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SUBJECT: DOCKET NO. 50-333
LICENSEE EVENT REPORT: LER-93-019-02:

Potential Design Inadequacies in the Control Room Ventilation System

Dear Sir:

This updated report is submitted in accordance with 10CFR50.73 (a)(2)(ii)(B). This is the final report which summarizes two previously reported conditions and a number of other Control Room Ventilation System adverse conditions, their potential impact on safety, and the corrective actions already taken or planned.

Questions concerning this report may be addressed to Mr. David A. Holliday at (315) 349-6359.

Very truly yours,

HARRY P. SALMON, JR.

HPS:DAH:tlc

Enclosure

cc: USNRC, Region I
USNRC Resident Inspector
INPO Records Center

Cert # P 264 860 151

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NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

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LICENSEE EVENT REPORT (LER)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)
Potential Design Inadequacies in the Control Room Ventilation System

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
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OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
			20.402(b)		20.405(c)		50.73(a)(2)(iv)		73.71(b)
POWER LEVEL (10)	100		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
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
			20.405(a)(1)(iv)	X	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 (Include Area Code)
Mr. David A. Holliday, Senior Licensing Engineer	(315) 349-6359

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 15 single-spaced typewritten lines) (16)

This LER updates information on two previously reported conditions and describes other adverse conditions related to the Control Room Ventilation (CRV) System found in the past nine months. The plant has been operating at 100 percent power in a steady state condition except during three maintenance outages in September, November and April, 1994. As previously reported, engineering determined on 9/23/93 that an un-quantified amount of unfiltered air would flow into the Control Room (through a normally open manually operated "bypass" damper) with the CRV System in the "isolate" mode of operation with a single failure, specifically, of an isolation motor operated valve (MOV) to close. An update reported that on 10/29/93 engineering identified single failure concerns in the routing of control and power cables for the CRV System fans, dampers, and isolation MOVs. The other CRV related events or conditions generally fell into four categories: single failure concerns; degraded equipment conditions allowing outside air infiltration; inadequately balanced air flows resulting in filter train flow rates that exceeded Tech Spec limits; and inaccurate design and licensing basis documentation. The causes were: inadequate design control and documentation by engineering organizations; inadequate preventive maintenance; inadequate surveillance testing; and no comprehensive CRV design basis document. The system has been returned to an operable status.

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DESCRIPTION

In the past nine months, two previously reported conditions and a number of other conditions have been identified related to the Control Room [NA] Ventilation (CRV) System [VI]. This update to the LER describes those conditions, their potential effect on safety, and the corrective actions.

To summarize, LER-93-019-00 identified the first condition. On September 23, 1993, the plant was operating at 100 percent power in a steady state condition. After a series of inspections and evaluations, engineering determined that an un-quantified amount of unfiltered air would flow into the Control Room with the CRV System in the "isolate" mode of operation with a postulated single failure, specifically, of an isolation motor operated valve (MOV) to close. The isolation MOVs are in the air intake duct and in the air exhaust duct. (Refer to the attached simplified ventilation system flow diagram.) The flow would be through a normally open manually operated "bypass" damper installed in parallel with a motor operated damper which is in series with the isolation MOV. The motor operated damper automatically closes when the CRV System is placed in the "isolate" mode of operation to limit unfiltered air entering the Control Room. The intake and exhaust isolation MOVs were closed and sealed to eliminate this single failure concern and to eliminate any leakage past the isolation MOVs.

Revision 01 of LER-93-019 reported an additional single failure concern. On October 29, 1993, engineering determined that some control and power cables for safety-related CRV System fans, dampers, and isolation MOVs were incorrectly identified as non-safety related and were routed in common, non-safety related electrical raceways. The control cables for the fans and dampers were temporarily disconnected and the power supply breakers for the closed MOVs were opened.

The other CRV related conditions described in this update generally fell into four categories: single failure concerns; degraded equipment conditions allowing outside air infiltration; inadequately balanced air flows resulting in filter train flow rates that exceeded Technical Specification limits; and inaccurate design and licensing basis documentation.

An assessment of licensing and design bases for Control Room habitability is nearly complete. Actions have already been taken to correct hardware deficiencies and the CRV System is now operable in all modes of system operation. Additional actions are being taken to correct documentation deficiencies.

DESCRIPTION (continued)

The following describes in more detail the adverse conditions and corrective actions taken to date on the CRV System:

Single Failure Concerns:

In July of 1993, engineering was evaluating the CRV System after a review of INPO OE 2465, Control Room Environmental Control System Single Failure. The OE identified a potential concern that the non-safety related portion of the CRV System may not swap over completely to a recirculation mode resulting in the inability to maintain positive pressure in the Control Room. A review of standards, regulations, design documents, surveillance tests and hardware by engineering resulted in questions regarding design and testing adequacy, as well as information contained in the 1981 NUREG-0737 (III.D.3.4) submittal.

During this review, a concern was raised over the existence of "bypass" dampers installed in parallel with the intake and exhaust dampers (and their purpose) since they were not described in plant documents. The bypass dampers were shown on an UFSAR figure. The original purchase specifications and vendor test reports for the isolation MOVs and dampers were reviewed to determine system design parameters. Since there was a possibility that the CRV System design would not meet assumptions regarding single failure criterion and since calculations associated with the 1981 NUREG-0737 submittal assumed a leakage rate that has not been verified by testing, the CRV System was placed in the "isolate" mode (the post LOCA lineup) on July 9, 1993. That action placed the CRV System in a condition that ensured it would perform its intended function. An Action Plan was developed to track and ensure resolution of this and other identified CRV related concerns.

In August 1993, the engineering organizations defined and verified the CRV System reference pressure parameters and evaluated the applicability of the single failure criterion. They also reviewed the 1981 NUREG-0737 submittal and re-evaluated compliance. It was during this review that, on September 23, 1993, engineering determined that the un-quantified amount of unfiltered air flowing into the Control Room (through the bypass damper) with the CRV System in the "isolate" mode of operation with a postulated single failure, specifically, of an isolation MOV to close was reportable. This was reported in LER-93-019-00.

DESCRIPTION (continued)

During subsequent reviews, engineering identified another single failure concern on October 29, 1993. Some control and power cables for safety-related CRV System fans, dampers, and isolation MOVs were identified as non-safety related and were routed in common, non-safety related electrical raceways. The components affected were the two Control Room Filter Train Fans and their associated dampers, and the Intake and Exhaust Isolation MOVs (70MOV-107 and 108). The concern was identified following an electrical separation review by engineering of all major CRV System equipment and components. The CRV System was kept in the isolate mode so that actuation of the dampers and MOVs would not be required until a modification was completed which rerouted and relabeled the subject cables. An automatic swap-over feature for the two filter train fans and their associated discharge dampers has been temporarily defeated by a modification until a further evaluation and any required hardware changes could be completed. This was reported in LER-93-019-01. (The isolation MOV cables have since been rerouted.)

Degraded Equipment Conditions:

On August 4, 1993, engineering discovered that the temperature indicators used to verify the operability of the CRV System as required by Technical Specifications (system capacity test) were not calibrated prior to the test. The temperature indicators were subsequently calibrated (they were within tolerance) and were added to the Preventive Maintenance Program.

On August 27, 1993, engineering personnel were measuring relative pressures between the Control Room and surrounding areas. The Control Room pressure was 0.14 inches of water lower than the Relay Room pressure and was 0.12 inches of water lower than outside atmosphere pressure. The Control Room pressure should have been higher than the other two pressures. Subsequent investigations revealed that the Control Room differential pressure controller measured pressure relative to the CRV equipment chiller room which is outside the CRV envelope. The chiller room pressure was found to be less than atmospheric which caused the controller output to be biased abnormally low. Steps were taken to disconnect the controller output and realign the modulating dampers to the positions which provided maximum Control Room pressure, restoring the proper differential pressure between the Control Room and all surrounding air spaces. Also, leaks were found in various locations on the Relay Room [NA] Ventilation System Filter Housing which is inside the CRV System envelope. The in-leakage was raising the Relay Room pressure. (The leaks have since been repaired.)

DESCRIPTION (continued)

Another degraded equipment condition was found on September 13, 1993, when an inspection performed by engineering in response to the Action Plan identified small gaps along the seating surfaces in three of the four closed isolation MOVs. The isolation MOVs were re-closed manually in an attempt to obtain a better seal. However, some leakage was still evident.

On September 22, 1993, differential pressure measurements were taken to determine system pressures and the direction and amount of leakage past the isolation MOVs. On September 23, 1993, engineering determined that an un-quantified amount of air was leaking past the isolation MOVs into the Control Room with the CRV System in the "isolate" mode of operation. The pressure in the ventilation duct was found to be lower than expected, resulting in the in-leakage of unfiltered air into the Control Room.

Concurrently, the air gaps in the isolation MOVs were being evaluated for their effect on system operability. The engineering organizations performed calculations to determine the in-leakage based on field measurements of the gaps. Engineering determined the leakage past the intake isolation MOV (70MOV-108) did not result in a habitability concern. There were no gaps found in the exhaust isolation MOV (70MOV-107). Engineering initiated an update to the Control Room Habitability Calculation. However, engineering noted that the adjacent Relay Room pressure was higher than the Control Room pressure and the leakage past two Relay Room ventilation system isolation MOVs was not quantified. A temporary modification was issued to seal all leaking isolation MOVs. (The isolation MOVs have since been repaired and returned to service during the April, 1994 maintenance outage. The calculation has been updated.)

Inadequately Balanced System Flows:

The manual balance dampers on the emergency filter trains had been adjusted in the past to provide the proper amount of flows through the filter trains. However, during work on a failed fresh air inlet damper (70MOD-113) in August, 1993, the manual balancing dampers on the filter trains were readjusted to maintain flows to the Control Room. Upon restoration of the inlet damper, flows through the filter trains increased due to reduced restriction in the recirculation flow path. This condition was not readily recognized because of the difference in flow characteristics for the recirculation and the fresh air flow paths. On September 17, 1993, engineering found that the CRV air supply flows through the two filter trains exceeded the maximum value of 1100 cubic feet per minute (cfm) as specified in the Technical Specifications. (The CRV System was subsequently balanced and proper filter train flows were restored.)

DESCRIPTION (continued)

Inaccurate Design and Licensing Basis Documentation:

On October 13, 1993, in response to an NRC question, engineering found that the description in the Updated Final Safety Analysis Report (UFSAR) (Section 9.9.3.11) of the automatic swapover function of CRV System air handling units, reciprocating water chillers and pumps, and recirculation exhaust fans was not consistent with other plant documents and with CRV System operation. The UFSAR states that all opposite train equipment will auto-start if one component in the operating train fails. A review by the engineering organizations verified that the existing configuration is consistent with the original design and plant drawings. By design, if one air handling unit fails, the other air handling unit (with associated chiller and pump) starts, and if one recirculation exhaust fan fails, the other exhaust fan starts. (A Nuclear Safety Evaluation supporting the UFSAR change was approved and the UFSAR will be revised.)

On November 8, 1993, engineering determined that the original Control Room Habitability Calculation (dated November 2, 1972), as well as a later Habitability Calculation dated September 30, 1993, had assumed a normal ventilation air intake flow rate of 1500 cfm prior to manually switching to the isolate mode following a radiological release. The UFSAR (Section 14.8.1.5) also contained the 1500 cfm value. Depending on weather conditions the intake air flow could be as much as 13,150 cfm. The higher flow rate was corroborated by the original engineering organization. (The calculation has since been revised and the UFSAR will be updated.)

The most recent concern was identified on February 24, 1994. Engineering noted that methods identified in the original CRV System design to limit relative humidity below 70 percent were not implemented during original plant construction. The original design had required a provision to recirculate a fraction of the CRV System charcoal filter train air supply to control humidity to less than 70 percent. According to Regulatory Guide 1.52, if relative humidity exceeds 70 percent, the filter effectiveness of 99 percent cannot be justified. Engineering found a 1974 calculation which assumed 99 percent effectiveness. This potential condition was reported to the NRC.

Subsequent review by engineering determined that the 1974 requirement for 99% effectiveness was based on a proposed configuration of the Main Steam Leakage Collection System (MSLCS) which was different from what was later installed in the plant. The requirement was not relevant and there was no adverse condition.

DESCRIPTION (continued)

Current Status:

The CRV System is now operable in all modes of system operation. Surveillance Testing has ensured that the Control Room pressure is positive relative to all surrounding areas. The CRV System Action Plan corrective actions are continuing to address programmatic issues and to implement necessary modifications. The CRV design basis document has been reviewed and is currently being revised. Additional actions are being taken to correct documentation deficiencies.

EVENT CAUSE

The cause of this event appears to be inadequate design control and design documentation (Cause Code B) by engineering organizations, combined with inadequate preventive maintenance on the MOVs and dampers, and inadequate surveillance testing for in-leakage (Cause Code E).

The failure to recognize the deviations during subsequent reviews and the differences in flow characteristics was caused by a lack of a comprehensive CRV System design and licensing basis documentation (Cause Code B).

EVENT ANALYSIS

The flow through the bypass dampers as a result of a postulated single failure was reportable under the provisions of 10CFR 50.73 (a)(2)(ii)(B) since the condition appeared to be outside of the current plant design basis. The purpose of maintaining a positive pressure in the Control Room during emergency operation is to ensure any leakage is out of (rather than into) the Control Room. The original Control Room Habitability Calculation did not allow for any unfiltered in-leakage.

Although there is insufficient data to quantify the amount of flows through the bypass damper and other leakage paths, engineering judgement is that the current Habitability Calculation (which assumes 2100 cfm) generally bounds the condition, based on flows and pressure drops obtained from recent CRV System capacity testing. The result of these calculations show that a control rod drop accident is the worst case scenario, with a thyroid dose of 6.26 rem. This is less than the regulatory exposure limits (from 10CFR50, Appendix A, GDC 19 and Standard Review Plan, Section 6.4) of 30 rem to the thyroid.

EVENT ANALYSIS (continued)

To demonstrate that a higher infiltration rate would not significantly degrade habitability, another calculation assuming an infiltration rate of 15,000 cfm yielded a dose of 8.5 rem to the thyroid. (A main steam line break outside containment is not the worst case scenario based on the assumption that reactor coolant activity levels are less than or equal to 0.2 uCi/gm does equivalent I-131. FitzPatrick Technical Specification 3.6.C.1 limits equilibrium reactor coolant activity levels to 3.1 uCi/gm. NRC Standard Technical Specifications limit activity to 0.2 uCi/gm.)

Another evaluation was approved on April 20, 1994, (and revised May 11, 1994) which evaluated the habitability of the Control Room based on the current, repaired configuration and the acceptability of returning the CRV System to the normal mode of operation. Based on these habitability evaluations, the safety significance of this occurrence is low.

CORRECTIVE ACTIONS

1. The CRV System was placed in the "isolate" mode of operation. This was done as a conservative measure in anticipation that the evaluation might indicate excessive in-leakage. Completed July 9, 1993. Since then, the CRV System has been repaired and has been returned to the normal mode of operation during the April, 1994 maintenance outage.

2. A CRV System Action Plan has been developed, revised, and expanded which outlines further evaluations, reviews, and corrective actions to be taken. The plan, initially issued July 30, 1993, has been updated periodically and has been used as a tool in managing the CRV System discrepancies as they are identified and resolved.

CORRECTIVE ACTIONS (continued)

3. The isolation MOVs were temporarily sealed and verified leak-tight. Engineering re-performed the pressure tests and verified the Control Room had a higher differential pressure, re-establishing the habitability in the Control Room. Completed September 25, 1993.

4. In order to temporarily resolve the cable separation concern, the two isolation MOV power supply breakers were opened and cables associated with the filter train fans and dampers were disconnected at both ends. Since then, the MOV cable separation issues were resolved through a modification during the April, 1994 maintenance outage.

5. The repair of the three leaking isolation MOVs (as well as the fourth MOV) was completed during the April, 1994 maintenance outage. The seals were tested by the direct measurement and pressure decay method.

6. A ventilation expert was hired to identify and resolve additional discrepancies and assist with balancing airflows. The system was balanced and a surveillance test confirmed a positive pressure in the Control Room relative to all surrou.ding areas.

7. The Preventive Maintenance Program evaluations will be reviewed and changed to incorporate the CRV MOVs and, if needed, the motor operated dampers. Estimated completion date: September 30, 1994.

8. The CRV design basis document has been reviewed and is being revised. Estimated completion date: September 30, 1994.

9. A revised NUREG-0737 submittal will be submitted. Estimated completion date: September 30, 1994.

ADDITIONAL INFORMATION

Failed Components: None

Previous Similar Events: None

Related Industry Experience: INPO OE 2465 - Control Room Environmental Control System Single Failure, 3/16/88.

NRCN 86-76 - Problems Noted in Control Room Emergency Ventilation Systems, 8/28/86.

SIMPLIFIED SKETCH OF CONTROL ROOM VENTILATION