# CATEGORY 1

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FACIL:50-315 Donald C. Cook Nuclear Power Plant, Unit 1, Indiana M 05000315
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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 98-005-03:on 980122,screws missing from ice condenser ice basket coupling rings were noted.Caused by overload during ice basket weighing process.Melted out ice condensers in both units to address varity of issues.W/980731

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AEP
AMERICAN ELECTRIC POWER

July 31, 1998

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Operating Licenses DPR-58
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:

98-005-03

Sincerely,

John R. Sampson

J. R. Sampson
Site Vice President

/mbd

Attachment

c: C. J. Paperiello (Acting), Region III
J. R. Sampson
P. A. Barrett
S. J. Brewer
R. Whale
D. Hahn
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NRC Resident Inspector

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NRC Form 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

# LICENSEE EVENT REPORT (LER)

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

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| Cook Nuclear Plant Unit 1 | 50-315 | 1 of 4 |

TITLE (4)

## Screws Missing from Ice Condenser Ice Basket Coupling Rings Results in Potential Unanalyzed Condition

| 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 |
| | | | | | | | | | | | Cook Unit 2 | 50-316 |
| 01 | 22 | 98 | 98 | – | 005 | – | 03 | 07 | 31 | 98 | FACILITY NAME | DOCKET NUMBER |

| OPERATING MODE (9) | 5 | 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) |
| POWER LEVEL (10) | 00 | 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) |
|---|---|
| Mr. Paul Schoepf, Mechanical Systems Manager | 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 Units 1 and 2 in Mode 5, personnel discovered screw heads in the ice condenser ice melt system trash filter. The screws were apparently from the Unit 1 ice condenser ice basket coupling rings, and a decision was made to inspect a sample of baskets in both units. The inspection identified baskets that were missing more than the maximum allowable number of screws per coupling ring at the bottom rim of the basket. This was determined to constitute an unanalyzed condition, and an ENS notification was made on February 14, 1998 at 0800 hours under 10CFR50.72(b)(2)(i) and interim LERs were submitted on February 23, 1998 and March 31, 1998 under 10CFR50.73(a)(2)(ii).

A decision was made to melt out each unit's ice condenser to address a variety of issues, including missing or damaged ice basket coupling screws. The Unit 1 ice condenser melt out is complete, and ice basket inspections and repairs are in progress, including replacement of missing or damaged ice basket coupling screws. The melt out of the Unit 2 ice condenser also has been completed. Metallurgical analysis of failed and intact screws has been performed and that analysis continues.

This condition was evaluated, and it was determined that the potential safety significance of this condition was bounded by the analysis performed by Westinghouse for LER 315/98-006-02. That LER reported the potential for 60 ice baskets to be unpinned in Modes 3 and 4. The safety significance for such a condition was found to be minimal, therefore, since that analysis bound the condition reported in this LER, the safety significance of the missing or damaged ice basket coupling screws is of minimal safety significance as well.

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

CONDITION 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, 4 broken off ice basket coupling screw heads were found in the Unit I ice melt vacuum -filter following the emptying of a series of ice baskets during the current outage. Prior to this discovery during the current outages, approximately four screw heads were seen on the floors of the lower ice condensers (in each unit). The screw heads were black Phillips head screws, indicating they were potentially original ice basket screws. When this condition was noted, the system engineer recalled that approximately two dozen ice basket coupling screws and screw heads have been discovered in the ice melt system filters since about 1991 (total for both units). The system engineer's belief was that these screws have originated from baskets damaged during ice baskets weighing surveillances. A decision was then made to conduct inspections of a sample of baskets in both units.

To address this issue and to confirm that the screws found in the ice melt system filter had originated from baskets that were known to be damaged, in early 1998 a plan was devised to perform full length video inspection of 60 random ice baskets in each unit. The intent of the inspection was to provide confidence that no more than 4 screws were missing from a given coupling ring. Video inspections were performed during February 1998. Approximately 30 screws were discovered to be missing from the Unit 1 ice baskets and 34 screws were found missing from the Unit 2 ice baskets. Although no baskets were found to have more than 4 screws missing at a given coupling ring, the inspection revealed a relatively high incidence of missing screws on the bottom rims of the ice baskets.

Concurrent with the inspections, Westinghouse was asked to perform an analysis to determine the allowable number of coupling screws missing. Westinghouse determined that, "..the ice condenser is expected to function as designed with any combination of 8 of the original 12 sheet metal screws functional at any single basket to coupling union."

Due to the incidence of missing screws among the sample of 60 baskets, an inspection of all accessible portions of bottom rims was performed. This inspection revealed 108 screws or screw heads missing from Unit 1 ice basket bottom rims and 198 missing from Unit 2 ice basket bottom rims. In 3 baskets on Unit 1 and 2 baskets on Unit 2, more than 4 screws allowed by the Westinghouse analysis were discovered to be missing from ice basket bottom rims.

CAUSE OF THE EVENT
The missing or damaged ice basket coupling screws can be attributed to failure in shear due to overload during the ice basket weighing process, and damage or backing out of screws during vibration of the baskets during the emptying process.

In March 1998, 21 fractured ice basket coupling screw heads, 20 intact screws and 2 failed screw heads were removed from the Unit I ice melt system filter. The melt system had been used to remove the ice recently vibrated out of approximately 100 Unit 1 ice baskets, so the screws and screw heads were assumed to have originated from those baskets. Given that the ice baskets were recently weighed and emptied, it followed that a logical cause of sheared and intact screws was damage during the weighing or emptying process.

Damage to the baskets can occur when the basket is lifted from the top rim for weighing. This can also occur if the basket is frozen in place and the lifting force applied to the basket is not closely monitored. The damage can include distortion of the basket top rim or separation of adjacent basket segments at a coupling ring. Both conditions can result in shearing of the coupling screws if the damage is severe.

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

CAUSE OF THE EVENT (cont'd)
Pneumatic concrete vibrators were used during the basket emptying process. Damage to the screws or backing out of the screws due to vibration can occur during this process.

The screw heads and most of the intact screws were of the original screw design, a Phillips head with zinc phosphate coating. One of the intact screws was the new cadmium plated with a Torx head design. These screws and screw heads were sent to a testing laboratory to determine the cause of the screw failures. Results from analysis of these screws was documented in a May 1998 report which confirmed the coupling screws failed in shear, or via a mixed failure mode which was likely induced by a shear load.

The test results raised additional questions regarding the significance of defects, such as cracks, in thread crests and roots. Due to this, the need for additional testing was identified. This testing is currently in progress.

ANALYSIS OF THE EVENT
On January 22, 1998, with Units 1 and 2 in Mode 5, plant personnel determined that the ice basket bottom rim coupling rings were missing more than the maximum allowable number of screws per coupling ring. This was determined to constitute an unanalyzed condition, and an ENS notification was made on February 14, 1998 at 0800 hours EST under 10CFR50.72(b)(2)(i). Interim LERs were submitted on February 23, 1998 and March 31, 1998 under 10CFR50.73(a)(2)(ii) for an unanalyzed condition.

The primary function of the safety-related ice condenser system is the absorption of thermal energy released abruptly in the event of a Loss of Coolant Accident (LOCA) or Main Steam Line Break (MSLB) inside containment, to limit the initial peak containment pressure. The system consists of a completely enclosed annular compartment covering an arc of approximately 300 degrees of the perimeter of the containment. The annular compartment consists of 24 bays containing 81 cylindrical ice baskets per bay, positioned in a vertical array of columns. Each ice basket is approximately 12 inches in diameter and 48 feet long, filled vertically with borated ice. The function of the ice condenser is dependent upon the quantity and distribution of the ice mass within the 1,944 baskets of the Ice Condenser.

The major constituent of the ice condenser is the mass of sodium tetraborate ice stored within the baskets inside the annular compartment. The sodium tetraborate solution produced by the melting ice absorbs and retains iodine released during a postulated design basis accident (LOCA) and serves as a heat transfer medium and neutron poison for reactivity control following the accident. The total ice mass provides sufficient heat removal capability to condense the steam released during a LOCA or a MSLB event. The ice condenser plays no role in the normal operation of the plant.

To perform their design basis function, the ice baskets are required to withstand design loads and are restrained to ensure they do not eject upward out of the ice bed during design basis accident blowdown forces. Upward movement could open up bypass flow routes; impact and damage other ice condenser equipment, or cause baskets to be ejected from the ice condenser. The basket restraint is achieved by a U-bolt arrangement connected to the cross bar and grid configuration on the bottom of the ice basket.

Each of the 1,944 ice baskets is comprised of multiple basket sections, joined together with coupling rings, which are sleeves that fit inside the adjoining basket segments. The ice basket tops and bottoms also have rims attached with coupling screws. The ice basket bottom provides the link between the ice basket and the ice condenser lower support structure for support and hold down to prevent basket ejection. Each coupling ring is attached to the ice baskets with a set of 12 sheet metal screws at each basket segment, which are inserted from the outside of the basket.

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

ANALYSIS OF THE EVENT (cont'd)
The original ice baskets consisted of four 12-foot segments, which resulted in 96 coupling screws per basket. Some 12-foot basket segments have since been replaced with 2 and 3-foot segments, increasing the number of coupling rings and screws. The sheet metal screws are made from AISI 1022 carbon steel. Two screw designs have been used in the past. The original screws were zinc phosphate coated Phillips head screws, which are black in color. The design was later changed to a cadmium plated Torx head screw. Both screw designs employ self-drilling, self-tapping and self-locking features. A third screw design, cadmium plated Phillips head screw, has also recently been utilized.

The condition resulting from the missing and damaged screws was evaluated, and it was determined that the potential safety significance of this condition was bounded by the analysis performed by Westinghouse for LER 315/98-006-02, "Ice Basket Weighing Option Results in Potential Unanalyzed Condition Due to Lack of Technical Basis for Option". LER 315/98-006-02 dealt with the potential for 60 ice baskets to be unpinned in Modes 3 and 4. The safety significance for such a condition was found to be minimal. Therefore, as the Westinghouse analysis bounded the condition dealt with in this LER, the safety significance of missing or damaged ice basket coupling screws is of minimal safety significance as well.

CORRECTIVE ACTIONS
A decision was made to melt out the ice condensers in both units to address a variety of issues, including missing or damaged ice basket coupling screws. The Unit 1 ice condenser melt out is complete, and ice basket inspections and repairs are in progress. These repairs include replacement of missing or damaged ice basket coupling screws. The melt out of the Unit 2 ice condenser has also been completed, however, inspections and repairs have not yet started.

Additional testing is in progress to confirm that the presence of minor defects in the screws does not challenge the screw's ability to carry design loads.

Training will be conducted for ice condenser workers on proper basket weighing technique to avoid damage to ice baskets. Supervisory responsibility for oversight of ice condenser production workers has been transferred from the Engineering department to the Maintenance department. The Maintenance department has more production supervisors with the skills necessary to provide thorough supervisory oversight to workers, therefore, this realignment of responsibilities is expected to result in improved worker performance in basket weighing techniques.

Ice condenser maintenance procedures are being revised to require inspection of baskets emptied for maintenance prior to refilling during future outages. The basket inspection will specifically include provisions for identifying ice basket damage and correcting damage that exceeds the threshold of detrimental damage.

FAILED COMPONENT IDENTIFICATION
Not Applicable

PREVIOUS SIMILAR CONDITIONS
LER 315/98-006-02
LER 315/98-008-02
LER 315/98-032-00