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U-602542
L45-96(01 - 25)LP
2C.220
WC-018-96
January 25, 1996
10CFR50.73

Docket No. 50-461

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

Subject: Clinton Power Station - Unit 1
Licensee Event Report No. 95-008-00

Dear Sir:

Enclosed is Licensee Event Report No. 95-008-00: Design Program Deficiency Results in Potentially Erroneous Indication and Inoperable Drywell Floor Drain Sump Monitoring System. This report is being submitted in accordance with the requirements of 10CFR50.73.

Sincerely yours,

Wilfred Connell
Vice President

RSF/csm

Enclosure

cc: NRC Clinton Licensing Project Manager
NRC Resident Office, V-690
Regional Administrator, Region III, USNRC
Illinois Department of Nuclear Safety
INPO Records Center

IE22

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)

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TITLE (4)
Design Program Deficiency Results in Potentially Erroneous Indication and Inoperable Drywell Floor Drain Sump Monitoring System

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
									None	05000
11	10	95	95	008	00	01	25	96	FACILITY NAME	DOCKET NUMBER
									None	05000

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)					
	1	20.2201(b)	20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
POWER LEVEL (10)		20.2203(a)(1)	20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
	100	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)
A. Henriquez, Engineering Projects Engineer	(217) 935-8881, Extension 3432

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)

During a plant shutdown, engineers discovered that a plant modification which provided an alternate system for monitoring drywell floor drain sump flow rate contained a deficiency that, under certain conditions, would have provided anomalous indication, potentially confusing to the operator when sump flow is beyond the design range of the instrumentation. The alternate system was determined to have been inoperable since installation, including a period when the primary system, a weir box, was inoperable. Therefore, the Technical Specification requirement to have an operable floor drain sump monitoring system was not met. The cause of the event was attributed to a design program deficiency. The program review standards did not contain a criterion for consideration of instrument operation outside the designed operating range when the modification was designed, verified and tested. Corrective actions for this event included correcting the modification, revising the calibration procedure for the monitoring system, revising the design program, and reviewing the generic implications of the design program deficiency.

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DESCRIPTION OF EVENT

On December 29, 1995, Illinois Power (IP) determined that the drywell floor drain sump monitoring system [IJ] had been inoperable longer than allowed by Action A of Technical Specification 3.4.7, Reactor Coolant System Leakage Detection Instrumentation, and that the inoperable condition was reportable under the provisions of 10CFR50.73. Action A requires restoration of the monitoring system to operable status within 30 days.

Reactor coolant leakage inside the drywell is detected by several monitoring methods including sump level changes, and drywell gaseous and particulate radioactivity levels. The drywell floor drain sump monitoring system monitors leakage collected in the floor drain sump from unidentified leakage sources such as control rod drives [A], valve [V] flanges or packing, floor drains, the component cooling water system [KG], and drywell air cooling unit condensate drains. All drywell leakage is routed through a weir box in the drywell floor drain sump. The weir box discharges through a "V" notch which measures flow by backing up water in the weir box, behind the notch, proportionally to the flow rate. A level probe measures the depth of the water in the weir box and reads it as a flow rate. The flow rate is integrated by a totalizer [FQ] to give total sump leakage volume. The flow rate is continuously recorded in the main control room.

An alternate system of drywell floor drain sump monitoring, modification LD-027, was designed and installed in September 1995, to measure sump flow. The alternate system was released for operations on September 27, 1995.

The LD-027 flow monitoring system consists of a magnetic flow meter [MTR] installed on the discharge piping of the drywell floor drain sump pumps [P] and a flow totalizer converter [CNV] in the vicinity of the flow element. The flow totalizer converter provides local indication of total pump discharge flow and actual pump discharge flow rate to a programmable logic controller (PLC) [PCM], a digital counter, a computer point, an two recorder channels in the main control room. The PLC calculates the total average and actual pump discharge flow by integrating the signal from the flow totalizer converter and dividing the result by the total time between pump cycles. The calculated result is the average flow rate into the sump since the last pump run. When the sump in the drywell reaches a high level, one of two pumps start (the pumps alternate between cycles) pumping water to the drain sump collector tank [TK]. This operation continues until the sump level reaches a low level setting. When the pump stops, the PLC senses a "no flow" signal and resets the timer [TMR], performs the average flow rate calculation, and transmits the resulting flow rate signal to a recorder channel, a computer point and to another totalizer (counter). This operation is repeated every time a sump pump completes one cycle.

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The intended function of the LD-027 system is to provide a backup drywell floor drain sump monitoring system to measure low flow rates. The range of the recorder which provides the indication is zero to eight gallons per minute. Flow rates into the sump greater than eight gallons per minute are manually calculated in accordance with plant procedures.

At about 0827 hours on October 11, 1995, with the plant in Mode 1 (POWER OPERATION) at about 100 percent reactor [RCT] power, the weir box indication failed a channel check surveillance due to suspected fouling and was declared inoperable. Therefore, the LD-027 system was the only method operable at that time to monitor leakage into the drywell floor drain sump.

Unrelated to the drywell floor drain sump monitoring issue, at about 0449 hours on December 10, 1995, operators placed the reactor mode switch [HS] into the shutdown position and the plant entered Mode 3 (HOT SHUTDOWN) in preparation for Planned Outage PO-7. At 1235 hours, the plant entered Mode 4 (COLD SHUTDOWN). In accordance with Technical Specification 3.4.7, the drywell floor drain sump monitoring system is required to be operable in Modes 1, 2 (STARTUP), and 3; the system is not required to be operable in Mode 4.

On December 14, 1995, with the plant shut down, test engineers were testing level switches [LS] for the drywell floor drain sump and using the LD-027 flow monitoring system to verify the test results. During this evolution, reactor recirculation system [AD] piping was being flushed due to installation of another modification, resulting in water draining into the drywell floor drain sump at a calculated flow rate greater than the 8 gallons per minute maximum range of the LD-027 monitoring system recorder. However, the test engineer noted that the recorder was indicating no flow. The estimated flow rate from the flushing activity was about 11 gallons per minute.

During the PO-7 outage, the weir box was cleaned and restored to an operable status. At 0900 hours on December 15, 1995, the weir box was declared operable.

At 1942 hours on December 15, 1995, following completion of the PO-7 outage, the plant entered Mode 2 in preparation for plant startup. The weir box was the operable method of drywell floor drain sump monitoring.

On December 21, 1995, at about 1430 hours, a test engineer initiated condition report (CR) 1-95-12-053 to track investigation and correction of the indication discrepancy.

On December 29, 1995, the LD-027 monitoring system was determined to have been inoperable since release for operations on September 27, 1995. The basis for this determination was a review that concluded the LD-027 sump monitoring system would have provided, under certain conditions, anomalous indications, potentially confusing to the operator when drywell floor drain flow is greater than eight gallons per minute. Regulatory Guide 1.97 (Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident), Table 1, Item 11 (Human Factors) states that monitoring instrumentation design should minimize the development of conditions that would cause instrumentation to give anomalous indications potentially confusing to the operator.

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Between October 11, 1995, and December 10, 1995, the plant operated in Modes 1 and 3 with no operable drywell floor drain sump monitoring. Technical Specification 3.4.7 requires a drywell floor drain sump monitoring system to be operable when the plant is in Modes 1, 2, and 3, and Action A of this specification requires restoration of the monitoring system to an operable status within 30 days. Therefore, the requirements of the Technical Specification were not met from 0827 hours on November 10 through 1235 hours on December 10, 1995. On November 10, 1995, at 0827 hours, the plant was in Mode 1 at about 100 percent reactor power.

No 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 to the extent that their inoperable condition contributed to this event.

CAUSE OF EVENT

The cause of this event is attributed to a design program deficiency.

The inaccurate indication when the flow was greater than eight gallons per minute was caused by the limitation of a digital to analog (D/A) converter. The flow rate signal is sent to the recorder via a 16-bit D/A converter within the PLC configuration. The D/A converter is a 16-bit 2's complement format. When the calculated flow rate is greater than 8.19175 gallons per minute (8.19175 gallons per minute corresponds to a digital number of 32,767 or two to the fifteenth power minus one) and less than 16.384 gallons per minute, the sign bit is set, producing a negative or down scale reading in the recorder. For flow rates greater than 16.384 and less than 24.576 gallons per minute, the sign bit is reset and the indication will be somewhere, erroneously, on scale. This pattern continues in multiples of about 8.2 gallons per minute. Thus, the instrumentation provided erroneous indication when sump flow was beyond the design range of the system.

The expected output of the instrumentation when sump flow was outside the design range was not included as a critical parameter for design of the LD-027 modification and was not verified or tested. The existing design program did not include a criterion in the General Design Review Standards (GDRS) for consideration of instrument operation outside the designed operating range. The GDRS provide criteria for reviewing design changes.

CORRECTIVE ACTION

The PLC ladder logic has been revised to clamp the flow indication at full scale when the instrumentation output is greater than full scale (eight gallons per minute). This action was completed by implementation of plant change (PC) #29470.

Drywell floor drain sump flow channel calibration procedure CPS No. 9443.09 has been revised to include instrument testing for output flow rates greater than eight gallons per minute. This action was completed as part of post modification testing required by PC #29504.

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The design program has been revised to include verification of instrument operation outside the designed operating range.

Nuclear Station Engineering performed a review to determine the generic implications of the design program deficiency. The review did not identify any additional installed hardware changes affected by the program deficiency. Hardware change team leaders for designs currently in progress and potentially susceptible to this type of deficiency were informed of the design program deficiency and were tasked with ensuring the modifications are reviewed for the potential error prior to release for operations.

ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(i)(B) as a condition prohibited by Technical Specification 3.4.7 which requires an operable drywell floor drain sump monitoring system when the plant is in Modes 1, 2, and 3.

Analysis of the safety consequences and implications of this event identified that this event was not nuclear safety significant. The plant is designed with several independent systems for monitoring leakage and alerting the operator when leakage rates are above background levels. The LD-027 monitoring system provided correct flow indication up to eight gallons per minute. The system would have indicated anomalous flow only if there was a sudden inleakage change greater than eight gallons per minute.

For flows greater than eight gallons per minute, the drywell atmospheric monitoring systems continuously monitor the drywell atmosphere for airborne particulate and gaseous radioactivity. A sudden increase in radioactivity which may be attributed to reactor coolant steam or reactor water leakage will initiate an alarm [ALM] in the main control room. Although these systems are not capable of quantifying leakage rates, they are sensitive enough to indicate increased leakage rates of one gallon per minute within one hour and larger changes in proportionally shorter times.

The drywell floor drain sump has level switches that start and stop the sump pumps when required. A timer starts each time the sump is pumped down to the low level setpoint. If the sump fills to the high level setpoint before the timer ends, an alarm sounds in the control room, indicating a leakage rate into the sump in excess of a preset limit. A second timer starts when the sump pumps start on high level. Should this timer run out before the sump level reaches the low level setpoint, an alarm is sounded in the control room indicating a leakage rate into the sump in excess of a preset limit.

Condensate from two of four drywell cooling system coil cabinets [CAB] is routed to the drywell floor drain sump and is monitored by an in-line rotometer that provides alarms in the control room. This drywell air cooler condensate flow rate monitoring system serves as an added indicator, but not quantifier, of reactor coolant system unidentified leakage.

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The leakage detection systems inside the drywell are designed with the capability of detecting leakage less than the established leakage rate limits. Identification of the leakage allows the operators to evaluate the significance of the indicated leakage and, if necessary, shut down the reactor for further investigation and corrective action. The allowed leakage rates are well below the rates predicted for critical crack sizes.

During this event the total drywell floor drain average leakage rate was less than one gallon per minute.

The plant operated from 0827 hours on October 11, 1995, until 1235 hours on December 10, 1995, with no operable drywell floor drain sump monitoring system. The weir box monitoring system was discovered to be inoperable on October 11, 1995 at 0827 hours. The LD-027 monitoring system was discovered to be inoperable on December 14, 1995.

ADDITIONAL INFORMATION

No equipment or components failed during this event.

Clinton Power Station has not reported previous similar events in recent history.

For further information regarding this event, contact A. Henriquez, Engineering Projects engineer, at (217) 935-8881, extension 3432.