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March 15, 2002

United States Nuclear Regulatory Commission
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Docket No. 50-315

Document Control Manager:

In accordance with the criteria established by 10 CFR 50.73 entitled Licensee Event Report System, the following report is being submitted:

LER 315/1999-012-01, "Auxiliary Building ESF Ventilation System may not be Capable of Maintaining ESF Room Temperatures Post-Accident"

There are no new commitments identified in this submittal.

Should you have any questions regarding this correspondence, please contact Mr. Gordon P. Arent, Manager Regulatory Affairs, at 616/697-5553.

Sincerely,

Eric A Larsen
S.V.

Joseph E. Pollock
Site Vice President

RW/pae

Attachment

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IE22

NRC Form 366 (7-2001) 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 7-31-2004

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Cook Nuclear Plant Unit 1	05000-315	1 of 6

4. TITLE

Auxiliary Building ESF Ventilation System May Not Be Capable Of Maintaining ESF Room Temperatures Post-Accident

5. EVENT DATE			6. LER NUMBER				7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER		REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										D.C. Cook, Unit 2	05000-316
04	20	1999	1999	--	012	-- 01	2002	03	15	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE		11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)			
		20.2201(b)	20.2203(a)(3)(ii)	50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)
10. POWER LEVEL		20.2201(d)	20.2203(a)(4)	50.73(a)(2)(iii)	50.73(a)(2)(x)
		20.2203(a)(1)	50.36(c)(1)(i)(A)	50.73(a)(2)(iv)(A)	73.71(a)(4)
		20.2203(a)(2)(i)	50.36(c)(1)(ii)(A)	X 50.73(a)(2)(v)(A)	73.71(a)(5)
		20.2203(a)(2)(ii)	50.36(c)(2)	50.73(a)(2)(v)(B)	OTHER Specify in Abstract below or in NRC Form 366A
		20.2203(a)(2)(iii)	50.46(a)(3)(ii)	50.73(a)(2)(v)(C)	
		20.2203(a)(2)(iv)	50.73(a)(2)(i)(A)	50.73(a)(2)(v)(D)	
		20.2203(a)(2)(v)	50.73(a)(2)(i)(B)	50.73(a)(2)(vii)	
		20.2203(a)(2)(vi)	50.73(a)(2)(i)(C)	50.73(a)(2)(viii)(A)	
		20.2203(a)(3)(i)	50.73(a)(2)(ii)(A)	50.73(a)(2)(viii)(B)	

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
R. A. Meister, Compliance Specialist	616-465-5901-1707

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED			15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If Yes, complete EXPECTED SUBMISSION DATE).	X NO				

16. Abstract (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

This LER supplement is being submitted to include revised information related to the completed root cause evaluation and replaces the previous LER in its entirety.

On April 20, 1999, during performance of the Expanded System Readiness Review for the Auxiliary Building Ventilation Systems, it was concluded that there was insufficient assurance that the Engineered Safety Features Ventilation (AES) system is capable of performing its safety and accident mitigation function. This conclusion was based on a preliminary evaluation of numerous identified system deficiencies taken in the aggregate. Specifically, the identified concerns were significant errors in calculations for auxiliary building Engineered Safety Features cubicle temperatures expected during postulated accident scenarios, vulnerability of AES damper control air system modification to single failure; and lack of missile protection for the Component Cooling Water pump area supply fans. Based on the combined effects of these deficiencies, the ability of the AES system to maintain auxiliary building temperatures to within safety-related equipment design temperatures under accident conditions could not be assured.

The cause for this condition was the failure to adequately control design basis calculations and supporting documentation. Specifically, documentation and calculations supporting the plant configuration related to Auxiliary Building ESF Ventilation System contained errors, or did not meet current standards for technical attributes. Corrective actions included implementation of analysis and implementation of plant modifications to demonstrate and ensure compliance with design requirements.

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Conditions Prior to Event

Unit 1 was in Mode 5, Cold Shutdown
Unit 2 was in Mode 5, Cold Shutdown

Description of Event

On April 20, 1999, during performance of the Expanded System Readiness Review for the Auxiliary Building Ventilation Systems, it was concluded that there was insufficient assurance that the Engineered Safety Features Ventilation (AES) system was capable of performing its safety and accident mitigation function. This conclusion was based on a preliminary evaluation of numerous identified system deficiencies taken in the aggregate. Specifically, the identified concerns were significant errors in calculations for auxiliary building Engineered Safety Features cubicle temperatures expected during postulated accident scenarios, vulnerability of AES damper control air system modification to single failure; and lack of missile protection for the Component Cooling Water pump area supply fans. Based on the combined effects of these deficiencies, the ability of the AES system to maintain auxiliary building temperatures to within safety-related equipment design temperatures under accident conditions could not be assured.

In accordance with the requirements of 10CFR50.72(b)(2)(iii)(D), a 4 hour notification was made to the NRC on April 20, 1999, at 1645 hours, for any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident.

This LER supplement is being submitted to include revised information related to the completed root cause evaluation and replaces the previous LER in its entirety.

Cause of Event

The cause for this condition was the failure to adequately control design basis calculations and supporting documentation. Specifically, documentation and calculations supporting the plant configuration related to Auxiliary Building ESF Ventilation System contained errors, or did not meet current standards for technical attributes.

These issues were symptoms of the larger generic issue of inadequate design and licensing basis control that had been previously identified and confirmed during the Expanded System Readiness Reviews. This issue was previously identified in AEP:NRC:1260GH, dated March 19, 1999, "Enforcement Actions 98-150, 98-151, 98-152 and 98-186, Reply to Notice of Violation Dated October 13, 1998."

Analysis of Event

The AES system safety and accident mitigation function is to provide sufficient cooling to the auxiliary building general areas and ESF equipment rooms required to operate during accident conditions. This includes the CCW, Containment Spray, Residual Heat Removal, Charging and Safety Injection equipment rooms. The AES system also maintains the auxiliary building at a negative pressure relative to the outside environment to ensure radioactive contamination released during an accident is contained within the auxiliary building, filtered and exhausted to the environment via a monitored release path. In addition, Technical Specification 3.7.6.1 requires that two independent AES ventilation system fan/filter exhaust trains be operable in Modes 1 through 4. The following concerns were identified in Revision 0 of this LER and are discussed below:

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1. Calculation Deficiencies in Determining ESF Cubicle Temperatures Expected During Accident Conditions

Identified issue:

Calculations were developed to establish the auxiliary building heat loads, ESF cubicle room and general area temperatures during normal, shutdown and accident conditions. During the ESRR review of these calculations, numerous discrepancies were identified. For example, calculations of auxiliary building area temperature during accident conditions did not include the heat load for the CCW system piping. This equipment is considered a significant heat load in the auxiliary building and excluding it from the calculation could result in non-conservative auxiliary building area temperature values. In addition, these values serve as input assumptions to other auxiliary building ventilation calculations. As a result, actual auxiliary building area and ESF cubicle room temperatures could impact the qualification of the ESF equipment located in the areas served by the AES and CCW pump area ventilation systems.

Evaluation:

There are numerous Condition Reports (CRs) associated with the various calculations that have been issued regarding Auxiliary Building temperatures in the areas served by the AES and CCW Pump area ventilation systems. As a result of the identified calculation deficiencies, an Operability Determination Evaluation (ODE) was performed under CR 00-06947 which, when combined with immediate actions, demonstrates operability of the AES system. Further, the ODE demonstrated the ability to maintain design temperatures under accident conditions in the areas housing safety-related equipment.

Additionally, since the Auxiliary Building is shared by both Units, the heat load from a Unit operating in modes 5 or 6 or in the defueled condition, when the AES system for that Unit is not required by TS 3.7.6, could affect the ability of the AES system (on the opposite Unit) to maintain temperatures in the areas served during an accident. Since no calculations previously existed to address this effect, the aforementioned ODE also addresses this shared nature of the Auxiliary Building.

In order to address the aforementioned calculational deficiencies, calculation TH-01-05, Rev. 0 was prepared and issued on 01/18/02. This calculation developed time-temperature curves for all rooms/areas in the Auxiliary Building served by the AES system under different accident scenarios. The calculation assumes the limiting AES system line-up of one AES fan operating on the accident unit (the non-accident unit is presumed to be in a mode for which TS do not require AES ventilation), with no credit for non-safety related General Supply or Exhaust fans being available on the accident unit, and no credit for safety related CCW pump area vent fans being available. The resultant temperatures in the areas served by the AES system have been assessed by the various disciplines for impact on the qualification of ESF equipment. These impact reviews have determined that the qualifications of all safety-related equipment in the rooms/areas served by the AES system and CCW Pump area ventilation system are maintained under the limiting AES system line-up of one AES fan operating on the accident unit (the non-accident unit is presumed to be in a mode for which TS do not require AES ventilation), with no credit for non-safety related General Supply or Exhaust fans being available on the accident unit, and no credit for safety related CCW pump area vent fans being available.

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2. Vulnerability of the AES Damper Control to Single Failure

Identified Issue:

The AES ventilation system consists of two fan/filter exhaust trains (one in standby) which draws air from the auxiliary building through the equipment cubicles from a common vent duct, and discharges the exhaust to the outside atmosphere via the vent stack. Each train consists of a roughing filter, high efficiency particulate air (HEPA) filters, and a normally closed pneumatically operated face damper. In addition, each train contains a bypass duct with a normally open pneumatically operated bypass damper, which directs air flow around the charcoal adsorbers. During normal operation, one fan/filter unit operates continuously, directing the exhaust air through the roughing and HEPA filters, bypassing the charcoal filters, and discharging to the unit vent. This operation aids in air distribution within the auxiliary building, isolates the atmosphere in the cubicles by inducing a draft through the entering portals and removes any heat generated within the enclosures.

In 1997, a modification to the damper control air system, 12-DCP-0049, Rev. 1, included the installation of solenoid valves in the air lines to the AES filter unit face and bypass dampers. During the performance of surveillance test 12 OHP 4030 STP.25A/B, on two separate occasions, the face damper solenoid valve failed, resulting in the face damper failing to open while the bypass dampers remained closed. For non-SI initiated events, a failure of the face damper solenoid to open the face damper or the bypass damper solenoid to open the bypass damper in response to a control signal could result in both the face and bypass dampers being in the closed position, blocking all air flow through the affected train.

In the event of a Phase B Isolation signal, the standby train is energized and the bypass dampers automatically close and the face dampers open to exhaust air directly through the charcoal filters, roughing and HEPA filters. Although the single failure of either the bypass or face damper solenoid valve would render one train of AES inoperable, it would not impact the capability of the standby fan/filter train from performing its safety and accident mitigation function.

Evaluation:

Design Change Modification 12-DCP-0049 made the following significant changes to the AES system:

On each AES unit, the two bypass dampers in series, were replaced with two dampers in parallel.
The bypass damper actuator compressed air source was changed from 20 pounds per square inch gauge (psig) to 85 psig.

Before Design Change 12-DCP-0049, each AES filter unit had two commercial grade bypass dampers mounted in series. Both bypass dampers closed in response to the same actuating signal. The filters units did not have the appurtenances for testing each damper separately, and reliance on both dampers acting together was required to pass the TS Surveillance leakage test. These two commercial grade dampers were replaced by one bank of nuclear grade, bubble-tight dampers. The new bank consists of two dampers side by side and provides a better individual damper geometry than the previous one long damper with a short height. The single bank of new bubble-tight dampers results in less leakage than the previous configuration of two commercial dampers in series.

Prior to Design Change 12-DCP-0049, 20-psi air was supplied through three solenoid valves (in series) to both the bypass dampers and the charcoal face dampers. The new leaktight bypass dampers require higher control pressure to the bypass damper actuator, which resulted in the actuators being transferred to the 85 psig air header while the face dampers remained on the 20 psig header. Loss of the 85 psig header with the 20 psig header remaining intact would result in the bypass dampers closing without the inlet dampers opening, thus blocking the flow path through the ventilation units. Subsequent to the installation of 12-DCP-0049 and the identified drawbacks, additional changes were installed under 1-DCP-4248, 2-DCP-0547, and 12-DCP-0854 to replace the AES filter unit face dampers and modify the control air supply to the face and bypass dampers. The current configuration for the AES filter units in both Units has 85-psi air supplied through three new solenoid valves (in series) to both the bypass dampers and the face dampers. The same signals that were supplied to the three original (pre-12-DCP-0049) solenoid valves are also supplied to the three new solenoids. Loss of air or loss of power to any of the three new solenoid valves will cause the new bypass dampers to fail closed and the face dampers to fail open. This is the same response to a loss of air or loss of power that existed prior to modification 12-DCP-0049.

Updated Final Safety Analysis Report Change Request (UCR), 98-UFSAR-0295 was subsequently issued to revise UFSAR Fig. 9.9-2 and UFSAR Section 9.9.3.1 to reflect the new AES filter unit bypass damper parallel arrangement. The UCR was evaluated by 10 CFR 50.59 Safety Evaluation 2000-0612-00 and concluded that the "change" was not an Unreviewed Safety Question.

3. Lack of Missile Protection for the Component Cooling Water pump area supply fans

Identified Issue:

The AES system design includes three vaneaxial supply fans located in the CCW equipment room which are located side by side, and connected to a common intake plenum and discharge duct. Because vaneaxial fans are susceptible to fan blade failures, the fan blades are a potential missile source which could impact the function of adjacent safety related components. As a result, failure of the CCW pump area supply fans could impact the ability of the AES system to maintain ESF cubicle temperatures to within equipment design temperatures, impacting the qualification of the ESF equipment.

Evaluation:

The three CCW Supply Fans (12-HV-ACCP-1,2,3) are located side-by-side in the equipment room at Elevation 633'-0" of the Auxiliary Building. The fans are connected to a common intake plenum and discharge duct. The fans are vaneaxial type and are manufactured by the Joy Manufacturing Co. The fan model number is 34-21-1150. Each fan supplies 15,000 cubic feet per minute (CFM). One fan is a standby fan. Per vendor technical manual (VTM)-JOYT-001, the fan housing is made of steel and the blades and the hub are cast aluminum.

An ODE-and an investigation had previously been conducted for potential missile generation from a vane failure for fans 2-HV-SGRS-1A and 2-HV-SGRS-4A (CR 99-13577). This investigation found that there have been vane failures associated with Joy vane-axial fans with similar material construction as for the CCW area supply fans (cast aluminum vanes and steel housings) in the past. However, the fans that failed were of much larger size than the CCW area supply fans and were contained in the fan housing and the connecting system ductwork. Also, per the ODE referenced above, the vane failure occurred due to the cyclic loading of the big vanes that resulted from not having a sufficiently long inlet duct to eliminate turbulent flow that was causing the cyclic loading. This is consistent with the INPO event evaluation in SER 63-83, Supplement 1. For fans 12-HV-ACCP-1,2,3, even though the inlet duct to the fan suction is not sufficiently long, there is a mitered elbow installed upstream of the fan suction has turning vanes,

which will prevent the flow being turbulent. Fans 12-HV-ACCP-1,2,3 are small and the cast aluminum vanes are much more rigid and are not susceptible to the flow induced cyclical loading associated with the failures of the larger fans vanes. Also, fans 12-HV-ACCP-1, 2, 3 operate at low speed (1150 revolutions per minute). A review of the failures identified in the INPO event reports indicated that aluminum vane fragments from the reported vane failures were contained by the steel fan housing of the fan unit and the system ductwork. The vanes for the CCW area supply fans are also contained in a steel housing. The vanes are located at the suction end of the steel housing. Based on the previous industry experience discussed above, it is expected that the CCW area supply fans steel housing will prevent the vanes from being ejected. Industry experience also indicates that the duct will also contain the vanes. Per specification ES-HVAC-0804-QCN, Revision 0, the duct material is a minimum 16-gauge steel. Although the duct is lighter than the housing, the impact by the aluminum vane fragments on the duct would not be perpendicular to the duct surface (the fragments would have to be deflected horizontally by the fan casing or other vanes to reach the duct skin). Therefore, the impact from the vanes would be significantly reduced from the impact of the housing. The ductwork drawing 12-5733-7 was reviewed and the ductwork and the fans were walked down to ensure there were no flexible connections near the fan that could allow vane fragments to penetrate the ductwork. All of the ductwork in the vicinity of the fans is of steel construction; no flexible joints were identified.

Based on above, CNP concluded that a failure of the aluminum vanes for fans 12-HV-ACCP-1,2,3 leading to missile generation is not expected to occur. However, If failure does occur, the failed vanes will be contained by their respective fan housing and the connecting system ductwork. Thus, the remaining CCW area supply fans themselves would not be adversely affected.

Corrective Actions

Calculations were developed and performed which demonstrated that the AES ventilation system is capable of providing the necessary cooling to affected safety-related equipment under accident conditions.

Design Changes were developed and implemented to eliminate single failure vulnerability of the AES ventilation system.

Analysis was performed to demonstrate adequacy of missile protection for the CCW Supply Fans.

Previous Similar Events

None.