NRC FORM 366 (4-95) 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 04/30/98



| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| Prairie Island Nuclear Generating Plant Unit 1 | 05000 282 |  |

TITLE (4)
Degraded Steam Generator Tube Sleeves

| 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 05000 |
| 03 | 13 | 96 | 96 | -- 07 -- | 00 | 4 | 12 | 96 | FACILITY NAME | DOCKET NUMBER 05000 |

| OPERATING MODE (9) | N |
|---|---|
| POWER LEVEL (10) | 100 |

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) |
|---|---|
| Jack Leveille | 612-388-1121 |

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 |
|---|---|---|---|---|---|---|---|---|---|
| B | AB | SLV | C490 | No | | | | | |
| | | | | | | | | | |

| SUPPLEMENTAL REPORT EXPECTED (14) | | | EXPECTED SUBMISSION | 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 November 17, 1995, an increase occurred in Unit 1 steam generator primary to secondary leakage to about 23 GPD after which the leak rate slowly decreased. The leakage was determined to be in No. 12 steam generator. Unit 1 was shut down for refueling on January 6, 1996. The inservice inspection of steam generator tubing began on January 10, 1996. On January 15, one sleeved tube, Row 7 Column 63, was determined to be leaking from the hot leg side during a secondary side pressure test. It was decided to remove this sleeved tube and four others that had circumferential indications per eddy current examination. The removal of the five sleeve/tube samples for metallurgical analysis was completed on February 15, 1996. On February 25, 1996, it was determined that there was a leakage path through the R7C63 sleeve upper weld of 0.1 cc/min at 550 psig primary side pressure in the laboratory. On February 27, 1996, 180 degrees of lack of fusion was found in the R7C63 sleeve weld.

The root cause of the inadequate weld heights and leakage paths was inadequate cleaning of the parent tube in the weld region prior to insertion of the sleeves. A secondary cause was insufficient control on procedure/equipment changes by the installation vendor.

## EVENT DESCRIPTION

On November 17, 1995, an increase occurred in Unit 1 steam generator (EEIS Component Identifier - SG) primary to secondary leakage to about 23 GPD after which the leak rate slowly decreased. The leakage was determined to be in No. 12 steam generator. Unit 1 was shut down for refueling on January 6, 1996. The inservice inspection of steam generator tubing began on January 10, 1996. All sleeves were being inspected by a new rotating coil technology probe called the +Point™ coil probe for the first time. On January 13, four sleeves with circumferential indications were confirmed and reported to the System Engineer at about 1500. On January 15, one sleeved tube, Row 7 Column 63, was determined to be leaking from the hot leg side during a secondary side pressure test. These indications, along with the Category C-3 inspection results status were reported to the NRC in a telephone conference call on January 16. Following additional discussions with the NRC concerning the circumferential and volumetric sleeve indications, it was decided on January 17, that tube/sleeve samples would be removed to determine the root cause of these unusual indications. The removal of the five sleeve/tube samples for metallurgical analysis was completed on February 15, 1996. On February 25, 1996, it was determined that there was a leakage path through the R7C63 sleeve upper weld of 0.1 cc/min at 550 psig primary side pressure in the laboratory. On February 27, 1996, 180 degrees of lack of fusion was found in the R7C63 sleeve weld. On March 13, final detailed results from the destructive examination measurements of Row 7 Column 63 determined that the average weld height, including the zero height for lack of fusion, was 0.020 inches whereas the licensing basis for these sleeves specified a minimum average weld height of 0.080 inches and a leak tight weld. On March 17, additional results from the other three inservice sleeves showed both possible leak paths and weld heights less than 0.080 inches.

## CAUSE OF THE EVENT

Beginning in 1991, the sleeve installation cleaning equipment was modified over time with the intent to improve reliability and to adapt to new controls and delivery equipment. In addition, the original customized cleaning brush heads were discontinued by the supplier and a substitute brush was used. These changes contributed to the cleaning problem seen in the Prairie Island pulled tubes.

The root cause of the inadequate weld heights and leakage paths was inadequate cleaning of the parent tube in the weld region prior to insertion of the sleeves. A secondary cause was insufficient control on procedure/equipment changes by the installation vendor.

## ANALYSIS OF THE EVENT

The Xenon primary to secondary leak rate increased from less than detectable to 12 GPD on November 17, 1995. The rate slowly increased to a maximum of 23 GPD on November 23, 1995 and then slowly decreased to about 8 GPD by January 6, 1996, the date of Unit 1 shutdown. The only positively

identified source of leakage found during the steam generator inspections was Row 7 Column 63 hot leg side. This sleeved tube was removed due to a volumetric indication as well as the evidence of leakage for metallurgical analysis, found to be leaking at rate of 0.1 cc/min in the laboratory at 550 psig primary side pressure and found to have a significant lack of fusion in the sleeve upper weld.

The eddy current indications were a result of the radial component of either or both of two weld condition termed Incomplete Fusion or Sleeve Outside Diameter Suckback. Both of these conditions are an anomaly associated with the sleeve installation process with no evidence of inservice induced degradation. Incomplete fusion is the result of insufficient removal of the parent tube inside diameter surface oxide prior to sleeve insertion and welding. Sleeve outside diameter suckback is a rounded cavity formed on the edge of the weld due to evolution of a gas within the joint. The source of his gas could be the contamination on the tube surface or moisture behind the sleeve.

No evidence of service induced propagation , including environmental degradation, of any type of discontinuities was present.

The sleeve licensing report, CE Report CEN-294-P, demonstrated that the original design value for the weld height of 0.080 inches met all of the requirements of the ASME Code with considerable margin. Additional calculations have shown that the minimum weld height for structural integrity is actually 0.019 inches. All sleeve samples met this minimum average weld height requirement for structural integrity. The ASME Code and Regulatory Guide 1.121 criteria for structural integrity were satisfied . In addition, the parent tube in the sleeve joint region remained intact in all of these samples. Therefore, the health and safety of the public were unaffected.

As a degraded condition, this event is reportable per 10CFR50.73(a)(2)(ii)(B).

CORRECTIVE ACTION

All tubes with circumferential indications were either pulled or plugged. All tubes with volumetric indications in the lower part of the weld were also plugged.

Future sleeve installations will use improved cleaning and additional nondestructive examination to prevent reoccurrence of this problem. The NDE improvements to be utilized in the future are:

a) An additional VT is being added to confirm cleaning prior to the sleeve insertion and welding operation, since the cleaning process has been identified as the root cause of the weld imperfections.
b) Enhanced ECT analysis and data acquisition methods established during the 9601 outage will be adopted by CE procedure for post installation sleeve acceptance testing

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

c) Sleeve ET and VT techniques and procedures will be qualified in accordance with the EPRI PWR Steam Generator Examination Guidelines Appendix H.

d) An amplitude UT system will be used for all sleeve weld inspections with improved procedures. A-scan, B-scan, B'-scan, and C-scans will be available and used for data analysis.

FAILED COMPONENT IDENTIFICATION

Combustion Engineering alloy 690 welded tubesheet sleeves installed in Westinghouse Model 51 steam generator.

PREVIOUS SIMILAR EVENTS

No previous Prairie Island LERs are similar to this event.