NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION
(6-1998)

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)

Ice Condenser Bypass Leakage Exceeds Design Basis Limit

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	DOCKET NUMBER
04	22	1999	1998	037	01	05	24	1999	Cook Nuclear Plant Unit 2	05000-316
									FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5
POWER LEVEL (10)	0%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)	20.2203(a)(2)(v)		50.73(a)(2)(i)	50.73(a)(2)(viii)
	20.2203(a)(1)	20.2203(a)(3)(i)	X	50.73(a)(2)(ii)	50.73(a)(2)(x)
	20.2203(a)(2)(i)	20.2203(a)(3)(ii)		50.73(a)(2)(iii)	73.71
	20.2203(a)(2)(ii)	20.2203(a)(4)		50.73(a)(2)(iv)	OTHER
	20.2203(a)(2)(iii)	50.36(c)(1)		50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)	50.36(c)(2)		50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Lyle R. Berry, Regulatory Compliance Engineer	(616) 465-5901 X1623

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

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

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED	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 August 12, 1998, with Unit 1 in Mode 5, cold shutdown, it was determined that the design basis limit of 5 square feet (ft2) for bypass flow around the ice bed during an accident had been exceeded by the cumulative effect of multiple bypass flow paths. This was determined reportable under 10CFR50.72(b)(2)(i), as a degraded condition discovered while the unit is shutdown that, if found while the reactor was operating, would have resulted in the plant being in an unanalyzed condition. An ENS notification was made at 1530 hours EDT. The LER was submitted in accordance with 10CFR50.73(a)(2)(ii). The individual bypass conditions identified in the original LER were attributed to unauthorized modifications. Significant bypass flow paths are being corrected as they are discovered.

On April 22, 1999, in Mode 5, during a review of the adequacy of the design and installation of the Divider Barrier Seal (DBS) as a part of the Expanded System Readiness Reviews, it was determined that the seal design and installation at the end walls of the ice condenser does not provide a pressure tight boundary. This newly identified condition further increased the cumulative bypass flow area above the design basis limit of 5 ft2. The apparent cause of the DBS ice condenser bypass is that the pressure seal required by a revised Westinghouse design was not incorporated into the AEP design. The reason for this discrepancy is unknown. The DBS ice condenser bypass will be corrected via a design change prior to Mode 4. The new and previously identified conditions have been evaluated and it has been determined that the safety significance of the cumulative bypass flow paths around the ice bed is negligible. If all known conditions had existed simultaneously, and passed flow at their maximum bypass capability, the cumulative effect would have been above the design basis limit of 5 ft2, but below the value assumed in the most limiting accident analyses. Therefore, there were no implications to the health and safety of the public.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Conditions Prior To Event

Unit 1 Mode 5 at 0% power
Unit 2 Mode 5 at 0% power

Description Of The Event

The Cook units are pressurized water reactors with ice condenser containments. The ice condenser containment requires that the steam and air flowing from the lower containment compartment in the event of an accident be routed to the upper compartment via the ice bed. To accomplish this, a structural barrier, called the divider barrier, separates the lower and upper containment compartments. The divider barrier includes the walls of the ice compartment, the upper deck, the compartments enclosing the upper portion of the steam generators and pressurizer, the gate separating the reactor cavity from the refueling canal, and portions of the walls of the refueling canal.

The design basis limits bypass flow around the ice bed to no more than 5 square feet (ft2). The installed bypass through the refueling cavity drains is equivalent to 2.2 ft2 plus approximately 0.36 ft2 bypass via the backdraft damper of the air return fans, totaling 2.56 ft2 of bypass area. While work was being performed in the upper ice condenser, it was determined that the 5 ft2 limit was potentially exceeded in the past as a result of multiple bypass conditions in addition to the installed bypass. The cumulative effect for the known bypass flow paths had been calculated to be 5.71 ft2. Since it could not be determined how long most of the identified conditions had existed, the bypass flow was conservatively assumed to have concurrently existed.

The degraded condition that was identified on August 12, 1998, which increased the bypass flow area above the design basis limit was an improperly sealed glycol line penetration, which was discovered in the end wall. The end wall of the ice condenser in the lower plenum area is a reinforced concrete wall with embedded pipe sleeves for glycol piping penetration and direct embedded conduit penetrations. The flashing around the penetration was removed and it was then discovered that the piping was wrapped in fibrous insulation but had no sealing mechanism. The insulation wrapping the pipe would not have constituted any appreciable deterrent to steam flow in the event of an accident.

On April 22, 1999, a condition was identified which further increased the bypass flow area above the 5 ft2 limit. This condition, an inadequate divider barrier seal (DBS) design and installation at the end walls of the ice condenser, does not provide a pressure tight boundary. This represents an additional ice condenser bypass area of approximately 30.78 ft2. When combined with the historical cumulative bypass area, this represents a total bypass area of approximately 36.49 ft2. The current known bypasses total approximately 35.51 ft2, which accounts for repairs made after the original LER submittal.

As described in the UFSAR, the divider barrier seal is a flexible barrier located between the bottom of the ice condenser compartment and the containment cylinder wall to prevent the flow of steam and air from bypassing the ice condenser. The seal does not function as the pressure boundary by itself, but is backed up by a steel plate with which it is in contact. The seal assembly is designed to withstand a peak pressure of 24 psi.

The DBS at the ice condenser end walls was installed as a ventilation barrier and not as a pressure retaining seal. It is postulated that this resulted from the original ice condenser design in which the ice baskets on the containment wall side extended all the way to the floor (58 ft). This original design was intended to ensure that any steam that entered the ice condenser would travel through the ice columns prior to entering upper containment, eliminating the need to have a pressure retaining seal on the end walls.

With the current ice condenser design, the bottom of the ice baskets is 10 ft above the bottom of the lower plenum floor. When an event occurs, the air and steam enter the ice condenser lower plenum and can pressurize the area up to 12 psi, exposing the DBS seal at the end walls to that same pressure. Due to the design of the seal, it is conservatively assumed that the seal will fail and allow the steam to bypass the ice baskets and enter into upper containment directly.

Cause Of The Event

The individual bypass conditions reported in the original LER were attributed to unauthorized modifications. A lack of documented configuration and inadequate implementation of the design change control process resulted in the creation of bypass paths via material substitutions, original construction discrepancies, inadequate service life, and unsealing of spare penetrations during the performance of work activities. The root cause of the cumulative bypass was attributed to lack of understanding of the design basis of containment as a system, and of the divider barrier in particular. This was coupled with a lack of a comprehensive inspection program for detection of defects and damage to the divider barrier.

The apparent cause of the newly discovered ice condenser bypass is that the pressure seal required by a revised Westinghouse design was not incorporated into the AEP design. The reason for this discrepancy is unknown. According to the original Westinghouse ice condenser design, the ice baskets on the containment wall side started at the level of the ice condenser bottom slab and extended upward 58 feet. This design was to ensure that all steam entering the ice condenser would travel through the ice baskets before entering upper containment. With this design, only a ventilation barrier was needed to seal the end walls. Later, Westinghouse implemented a new design which located the bottoms of all ice baskets 10 ft above the ice condenser bottom slab. This is the basket design that was installed at Cook Nuclear Plant. However, when the later design was introduced, the ventilation barrier was not upgraded to a include a pressure seal capable of withstanding 24 psi.

Analysis Of The Event

The originally identified condition was determined to be reportable on August 12, 1998, in accordance with 10CFR50.72(b)(2)(i), as a degraded condition discovered while the unit is shutdown that, if found while the reactor was operating, would have resulted in the plant being in an unanalyzed condition, and an ENS notification was made at 1530 hours EDT. The original LER was submitted in accordance with 10CFR50.73(a)(2)(ii) as an event or condition outside the design basis of the plant. An additional ice condenser bypass condition involving the DBS identified on April 22, 1999 was also determined to be reportable pursuant to the requirements of 10CFR50.73(a)(2)(ii). The DBS ice condenser bypass condition is applicable to both units. For Unit 2, refer to LER supplement 316/98-004-01.

The known bypass flow paths summarized below represent the condition as reported on August 12, 1998:

	Open Area in Ft2
Refueling Cavity Drains	2.20
Backdraft damper of air return fans	0.36
Ice Condenser Air Handling Unit line	0.005
1-CPS-209, 1-CPS-210	0.017
1-VMO-101	1.069
Divider Barrier Hatches	1.4
Glycol Lines through Ice Condenser End Wall	0.66
TOTAL	5.71

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The known bypass flow paths summarized below represent the current condition:

	Open Area in Ft2
Refueling Cavity Drains	2.20
Backdraft damper of air return fans	0.36
Ice Condenser Air Handling Unit line	0.005
1-CPS-209, 1-CPS-210	0.0 (repaired)
1-VMO-101	0.0 (repaired)
Divider Barrier Hatches	1.4
Glycol Lines through Ice Condenser End Wall	0.66
CEQ Stairwell and Vent Well Drain Lines	0.1
CEQ Fan Room	0.007
Divider Barrier Seal	30.78
TOTAL	35.51

The cumulative bypass has been evaluated, and it has been concluded that the safety significance of this condition is negligible. Therefore, there were no implications to the health and safety of the public. Updated Final Safety Analysis Report (UFSAR) Chapter 5, Section 5.2.2.4 states that the design basis bypass area is 5 ft2. UFSAR Chapter 14.0 describes the accident analyses for different size pipe breaks and the allowable ice condenser bypass flow for each case. Analysis results indicate a value of 35 ft2 as the allowable deck leakage area for the entire spectrum of break sizes. The limiting case is an 8 inch break with one spray pump operating (2000 gpm at 80 degrees F).

A second UFSAR analysis, using a more realistic method, states that with one spray pump the deck leakage could be 56 ft2 for an 8 inch break. This analysis takes credit for passive heat sinks and additional containment spray. Thus the identified value of historical value of bypass (approximately 30.78 + 5.71 = 36.49 ft2) for Unit 1 is bounded by UFSAR analysis, but is outside of the ice condenser design basis value of 5 ft2. Therefore, since the plant was not in an unanalyzed condition, the ENS report made August 12, 1998, in accordance with 10CFR50.72(b)(2)(i), was determined to have been unnecessary.

CORRECTIVE ACTIONS

Numerous material condition walkdowns and assessments have been performed, which have increased the potential to identify bypass paths in the divider barrier. Significant degraded conditions resulting in divider barrier bypass are being corrected via corrective maintenance or design changes as they are identified. The Refueling Cavity Drains are permanent bypasses, which of course will remain open. The backdraft damper of the air return fans, ice condenser AHU line and the CEQ stairwell and vent well drain line bypasses are currently not scheduled for repair and represent an insignificant contribution to the cumulative ice condenser bypass. The DBS ice condenser bypass will be corrected via a design change prior to Mode 4.

To prevent unauthorized or inadvertent design changes, 12 PMI 5040.DCP.001 "Design Change Determination", has been developed and implemented. To enhance recognition of a design change, 12 PMI 2291.PLAN.001 "Work Control Planning Process," is being implemented. Additionally, the UFSAR validation project will enhance the quality of the design basis and configuration documentation. Containment is one of the selected systems. Procedure 12 EHP 6040 PER.154, "Containment Divider Barrier Walkdown," has been developed to guide inspection of the divider barrier on a refueling outage frequency for possible bypass paths. This procedure includes provisions to ensure that the design basis allowable cumulative bypass is not exceeded, through correction and/or tracking of any identified bypass paths.

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SIMILAR EVENTS

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