NRC FORM 366 (5-92)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	
Donald C. Cook Nuclear Plant - Unit 1	50-315	

TITLE (4)
Inadequate Maintenance and Surveillance Practices Result in Restricted Ice Condenser Flow Passages

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: Cook Unit 2	DOCKET NUMBER: 50-316
01	22	98	98	-- 004 --	02	05	15	98	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	0	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
			20.2201(b)		20.2203(a)(3)(i)		50.73(a)(2)(iii)		73.71(b)
POWER LEVEL (10)	5		20.2203(a)(1)		20.2203(a)(3)(ii)		50.73(a)(2)(iv)		73.71c
			20.2203(a)(2)(i)		20.2203(a)(4)		50.73(a)(2)(v)		OTHER
			20.2203(a)(2)(ii)		50.36(c)(1)		50.73(a)(2)(vii)		(Specify in Abstract below and in Text, NRC Form 366A)
			20.2203(a)(2)(iii)		50.36(c)(2)		50.73(a)(2)(viii)(A)		
			20.2203(a)(2)(iv)		50.73(a)(2)(i)		50.73(a)(2)(viii)(B)		
			20.2203(a)(2)(v)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Mr. Paul Schoepf, Safety Related Mechanical Engineering Superintendent	616/465-5901, x2408

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)

On January 22, 1998, with Unit 2 in Mode 5, while personnel were touring the Unit 2 containment, it was noted that one of the ice condenser flow passages contained a large amount of frost and ice. A subsequent inspection of the ice condensers for both units identified that there were restricted flow passages in each unit's ice condenser bays, primarily in radial rows adjacent to the containment wall. As the Technical Specifications define more than one restricted flow passage as evidence of abnormal degradation, this was determined to constitute an unanalyzed condition. An ENS notification was made on January 28, 1998 at 1706 hours under 10CFR50.72(b)(2)(ii), as an unanalyzed condition found while the reactor was shutdown.

The root cause of this condition has been attributed to inadequate ice condenser maintenance practices which resulted in the blockage forming, in combination with an ineffective surveillance, which did not provide early detection of the blocked flow passage condition to allow timely corrective actions. A decision has been made to completely thaw both units ice condensers in order to address a variety of issues identified during the current unit outages. Flow passages will be confirmed clear at the conclusion of planned work. Maintenance and surveillance practices are being reviewed to ensure they adequately support ice condenser operability. These reviews will be completed and appropriate improvements in maintenance practices and surveillances will be implemented prior declaring either unit's ice condenser operable.

Detailed mapping and quantification of the flow passage blockage has been completed. This information was transmitted to Westinghouse for assessment of the impact on ice condenser and containment operability. It was concluded that the ice condensers in both units were considered operable relative to the 15 percent ice blockage criteria. Therefore, this condition was determined to be of minimal safety significance, and the health and safety of the public was never jeopardized.

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

Conditions Prior to Event
Unit 1 was in Mode 5, Cold Shutdown
Unit 2 was in Mode 5, Cold Shutdown

Description of Event
On January 22, 1998, with Unit 2 in Mode 5, while NRC and AEP personnel were touring the Unit 2 containment, it was noted that one of the ice condenser flow passages contained a large amount of frost and ice. A subsequent inspection of the ice condensers for both units identified that there were restricted flow passages in each unit's ice condenser bays, primarily in radial rows adjacent to the containment wall. As the Technical Specifications (T/S) define more than one restricted flow passage as evidence of abnormal degradation, this was determined to constitute an unanalyzed condition. An ENS notification was made on January 28, 1998 at 1706 hours under 10CFR50.72(b)(2)(ii), as an unanalyzed condition found while the reactor was shutdown.

Each ice condenser consists of 24 bays containing 81 ice baskets per bay, covering an arc of 300 degrees in the containment structure. Each ice basket is approximately 12 inches across and 48 feet long, filled with borated ice. The flow passages in between the ice baskets must be kept clear of obstruction to assure even steam flow through the ice beds during a post-accident period.

T/S surveillance 4.6.5.1.b.3 requires a once per 18 month verification, "by visual inspection of at least two flow passages per ice condenser bay, that the accumulation of frost or ice on the top deck floor grating, on the intermediate deck and on flow passages between ice baskets and past lattice frames is restricted to a nominal thickness of 3/8 inches. If one flow passage per bay is found to have an accumulation of frost or ice greater than this thickness, a representative sample of 20 additional flow passages from the same bay shall be visually inspected. If these additional flow passages are found acceptable, the surveillance program may proceed considering the single deficiency as unique and acceptable. More than one restricted flow passage per bay is evidence of abnormal degradation of the ice condenser."

The T/S surveillance of ice condenser flow passages is implemented via procedure 12 EHP 4030 STP.250, "Inspection of Ice Condenser Flow Passages." Flow passage surveillances were performed during the current unit outages at the beginning and conclusion of initial work in each ice condenser. These inspections, performed by contract personnel, did not identify the existence any abnormal ice build up in the flow passages. An NRC inspector subsequently identified a blocked flow passage in late January, 1998. As a result of the inspector finding, a 100% flow passage inspection was subsequently performed in each unit. A preliminary calculation was done to estimate the flow passage blockage on a bay-by-bay basis. The average flow passage blockage was estimated to be 10.7% in Unit 1 and 11.5% in Unit 2. Also, the 100% flow passage inspection revealed that some of the flow passages included in the earlier inspections and documented as being clear were subsequently determined to be blocked. A formal calculation was later done to determine the blockage on a bay-by-bay basis, and this information was transmitted to Westinghouse for analysis.

Cause of the Event

The root cause of this condition has been attributed to inadequate ice condenser maintenance practices which resulted in the formation of flow passage blockage, in combination with an ineffective surveillance which did not provide early detection of the blocked flow passage condition to allow timely corrective actions.

Inadequate ice condenser maintenance refers to practices which both contribute to formation of frost and ice in flow passages, and which do not result in effective clearing of deposits following maintenance or when otherwise identified. The following maintenance related factors are considered to be contributors to the formation of frost and ice in ice condenser flow passages.

Ice condenser doors are frequently opened for personnel or equipment access during maintenance periods, and doors which do not seal tight in the closed position, allow heat and humidity to enter the ice condenser. Lower ice condenser access doors are also left open during portions of outages, enclosed in tenting, to accommodate the passage of vacuum hoses used for ice bed maintenance. The situation is worsened by the extra humidity in containment during refueling outages, particularly during summer months. This contributes to frost and ice formation on latticework and in the flow passages.

Ice also accumulates between ice baskets and lattices during basket fill activities, which contributes to frost and ice blockage in the flow passages. Ice may be deposited on latticework during filling of ice baskets. Plastic bags are normally placed in the flow passages between adjacent baskets as a means to contain the ice in the basket being filled. However, because the basket and the lattice structure are so close together, the bags do not prevent some ice from accumulating between the basket and the lattice. Normal practice is to clear this ice following ice basket maintenance.

The ice condenser design provides for wall defrosts to clear ice and frost buildup. Ice condenser maintenance strategies have not effectively utilized defrosts to clear blockage near the ice condenser walls. Sublimation and transport of ice occurs from one area of the ice condenser to another. This generally occurs from the radial row 9, the row next to the crane wall, toward radial row 1, the row adjacent to the outside wall of containment. Temperature gradients within the ice bed are considered to be contributors to the ice sublimation and transport. Temperature gradients occur when air handler units are not in service due to failure or planned maintenance.

Finally, maintenance of ice condenser air handler units, which help achieve uniform temperature distribution in the ice condenser, has not been optimized. The air handler units occasionally malfunction, indicating that preventive maintenance improvements are warranted. Additionally, corrective repairs to these units were not always given a high priority within the work control process.

The flow passage blockage documented in this report is considered to be the result of a combination of these factors. For example, the priority assigned to corrective maintenance on air handler units was reviewed. It was noted that corrective maintenance on air handler units typically receive a relatively low priority for completion, given that failure of an air handler does not directly result in any inoperability of equipment. With regard to the addition of humidity to the ice condensers, at the time the noted condition was identified, both units had been in extended outages approaching six months in duration, during which significant work was performed in the ice condensers. This work required frequent opening of ice condenser doors for personnel and equipment access, which contributes to humidity in the ice condenser. Finally, numerous ice baskets were emptied and refilled during these outages, which had the potential to result in the accumulation of ice on latticework during basket filling.

Cause of Event (cont'd)

A final maintenance consideration involves the use of defrosts to control ice buildup. The ice condenser design includes provisions for both floor and wall defrosts. These design features were not effectively utilized during the current outages to control the buildup of frost and ice in areas adjacent to walls.

Surveillance activities have not been effective in consistently identifying blocked flow passages. Ineffective surveillances contributed to this event in that they did not provide early detection of the blocked flow passage condition to allow timely corrective actions. This is supported by differing results from recent surveillances performed in proximity to one another. Ice condenser surveillance deficiencies, which contributed to this event, include lack of a T/S definition of what level of flow passage blockage results in an inoperable ice condenser. Other deficiencies included lack of guidance on required qualifications for personnel performing ice condenser flow passage surveillances, lack of guidance on quality techniques to be used and lack of guidance on the use of lighting aids during inspections.

As previously noted the T/S surveillance of ice condenser flow passages is implemented via engineering procedure 12 EHP 4030 STP.250, "Inspection of Ice Condenser Flow Passages." Flow passage surveillances were performed during the current unit outages at the conclusion of initial work in each ice condenser. These inspections, performed by contract personnel, did not identify the existence of any abnormal ice build up in the flow passages. Subsequent inspection revealed that some of the flow passages included in the earlier inspections and documented as being clear were subsequently determined to be blocked. This points to ineffectiveness of the initial surveillances in detecting the flow passage blockage.

T/S surveillance 4.6.5.1.b.3 requires a once per 18 month verification, "by visual inspection of at least two flow passages per ice condenser bay, that the accumulation of frost or ice on the top deck floor grating, on the intermediate deck and on flow passages between ice baskets and past lattice frames is restricted to a nominal thickness of 3/8 inches. If one flow passage per bay is found to have an accumulation of frost or ice greater than this thickness, a representative sample of 20 additional flow passages from the same bay shall be visually inspected. If these additional flow passages are found acceptable, the surveillance program may proceed considering the single deficiency as unique and acceptable. More than one restricted flow passage per bay is evidence of abnormal degradation of the ice condenser."

While the T/S define that more than one restricted flow passage per bay is evidence of abnormal degradation of the ice condenser, the T/S do not state what amount of flow passage blockage renders the ice condenser inoperable. In response to previous instances of flow passage blockage, a blockage limit of 15% of the total upward flow area was determined based on the analysis performed for the Unit 1 Reduced Temperature and Pressure program. However, procedure 12 EHP 4030 STP.250 does not provide the detailed information necessary to determine the percentage of flow passage blockage, nor does it define the inspection acceptance criteria to ensure that the 15 percent ice condenser flow blockage limit is not exceeded.

Procedure 12 EHP 4030 STP.250 also excepts hoarfrost deposits from inspection of frost and ice buildup in the flow passages. Hoarfrost is frost that can be easily wiped away by hand.. This exception is based on a 1988 T/S Interpretation, which concluded that hoarfrost extending beyond 3/8 inches in length is not considered as blockage in the flow passage. However, T/S 4.6.5.1.b.3 states that "frost or ice" in the flow passages greater than a nominal thickness of 3/8 inches is the critical dimension for determining flow passage blockage. There is no discussion in the

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL	REVISION	
Cook Nuclear Plant - Unit 2	50-315	98	– 004 –	02	5 OF 6

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

Cause of Event (cont'd)
T/S permitting hoarfrost. As a result of this interpretation, condition reports were not written on hoarfrost blocked flow passages, which contributed to limited awareness of the trending toward more significant flow passage blockages.

The flow passage surveillance procedure also does not give guidance on how flow passages are selected for inspection. Past practice has been for the system engineer to select flow passages for inspection based on judgement. Procedural guidance was not available to accomplish random inspections in combination with inspection of areas most likely to exhibit problems based on past experience.

Another weakness noted in the surveillance procedure was the lack of guidance on required qualifications for personnel performing the flow passage inspections, and also lack of guidance on the use of quality techniques such as dual concurrent verification. The most recent surveillances were performed by contract personnel, who may have only received general training on ice condenser maintenance activities, and the procedure allowed for a single individual to perform the surveillance.

A final weakness noted in procedure 12 EHP 4030 STP.250 was the lack of detailed guidance on the use of lighting aides during the inspection. The flow passage inspection procedure states as a prerequisite that "Portable lights to inspect the ice condenser passages will be obtained as necessary." The procedure does not specify the light conditions that must be met to visually inspect the flow passages.

Following this event, both ice condenser maintenance and surveillance practices and historical information were reviewed to determine causes for the formation of the blockage, and for the failure to detect the blockage during ice condenser flow passage surveillances.

Analysis of the Event
This event is reportable under 10CFR50.72(b)(2)(ii), as an unanalyzed condition found while the reactor was shutdown and was reported via ENS notification on January 28, 1998 at 1706 hours.

As a result of the 100 percent inspection, a formal calculation was performed to determine the percent blockage of each of the 48 bays. This calculation indicated that the blockages for Unit 1 ranged from 6.7 percent to 18.8 percent per bay, and the blockages in Unit 2 ranged from 4.1 percent to 17.4 percent. Ten bays were found with blockage greater than 15 percent. This formal calculation replaced the preliminary calculation that had only estimated the blockage.

The results of the formal calculation were sent to Westinghouse for analysis of the impact on ice condenser and containment operability. Based on this data, and by utilizing a "lumping" method, which combines several bays, Westinghouse determined that the highest calculated blockage percentage was less than 12.5 percent per lumping for Unit 1 and less than 14.0 percent per lumping for Unit 2. Therefore, Westinghouse concluded that the ice condensers in both units were considered operable relative to the 15 percent flow passage blockage criteria.

Therefore, this condition was determined to be of minimal safety significance, and the health and safety of the public was never jeopardized.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL	REVISION	
Cook Nuclear Plant - Unit 2	50-315	98	-- 004 --	02	6 OF 6

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

Corrective Actions
Both units' Ice Condensers will be thawed during the current outages to address a variety of issues. Flow passages will be confirmed clear of blockage at the conclusion of planned work.

Preventive Actions
Maintenance and surveillance practices will be reviewed and revised as necessary to ensure they adequately support ice condenser operability. These reviews will be completed and appropriate improvements in maintenance practices and surveillances will be implemented prior declaring either unit's ice condenser operable. Items, which will be specifically covered in these reviews, include consideration of possible improved methods and controls for reducing ice condenser door openings. (i.e. use of air locks for personnel passage or addition of penetrations for hoses rather than doors).

Priorities assigned to maintenance of air handler units will be revisited, to ensure this equipment receives the proper attention for corrective maintenance. Preventive maintenance activities for air handlers will also be reviewed and revised as necessary to ensure appropriate activities are being pro-actively performed for these units.

Techniques for inspecting and clearing flow passages following basket filling activities will also be reviewed and revised as necessary to ensure any residual ice is removed from latticework following ice basket maintenance.

Finally, ice condenser defrosts will be revisited, to ensure there is guidance on when and how to control frost and ice accumulation before it becomes significant.

With regard to ice condenser surveillances, a wholesale review of all ice condenser surveillance procedures is being performed for both units. Items being considered in this review include the basis for procedure acceptance limits, guidance for performing surveillances, the use of margins to T/S limits, and required qualifications and quality techniques for personnel performing the surveillances. This review will be performed on all ice condenser surveillance procedures, including flow passage surveillance procedures

Finally, the aforementioned T/S interpretation on what constitutes flow passage blockage will be reviewed. The basis for the T/S will be reviewed for possible revision to clarify what constitutes unacceptable flow passage blockage.

The ice condenser surveillance program reviews will be completed, and improvements incorporated into surveillance procedures prior to declaring either unit's ice condenser operable.

Failed Component Identification
Not applicable

Previous Similar Events
315/83-099-00
316/85-013-00
315/87-013-00
315/88-002-00
315/88-007-00
316/88-005-00
316/88-015-00