Iowa Electric Light and Power Company

February 14, 1992
DAEC-92-0068

Mr. A. Bert Davis
Regional Administrator
Region III
U. S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License DPR-49
Licensee Event Report #92-001

Gentlemen:

In accordance with 10 CFR 50.73 please find attached a copy of the subject Licensee Event Report.

Very truly yours,

David L. Wilson

David L. Wilson
Plant Superintendent - Nuclear

DLW/JA/eah

cc: Director of Nuclear Reactor Regulation
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NRC Resident Inspector - DAEC

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NRC Form 366A (5-83) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO 3150-0104

EXPIRES 4/30/92

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)	DOCKET NUMBER (2)	PAGE (3)
Duane Arnold Energy Center	0 5 0 0 0 3 3 1	1 OF 0 8

TITLE (4) Potential Loss of Vessel Level Instrumentation Functions Due to Inaccuracies Under High Drywell Temperature Conditions

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 1	1 5	9 2	9 2	— 0 0 1	—	0 2	1 4	9 2	None	0 5 0 0 0
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OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 8 6	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
Jeff S. Axline, Technical Support Engineer	3 1 9 8 5 1 - 7 6 0 0

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	J E	L I S	Y 0 1 0	Yes							
B	B J	L I S	I 2 0 4	Yes							

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 fifteen single-space typewritten lines) (16)

On 1/15/92, with the plant operating at 86% power coasting down for a refuel outage, it was determined that the triple low level trip function associated with Yarway level switches may not be functional at high drywell temperatures. On 1/29/92, during review of the effects of high drywell temperatures on other vessel level instrumentation, it was determined that the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) system automatic high level trips may not function at high drywell temperatures. Following verification of the problems on 1/15 and 1/29, the associated instrumentation was satisfactorily re-calibrated to ensure trips would occur, as required, under high drywell temperature conditions.

The cause of the problem identified on 1/15 was incorrect information contained in GE SIL 299 compounded by an incorrect statement in information provided by the instrument vendor and the verification calculation performed by General Electric. The cause of the problem identified on 1/29 was failure to account for the effects of high drywell temperatures on the high level trip instrumentation when the instrument line reference legs were re-routed during the 1988 refuel outage.

Neither of the instrumentation problems had an effect on the safe operation of the plant.

I. DESCRIPTION OF EVENT:

TRIPLE LOW LEVEL INSTRUMENTATION

On January 15, 1992, with the plant operating at 86% power coasting down for a refuel outage, it was determined that the triple low level trip function associated with Yarway wide range (8-218 inches above top of active fuel) level switches, would not be functional with reference leg temperatures above approximately 420 degrees F. This equates, worst case, to a drywell temperature of approximately 230 F., however, it should be noted that there is a significant time lag (approximately 20 - 30 minutes) between the time drywell temperatures reach 230 degrees and reference leg temperatures reach 420 degrees. The triple low level function associated with these switches provides initiation signals for Low Pressure Coolant Injection (LPCI), Core Spray (CS), Emergency Diesel Generators (EDGs), Group I Isolation (main steam lines), Group VII Isolation (Reactor Building Closed Cooling Water System (RBCCW) and well water containment cooling), and the Automatic Depressurization System (ADS). In addition to the above initiations, the River Water Supply (RWS) valves fail open and the radwaste dilution valves fail closed on the triple low level signal.

The above determination was made during review of setpoint calculations as part of the Duane Arnold Energy Center (DAEC) setpoint design basis reconstitution program.

At 2307 hours, following General Electric verification of the DAEC setpoint calculations, 6 and 24 hour Limiting Conditions for Operation (LCO) were entered as required by Primary Containment Isolation System (PCIS) and Emergency Core Cooling System (ECCS) instrumentation Technical Specifications, respectively. At 0005 hours on 1/16/92 the 6 hour LCO was exited when calibration of the PCIS triple low level instruments to the new setpoint was complete. At 0555 on 1/16/92, the 24 hour LCO was exited following calibration of the remaining triple low level instruments.

HIGH LEVEL INSTRUMENTATION

During review of the effects of high drywell temperatures on other vessel level instrumentation, it was identified that the instruments which feed into the feedwater level control system as well as instruments which provide the high level High Pressure Coolant Injection (HPCI), Reactor Core Isolation Cooling (RCIC), feed pump, and main turbine trips would be affected. The resultant effect would cause indicated level to be lower than actual for high drywell temperature conditions.

There are two sets (one set associated with Condensing Chamber CC-4561 & the other with CC-4562) of instrument lines associated with the above instrumentation. Due to differences in the variable leg lengths in the [illegible] for each set of instrument lines, the temperature responses for the lines will be different. Once vessel level exceeds the upper tap of the reference legs, indicated level will no longer increase. The calculated variable leg temperatures at which the 211" HPCI and RCIC trip points would not be reached (because indicated level is lower than the trip point when vessel level exceeds the upper reference leg taps) is approximately 305 degrees F for instruments associated with the CC-4561 instrument lines and 205 degrees F for instruments associated with the CC-4562 instrument lines. Due to the configuration of the HPCI and RCIC logic (2 of 2 once), the HPCI and RCIC high level trips would become inoperable at a variable leg temperature of approximately 205 degrees F. The feed pump and main turbine trips would become inoperable at approximately 305 degrees F due to their logic configuration (2 of 3 once with two instruments being connected to the CC-4561 instrument lines).

On 1/29/92, with the plant operating at 82% power, following verification of the above calculations, the level switches associated with the HPCI and RCIC 211" high level trips were declared inoperable. In compliance with Technical Specifications, a 24 hour LCO was entered at 2111 hours. At 0323 hours, on 1/30/92, following re-calibration of the level instruments to ensure HPCI and RCIC trips would occur as required, the 24 hour LCO was exited.

II. CAUSE OF EVENT

TRIPLE LOW LEVEL INSTRUMENTATION

The cause of this event was incorrect information contained in General Electric (GE) Service Information Letter (SIL) 299 along with incorrect communication of information by the instrument vendor. An additional factor which contributed to using the incorrect information provided by the SIL and the instrument vendor was the response GE provided when contracted by Iowa Electric to perform the verification of the instrument vendor's triple low level calculation. This verification restated that the SIL information was correct.

SIL 299 identified that large increases in drywell temperature, such as those which could occur during a pipe rupture in the drywell, would cause level instruments associated with Yarway sensing lines to be inaccurate. The SIL identified that "the indicated reactor vessel water level can be higher than the true level by 12.7% of the reference leg's total length (scale length + 6 inches top suppression + 6 inches bottom suppression)". The example in the SIL for this calculation stated that an instrument with

a 210 inch scale (the wide range Yarway instrument columns at the DAEC are 210 inches) length could experience a maximum inaccuracy of "+12.7% of 222 inches, or +28 inches in the indicated reactor vessel water level". What the SIL should have said was +18% of 222 inches, or +40 inches in the indicated reactor vessel water level. This is equivalent to +28 inches (+12.7% of 222) measured differential pressure at standard temperature (approximately 70 degrees F.) and atmospheric pressure at the Yarway differential pressure instrument. The conversion factor between instrument differential pressure and indicated level is a factor of 1.4.

During initial review of SIL 299, DAEC personnel identified a discrepancy between measured drywell temperatures in the area of the two wide range Yarway instrument columns. The instrument manufacturer was contacted to address this discrepancy. The response provided by the manufacturer included calculations of the affects, identified in SIL 299, on the Yarway instrument columns. These calculations were performed using units of differential pressure measured at the instrument, however, the last statement made in the calculation concluded that the ECCS setpoint change from 18.5 inches to 46.5 inches (setpoint increase of 28 inches) instrument scale was conservative.

Following receipt of the information from Yarway, General Electric was contracted to provide an independent verification of the Yarway triple low level calculation. GE performed an independent calculation with the results being similar to those in the Yarway calculation. In conclusion, GE stated that the instrumentation correction recommended by SIL 299 is, therefore, considered verified.

HIGH LEVEL INSTRUMENTATION

The cause for the HPCI and RCIC high level trips being inoperable at high drywell temperatures is the configuration of their associated instrument lines in the drywell. Both CC-4561 and CC-4562 reference legs have very short lengths (approximately 2') of vertical piping in the drywell, however, the variable legs have approximately 13' and 32' of vertical piping in the drywell, respectively. The difference in vertical piping length in the drywell between the reference leg and variable leg, associated with an instrument, introduces inaccuracies in measured differential pressure with changes in drywell temperature. These inaccuracies result in lower than actual level measurements at the instruments associated with CC-4561 and CC-4562 instrument lines for the current piping configuration.

The reference legs which feed the narrow range vessel level instruments are shared by the fuel zone level instruments. To improve vessel level indication over a wide range of vessel level and high drywell temperatures (Ref Reg Guide 1.97 and Generic Letter 84-23), the reference legs were re-routed to minimize the difference between the reference leg piping length and fuel zone variable leg piping length in the drywell, during the 1988 refuel outage. This significantly reduced the fuel zone instrument error introduced during high drywell temperature conditions, as well as reversing the direction of the error such that actual level would be higher than indicated. The effect on the narrow range vessel level instruments at high drywell temperatures was to reduce indicated level below actual level to the extent that at a variable leg temperature of approximately 205 degrees F. the HPCI and RCIC high level trips would not occur.

Review of the design change package which re-routed the above reference legs identified that the effects of high drywell temperatures on the narrow range level instrumentation high level trip setpoints were not calculated, and therefore, not addressed.

III. ANALYSIS OF EVENT

Neither of the above setpoint discrepancies had an effect on the safe operation of the plant. Following verification of acceptable triple low level and high level setpoints, the affected instrumentation was re-calibrated satisfactorily.

TRIPLE LOW LEVEL INSTRUMENTATION

To address the effects of the triple low level trip interrelation with drywell temperatures during other plant conditions, the accident scenario discussed in SIL 299 was evaluated for the DAEC.

The level indication changes due to increasing drywell temperature occur rather slowly because the heat-up time of the Yarway reference leg is calculated to be 20 to 30 minutes. The drywell temperature related events of concern are steam line breaks in the drywell. Analysis of these events shows that the diverse parameter, high drywell pressure, will initiate the HPCI, LPCI, and CS parts of the ECCS as well as the EDGs, before double low or triple low reactor water level is reached. Although the low pressure ECCS are initiated and ready to inject water on high drywell pressure, they will not inject water into the vessel until vessel pressure is below the 450 psig interlock for the low pressure ECCS. Available early in the event is RCIC which is initiated on double low reactor water level and is not affected by the high drywell temperatures.

For breaks that are larger than .1 square feet, the ADS (which is automatically initiated at triple low water level) is not required because the combination of the break area and the high pressure core cooling (RCIC as HPCI is assumed failed) will depressurize the reactor and allow the low pressure ECCS to inject into the vessel. For breaks that are smaller than .1 square feet, it is expected that RCIC will be able to maintain reactor water level and therefore low pressure ECCS will not be required. If the low pressure ECCS is not required to maintain reactor water level then a depressurization accomplished by ADS also would not be required. Therefore, the operability of the triple low level instrument that provides the input to ADS logic would not be required.

SIL 299 supplement 1 states that RCIC may be lost due to high pressure at the turbine exhaust. This would result in low pressure ECCS and ADS being required. The RCIC high exhaust pressure trip point at the DAEC occurs at a pressure sufficiently high enough that the RCIC system will not be affected by high drywell pressure.

HIGH LEVEL INSTRUMENTATION

To address the affects of the high level trips interrelation with drywell temperatures during other plant conditions, a Loss Of Offsite Power Loss Of Coolant Accident (LOOP LOCA) event was reviewed. For large break LOCAs, HPCI and RCIC would not be required to function shortly after event initiation as vessel pressure would be reduced to the point that low pressure ECCS would begin to inject to ensure adequate core cooling. For this reason, failure of the high level trips to function at high drywell temperatures would have no adverse effect.

For small break LOOP LOCAs, vessel pressure would not reduce quickly enough to allow low pressure ECCS to function early in the event. Therefore, HPCI and/or RCIC would be required to maintain vessel level. High drywell pressure would be reached soon into the event initiating a SCRAM along with HPCI. At the same time drywell temperatures would continue to rise (Note: Emergency Operating Procedures (EOPs) direct operators to initiate a plant shutdown if bulk average drywell temperatures cannot be maintained below 150 degrees F., therefore, depending on the rate of drywell temperature/pressure increase, a shutdown may be initiated before the automatic scram occurs.) towards 280 degrees which is the bulk average drywell temperature at which EOPs require drywell spray. The high level trip instruments' variable leg temperatures would lag behind drywell temperatures by several minutes. It should be noted that the two narrow range level indicators associated with CC-4561 instrument lines would continue to function (with an offset), at a bulk average drywell temperature of 280 degrees, for several minutes into the event. It is expected that this information along with indicated

increasing level on other control room instrumentation would provide the operators with adequate information to minimize vessel overfilling in the event that the high level trips did not occur automatically. In addition, the HPCI and RCIC turbines are constructed such that introduction of some amount of water into the steam lines would not damage the turbines. Therefore, following an automatic or manual trip of HPCI or RCIC, the units would still be functional and able to restart if level were to drop below their initiation setpoint.

IV. CORRECTIVE ACTIONS:

TRIPLE LOW LEVEL INSTRUMENTATION

Following verification of DAEC setpoint calculations by GE, the affected Yarway level instruments were calibrated to the new setpoint of 64 inches. Note: The setpoint of 64 inches includes a correction factor for the SIL miscommunication along with an additional conservatism factor (approximately 10 inches) in accordance with new GE setpoint calculation methodology. Updating of procedures, training, and plant documentation to reflect the new triple low setpoint has been initiated.

HIGH LEVEL INSTRUMENTATION

To correct for the loss of the HPCI and RCIC high level trips at high drywell temperatures, the setpoints on the associated instruments were reduced to ensure high level trips would occur as required. Due to the large temperature affect on the instruments associated with the CC-4562 instrument lines, the setpoints associated with these instruments had to be reduced significantly (from 211" to 182"). The setpoint of 182" is below the normal vessel level of 192", therefore, half of the HPCI and RCIC trip logic is complete during normal plant operation. As reduction in the setpoints is not considered to be an acceptable long term corrective action, modifications will be made to appropriate logic and/or instrument lines to allow the high level trip points to be acceptably above the normal operating range. (Note: The setpoints for instruments associated with CC-4561 had to be reduced by only 4 inches.) Long term corrective actions that have been completed prior to submittal of the next update to the Integrated Living Schedule, as well as any pending corrective actions, will be discussed in that update. Guidance on the effects of drywell temperatures on level instrumentation was issued to the Operations Department.

In February of 1990, an Instrumentation and Controls Engineering (I&CE) group was formed within the Engineering Department. This group is actively involved in the initial stages of the design change process and serves to support review of industry documentation related to instrumentation. Along with providing dedicated personnel, specifically for instrumentation and control work, the I&CE group is currently working on a setpoint design basis reconstitution program. It was this program that identified the level instrumentation discrepancies. Completion of this program will provide confidence that instrumentation setpoints are acceptable. Program completion will be in accordance with the existing Integrated Living Schedule.

V. Additional Information

A. Previous Similar Events

A review of DAEC LERs since 1984 did not identify any previous events where incorrect information in a SIL led to inadequate instrument setpoints. In addition, no previous events were identified where failure to account for the affects of high drywell temperatures on instruments resulted in inadequate setpoints.

B. EIIS SYSTEM AND COMPONENT CODES

Systems: BO, BM, EK, JM, CC, SB, BS, BJ, BN, JE

Components: LI, LIC, LIS

This event is being reported pursuant to 10 CFR 50.73 (a)(2)(ii).