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DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
LICENSEE EVENT REPORT 88-013-03 - INOPERABLE CONTROL ROOM VENTILATION SYSTEM

Licensee Event Report (LER) 88-013-03 (Inoperable Control Room Ventilation System) is attached. This event was reportable to the NRC per 10CFR50.73(a)(2)(i) on September 22, 1988 and revised on November 17, 1988 and March 31, 1989. This revision provides final information regarding the results of engineering evaluations concerning the installation of control room HVAC modification. The changes are marked by a vertical line in the right margin.

Brian D Johnson
Staff Licensing Engineer

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

Attachment

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OC0889-0016-NL02

NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
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LICENSEE EVENT REPORT (LER)

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TITLE (4)

INOPERABLE CONTROL ROOM VENTILATION SYSTEM

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)
									N/A	0 5 0 0 0
0 8	2 3	8 8	8 8	0 1 3	0 3	0 8	3 1	8 9	N/A	0 5 0 0 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	X 50.73(a)(2)(viii)(A)	
		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
C S Kozup, Technical Engineer, Palisades Plant	AREA CODE 6 1 6 7 6 4 - 8 9 1 3

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	V I			No					

SUPPLEMENTAL REPORT EXPECTED (14)

		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

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

At 1700 hours on August 22, 1988 the Control Room (CR) Heating Ventilation and Air Conditioning (HVAC) system [VI] was declared inoperable for failing to meet acceptance criteria defined in Technical Specification Surveillance Procedure RO-28, "Control Room/Technical Support Center Ventilation". During this test the CR HVAC system failed to maintain the required 0.125 inches water-gauge required. On October 27, 1988 errors were identified in analyses which were utilized to specify CR HVAC iodine removal capabilities. These errors resulted in the CR HVAC being unable to meet General Design Criterion (GDC) 19 since its original operation in 1983.

Failure of the CR HVAC to meet surveillance requirements was due to electrical penetrations in the CR floor being opened for outage modifications and an improper fan line-up specified in RO-28 for the adjacent switchgear area ventilation system. The failure of the CR HVAC system to meet GDC 19 is due to calculation errors made when prescribing the required iodine removal capacity. Acceptable CR habitability analyses have been performed for all Design Basis Accidents. Radiation monitoring instrumentation was placed within the CR HVAC envelope to provide for early detection. Automatic switchover of the CR HVAC into the emergency mode will be provided from detection of preset radiation levels within the radioactive gaseous monitoring system and the main steam line gamma monitor.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Description

At 1700 hours on August 22, 1988 the Control Room (CR) Heating, Ventilation and Air Conditioning (HVAC) system [VI] was declared inoperable for failing to meet acceptance criteria defined in Technical Specification (TS) Surveillance Procedure RO-28, "Control Room/Technical Support Center Ventilation". During the surveillance test, while in the emergency mode, the CR HVAC system maintained a positive pressure of approximately 0.020 inches water-gauge, however, 0.125 inches water-gauge is required. This differential pressure aids in assuring the radiation exposure of CR personnel will be within the guidelines of 10CFR50 Appendix A, General Design Criterion (GDC) 19 during postulated design basis accidents. In the normal mode, the CR HVAC maintained the required differential pressure. During subsequent analyses to determine the significance of the surveillance test failure, errors were identified on October 27, 1988 in analyses which were utilized to specify CR HVAC iodine removal capabilities. The Plant was in the refueling condition when both the test failure and design deficiencies were noted.

The function of the CR HVAC is to maintain an environment suitable for continuous personnel occupancy in both normal and emergency modes for the CR and Technical Support Center (TSC). During post Design Basis Accident (DBA) operation, the system removes (by filtration) airborne radioactive materials to ensure habitability. The system is made up of two redundant trains. Each train is capable of maintaining a suitable environment and consists of an air handling unit [VI;FAN], filtration unit [VI;FLT], condensing unit [VI;CDU] and associated control circuitry. Each train is powered by an appropriate safety-related bus and backup emergency diesel generator [EK;DG].

The HVAC system has three modes of operation; normal, emergency and 100 percent recirculation. The normal operating mode provides outside air to the CR/TSC via the air handling unit. The emergency mode is initiated by a containment high pressure or high radiation signal. On receiving one of the above signals, the normal air supply is isolated and the supply source of outside air is transferred to a location 100 meters from the Containment Building. The outside is then routed through the filter unit (HEPA & charcoal filters) before introduction into the CR/TSC area. The third mode of operation is the 100 percent recirculation mode which is initiated only by operator action. The operator may close the outside air supply damper which then provides for recirculation of 100 percent of the CR/TSC air through the air handling unit/air filter unit and back to the CR/TSC.

Investigation by Plant engineering personnel following the August 22, 1988 test failure revealed that ten electrical penetrations in the floor of the CR were open in support of on-going modifications. In order to determine the cause of the test failure, the open penetrations were resealed that same day and the surveillance test reperformed on the following day. With all penetrations resealed, the CR HVAC system met the 0.125 inch water-gauge

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acceptance criteria. Due to the immediate inability to determine the maximum size of an open penetration which would cause the CR HVAC to exceed its design basis, the condition was deemed to be reportable per 10CFR50.72 and both trains of the HVAC system declared inoperable at 1700 on August 23, 1988.

An analysis was completed on August 27, 1988 which analytically established the maximum open area of a penetration within the CR envelope such that the CR HVAC would remain operable. This area was determined to be 266 square inches. Also on August 27, 1988 an analysis was completed to assure the guidelines of Criterion 19 of 10CFR50 Appendix A would be satisfied following the hypothetical fuel handling accident. This analysis concluded that the equivalent whole body odes to CR personnel would not exceed 3.845 Rem. As this is bounded by the 5 Rem requirement presented in Criterion 10, refueling activities were allowed to proceed in parallel with ongoing modification activities.

On August 30, 1988 CP submitted a letter to the NRC which identified that the changes requested for our proposed TS Change Request of February 28, 1986 to be overly restrictive for cold shutdown and refueling conditions. The August 30, 1988 submittal further noted that administrative controls have been developed which ensure that the Plant will remain within its design basis positive pressure limits. These controls include Action Statements regarding CR HVAC system operability for cold shutdown and refueling conditions and restricting the size of openings within the CR envelope to less than 266 square inches.

While performing a new analysis, it was determined that the previous CR habitability study which form the design basis for the CR HVAC only included a dose consequence analysis following the "Maximum Hypothetical Accident" (MHA). This previous analysis was reviewed via NRC SER dated April 29, 1983.

A dose consequence analysis was initiated for the hypothetical volume control tank (VCT) [CB;TK] rupture utilizing a source term defined by the highest peak primary coolant system (PCS) [AB] iodine concentration since 1983. The rupture of the VCT has been previously analyzed in Palisades FSAR Section 14.21, "Waste Gas Incident" with respect to offsite dose consequence. As stated in the FSAR, "the VCT and the associated piping are not subjected to high temperatures or high stresses. The VCT is designed for a differential pressure of 90 pounds per square inch and temperature of 250 degrees F" with "normal operation at 10 pounds per square inch and 120 degrees F". Further, the VCT is equipped with level instrumentation and alarms and is protected against overpressurization by dual relief valves [CB;RV].

An evaluation by Plant engineering personnel indicates that either of the two relief valves could provide protection against inadvertent tank overpressurization. The discharge from these relief valves is routed to

dirty waste drain tank T-60 [WF;TK] located in the East Engineered Safeguards Room. This room and the adjacent West Engineered Safeguards Room are equipped with radiation monitors which isolate (typically at 900 counts per minute). Any failure in this system is considered highly improbable, however, the analysis was performed to determine the consequences of a VCT rupture from past operational data. Since Standard Review Plan Sections 15.7.1, "Waste Gas System Failure" and 15.7.2, "Radioactive Liquid Waste System Leak or Failure (Release to Atmosphere)" were deleted July 9, 1981, no guidance regarding analysis parameters could be identified. Therefore, many conservative, simplifying assumptions were used in this particular analysis. The results of this analysis determined that the existing CR HVAC has been in compliance with GDC 19 for this scenario. The results and a copy of this analysis were presented to the NRC Resident Inspector.

Since the original CR habitability analysis was completed, several changes have been made to the MHA analysis. These changes include the use of site specific atmospheric dispersion coefficients, a more accurate delivery time for hydrazine into containment spray water and an additional release pathway due to containment venting practices. While completing the reanalysis for CR habitability following the MHA, corporate engineering personnel further identified that two errors had been made in the original design calculations for prescribing the required CR iodine protection factor. The original design calculation misinterpreted the MHA radionuclide inventory which was available for release from the containment. This misinterpretation introduced a factor of approximately two non-conservative error into the CR HVAC system design requirements. Further, an error was made when utilizing the iodine protection factor calculational method described in "Nuclear Power Plant Control Room Ventilation System Design for Meeting General Design Criterion 19", K G Murphy, etal. This method calculates the protection factor granted by the iodine removing charcoal installed in CR HVAC system. The "unprotected" thyroid dose is then divided by this factor to yield the resulting "protected" thyroid dose. While deriving the iodine protection factor, an error was made when utilizing an "effective" atmospheric dispersion coefficient to account for unfiltered inleakage and incoming make-up air. When applying this "effective" atmospheric dispersion coefficient to the filter efficiencies of the CR HVAC another factor of approximately two non-conservative error was introduced. Therefore, the CR HVAC iodine removal efficiency was inadequately designed and installed with a factor of approximately four non-conservative error. This discovery was reported under 10CFR50.72(b)(2)(i) on October 27, 1988.

In order to re-evaluate CR habitability following the MHA, the MHA radionuclide inventory available for release and release rates for the containment ventilation pathway, the maximum containment and engineered safety feature (ESF) equipment leakage were recalculated. From this data, the dose commitments (in Rem) at the site boundary and low population zone listed below were derived:

	Containment Vent Pathway	Containment Leakage	ESF Leakage	Total
Site Boundary				
Thyroid	2.28E-2	42.92	26.78	69.72
Whole Body	2.76E-5	0.899	7.60E-2	0.975
Low Population				
Thyroid	2.00E-3	12.88	26.75	39.63
Whole Body	3.38E-6	0.204	2.70E-2	0.231

The CR habitability analysis following the revised MHA was then completed. This initial effort resulted in a calculated dose commitment to CR operators which exceeded the limits specified in GDC 19. Following discussions with NRC personnel on November 2, 1988, CR habitability was re-analyzed.

The CR habitability analysis following an MHA recently completed, yields a committed whole body equivalent dose of 4.86 Rem. This dose commitment is in compliance with the GDC 19 value of 5.00 Rem whole body equivalent dose. This analysis incorporates the revised MHA source term, takes credit for zero unfiltered inleakage (as recognized by Standard Review Plan 6.4) and utilizes the methods of calculating equivalent whole body dose presented in Publication 30 of the International Commission on Radiation Protection (ICRP 30).

Cause Of The Event

Failure of the CR HVAC system to maintain 0.125 inches water-gauge in the emergency mode during the performance of Surveillance Test RO-28 was due to open electrical penetrations in the floor of the CR and the switchgear area ventilation fan line-up required by revision 10 of RO-28. The penetrations had been opened during Plant operation to support ongoing modifications being performed during the present refueling outage and formed an open bridge between the normally isolated CR and switchgear area inlet fan, V-33 be secured, while exhaust/recirculation fan V-43 remain in operation. Therefore, the unbalanced ventilation system in the switchgear area took suction from the CR ventilation envelope. This fan line-up is not believed to have existed during periods of Plant operation. The previous revision of RO-28 did not incorporate this abnormal fan line-up. The reason for revision RO-28 to present an improper fan line-up could not be determined.

The root cause of this event is attributed to the failure to control the opening of penetrations, an improper test fan line-up and the subsequent outward leakage within the envelope controlled by the CR HVAC system. A review of the 10CFR50.59 analyses (Safety Evaluations) completed in support of the modifications, was conducted to determine the adequacy of the safety

evaluations in regard to maintenance of CR HVAC system operability in required modes of operation. This review determined that neither the 10CFR50.59 analysis preparer or its subsequent reviewers considered the potential impact on the CR HVAC system. The 10CFR50.59 analysis did adequately consider fire protection, cable separation and worker safety issues.

The existing Palisades TS do not specifically identify the applicable operational conditions for the CR HVAC system. To compensate for this, administrative controls via Standing Order 54 delineate CR HVAC system operability as "at all times". This section of Standing Order 54 was established in support of a TS change request submitted to the NRC on November 19, 1984 and its revision submitted on February 28, 1986.

The failure to provide a CR HVAC system which would meet GDC 19 when it was installed is due to calculational errors made by CP personnel when prescribing the required iodine removal capacity. These errors are attributable to mis-interpretation and mis-application of available data and calculational methodologies. Since the original design inputs for the CR HVAC were prescribed, the MHA analysis has been revised twice. However, the CR HVAC habitability analysis, Palisades FSAR Section 14.24 was not revised to account for the changes. The failure to update all affected accident/incident analysis described in Section 14 has been attributed to inadequate review for applicability of changes on previously defined analysis.

Corrective Actions

TS Surveillance Test RO-28 was completed on November 11, 1988 with resulting positive pressure approximately two times the required 0.125 inches water-gauge. RO-28 was revised on October 28, 1988 to correct the improper fan line-up specified for the switchgear area ventilation system.

CR habitability analyses for all design basis accidents were completed on February 20, 1989. Credit was taken for vestibules as permitted by Standard Review Plan 6.4, for two points of ingress/egress into the CR HVAC envelope. Use of the remaining two points of ingress/egress will not be allowed during times when airborne radioactivity is detected in the CR. An engineering analysis has been completed which characterizes the existing vestibules. Sealing material was installed on the two outer vestibule doors as part of this characterization in November 1988. Preventive maintenance activities are being generated to inspect and repair as necessary the seals on doors associated with the CR HVAC envelope. The results of all the recently completed analyses demonstrate compliance with GDC 19 as indicated below:

FSAR Section	Event Description	Dose
14.11	Postulated Cask Drop Accidents - 30 day decay with filtration operable	3.07
14.11	Postulated Cask Drop Accidents - 90 day decay with no filtration	0.116
14.14	Steam Line Rupture Incident - Outside containment/concurrent iodine spike	0.693
14.14	Steam Line Rupture Incident - Outside containment/previous iodine spike	0.648
14.14	Steam Line Rupture Incident - Inside containment/previous iodine spike	2.29
14.15	Steam Generator Tube Rupture Incident - Concurrent iodine spike	2.03
14.15	Steam Generator Tube Rupture Incident - Previous iodine spike*	4.56
14.16	Control Rod Ejection Incident - **	4.59
14.19	Fuel Handling Incident -	0.527
14.20	Liquid Waste Incident -	N/A
14.21	Waste Gas Incident - VCT Rupture/ equilibrium iodine	0.172
14.21	Waste Gas Incident - VCT Rupture/ previous iodine spike	4.27
14.22	Maximum Hypothetical Accident -	4.86
14.23	Failure of Small Lines Outside Containment - equilibrium iodine	0.156
14.23	Failure of Small Lines Outside Containment - Previous iodine spike	3.32

All doses are total committed equivalent whole body dose in Rem

*Assumes a maximum PCS iodine concentration (spiking conditions) of 25 micro-Curies per gram dose equivalent iodine - 131. TS 3.1.4.c currently specifies 40 micro-Curies per gram.

**Assumes primary to secondary leakage in each steam generator to be 0.2 gallons per minute during steady state operation and 0.4 gallons per minute during transient operating periods. TS 3.1.5.d currently specifies 0.3 and 0.6 gallons per minute during steady state and transient operating periods respectively.

Administrative controls have been instituted to maintain these administrative limits.

Radiation detection instrumentation was installed within the CR HVAC envelope to provide for detection of airborne radioactivity in November 1988. An Operations Department Standing Order was in-place prior to Plant criticality which delineated required actions in the event of detection instrumentation alarms. This Standing Order directs operators to; 1) place the CR HVAC in the emergency mode, 2) restrict access through the two ingress/egress pathways without existing vestibules, 3) review Plant operating parameters, and 4) request Health Physics personnel to obtain appropriate air samples to confirm the presence of airborne radioactivity.

An evaluation was conducted which determined that installing processing radiation monitors in the normal CR HVAC intake for early detection would provide margin with respect to limits specified in GDC 19. However, due to the prohibitive preliminary cost estimate of this type of modification, additional evaluations were conducted to determine if other cost beneficial engineering options were available. These evaluations reviewed the desirability of having the CR HVAC system automatically switched into the emergency mode upon detection of airborne radioactivity by existing radiation detection instrumentation. As a result of this evaluation, automatic switchover of the CR HVAC system into emergency mode will be provided from detection of present radiation levels within the radioactive gaseous effluent monitoring system and the main steam line gamma monitor.

On August 30, 1988 CP submitted a letter to the NRC which committed to provide a revised TS change request and supporting analysis with specific operability requirements for the CR HVAC system prior to Plant restart. In light of the design errors discovered, analysis remaining to be completed and efforts associated with the Combustion Engineering Owner's Group Restructured Standard Technical Specifications, the submittal will not be made as originally planned. Until such time that remaining evaluations are complete and the applicability of the Restructured Standard TS is determined, CR HVAC operability requirements will be defined by existing Plant TS and enhancements to an Operations Department Standing Order. This Standing Order will include the requirement to maintain zero open penetrations above the cold shutdown condition, not including normal ingress/egress pathways, until such time that analysis can justify the opening or NRC acceptance has been obtained.

An evaluation to determine the desirability of installing a vestibule at the two pathways currently without vestibules was recently completed. As a

result of this evaluation, current plans are to perform a modification which will install these vestibules, thereby providing an additional ingress/egress pathway during required conditions.

Analysis Of The Event

The current radiological habitability analysis for the CR HVAC system was performed in accordance with Standard Review Plan 6.4. The source term utilized in this analysis is based on Regulatory Guide 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors", FSAR Section 14.22, "Maximum Hypothetical Accident" and methods described in Publication 30 of the International Commission on Radiation Protection, "Limits for Intakes of Radionuclides by Workers". As detailed above, the installed CR HVAC system meets the limits specified in GDC 19 when zero unfiltered inleakage is assumed. This assumption is recognized in Standard Review Plan 6.4 "when two door vestibules or equivalent" are utilized at points of ingress/egress.

An analysis was completed on August 27, 1988 which satisfactorily demonstrated CR HVAC system operability with open penetrations during the hypothetical fuel handling accident.

This condition is being reported per 10CFR50.73(a)(2)(ii) as a potential condition that was outside the design basis of the Plant and 10CFR50.73(a)(2)(vi).

Additional Information

For information regarding changes in the MHA analysis due to hydrazine delivery time to containment spray water, reference Licensee Event Report 87-007.

For information regarding the additional radionuclide release pathway due to current containment venting practice, reference Licensee Event Report 88-010.