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AUTH.NAME AUTHOR AFFILIATION
BREWER,S.J. Indiana Michigan Power Co. (formerly Indiana & Michigan Ele
BLIND,A.A. Indiana Michigan Power Co. (formerly Indiana & Michigan Ele
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 90-009-00:on 900921,potential loss of control rroom NVAC during postulated fire w/o conpensatory action.

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October 19, 1990

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

90-009-00

Sincerely,

A. Adam Blind
A.A. Blind
Plant Manager

AAB:clj

Attachment

cc: D.H. Williams, Jr.
A.B. Davis, Region III
M.P. Alexich
P.A. Barrett
J.E. Borggren
R.F. Kroeger
B. Walters - Ft. Wayne
NRC Resident Inspector
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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
D. C. Cook Nuclear Plant, Unit 2	0 5 0 0 0 3 1 6	1 OF 0 6

TITLE (4) Potential Loss of Control Room HVAC during Postulated Fire, Without Compensatory Action, due to Oversight in Appendix R Loss of HVAC Study

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)
0 9	2 1	9 0	9 0	0 0 9	0 0	1 0	1 9	9 0	D. C. Cook, Unit 1	0 5 0 0 0 3 1 5
										0 5 0 0 0

OPERATING MODE (9)	5	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)	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
S. J. Brewer, Nuclear Safety and Licensing Section Manager	AREA CODE 6 1 4 — 2 2 3 - 2 0 2 0

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

On September 21, 1990 during an investigation concerning the need for Control Room Heating, Ventilation and Air-Conditioning (HVAC) System for safe shutdown of either unit, it was determined that a single fire in Fire Zones 44N/44S, 51/52 or 69 could cause a loss of both primary and redundant HVAC Systems for both control rooms which is not currently covered by Plant procedures.

Immediately upon determination that the problem existed, fire watches were posted for the affected areas. The long-term corrective action is to institute procedures to cope with fire-induced loss of normal control room HVAC. The primary cause of the condition was an oversight in the HVAC Systems evaluated for the Appendix R loss of HVAC study.

Without in-place procedures and training, the exact course of events for the postulated fire cannot be determined. However, if reasonable operator actions are taken to mitigate a rise in control room temperature following a fire, the control room(s) would not require evacuation due to habitability or equipment operability concerns for a number of hours. Based on this, we believe this condition does not represent a significant hazard to the health and safety of the public.

Conditions Prior to Occurrence

Unit 1 in Mode 1 at 100 percent Rated Thermal Power.
Unit 2 in Mode 5 (Cold Shutdown).

Description of Event

During an investigation concerning the need for control room Heating, Ventilation and Air-Conditioning (HVAC) System (EIIS/VI) for safe shutdown of either unit, it was determined that a single fire in either fire zone 44N/44S, 51/52 or 69 could cause a loss of both primary and redundant HVAC Systems for both control rooms. Calculations performed during the evaluation of the need for control room cooling following an Appendix R fire revealed that control room temperatures would increase to unacceptably high values within several hours unless the operator takes simple actions to mitigate the temperature rise. Even without operator action to restore cooling, the Plant could have achieved Hot Standby before control room temperature increase became a concern.

The control rooms at Cook Nuclear Plant are each provided with a control room ventilation system that includes two air-conditioning systems, each of which is capable of providing 100% of the required air-conditioning capacity. The two air-conditioning systems for each unit share a common air distribution (duct) system. Each system includes a liquid chiller, air handling unit, circulating water pump, water piping, duct heaters, humidifier, mixing valves, duckwork, dampers, and automatic controls.

In order to determine whether a fire posed a common failure mode for the control room ventilation systems, the cable routings (EIIS/VI-CBL) for the power and control cables associated with the air handling unit were determined. The cables associated with the remainder of the control room ventilation system were not evaluated. The reason for not including cables associated with chiller operation is that as long as an air handler ventilation fan (EIIS/VI-FAN) is running, the control room can be maintained below 120 degrees F by manually diverting essential service water (ESW) directly through the water coils of an air handling unit. Present Plant procedures provide the control switch positions and manual valve operations necessary to establish this mode of control room cooling in the event that both chiller packages fail while the air handling units are functional.

The initial investigation of electrical cable routings associated with the control room air handling units reviewed the routing of: 1) the power cable for the ventilation fan motor between its motor control center (MCC) and the air handling unit; and 2) control cables associated with the air handling unit. A review of these cable routes determined that electrical

cables for the redundant air handling units for both control rooms were located in Fire Zones 6M, 44N, 52 and 69.

Since Fire Zone 6M is common to both Units 1 and 2, the HVAC cable routing in adjacent fire zones was not needed for further analysis. In FZ's 44N/44S and 51/52, the cabling for all four of the HVAC units is within 20 feet of each other; and in FZ 69 the cabling for three of the four HVAC units is within 20 feet of each other. In addition, in FZ's 51/52 and 69, some of the Unit 1, Train A and B cables are routed in the same tray. Due to this lack of separation between these cables, even the low fixed combustible loadings for these areas could not prevent a postulated fire from resulting in a loss of some of the cables. In FZ 6M, it was determined that at least one HVAC unit from Unit 1 and Unit 2 would survive. Therefore, Fire Zone 6M was removed from the unacceptable list.

Fire Protection systems are provided in FZ's 44N/44S, 51/52 and 69. An ionization detection system is provided in each of these fire zones in the areas where the HVAC cables are routed. These detection systems would provide early warning fire detection in the Unit 1 Control Room. Upon notification, the control room operators would initiate manual fire fighting activities. The fire brigade would utilize the available manual fire fighting equipment to control and/or extinguish the fire. The fire brigade's activities would assist the automatic fire suppression systems provided in FZ's 44N/44S, and 51/52.

The sprinkler systems in FZ's 44N and 44S are located beneath the obstructions caused by cable trays, conduits, piping, etc. These sprinkler systems would control and/or extinguish a floor-based fire, but would not be able to control or extinguish a fire in the cable trays above. These fire detection and suppression systems would be able to mitigate the extent of the fire's damage, but may not be able to prevent damage to all of the HVAC cables located in these fire zones.

Assuming a loss of ventilation to the control rooms, an evaluation was needed to examine control room temperature response. The initial evaluation of loss of control room cooling condition concluded that control room temperature would reach 120 degrees F in two hours, 135 degrees F in ten hours and 175 degrees F at the end of the 72-hour period evaluated. This evaluation assumed normal control room electrical heat gains without a concurrent loss of off-site power. Upon discovery that a design basis fire could render the control room cooling systems inoperable, the condition was reported to the NRC under 10 CFR 50.72 Section (b)(ii)(C), "In a condition not covered by the Plant's operating and emergency procedures," on September 21, 1990. This determination was made because Plant procedures do not provide guidance for restoring control room cooling following the postulated scenario. Additionally, a roving fire watch was established in the fire areas of concern as an interim compensatory measure.

Further control room temperature evaluations were performed to determine whether operator actions that could reasonably be expected to be taken would mitigate the control room temperature rise.

One of the potential operator actions that would have had a significant effect on reducing the control room heat-up rate would be to shut off normal control room lighting and rely on emergency lighting. This action, combined with propping open the control room doors leading to the turbine building, is expected to delay the time to reach 120 degrees F to 18 hours and reduces the maximum control room temperature to 133.9 degrees F. It is noted that loss of normal control room lighting would occur if the Plant experienced a loss of off-site power concurrent with the fire. Therefore, a loss of off-site power scenario is less severe with respect to fire-induced loss of control room cooling.

A poll of operators revealed that most operators would try to mitigate the control room heat-up by propping open both the control room doors leading to the turbine building and the door leading to the auxiliary building and using portable fans to force air to circulate through the control room. It is reasonable to expect that power will be available for powering portable electric fans during an Appendix R fire scenario when off-site power is available. A control room temperature evaluation assuming normal control room lighting and a 4000 cfm portable fan flow rate would delay the time to reaching 120 degrees F to ten hours and would minimize the maximum control room temperature to 132.2 degrees F.

An almost infinite number of response models could have been evaluated. Without in-place procedures and training, the exact course of events for the postulated fire cannot be determined.

Cause of Event

The primary cause of the condition was an oversight in the HVAC Systems evaluated for the Appendix R loss of HVAC study. The study did not include an evaluation of the susceptibility for loss of control room HVAC systems due to fire or analyze the resulting control room temperature increase for such a scenario. The control room HVAC Systems were omitted from the study due to the lack of high heat generating equipment in the control room, and because our station blackout study indicated that control room temperature would only increase to approximately 104 degrees F after four hours. In addition, every safety-related HVAC System normally considered to be required for safe shutdown should have either been evaluated for the effect of loss of HVAC, or should have been documented to have been protected from fire. The control room was a system identified with no evaluation performed.

Analysis of Event

10 CFR 50.73 Section (a)(2)(ii)(C) requires that conditions resulting in the Nuclear Power Plant being in a condition not covered by the Plant's operating and emergency procedures to be reported. Our investigation of the control room HVAC revealed that certain fires have the ability to disable the Control Room Ventilation System for both control rooms. It has been demonstrated that control room cooling is needed to maintain control room operability/habitability following such a fire and that operator actions may be required to mitigate control room heat-up. Since the actions required to restore control room cooling capability have not been incorporated into Plant procedures, the condition described is reportable per 10 CFR 50.73 Section (a)(2)(ii)(C).

An almost infinite number of response models could have been evaluated. With in-place procedures and training, the exact course of events for the postulated fire cannot be determined. However, if operator actions are taken to mitigate a rise in control room temperature following a design basis fire, the control room(s) would not require evacuation due to habitability or equipment operability concerns for a number of hours. We believe that this would have allowed the Plant to proceed to cold shutdown conditions while additional control room ventilation restoration actions are taken to ensure that long-term control room temperatures are limited to acceptable values. Based on this, we believe this condition does not represent a significant hazard to the health and safety of the public.

Corrective Actions

Immediately upon determination of the problem, fire watches were posted for the affected area. The roving fire watch will continue to be posted in the areas of concern until: 1) Plant procedures are revised to incorporate actions for restoration of control room cooling capability in the event of fire-induced loss of this capability; 2) the necessary repair equipment is made available and MCC power supplies called for in the restoration procedure have been committed for Appendix R use; and 3) cognizant personnel are made aware of the actions required to mitigate the loss of control room cooling during a fire. The long-term corrective action is to institute procedures to cope with fire-induced loss of normal Control Room HVAC. The procedure will provide detailed steps necessary to temporarily repower the fans in case of fire-induced failure. The procedural changes will be coupled with: 1) assuring that MCC's are available and controlled; and 2) assuring that wiring necessary to make the temporary changes is dedicated and conveniently available. In addition to the above actions, additional documentation changes are The wall between the control room machine rooms (HVAC equipment rooms) is

currently maintained as a three-hour barrier. The following documents need to be revised to reflect the need for this barrier to remain intact following a fire in either machine room:

Fire Protection Program Manual
Safe Shutdown Capability Assessment
Fire Hazard Analysis
Safe Shutdown System Analysis

We are also considering protecting or rerouting the HVAC cables of concern as a long-term corrective action.

At the time the loss of HVAC evaluation was performed, there were no formal procedures requiring documented information for such evaluations. Since this evaluation was performed, we have reorganized. New procedures developed after the reorganization include requirements to document information such as the safe shutdown equipment list for Appendix R. It is unlikely that a similar situation would recur. Therefore, preventative actions have already been taken and no further actions are required.

Failed Component Identified

Not Applicable

Previous Similar Events

050-315/90-6
050-315/90-8
050-315/90-10
050-315/88-14