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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 91-009-00:on 911111,steam generator feedwater isolations occurred on both steam generators.Caused by perturbations of advanced digital feedwater control sys.Feedwater regulating valves manually controlled.W/911211 ltr.

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AREA CODE 716 546-2700

December 11, 1991

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: LER 91-009, Automatic Feedwater Control Perturbations, Due To Electromagnetic Noise Spikes From Unrelated Relay Actuation, Caused Steam Generator Feedwater Isolation on High Level
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

In accordance with 10 CFR 50.73, Licensee Event Report System, item (a)(2)(iv), which requires a report of, "any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)", the attached Event Report LER 91-009 is hereby submitted.

This event has in no way affected the public's health and safety.

Very truly yours,

Robert C. Mecredy

Robert C. Mecredy

xc: U.S. Nuclear Regulatory Commission
Region I
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Ginna USNRC Senior Resident Inspector

Cert No P364971096
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NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104 EXPIRES 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
R.E. Ginna Nuclear Power Plant	0 5 0 0 0 2 4 4	1 OF 0 9

TITLE (4) Automatic Feedwater Control Perturbations, Due To Electromagnetic Noise Spikes From Unrelated Relay Actuation, Caused Steam Generator Feedwater Isolation on High Level

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)
1 1	1 1	9 1	9 1	0 0 9	0 0	1 2	1 1	9 1		0 5 0 0 0
										0 5 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 9 8

[ ] 20.402(b)	[ ] 20.405(c)	[X] 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)	[ ] 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
Wesley H. Backus Technical Assistant to the Operations Manager	AREA CODE 3 1 5 5 2 4 - 4 4 4 6

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)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH DAY YEAR

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

On November 11, 1991 at approximately 1214 EST, with the reactor at approximately 98% full power, steam generator feedwater isolations occurred on both steam generators. These feedwater isolations were caused by perturbations of the advanced digital feedwater control system which increased feedwater flow to the steam generators.

Immediate operator action was to manually control the feedwater regulating valves to reduce steam generator levels and stabilize the plant.

The underlying cause of the event was determined to be electromagnetic noise spikes affecting the advanced digital feedwater control system.

Corrective action taken was to modify specific relay circuits that were causing these spikes.

I. PRE-EVENT PLANT CONDITIONS

The plant was at approximately 98% steady state reactor power with no major activities in progress. The Maintenance Department was performing troubleshooting, to determine the source of electromagnetic noise spikes in the Advanced Digital Feedwater Control System (ADFCS). The troubleshooting was being performed under the guidance of Work Order package #9122181. Unexplained electromagnetic noise spike problems were identified previously as coinciding with the start of the diesel fire pump, and which had minor effect on the ADFCS control functions.

The ADFCS was installed during the 1991 Annual Refueling and Maintenance Outage. These electromagnetic noise spikes were first noticed on June 4, 1991, when a minor feedwater perturbation occurred, following a diesel fire pump start. Since June 4, spikes have occurred almost every time the diesel fire pump has started. The ADFCS has handled spikes with no noticeable feedwater perturbations, except for two (2) occasions. These occasions, the first on June 4, 1991 and the second on September 13, 1991, were handled by the ADFCS in automatic and no operator action was required.

There has been an ongoing search for the possible source of this electromagnetic noise spike so that it could be corrected. As part of this ongoing search, the Electrical Engineering Department evaluated their cable tray database and identified circuit E174 as a possible source. Circuit E174 is the 125 Volt DC power feed to the fire relay panel and shares some cable trays with ADFCS input cables, most notably, the feedwater header pressure inputs to ADFCS (P501 and P502).

Westinghouse Electric Corporation (the manufacturer of the ADFCS) was contacted and could not explain the ADFCS excursions based on data available. In conjunction with the Electrical Engineering Department, Westinghouse had previously recommended that the shielding and grounding schemes for all ADFCS inputs be checked. These inputs were checked in August, 1991. This check indicated that all ADFCS inputs are correctly shielded and grounded.

II. DESCRIPTION OF EVENT

A. DATES AND APPROXIMATE TIMES OF MAJOR OCCURRENCES:

- o November 11, 1991, 1214 EST: Event Date and Approximate Time.
- o November 11, 1991, 1214 EST: Discovery Date and Approximate Time.
- o November 15, 1991: Cause of EMP noise spike identified and suppressed to acceptable levels.

B. EVENT:

On November 11, 1991, at approximately 1214 EST, with the reactor at approximately 98% full power, the diesel fire pump was started, as required for ADFCS troubleshooting per Work Order #9122181.

Approximately thirty (30) seconds after the diesel fire pump was started an "ADFCS System Trouble" alarm (G-22) was received.

The Control Room operator responsible for feedwater control had pre-positioned himself in front of the "A" and "B" S/G Main Feedwater Regulating Valves (FRV) control panel prior to the start of the diesel fire pump.

At this time, the Control Room operator noticed that both the "A" and "B" Steam Generator (S/G) main feedwater flows were pegged high with both "A" and "B" S/G Main Feedwater Regulating Valves continuing to open further.

The condensate low pressure heater bypass valve opened automatically and the standby condensate pump started automatically (to increase main feedwater pump suction pressure). Main Feedwater pump suction pressure was decreasing due to the increased feedwater flow to the S/Gs. The "A" and "B" S/G levels continued to increase and before the Control Room operator could shift the FRVs to manual, ADFCS automatically shifted the FRVs to manual. While the Control Room operator was manually lowering the setpoints for the FRV controllers, to control S/G level, the following alarms annunciated and feedwater isolation occurred on both S/Gs; G-4 (S/G A HI LEVEL CHANNEL ALERT 67%) and G-6 (S/G B HI LEVEL CHANNEL ALERT 67%).

Immediately following the feedwater isolation, the condensate booster pumps tripped on high pressure. A load decrease was initiated at 10%/hour to lessen the impact of unstable S/G levels. Main feedwater to the S/Gs was controlled in manual in order to stop secondary system oscillations that were occurring due to the event. During the S/G level stabilization, S/G feedwater isolation occurred several times. The S/G levels were subsequently stabilized and main feedwater control was returned to automatic.

After main feedwater control was returned to automatic the load decrease was terminated. Total load decrease was approximately 0.5% full power during the event. Subsequently, the condensate low pressure heater bypass valve was closed, the condensate booster pumps were restored, and the standby condensate pump was secured and realigned for automatic standby.

C. INOPERABLE STRUCTURES, COMPONENTS, OR SYSTEMS THAT CONTRIBUTED TO THE EVENT:

None.

D. OTHER SYSTEMS OR SECONDARY FUNCTIONS AFFECTED:

None.

E. METHOD OF DISCOVERY:

The event was immediately apparent due to alarms and indications in the Control Room.

F. OPERATOR ACTION:

The Control Room operators took immediate manual actions to control S/G levels, reduce power level, and stabilize the plant. Subsequently, the Control Room operators notified higher supervision and the Nuclear Regulatory Commission per 10 CFR 50.72, non-emergency, 4 hour notification.

G. SAFETY SYSTEM RESPONSES:

The "A" and "B" FRVs closed automatically from the feedwater isolation signal.

III. <u>CAUSE OF EVENT</u>

A. IMMEDIATE CAUSE:

The feedwater isolation of the "A" and "B" S/G was due to the "A" and "B" S/G narrow range levels being >/ = 67%.

B. INTERMEDIATE CAUSES:

The "A" and "B" S/G narrow range levels were >/= 67% due to increased feedwater flow to both S/Gs caused by a perturbation of the ADFCS.

The perturbation of the ADFCS was apparently due to electromagnetic noise spikes affecting the feedwater header pressure inputs to ADFCS, (i.e. P501 and P502).

C. ROOT CAUSE:

After extensive troubleshooting, it was determined that the spikes that affected the ADFCS feedwater header pressure inputs were caused by the de-energization of Relay AR80, located in the fire relay panel. This relay, which lights the diesel fire pump trouble light, de-energizes approximately 10 to 15 seconds after a diesel fire pump start. During this de-energization, inductive "kickback" causes an electromagnetic noise spike to be generated and induced into the feedwater header pressure inputs. The signal cables carrying the feedwater header pressure transmitter (PT-501 and PT-502) inputs share some common cable trays with the DC power source for the AR80 relay, and a noise spike was induced from the AR80 relay cable to the feedwater header pressure input cables.

IV. <u>ANALYSIS OF EVENT</u>

This event is reportable in accordance with 10 CFR 50.73, Licensee Event Report System, item (a)(2)(iv), which requires reporting of, "any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF) including the Reactor Protection System (RPS)". The feedwater isolation of the "A" and "B" S/Gs was an automatic actuation of an ESF system.

An assessment was performed considering both the safety consequences and implications of this event with the following results and conclusions:

There were no operational or safety consequences or implications attributed to the feedwater isolations because:

- o The feedwater isolations occurred at the required S/G levels.
- o The plant was quickly stabilized and manual control of the FRVs was accomplished to mitigate the transient.
- o As the feedwater isolation occurred as designed, the assumptions of the FSAR for steam line break were met.

Based on the above, it can be concluded that the public's health and safety were assured at all times.

V. CORRECTIVE ACTION

A. ACTION TAKEN TO RETURN AFFECTED SYSTEMS TO PRE-EVENT NORMAL STATUS:

- o The Diesel Fire Pump was temporarily removed from service pending the outcome of root cause troubleshooting and determination. (The pump was returned to service after a noise suppression diode was installed across relay AR80).
- o When S/G levels were stabilized, subsequent to the ADFCS perturbation termination, the FRVs were placed in automatic control.
- o After the plant had been stabilized and the FRVs returned to automatic control, the condensate low pressure heater bypass valve was closed, the condensate booster pumps were restored and the standby condensate pump was secured and realigned for automatic standby.

B. **ACTION TAKEN OR PLANNED TO PREVENT RECURRENCE:**

- o A reverse-biased diode was temporarily installed across the coil of AR80 on November 15, 1991 and subsequent testing determined that the spikes from the AR80 circuit, affecting ADFCS feedwater pressure inputs following diesel fire pump starts, were eliminated. This noise suppression diode was permanently installed on November 18, 1991.

After reviewing the results of troubleshooting and the discussion with Westinghouse, the following is an outline of the corrective actions being taken or planned in response to the ADFCS noise spiking events:

- o Short Term Response

  a) Operations personnel were made aware that one source of spikes on ADFCS was eliminated, but that spikes from other sources, while reduced in frequency and magnitude, might occur. Operations will identify any new spikes on the ADFCS by submitting a Work Request/Trouble Report (WR/TR).

  b) A WR/TR was submitted for installation of a diode for the fire booster pump relay AR85 (which also produces small spikes on ADFCS). However, these spikes are not of the same magnitude as the noise spikes that were caused by the Diesel Fire Pump starts.

- o Intermediate Term Response

  Electrical Engineering will consult with Westinghouse concerning a database change to increase the ADFCS slew rate filter constant. This filter is used to dampen any abrupt changes to feedwater regulating valve demand in the event that feedwater header pressure input values are rejected due to noise spikes. It is thought

that this filter can also "Lock In" an erroneous value following a feedwater header pressure spike. Increasing this constant will more quickly restore a correct value for feedwater header pressure, after a spike has decayed. The spikes last less than five (5) seconds.

- o Long Term Response

  a) Electrical Engineering will check with Westinghouse for the results of their review of ADFCS arbitration error checking software. This review will determine if the error checking routine for the switching to arbitration values instead of feedwater header pressure field input values is substituting erroneous values for feedwater header pressure used in FRV demand calculations.

  b) Electrical Engineering will evaluate the routing of feedwater header pressure input circuits (to the ADFCS), and will identify any additional modifications that may be required to eliminate the electromagnetic noise spike concern.

VI. ADDITIONAL INFORMATION

A. FAILED COMPONENTS:

None

B. PREVIOUS LERs ON SIMILAR EVENTS:

A similar LER event historical search was conducted with the following results: No documentation of similar LER events with the same root cause could be identified.

C. SPECIAL COMMENTS:

None.