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SUBJECT: LER 89-009-00:on 890612,reactor scram due to unanticipated
 response of RPS instrumentation to radio interference.

W/8 ltr.

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Iowa Electric Light and Power Company

July 12, 1989
DAEC-89-0526

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 #89-009

Gentlemen:

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

Very truly yours,

 7-12-89

Rick L. Hannen
Plant Superintendent - Nuclear

RLH/JRP/go

cc: Director of Nuclear Reactor Regulation
Document Control Desk
U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D. C. 20555

NRC Resident Inspector - DAEC

File A-118a

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Duane Arnold Energy Center (DAEC)										DOCKET NUMBER (2) 0 5 0 0 0 3 3 1										PAGE (3) 1 OF 0 5	
TITLE (4) Reactor Scram Due to Unanticipated Response of Reactor Protection System Instrumentation to Radio Frequency Interference																					
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 None					DOCKET NUMBER(S) 0 5 0 0 0							
0 6	1 2	8 9	8 9	0 0 9	0 0	0 7	1 2	8 9						0 5 0 0 0							
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) 1 0 0		20.402(b)				20.405(c)				<input checked="" type="checkbox"/> 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 365A)							
		20.405(a)(1)(iii)				50.73(a)(2)(i)				50.73(a)(2)(viii)(A)											
		20.405(a)(1)(iv)				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)(ix)													
LICENSEE CONTACT FOR THIS LER (12)																					
NAME James R. Probst, Technical Support Engineer										TELEPHONE NUMBER 3 1 1 9 8 5 1 1 - 7 3 0 8											
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																					
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC											
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)											
<input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE)										<input checked="" type="checkbox"/> NO											

ABSTRACT (Limit to 1400 spaces - ie approximately fifteen single-space typewritten lines) (16)

On June 12, 1989, while at full power a Reactor Protection System (RPS) actuation and reactor scram occurred. Two ITT Barton Model 764 flow transmitters which help to determine the Average Power Range Monitor upscale setpoint were affected by hand-held radio frequency interference. Primary Containment Isolation System Groups II through V isolated and the Standby Gas Treatment System initiated as expected on low level following void collapse. Some feedwater control problems during recovery resulted in vessel level approaching the low level setpoint thirty-eight minutes after the reactor scram. Due to conservative instrument setpoints, an RPS trip and the aforementioned safety systems were initiated. The root cause of the scram was the unanticipated response of the flow transmitters to hand-held radio frequencies. The transmitters were in a low traffic area where radios are infrequently used. The root cause of the second low level event was inadequate preventive maintenance on a feedwater valve position indicator in the Control Room. A loose adjustment spring locknut on a feedwater valve pneumatic positioner also contributed. Corrective actions were to place further restrictions on hand-held radio use, shorten the calibration frequency of the position indicator, and require the use of Loctite when adjusting the pneumatic positioner.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER(6)			PAGE(3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
Duane Arnold Energy Center	05000331	89	-009	-00	2	OF	5

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

I. DESCRIPTION OF EVENT:

On June 12, 1989, at 0016:54 hours, the reactor was operating at 100% power when an automatic reactor scram occurred upon an induced Average Power Range Monitor (APRM, EIIS System Code IG) upscale trip as sensed by the Reactor Protection System (RPS, EIIS System Code JC). Upon the RPS signal, all control rods fully inserted. Reactor level decreased as expected to approximately 150 inches above the top of the active fuel (TAF) in response to vessel inventory void collapse, and was recovered using normal feedwater flow. As reactor level passed through the "low" water level setpoint (nominally 170 inches above TAF), Primary Containment Isolation System (PCIS, EIIS System Code JM) Groups II - V isolated and the Standby Gas Treatment System (SGTS, EIIS System Code BH) initiated as expected. Reactor pressure remained within the normal band with the Electro-Hydraulic Control System (EIIS System Code JG) operating to control pressure.

Operations personnel responded to the event and performed the immediate post-scram procedural actions. Some difficulties were experienced in feedwater level control during the scram recovery due to equipment problems. Reactor level increased above the high level setpoint of 211 inches above TAF and the feed pumps tripped as expected. Level reached 220 inches above TAF at 0021 hours before being reduced.

Difficulties with level control continued, and approximately thirty-eight minutes after the initial scram, at 0054:51 hours, an RPS trip and the expected PCIS and SGTS actuations occurred as the reactor water level approached the 170 inch above TAF low level setpoint. A low of 174 inches above TAF was reached. (Setpoints of low water level instruments are conservatively set higher than 170 inches above TAF). Operator action increased vessel level to the normal value of 190 inches above TAF within one minute. The shutdown then proceeded to a hot standby condition.

This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv), as actuations of RPS and Engineered Safety Features (ESFs).

II. CAUSE OF EVENT:

A. Induced APRM Upscale Trip

Immediately following the event, Operations personnel determined the scram had occurred due to upscale trips on each of the six Average Power Range Monitors in the RPS logic. A review of the neutron flux records shortly thereafter found no evidence of a reactor power increase having proceeded the scram. The APRM reactor neutron flux upscale setpoint logic was then reviewed to ascertain the cause of the signal.

The reactor neutron flux upscale setpoint for the APRMs varies proportionally with reactor power by means of a flow-biasing

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network. The setpoint is automatically adjusted based on recirculation pump flow. (At 100% recirculation pump output, the trip setpoint is 120%; at lower output levels the setpoint is reduced). A disturbance in the total recirculation flow signal provided to the APRM flow-biasing network could change the APRM upscale setpoint to a value below actual reactor power, which would result in an APRM upscale trip.

Four flow transmitters, located on two separate instrument racks, monitor core flow and provide signals to the APRM flow-biasing network. A mechanism which might disturb these transmitters' output was sought. Interviews with plant personnel determined that a radio signal had been transmitted at the time of the scram in the vicinity of two of the flow transmitters. This signal came from a hand-held radio (walkie-talkie) in use by an Iowa Electric employee during routine plant activities. Further review of the APRM flow biasing logic found that a change in the output signal of these two flow transmitters, if severe, could result in a reduction of the APRM upscale trip setpoints to below actual reactor power level.

Late in the day on June 12, the radio transmissions near the flow transmitters were recreated and monitoring of one of the transmitters indicated a downscale signal was induced. Further testing on June 14 confirmed that one or both transmitters could emit downscale signals upon exposure to hand-held radio frequencies. These would result in a lowering of APRM setpoints sufficient to cause a partial or full actuation of the RPS scram logic at high reactor power levels.

The cause of the reactor scram on an APRM upscale trip on June 12, 1989, was operation of a hand-held radio in the vicinity of flow transmitters feeding the APRM logic. The flow transmitters in question are located in a small, basement level room within the reactor building. Both a plant page and a telephone are located within this room, decreasing the need for radio transmission in this area. A radio was used in this instance as it was convenient and readily available.

At the time of these events, radio operation was prohibited in the first floor of the reactor building and the backpanel area of the Control Room due to problems experienced early in the plant's operation. These areas were marked with signs. The other two (identical) flow transmitters feeding the APRM logic are located on the first floor of the reactor building where radio use is not permitted.

The root cause of the reactor scram was an unanticipated response of components within the Reactor Protection System due to radio frequency interference. When contacted, the manufacturer of the flow transmitter was unaware that this response could occur.

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B. RPS Trip and ESF Actuations on Low Reactor Level

The cause of the RPS trip and ESF actuations on low reactor vessel level at 0054 hours on June 12, 1989 was primarily an erroneous position indication in the Control Room for the "A" feedwater block valve. This motor-operated valve was being used in conjunction with the feedwater regulation valves to control reactor vessel level. When the feedwater block valve was full closed, the position indication read 25% open. The intermediate cause of the erroneous indication was a misadjusted zero setting on the valve position meter in the Control Room. The root cause was inadequate preventive maintenance to ensure a high level of reliability for this non-safety-related Control Room instrumentation.

A second factor in the low level actuations was the "A" feedwater regulation valve reaching only 95% full closed on a full closed signal. The leakage into the vessel through this pneumatically controlled valve affected level control throughout the event. The cause of the leakage past the "A" feedwater regulation valve was a slightly loose adjustment spring locknut on the pneumatic positioner which resulted in a full close signal being translated into only 95% stem motion. This positioner is subject to some vibration under normal plant conditions. A review of recent performance history does not indicate a recurring problem.

III. ANALYSIS OF EVENT

These events had no adverse effect on the safe operation of the plant. The reactor scram at full power occurred as designed upon receipt of induced APRM upscale signals. All control rods inserted to the full-in position. During recovery from the scram, some problems with feedwater control equipment resulted in an RPS trip and ESF actuations, as designed, when the reactor vessel level neared the low level setpoint. The low level was promptly compensated for. Throughout the initial scram and shutdown period, vessel level and pressure were maintained within safe operating limits via the Feedwater Control System (EIIS System Code JB), the Electro-Hydraulic Control System, and Operator action. All Engineered Safety Features were operable at the time.

IV. CORRECTIVE ACTIONS

A. Induced APRM Upscale Trip

Following the determination that hand-held radio use was responsible for the scram signal, a review of plant use of radios was conducted. Further restrictions were placed on on-site radio use. Areas prohibited now include the entire Reactor Building and Control Room. All areas have been posted, and the new restrictions have been widely disseminated among plant personnel. This event will be incorporated into plant training.

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B. RPS Trip and ESF Actuations on Low Reactor Level

The Control Room meter for the "A" feedwater block valve was readjusted to properly indicate valve position. This instrument is a General Electric 180 meter, a standard piece of equipment used in many applications at the Duane Arnold Energy Center. This meter is scheduled for calibration every four years, with its last calibration having occurred in 1986. The calibration frequencies for this meter and its Control Room counterpart for the "B" feedwater block valve have been changed to once per cycle.

The spring locknut for the "A" feedwater regulation valve pneumatic positioner was tightened to allow for full valve closure and Loctite was applied. Discussions with plant personnel familiar with this positioner indicate Loctite is sometimes applied to the locknut following calibration, but it is unknown if that was the case during the previous calibration in March, 1989. The positioners for the "A" and "B" feedwater block valves are calibrated every shutdown. The "B" valve was also examined during this shutdown, with small adjustments being made and Loctite subsequently applied. The procedure used for calibration of the pneumatic positioner has been modified to require use of Loctite after calibration to prevent vibration-induced loosening of the locknut.

V. ADDITIONAL INFORMATION

A. Failed Component Identification

The APRM flow transmitters (IG-FT) found susceptible to radio frequency interference are ITT Barton Model 764.

The feedwater regulation valve pneumatic positioner (SJ-LCV) is a Moore Products, Series 74.

As previously noted, the feedwater block valve position indicator (SJ-ZI) is a General Electric Model 180.

B. Previous Similar Events

A Reactor Water Cleanup System isolation occurred in 1987 due to radio use in the restricted Control room backpanel area (LER 87-024). The area was remarked with signs following the event.

Since 1985, reactor scrams at power have been documented in LERs 88-008, 89-003 and 89-008. These events, and LER 86-017, a manual scram due to feedwater level controls problems, all resulted in Group II through V isolations on low vessel level. RPS trips have occurred in the past due to a variety of causes. Since 1985 there have been no RPS trips due to low water level.