Commonwealth Edison Company
Byron Generating Station
4450 North German Church Road
Byron, IL 61010-9794
Tel 815-234-5441

ComEd

DATE: December 4, 1995

LTR: BYRON 95-0388
FILE: 3.03.0800 (1.10.0101)

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

The Enclosed Licensee Event Report from Byron Generating Station is being transmitted to you in accordance with the requirements of 10CFR50.73(a)(2)(ii).

This report is number 95-011; Docket No. 50-454.

Sincerely,

K. L. Kofron

K. L. Kofron
Station Manager
Byron Nuclear Power Station

KLK/PW/ba

Enclosure: Licensee Event Report No. 95-011

cc: H. J. Miller, NRC Region III Administrator
NRC Senior Resident Inspector
INPO Record Center
CECo Distribution List

(p:\regassur\pifler\ler\wp9797r.wpf\112295-7)

IE22 1/1

SIGNATURE PAGE FOR LICENSEE EVENT REPORT

LER Number
454:95-011

Title of Event: Increased Tube Degradation in the Byron Unit 1 Steam Generators

Occurred: 11-07-95/1545
Date Time

Licensee Contact: Joe Lonigro

OSR DISCIPLINES REQUIRED: ABG

/ 11/22/95
SES DATE

Acceptance by Station Review:

/ ABG / 12/1/95
QE Disciplines Date

ABFG / 12/1/95
SES Disciplines Date

AG / 12/1/95
for RAS Disciplines Date

AG / 12/2/95
Other Disciplines Date

/ NONE / 12/7/95
Other Disciplines Date

Approved by: / 12/5/95
Station Manager Date

(p:\regassur\pifler\ler\wp9797r.wpf\112295-1)

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)
BYRON NUCLEAR POWER STATION	05000454	1 OF 5

TITLE (4)

INCREASED TUBE DEGRADATION IN THE BYRON UNIT 1 STEAM GENERATORS

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
11	07	95	95	-- 011 --	00				NONE	05000
									FACILITY NAME	DOCKET NUMBER 05000

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)
JOSEPH K. LONIGRO, SITE ENGINEERING, EXT. 2166	815-234-5441

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
X	AB		W120	N					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
X YES (If yes, complete EXPECTED SUBMISSION DATE).	NO		05	30	96

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

A steam generator (SG) eddy current inspection was performed in accordance with Technical Specification Surveillance Requirement (TSSR) 4.4.5.0 during the Byron Unit 1 Cycle 7 planned steam generator inspection outage. The results of this inspection classified each of the four SGs as category C-3, as defined in TSSR 4.4.5.2. Category C-3 was declared due to more than 1% of the tubes inspected being defective. All defective tubes will be removed from service by plugging or sleeving. The primary mode of the tube degradation was circumferentially oriented Outer Diameter Stress Corrosion Cracking (ODSCC) at the hot leg top of tubesheet roll transition region.

The occurrence of this defect mode was experienced during the last refueling outage (B1R06). At that time, a total of one-hundred and thirty-two (132) tubes were found to contain circumferential cracking at the top of the tubesheet. This mode of degradation has been experienced at a number of other plants in the industry. Industry efforts are on-going to determine corrective actions to mitigate ODSCC at the top of the tubesheet.

This event is reportable per 10CFR50.73(a)(2)(ii) due to the serious degradation of a principal safety barrier.

(p:\regassur\pifler\ler\wp9797r.wpf\112295-2)

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
BYRON NUCLEAR POWER STATION	05000454	95 --	011 --	00	2 OF 5

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

A. PLANT CONDITIONS PRIOR TO EVENT:

Event Date/Time 11/7/95 / 1545

Unit 1 MODE 5 - Rx Power 0% RCS [AB] Temperature/Pressure 71°F/0 psig

Unit 2 MODE 1 - Power Op Rx Power 99% RCS [AB] Temperature/Pressure NOT/NOP

B. DESCRIPTION OF EVENT:

During the previous Unit 1 refuel outage (B1R06), Byron identified circumferential cracking for the first time. At that time a total of one-hundred and thirty-two (132) tubes were found to contain circumferential cracking utilizing the Motorized Rotating Pancake Coil (MRPC) eddy current probe. During the recent planned outage (B1P02), a total of two-thousand seven hundred and twenty-one (2721) indications were found to contain defective conditions, of which a total of two-thousand six hundred and ninety-five (2695) indications were found to contain repairable degradation at the top of the tubesheet (TTS). Byron Station's definition of a defective condition is an indication that is greater than or equal to 40% through wall (TW), indications that exceed the Byron Station Interim Plugging Criteria (IPC) for Outer Diameter Stress Corrosion Cracking (ODSCC) at the tube support plates (TSP), indications that do not meet the acceptance criteria in the wedge regions of support plates, and any indication found at the top of tubesheet utilizing three coil technology (i.e., MRPC or Plus Point probes). During B1P02, the Plus Point probe was utilized for the first time to enable better characterization of degradation at the top of the tubesheet.

Prior to B1P02, a Technical Specification revision was requested to address the ODSCC concern in the tube support regions. A higher voltage repair limit of 3.0 volts was requested by Byron Station. This Technical Specification revision was approved by NRC on November 9, 1995. As a result, only one tube in all four steam generators exceeded the 3.0 volt repair limit. This tube will be repaired utilizing a plug. Had 1.0 volt IPC been applied, a total of six hundred and ninety-nine (699) tubes would have been repaired due to TSP cracking.

On October 29, 1995, steam generator bobbin coil eddy current inspections began pursuant to TSSR 4.4.5.0, including the revision for the 3.0 volt IPC implementation. The initial sample consisted of 100% of the inservice hot leg and cold leg tubes in each of the four steam generators. Also, a 100% sample of the top of tubesheet hot leg commenced utilizing the Plus Point probe (a combination probe with two pancake coils and the Plus Point coil). The primary purpose of the TTS inspection was to detect and repair all top of tubesheet cracking.

At 1545, on November 7, 1995, the determination that Byron should be classified as C-3 was made based on the results of the current inspection plan. A C-3 classification is defined as more than 10% of the tubes inspected are degraded (imperfections greater than or equal to 20% TW or more than 1% of the tubes are defective (an imperfection that exceeds the repair limit, 40% TW or 3.0 volt for IPC). Byron determined that the C-3 category requirements were exceeded due to more than 1% of the tubes inspected being defective. The appropriate NRC notification via the ENS phone system was made at 1647 on November 7, 1995, pursuant to 10CFR50.72(b)(2)(i). At that time, the phone call was made based on a 1.0 volt IPC and the top of tubesheet results. On November 9, 1995, 3.0 volt IPC was approved for use at Byron Station. Byron Station completed the inspections and on November 17, at approximately 1600, a follow up red phone call was made to provide the staff with complete data on total tubes considered defective per category C-3, as specified in TS 4.4.5.2.

B. DESCRIPTION OF EVENT: (cont.)

The table below identifies the inspection results and classification of each steam generator:

	SG A	SG B	SG C	SG D	TOTAL
# Inspected (100%)	4120	4064	4016	4360	16560
# Defective Indications (Circumferential and mixed mode @ TTS)	208	980	709	681	2578
# Defective Indications (Axial @ TTS only)	70	15	25	7	117
# Defective Indications (Exceeds IPC for ODSCC A TSP's)	1	0	0	0	1
# Defective Indications (>/=40% TW)	1	2	2	0	5
# Defective Indications (Located in Wedge Regions (LOCA & SSE))	1	5	9	5	20
Total Indications Defective	**281**	**1002**	**745**	**693**	**2721**
Total # / (%) Tubes Defective (*)	**280 (6.8%)**	**1002 (24.7%)**	**742 (18.5%)**	**693 (15.9%)**	**2717 (16.4%)**
Inspection Category	C-3	C-3	C-3	C-3	C-3

* Tube may contain more than one defective condition.

C. CAUSE OF EVENT:

Due to the complex environment at the top of the tubesheet of the Model D-4 SG, it is difficult to determine the exact cause of the degradation. A supplemental report will be submitted to identify progress made on determining root cause.

As previously stated, circumferential cracking at the top of the tubesheet was first found during the Unit 1 refueling outage (B1R06). As a result, Byron Station elected to perform a 100% top of tubesheet Plus Point inspection on the hot leg side during the recent B1P02 outage. This was the first time that the Plus Point probe was utilized as an inspection technique at Byron Station. The Plus Point probe has been found to be more sensitive to circumferential cracking that the standard RPC probe.

C. CAUSE OF EVENT: (cont.)

The primary mode of the degradation found is circumferentially and axially oriented ODSCC located at the top of the tubesheet region. The occurrence of ODSCC can be affected by tube material properties, manufacturing induced stresses, temperature, crevice conditions, operational environment, and chemical environments.

The Byron Unit 1 steam generators are Westinghouse Model D-4s that contain Inconel 600 tubing with carbon steel tube support plates and a carbon steel tubesheet. Mill-annealed Inconel-600 SG tubing has been found to be subject to axial and circumferential cracking at the top of the tubesheet at many PWRs. The cause of this cracking is not clearly known at this time.

D. SAFETY ANALYSIS

During B1R06, the tube with the largest circumferential indication was removed from Steam Generator C. Based on the laboratory and analytical results of this tube, the structural integrity of the tube was met. Preliminary analyses indicate circumferential indications found during B1P02 appear to be smaller based on signal amplitude.

Byron Station will operate for five months after the B1P02 outage is complete. The five months duration is less than half as long as the cycle that Byron had completed prior to B1P02. During B1R07, the appropriate eddy current technology will be utilized for the top of tubesheet inspection to determine if additional circumferential cracking has occurred.

Due to the increased sensitivity and detectability of the Plus Point probe over the regular RPC probe, it is believed that smaller through-wall degradation is easier to detect than if the RPC probe was utilized. More indications were found with the Plus Point coil than the standard 0.080" pancake coil.

The primary-to-secondary leak rate is limited to 150 gpd per steam generator by the Technical Specification (TS 3.4.6.2.c). If leakage exceeds this limit, the unit will be shut down for inspection and repair of defective tubes. With the request for 3.0 volt IPC, ComEd reduced the Unit 1 RCS iodine limit from 1.0 microCurie/gm to 0.35 microCuries/gm (TS 3.4.8.a). This provides an added margin of safety to ensure that offsite doses remain a small fraction of the 10CFR100 limits.

All tubes with circumferential indications found during this inspection will be repaired either by Laser Welded sleeving the repairable indication or inserting a stabilizer and plugging the two tube ends with mechanical plugs. The stabilizer will prevent the plugged tube with the circumferential indication from severing during normal operations and possibly creating a condition were adjacent tubes could be affected by the severed tube.

There is no impact on the health and safety of the public. All tubes with this type of indication have been identified and dispositioned either by stabilizing and plugging or sleeving the tubes.

E. CORRECTIVE ACTIONS

Immediate corrective actions included the removal of defective tubes from service either by plugging and stabilizing or sleeving the defective region.

Longer term corrective actions will include the following:

1. Tube Pulls

   A total of ten tubes are scheduled to be removed from steam generator A in order to perform laboratory testing and analysis. ComEd, in conjuction with EPRI, will be performing the testing and analysis of these tubes. The pulled tube analysis and testing will help gain insight into the mode of degradation and to provide additional data points to the industry leak and burst correlations for circumferentially orientated degradation at the top of the tubesheet. (NTS #454-180-95-0011-01)

2. Eddy Current

   During future inspections of the steam generators, Byron Station will continue evaluate various eddy current techniques for the top of tube sheet inspections and utilize the appropriate technology. (NTS #454-180-95-0011-02)

3. Supplemental Report

   As previously stated in the Cause of Event section, a supplemental report will be submitted to identify progress made on determining the root cause of this event. (NTS #454-180-95-0011-03)

F. RECURRING EVENTS SEARCH AND ANALYSIS

This is the second occurence of a Byron Unit 1 or Unit 2 steam generator being classified as inspection category C-3. The first time a C-3 classification for steam generator tubes was made was on October 6, 1994, during the B1R06 refueling outage. At that time the classification of C-3 was based on tubes that were greater than the IPC requirements of 1.0 volt at the tube support plates (LER #454-94-012).

Braidwood Unit 1 experienced a similar event during their Cycle 4 (Spring 1994) inspection when three of the four steam generators identified with a C-3 classification due to an increase of repairs from ODSCC at tube support plates. (LER #456-94-007) In addition to LER #456-94-007, Braidwood has categorized their steam generators as C-3 on two other occassions for an increase of repairs from ODSCC at tube support plates (LER #456-95-003 and LER #456-95-015).

ODSCC at the top of the tubesheet has been experienced at a number plants throughout the industry. Industry efforts are on-going to understand and correct this mode of degradation. ComEd is actively involved in these efforts.

COMPONENT FAILURE DATA

Manufacturer Nomenclature	Model Number	MFG Part Number
Westinghouse Steam Generator	D-4	n/a