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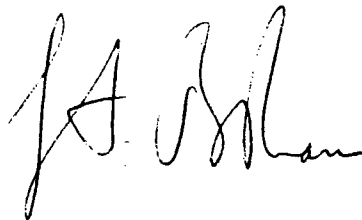
September 27, 1991

Re: Indian Point Unit No. 2
Docket No. 50-247
LER 91-04-01

Document Control Desk
US Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555

The attached Licensee Event Report LER 91-04-01 is hereby submitted as a follow-up to a voluntary submittal of information of interest to the NRC.

Very truly yours,



Attachment

cc: Mr. Thomas T. Martin
Regional Administrator - Region I
US Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. Francis J. Williams, Jr., Project Manager
Project Directorate I-1
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US Nuclear Regulatory Commission
Mail Stop 14B-2
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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Indian Point Unit No. 2	DOCKET NUMBER (2) 0 5 0 0 0 2 4 7	PAGE (3) 1 OF 0 5
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TITLE (4)
Damaged Hold-Down Bolts for Polar Crane Rail

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 NAMES	DOCKET NUMBER(S)
0 2	1 2	9 1	9 1	0 0 4	0 1	0 2	7 9	1		0 5 0 0 0 0
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)										

OPERATING MODE (9) N	POWER LEVEL (10) 0 1 0 1 0	<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.406(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)
		<input type="checkbox"/> 20.406(a)(1)(i)	<input type="checkbox"/> 50.38(c)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)
		<input type="checkbox"/> 20.406(a)(1)(ii)	<input type="checkbox"/> 50.38(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input checked="" type="checkbox"/> OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		<input type="checkbox"/> 20.406(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
		<input type="checkbox"/> 20.406(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
		<input type="checkbox"/> 20.406(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)	

LICENSEE CONTACT FOR THIS LER (12)

NAME Joan F. Etzweiler	TELEPHONE NUMBER
	AREA CODE: 9 1 1 4 5 2 6 1 - 1 5 3 6 5

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
E	L R C O I N		X 1 0 1 0 1 0	N					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

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

On February 12, 1991, while the plant was shutdown for a refueling outage, some of the studs used to secure the containment building polar crane rail to the concrete support wall were determined to have failed. 47 out of the 140 studs in one quadrant were affected. Based on the NUREG 0612 analysis, sufficient margin existed such that with the reduced bolt configuration, original acceptance criteria were met. Nevertheless, repairs were made before a heavy load lift was made. Root cause analysis indicates that the failures occurred several years ago and were caused by either a single overload event or corrosion fatigue/stress corrosion cracking, possibly due to excess torquing during installation. This report is provided as a voluntary submittal of information of interest to the NRC.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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

PLANT AND SYSTEM IDENTIFICATION:

Westinghouse 4-Loop Pressurized Water Reactor

IDENTIFICATION OF OCCURRENCE:

Damaged hold-down bolts for containment polar crane rail.

EVENT DATE:

February 12, 1991

REFERENCES:

Open Item Report 91-02-075
LER 91-004-000

PAST SIMILAR OCCURRENCE:

None

DESCRIPTION OF OCCURRENCE:

Subsequent to plant shutdown for a refueling outage, personnel were performing an inspection of the containment building polar crane components during scheduled work on the trolley beam end connections. During this inspection, it was determined that certain nuts which fasten the polar crane rail to the supporting concrete were loose. Consequently, snug tightening by use of an open end box wrench was attempted on all 648 nuts. As a result, 47 studs, all located within one quadrant, were discovered to have failed. The failed studs showed evidence of corrosion and in most cases fractured heads. In addition to the studs which fasten the rail to the concrete, similar bolts are also used for the rail clamp. The rail clamp bolts were determined to be acceptable by wrench tightening of the nuts.

Additionally, to determine the extent of the damaged studs, ultrasonic testing (UT) was performed on 140 of the remaining studs located in the quadrant where the failed studs were found, and 86 others were sampled at five foot intervals along the entire circumference of the railway. In the quadrant with the failed studs, 47 other studs were found to have ultrasonic indications. However, these studs were considered acceptable because torquing their nuts beyond snug tight did not reveal failure. Only 2 studs in the other three quadrants had indications.

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

ANALYSIS OF OCCURRENCE:

Based on the loading requirements in the NUREG 0612 analysis, we believe that sufficient margin exists such that the as found reduced bolt configuration satisfied the original acceptance criteria.

CAUSE OF OCCURRENCE:

Chemical analysis, metallographic analysis and hardness measurements were performed on samples of the failed studs, nuts from the failed studs, and intact studs from both damaged and undamaged quadrants.

The chemical composition for all samples met ASTM requirements for the specified materials. Microstructures for failed and intact bolts were also very similar.

Fractographic analysis of the failed studs indicated brittle cleavage fracture. The failed studs also exhibited a heavy layer of tenaciously adhered corrosion products both on the sides and on the fracture surface. The intact sample stud from the quadrant with failed studs was also severely corroded; the other intact studs, from the quadrants without failed studs, were not.

In tensile tests, the samples from the intact studs met ASTM specifications for yield stress, ultimate tensile stress and total elongation, and showed the appearance of ductile failure. Samples from the intact studs were also given Charpy impact tests. Except for one sample, they failed in a tough manner, showing ductile tearing. The exception was a sample from a stud from the quadrant with the failed studs, which showed brittle cleavage failure at low toughness. This sample was found to have a relatively high density of large manganese sulfide inclusions, as compared with other samples which varied widely.

The root cause for the failure of the polar crane rail anchor studs was either a single overload event or stress corrosion cracking due to a high preload of the studs from excessive torquing during installation and continued exposure to water. Fatigue loading during service (i.e., corrosion fatigue) would have accelerated the crack growth rate due to stress corrosion cracking. These failures were concentrated in one quadrant of the polar crane rail system, the quadrant in the lowest area, where water would tend to collect.

The total failure of forty seven of the anchor studs occurred several years ago. This conclusion is based on the excessive quantity of corrosion products (i.e., rust) that exists on the fracture surfaces. These fractures may have occurred prior to start-up. Fractograph analysis of these studs showed a brittle cleavage fracture that is typical for a signal rapid overload event in this steel.

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

CAUSE OF OCCURRENCE: (continued)

Charpy impact testing was performed on six samples, two each from a stud removed from the damaged quadrant and from two studs removed from regions where no failures or cracks were observed. Brittle fracture was observed on only one sample, from the stud taken from the damaged quadrant. Fractography of this brittle sample revealed a brittle cleavage fracture surface that was identical to the fracture surface on the studs that had failed in service. The cause for this brittle fracture of the Charpy sample was determined to be manganese sulfide inclusions in the anchor stud.

Ultrasonic testing (by Consolidated Edison personnel) of the remaining anchor studs in the same quadrant where the failed studs were observed gave forty seven "indications". These ultrasonic indications could be either metallurgical defects in the stud or partial cracks. If these ultrasonic indications are partial cracks, then the partial cracks could be due to either a single rapid overload event or stress corrosion cracking.

CORRECTIVE ACTION:

As a repair, 33 new bolts were installed at selected locations between the failed bolt locations. The samples of sound bolts which were removed were also replaced by new bolts. The new bolts are Drillco Maxi-Bolts and are substantially stronger than the original bolts. They were installed by drilling through the existing base plates and concrete, and expanding their anchor systems into place by using a hydraulic torque wrench. A nut and washer is then installed on each bolt and torqued to a specified value. The new bolting configuration was analyzed and determined to satisfy original design conditions for the rail installation; therefore, no change in crane loading capability is contemplated.

To check for any further deterioration, an inspection will be performed during the next refueling outages. This inspection will include nut tightness testing and ultrasonic testing on selected samples. Future inspections will be performed as warranted by the results of the first inspection.

If the failures were due to a single overload event, the replacement procedure utilizing the maxi-bolts is sufficient to ensure the full lift capability of the crane. A future overload event is very unlikely because of improvements in the use of procedures for lifting heavy loads for the refueling process, the use of engineered lifting rigs for special heavy loads, and the training of the crane operators in the correct lifting process.

**LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION**

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20565, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Indian Point Unit No. 2	DOCKET NUMBER (2) 0 5 0 0 0 2 4 7	LER NUMBER (8)			PAGE (3)		
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TEXT (If more space is required, use additional NRC Form 386A's) (17)

CORRECTIVE ACTION: (Continued)

If these failures were due to stress corrosion cracking and/or corrosion fatigue, then it is reasonable to expect that all of the possible failures would have occurred during the past 20 years. The planned inspection program will be performed to confirm this expectation. The possibility for a future failure of any anchor studs by stress corrosion cracking is dependent on the existence of three necessary conditions; namely, stress, susceptible material and environment. If any of these conditions are removed, the studs should not fail. The refueling procedure will be revised before the next refueling outage to insure that any spill of liquid into the polar crane rail trough is promptly dried up. In the other quadrants, where there is no moisture and the studs do not exhibit any corrosion, there is no expectation of stress corrosion cracking or corrosion fatigue. The good condition of these studs indicates that the high temperature and relative humidity of the containment environment do not make them vulnerable to corrosion.