, the PRG determined that a 48 hour time clock had been entered when the 6 hour time clock was exited. It was determined that LLRT of CM-V1, 2, 3, and 4 in accordance with SP 1303-11.18, "RB Local Leak Rate Testing," was necessary and plans were established to conduct the tests the next day.

The next day on February 12, 1999 the decision was made to retighten the packing on valves CM-V-3 and 4 to 100 inch-pound of torque, and cycle the valves several times. It was believed that this "conditioning" of the packing would reduce the stem loads and allow the valves to stroke fully open/close. At this time, the CM-V-3 packing was tightened to 100 inch-pounds. The valve was then stroked and was directly observed to be unable to fully close. When the packing load was removed, it cycled successfully. The packing load was then increased in 10 inch-pound torque increments. It was found that CM-V-3 was only able to fully stroke satisfactorily with up to 50 inch-pounds of packing torque. The same testing was performed on CM-V-4 and 40 inch-pounds was found to be the limiting packing torque for proper valve operation. The packing load on CM-V-1 had to be reduced to 15 inch-pound for the valve to properly close. CM-V-2 was not stroke tested at that time and the packing was left at 100 inch-pounds. LLRT was commenced at 1300 hours and the results were as follows:

CATPASS CIV	Leakage Results
CM-V-1	12,563 sccm
CM-V-2	441 sccm
CM-V-3	88,764 sccm
CM-V-4	6,812 sccm

These results showed that CM-V-1and 3 leakage was well above the historical leakage trend for these two valves since their previous leakage target criteria had been under 1,000 sccm for each of these two valves. The PRG declared CM-V-1 and 3 inoperable at 1450 hours and decided to report this as a condition that alone could have prevented the fulfillment of the safety function of the structures or systems that are needed to control the release of radioactive material. Since valve packing adjustments were performed on both CIVs in a single containment penetration line, this was seen as having potentially created a common cause failure where, due to the high packing load, the valves could not be relied upon to repeatedly go to the fully closed position. In accordance with 10CFR50.72(b)(2)(iii)(C), at 1821 hours on February 12, 1999, the NRC was notified via the Emergency Notification System (ENS) telephone.

At 2230 hours on February 12, 1999, pipe caps were installed on both containment penetration lines inside the RB and successfully leak tested to 60 psig in accordance with IC-132. (Note: IC-132 was revised for this test to pressurize the lines with the four CIVs in the open position in order to test the pipe cap seal.) The pipe cap was also "Snoop" checked with no indication of leakage. The containment penetrations were declared operable and the 48 hour time clock in accordance with TS 3.6.6 was exited at 2230 hours after 27 hours 45

minutes. After pipe cap installation and leak testing to verify containment integrity, the CM-V-1 and 3 valves and actuators were rebuilt.

The following morning, on February 13, 1999, during the subsequent leak check per IC-132, the packing on CM-V-1 and 3 was tightened until no stem leakage was observed. CM-V-1 packing was left at approximately 22 inch-pounds and CM-V-3 packing was left at approximately 51 inch-pounds. Since CM-V-2 and 4 had passed the leak rate test, no maintenance was performed. The packing load on CM-V-2 was left at 100 inch-pounds, and CM-V-4 was left at 40 inch-pounds. All four valves were again successfully stroke time tested.

On the afternoon of February 13, 1999, Engineering discovered that the 100 inch-pound packing load identified in Vendor Manual VM-TM-1042 was intended for a 2 inch valve and did not apply to TMI-1 CIVs CM-V-1, 2, 3, and 4 which are 1 inch model N-1380 Crane valves. Since the valves were already field adjusted such that they operated smoothly, it was decided that no additional packing adjustments were appropriate until LLRT testing was performed. The packing of CM-V-2 was left at the 100 inch-pounds setting. Based on acceptable stroke and leak test results, the condition of CM-V-2 was judged to be acceptable until maintenance could be performed during the next refueling outage, which is scheduled to begin in September 1999.

At 1735 hours the pipe end caps were removed from the RB side of the containment penetration to perform LLRT of all four CIVs, CM-V-1, 2, 3, and 4, and the 48 hour time clock for TS 3.6.6 was entered. At 1819 hours, the LLRT was successfully completed on all four valves, and the TS 3.6.6 time clock was exited for the final time. The final test results were as follows:

CATPASS CIV	Leakage Results
CM-V-1	67 sccm
CM-V-2	306 sccm
CM-V-3	67sccm
CM-V-4	5,440 sccm

Although CM-V-4 leakage is higher than desirable, the results were determined to be acceptable because the total containment leakage was well below the TS limit and the other valves' leakage results were exceptionally good.

IV. Component Failure Data:

These CIVs are 1 inch pneumatic ball valves manufactured by Crane-Flomatics (now owned by the Hi-Gear Valve Company).

CM-V-1 and 3 valves and actuators were rebuilt on February 12, 1999 as follows:

Actuators (JM/ISV)*: Total rebuild of the valve actuators included all new O-rings and replacement of the copper crush washer. The internals were cleaned and grease was applied to the rack and pinion. Both actuators were found to contain grease in the rack and pinion that had crystallized; this had apparently caused the operators to be extremely hard to turn (CM-V-1 was not as hard to turn as CM-V-3).

Valves (JM/75)*: Total rebuild of the valves included replacing the O-rings, backing rings, seats, packing and the ball. The valve stem packing, O-rings, and backing rings showed signs of wear. The fact that CM-V-1 and 3 valve seats were very dirty had probably caused the balls to be scored.

It is noteworthy that CM-V-2 and 4 (valves, but not the actuators) were rebuilt during the 12R outage because of higher than expected leakage results from the 12R LLRT. Maintenance records from 12R do not indicate that the valve seats were dirty or the balls scored.

V. Identification of Root Cause:

The root cause evaluation team determined that the root cause of this event was inappropriate use of vendor information in that the requirements of the Vendor Document Control Program in Administrative Procedure (AP) 1065, "Vendor Document Control," were not followed. It was determined that familiarization with the expectations of the Vendor Manual program had not been included in the engineering initial training, position specific training, or any recent continuing training programs. Other factors that contributed to the event included the lack of a preventive maintenance program for CM-V-1, 2, 3, and 4 and inadequate post maintenance testing.

Packing torque data (later found not applicable to this component) was taken from an "Information Only" vendor manual without first performing the written evaluation required by the Vendor Document Control Procedure AP 1065. This error was compounded when the decision was made to adjust the packing on the other three containment isolation valves. It was not apparent that the torque value that was used applied specifically to just a 2" valve and not the CATPASS 1" CIVs. The front of the document is stamped "Information Only," which should have raised sufficient doubt about the use of this information without performing further evaluation as required by the Vendor Manual program in accordance with AP 1065.

Since CM-V-1, 2, 3, and 4 are in the IST program scope, the Post Maintenance Testing (PMT) requirements were determined from AP 1041,"IST Program Requirements," which

specified SP 1300-3Q (stroke timing) and SP 1303-11.18 (LLRT) as the applicable PMTs. AP 1041 further indicated that adjustment of valve stem packing could affect the performance of the valve, thus requiring that IST be performed, and the stroke time test was deemed to be the appropriate IST in this case. It was determined that a Local Leak Rate Test (LLRT) was not required by this procedure since adjustment of the packing was not expected to affect the seat tightness of this type valve.

Additionally, the LLRT procedure, SP 1303-11.18, required that an LLRT be performed for replacement of the packing or adjustments to the valve operator where it "could be expected to significantly change closing force," neither of which was the case in this event. The basis for the decision was that the 100 inch-pound packing load listed in Vendor Manual (VM-TM-1042) was believed to be the "as qualified" state of the valves that were sent to TMI-1 and that the packing adjustment is within torque limits specified by the manufacturer. The industry LLRT requirements are specified in NEI 94-01, which is recognized by the NRC as appropriate for Performance-based (Appendix J - Option B) ILRT/LLRT. NEI 94-01 requires LLRT for any valve "... replacement, repair, modification, or adjustment activity." TMI-1 programs incorrectly interpret "adjustment activity" to include adjustments of stroke length or operator force, and to exclude stem packing adjustments that are within the range allowed by the vendor or appropriate engineering judgement. The IST guidance specified in NUREG-1482 is more specific and requires the valve stroking and leak testing (LLRT in this case) whenever packing is adjusted unless this testing is impractical. Allowing an assessment of the effect of the packing adjustment on the valve's performance in lieu of immediate testing was incorrectly applied in this case. Therefore, it is concluded that the Post Maintenance Testing, which consisted of only stroke timing, was inadequate for the work performed on CM-V-1, 2, 3, and 4. The LLRT procedure did not recognize valve packing adjustment as one of the maintenance activities that could affect the performance of any of the containment Isolation Valves.

VI. Assessment of the Safety Consequences and Implications of the Event:

The purpose of the containment is to limit the release of radioactive material in the event of a postulated Loss of Coolant Accident (LOCA) to less than 1% of the containment volume per day (La). This event which involved CIV leakage in excess of the required TS limits did not involve an unacceptable release of radiation and could not have caused an accident to occur.

The TS containment total leakage criterion of less than or equal to 0.6 La for combined Type B and Type C leakage ensures that the off-site dose consequences from a postulated accident are bounded by the assumptions of the safety analysis. From the last LLRT, the maxpath total leakage was less than 30,000 sccm, which left a margin of approximately 75,000 sccm for additional leakage before the 0.6 La limit of 104,846 sccm would be reached. On February 12, 1999 the measured leakage for the CM-V-3 and 4 pathway was 6,812 sccm.

Based on an undocumented observation by the technician that the CATPASS leak check pressure drop was 5 psi in 30 seconds, where the flow was calculated to be less than the subsequent LLRT measured flow of 6812 sccm and on a conservative estimate for the time period in which the CATPASS leak check found air flow into the RB with both CM-V-3 and 4 closed, the 0.6 La leakage limit was never exceeded. Therefore, the off-site dose analysis would have remained valid for the entire event.

VII. Previous Events of a Similar Nature:

None.

VIII. Corrective Actions:

A. Actions Taken:

1. CM-V-1 and CM-V-3 valves and valve actuators were rebuilt on February 13, 1999.

2. Containment Isolation Valves, CM-V-1, 2, 3, and 4 were successfully leak rate tested in accordance with SP 1303-11.18 on February 13, 1999.

3. Evaluation of the CM-V-2 for continued operation with packing load of 100 inch pounds has been evaluated in CAP Item T1999-0228.

B. Corrective Actions to be Taken:

1. Lessons learned from this event, including the expectations of the Vendor Manual Program, will be provided to Engineering and Maintenance groups prior to the 13R Outage, which is scheduled to begin in September 1999.

2. Coverage of the proper use of Vendor Manuals in the applicable Engineering orientation module will be reviewed and necessary modifications to that module will be made by September 1999.

3. PM Tasks will be established for the CM-V-1, 2, 3, and 4 valves and actuators prior to the 13R Outage.

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4. PM Tasks for other air-operated CIVs will be evaluated for adequacy in response to this event prior to the 13R Outage. 10 OF

5. Valve CM-V-2 will be repacked during the 13R Outage.

6. Valve actuators on CM-V-2 and 4 will be rebuilt during the next refueling outage, the Cycle 13 Refueling (13R) Outage.

7. The IST Program requirements and the LLRT procedure will be revised prior to the 13R Outage to provide appropriate PMT guidance for leakage testing when adjusting the valve packing.

8. Vendor Manual VM-TM-1042 will be revised to clarify the appropriate valve parameters for 1 inch, 1-1/2 inch and 2 inch valves by May 1999.

9. IC-132 will be revised by July 1999 to clarify that no maintenance on CIVs CM-V-1, 2, 3, and 4 is permitted under this procedure.

* The Energy Industry Identification System (EIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, [SI/CFI], where applicable, as required by 10 CFR 50.73 (b)(2)(ii)(F).