CLINTON POWER STATION. P.O. BOX 678. CLINTON. ILLINOIS 61727-0678. TELEPHONE (217) 935-8881

U-601681 145-90(06-05)-LP 2C.220

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June 5, 1990

10CFR50.73

Docket No. 50-461

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

Subject: Clinton Power Station - Unit 1 Licensee Event Report No. 90-010-00

Dear Sir:

Please find enclosed Licensee Event Report No. 90-010-00: Femoval of Tie-Rods from Shutdown Service Water Piping Expansion Joint Due to Construction Error Results in Inoperable Division I and II Diesel Generators. This report is being submitted in accordance with the requirements of 10CFR50.73.

> Sincerely yours, J.A. Sangenberg, IA Manager - Licensing and Safety

RSF/alh

Enclosure

cc: NRC Clinton Licensing Project Manager NRC Resident Office Illinois Department of Nuclear Safety INPO Records Center NRC Region III, Regional Administrator

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S NUCLEAR REGULATORY COMMISSION APPROVED OMB NO 3150 0104

EXPIRES 8/31/88

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On May 8, 1990, with the plant in Mode 1 (POWER OPERATION) at 100 percent reactor power, the Shift Supervisor declared the Division I and II emergency diesel generators (DG) inoperable because expansion joints in the Shutdown Service Water (SX) system piping for the DG heat exchangers did not have required tie-rods installed to prevent expansion beyond design limitations. The cause of this event is attributed to construction/installation error. During installation of the expansion joints, the mounting lugs for the tie-rods were mistakenly identified as lifting lugs used for installation and shipping purposes and were removed in accordance with approved contractor work documents. Corrective actions included: performing a stress analysis of piping, pipe supports, expansion anchors and auxiliary steel to determine if not having tie-rods installed had an impact on the piping system; reworking and repairing pipe supports; examining the piping system for damage; verifying that no other safety-related expansion joints required tie-rods; replacing a leaking expansion joint and shipping this joint to an off-site laboratory for examination to determine the cause of the leak; installing tie-rods on the remaining seven DG heat exchanger expansion joints; and observing initial pressurization of the SX system following repairs and rework.

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DESCRIPTION OF EVENT

On May 8, 1990, at approximately 1840 hours, with the plant in Mode 1 (POWER OPERATION) at 100 percent reactor [RCT] power, the Shift Supervisor (SS) declared the Division I and II emergency diesel generators [DG][EK] inoperable because expansion joints [EXJ] in the Shutdown Service Water (SX) system [BI] piping for the DG heat exchangers [HX] did not have required tie-rods installed to prevent expansion beyond design limitations. As a result, at 2040 hours, in accordance with Action g of Technical Specification 3.8.1.1, operators began an orderly shutdown of the reactor.

The expansion joints are installed between the SX system piping and the DG heat exchangers to isolate vibratory motion between SX piping and the diesel generators. The tie-rods should have been located between the flanges of the expansion joints to prevent their expansion beyond design limitations.

On Mav 2, 1990, the plant was in Mode 1 at 100 percent reactor power and a planned maintenance outage of the Division I DG was in progress. A mechanical maintenance crew was cleaning bolting material in a flanged connection of SX system expansion joint 1SX04MA when they noticed water on the floor. The crew foreman contacted the DG system engineer who investigated the source of the water. At 1530 hours, the system engineer determined that the water was leaking from expansion joint 1SX04MA which is located at the outlet of Division I DG heat exchanger 1DG12AA. The system engineer documented the expansion joint leak on Condition Report (CR) 1-90-05-017 and discussed the leak with the SS. As a result of this discussion, it was concluded that the leak was slow and would have no impact on DG system operability.

On May 3, 1990, a replacement expansion joint was located on site; however, the replacement was manufactured by Parker-Hannifin Corporation and the leaking expansion joint was manufactured by Pathway Bellows, Incorporated. The plant design would not allow use of the Parker expansion joint due to some differences in configuration. For this reason, plant modification SXF018 was initiated to allow installation of the Parker expansion joint.

On May 4, 1990, IP decided to delay installation of the Parker expansion joint until the next diesel generator maintenance outage. At 0505 hours, the Division I DG was restored from the maintenance outage.

On May 4, 1990, during completion of the design for plant modification SXF018, a field engineer checked the installed dimensions of the leaking expansion joint and discovered that the joint had expanded beyond the original length shown or the vendor drawing. The field engineer also

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noticed the leaking expansion joint (manufactured by Pathway) had no tierods whereas the replacement expansion joint (manufactured by Parker) did have tie-rods.

A design engineer contacted Pathway to discuss the as-found length of the expansion joint, the leak, and the need for tie-rods. Pathway indicated that the as-found length of the expansion joint may be acceptable, but may reduce the fatigue life of the joint. Pathway also indicated that the leak may have been caused by corrosion, and stated that the tie-rods were not required but should be installed. Further, Pathway indicated they had shipped the expansion joint to Clinton Power Station (CPS) with tie-rods installed. Pathway indicated they would review the fatigue effects of the extended expansion joint.

On May 7, 1990, a design engineer measured three of the four Division I DG/SX expansion joints (the fourth was not accessible due to installed insulation) and determined all three were extended beyond the original length shown on the vendor drawings. None of the three had tie-rods installed. The engineer also examined the two expansion joints in the SX piping for the Division III DG HX and found them to be the correct length and to have tie-rods. The dimensions of the three extended Division I expansion joints were also provided to Pathway for evaluation.

On May 8, 1990, the insulation was removed from the remaining Division I expansion joint and the four expansion joints in the SX piping for the Division II DG HXs. Following removal of the insulation from the five expansion joints, the length of the joints was measured and all five were determined to be extended beyond the original length shown on the vendor drawings. The dimensions of these expansion joints were also provided to Pathway for evaluation. Pathway's evaluation determined the eight expansion joints for Divisions I and II were acceptable in their extended condition but Pathway recommended tie-rods be installed. Additiona'ly, Pathway did not indicate any impact on fatigue life of the expansion joints.

A search for documentation that would have authorized removal of the tierods identified the work travelers used during construction to remove the tie-rod lugs. These travelers indicated that the tie-rod lugs were mistaken for lifting lugs and thus removed.

IP requested that the plant Architect/Engineer, Sargent and Lundy (S&L), review piping stress analysis calculations to determine if tie-rods were required on the expansion joints. At 1400 hours, this review identified that the calculations assumed tie-rods were installed on the expansion joints to limit piping movement. Because of this, at 1410 hours, CR 1-90-05-028 was initiated to document the missing tie-rods. The SS reviewed the CR and determined that operability of the Division I and II

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emergency diesel generators was indeterminate pending further evaluation by S&L.

On May 8, 1990, field examinations of Division 1 and II SX system piping supports [SPT] identified damage to two supports. Division I support 1SX15009R located downstream of DG HX 1DG12AA outlet isolation valve [ISV] 1SX065A was bent. Division II sliding support 1SX11009R located downstream of DG HX 1DG12AB outlet isolation valve 1SX065B was not in contact with its support plate. CR 1-90-05-029 was initiated at 1830 hours to document the two damaged supports. Additionally, several other piping supports were found shifted from their design locations.

The bent and displaced supports indicated excessive piping movement had occurred and the piping supports and associated components may have been subjected to stresses, during previous system testing or operation, which may have exceeded those allowed by industry codes and standards.

On May 8, 1990, since diesel generator operability could not be proven for the plant design basis events with the missing tie-rods and the noted field damage of the SX piping supports, CPS management determined that both Divisions I and II DG should be declared inoperable. As a result of this determination, at 1840 hours, the SS declared them inoperable.

At 2040 hours, in accordance with Action g of Technical Specification 3.8.1.1, operators began an orderly shutdown of the reactor.

On May 9, 1990, at 0726 hours, operators initiated a manual scram to place the plant in Mode 3 (HOT SHUTDOWN).

On May 10, 1990, at 0515 hours, the plant achieved Mode 4 (COLD SHUTDOWN).

No other automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. No other equipment or components were inoperable at the start of this event such that their inoperable condition contributed to this event.

CAUSE OF EVENT

The cause of this event is attributed to construction/installation error. Baldwin Associates (BA), the CPS construction contractor, authorized removal of the expansion joint tie-rods in error during plant construction.

A review of the Pathway shipping documents contained in IP's receiving inspection reports determined that the tie-rods were in place when the expansion joints were shipped to CPS. During installation of the expansion joints, the mounting lugs for the tie-rods were mistakenly

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identified as lifting lugs used for installation and shipping purposes and were removed in accordance with approved BA work travelers.

IP has determined two factors may have contributed to incorrectly identifying the tie-rod lugs as lifting lugs.

- The installation instructions portion of the Pathway vendor manual has a sketch of an expansion joint with shipping bars in place and lifting lugs. It does not show any tie-rods. Associated installation instructions do not mention the existence of tie-rods but do say that shipping bars are installed to maintain shipping length and provide expansion joint stability. Removal of these bars is specified after installation of the expansion joints.
 - The only safety-related expansion joints installed at CPS (a total of forty-six) having tie-rods are the ten located on the SX piping to the three divisional diesel generators. The other safetyrelated expansion joints such as the diesel exhaust bellows [BLL] do not have tie-rods.

CORRECTIVE ACTION

IP performed a stress analysis of piping, pipe supports, expansion anchors, and auxiliary steel with piping in the as-found configuration (that is, no tie-rods installed) using the worst case loads (hydrostatic test loads) to determine the impact of this event on the SX piping system. An evaluation of heat exchanger nozzles [NZL] and anchors was performed to verify that local areas did not exceed the allowable design yield strength of the material.

The stress analysis identified piping system areas where calculated stresses were greater than the allowable design yield strength; however, review of certified material test reports for the areas verified that the stresses were not greater than the actual material yield strength.

The analysis also identified loads applied to pipe supports that potentially exceeded support capacity. IP inspected the pipe supports for out-of-tolerance conditions. Twenty-six supports, twelve in Division I and fourteen in Division II, were adjusted to within design tolerances except as noted below:

- Support 1SX13C2OR could not be returned to original design tolerance and therefore a design change, Engineering Change Notice (ECN) Number 9600, was issued to accept the support as is.
- The paddle on strut 1SX15012X appeared to be locked and was therefore replaced in accordance with Maintenance Work Request (MWR) D15461.

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The stress analysis identify potential problems. These of anchor plates and auxiliary damage and evaluated as accord	led eight structural of components were embedd steel. The component eptable.	compone led pla is were	nts havi tes, exp examine	ng ansion d for		
IP performed a review of design, no other safety-rel	sign documentation and ated expansion joints	i verif requir	ied that ed tie-r	, by ods.		
The leaking expansion joint plant modification SXF018 an joint was installed with ti examined at an off-site lab The joint is scheduled to b	, 1SX04MA, was replace nd MWR D15184. The re e-rods. The leaking oratory to determine e shipped to the labo	ed in a eplacemexpansion the cau ratory	accordance ment expa ion joint use of th by June	e with nsion will b e leak 29, 199	ре 90.	
Tie-rods were installed on Division I: DG heat exchang performed in accordance wit and MWRs D15458 and D15459.	the three remaining D er expansion joints. h Field Engineering C	ivision These hange 1	n I and t installa Notice (1	the found tions of FECN) 24	r were 4743	
During initial pressurizati following repairs, IP obser displacement occurred.	on of the Divisions I eved piping movement t	and I o ensu	I SX sys re no ex	tem cessive		
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IP will revise the vendor r clearly indicate that tie- clarify the method for adj	manuals for the DG/SX rods are required for usting tie-rods.	expans these	ion join joints a	ts to nd to		
ANALYSIS OF EVENT						
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An assessment of the safety consequences and implications of this event has not yet been completed. IP will review the safety significance of the missing expansion joint tie-rods and incorrect pipe clamp by analyzing piping and supports using expected operating and seismic loads. This assessment will determine if the Division I and II DGs would have performed their design functions in the as-found condition. This analysis is scheduled to be complete by June 29, 1990. IP will provide the completed assessment of the safety consequences and implications in a supplemental report which is scheduled to be submitted by August 3, 1990.

Based on the tie-rods not being installed during construction of CPS, the Division I and II DGs may have been inoperable since initial plant operation. These DGs were restored to operability on May 12, 1990 at 0700 hours.

ADDITIONAL INFORMATION

The extended expansion joints discussed in this LER were six-inch nominal diameter testable expansion joint assemblies manufactured by Pathway Bellows, Incorporated in accordance with Pathway Drawing D-3-5945. Pipe supports 1SX13020R, 1SX15012X, 1SX11009R, 1SX15009R, and 1SX09023X were installed by BA using standard hardware supplied by Basic Engineers and have no model number.

LER 89-017-00 discussed a construction/installation error that resulted in mounting hardware for the Division III DG heat exchanger not being installed as designed and failure of the DG to meet seismic qualifications.

For further information regarding this event, contact D. L. Holtzscher, Director-Nuclear Safety, at (217) 935-8881, extension 3408.