

LICENSEE EVENT REPORT (LER)

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TITLE (4)
Electrical Noise Caused Spikes On IRMs Resulting In RPS Actuations

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												
0	3	2	4	8	6	8	6	0	0	1	0	1	1	0	1	0	8	6			
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THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §. (Check one or more of the following) (11)

OPERATING MODE (9) 5	20.402(b)	20.406(a)	<input checked="" type="checkbox"/>	90.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10) 0 1 0 1 0	20.406(a)(1)(i)	90.38(a)(1)	<input type="checkbox"/>	90.73(a)(2)(v)	73.71(a)
	20.406(a)(1)(ii)	90.38(a)(2)	<input type="checkbox"/>	90.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
	20.406(a)(1)(iii)	90.73(a)(2)(i)	<input type="checkbox"/>	90.73(a)(2)(viii)(A)	
	20.406(a)(1)(iv)	90.73(a)(2)(ii)	<input type="checkbox"/>	90.73(a)(2)(viii)(B)	
	20.406(a)(1)(v)	90.73(a)(2)(iii)	<input type="checkbox"/>	90.73(a)(2)(ix)	

LICENSEE CONTACT FOR THIS LER (12)

NAME Paul Russ, Compliance Engineer, ext. 6472	TELEPHONE NUMBER AREA CODE: 2 1 1 6 2 1 5 9 1 - 3 7 1 3 7
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPROS

SUPPLEMENTAL REPORT EXPECTED (14) <input type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE:)	<input checked="" type="checkbox"/> NO	EXPECTED SUBMISSION DATE (15) MONTH: DAY: YEAR:
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On March 24, 1986, at 0845, March 27 at 1258, March 31 at 1053 and April 20 at 1328, Reactor Protection System (RPS) actuations occurred due to upscale trips of the neutron monitoring system Intermediate Range Monitors (IRMs). All four RPS actuations were attributed to "noise" in the IRMs caused by grounding bus fluctuations. In each case, Control Room operators verified proper plant conditions, bypassed the Scram Discharge Instrument Volume high level trip and reset the RPS actuation. During the March 31 scram, improper control rod position indication was observed following the scram. The problem was traced to the receipt and installation of an incorrect Rod Control and Information System (RCIS) Probe Data Receiver Card. The card was subsequently replaced with the correct revision circuit board.

Additional corrective actions include; improvements to IRM cabling and preamplifier housing grounds through cable connection maintenance, improved cable shielding, electrical insulation of IRM preamplifier housings and Control Room ground bus design changes. The vendor of the RCIS card has modified its component supply system to preclude issuance of incorrect circuit boards.

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

On March 24, 1986, at 0845, March 27 at 1258, March 31 at 1053 and April 20, at 1328, Reactor Protection System (RPS)[JC] actuations occurred due to upscale trips of the neutron monitoring system Intermediate Range Monitors (IRMs)[IG]. At the time of each event, the reactor was shutdown, the reactor vessel [RPV] and drywell heads removed, the cavity flooded and the Steam Dryer Storage Area/Reactor Well Gate [GATE] removed. Reactor temperature was approximately 75 degrees and pressure atmospheric.

Prior to the first event, the mode switch [HS] was in the "Refuel" position, core [AC] alterations were suspended for surveillance testing, thirty six new fuel bundles had been loaded into the core and all control rods [ROD] were inserted. Surveillance Test (SVI)-C51-T0022A "IRM A and E Neutron Flux Trips Channel Functionals" was in progress with the "A" IRM Channel in the tripped condition. On March 24 at 0845, an IRM spike occurred on IRM D causing a full Reactor Protection System actuation. The IRM spike did not originate from an actual neutron flux change since none of the four Source Range Monitors (SRM) [IG] showed any appreciable change in flux level. At 0849 in response to the actuation, operators bypassed the Scram Discharge Instrument Volume (SDIV) [AA] high level trip and reset RPS. At 0858, the SDIV high level trip was taken out of bypass. At 1043, in an attempt to discover the cause of the problem, the steps in SVI-C51-T022A where the actuation occurred were reperformed with IRM D bypassed. The IRM spike did not recur. SVI-C51-T0022A was subsequently completed satisfactorily at 1245. At 0600 on March 25, SVI-C51-T0022D "IRM D and H Neutron Flux Trips Channel Functionals" was performed satisfactorily. No problems were identified with either IRM.

An investigation of the problem determined the most probable cause of the spiking to be "noise" in the IRM caused by grounding bus [BUS] fluctuations. In order to reduce noise and prevent recurrence, the IRM cabinet [CAB] doors were to be grounded to the IRM cabinets. At 1258 on March 27, while preparing to install these grounding leads, one IRM cabinet door was opened and another set of IRM spikes (channels A, E and D, H) was received by RPS and another full actuation occurred. Again, all rods were inserted prior to the trip, and no change in neutron flux on source range neutron monitors was detected. The operators response was similar to their response in the first event. The cause of the actuation was again attributed to "noise" in the IRM caused by grounding bus fluctuations. The installation of the grounding leads for the IRM cabinets was subsequently completed.

At 1004 on March 31, 144 new fuel bundles had been loaded into the core, and the reactor mode switch was placed in "Startup" in accordance with Startup Test Instruction STI-J11-003 "Fuel Loading". Earlier that day, at 0528, the RPS shorting links [57] had been removed as required by Technical Specifications. This action would place RPS in a non coincidence mode and allow a single neutron monitoring instrument to cause a full RPS actuation.

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At 1006, rod withdrawal began for the partial core shutdown margin verification. At 1053, a single channel RPS actuation occurred due to IRM spiking causing an upscale trip of IRMs C and G. The five control rods withdrawn at the time, inserted as designed. No neutron flux spike was detected on the source range neutron monitors.

At 1055, in response to the scram, the reactor mode switch was placed in shutdown. The Supervising Operator (SO) observed blank indications on the full core display for all rods except rod 22-31 which continued to indicate position 12 (its pre-scram position). Rod 22-31 had been selected and was being withdrawn at the time of the scram. No full in green lights were lit for any rod. Rod Control and Information System (RCIS) mode selection of data was cycled from raw data to processed data repeatedly in an attempt to obtain updated information on rod 22-31, in accordance with Off Normal Instruction (ONI)-C71 "Reactor Scram". No apparent change in rod position indication for rod 22-31 occurred. At 1058, the scram discharge instrument volume high level trip was bypassed and the scram reset. Within seconds of resetting the scram, all rods indicated "00" and all rod green "full in" lights were lit. STI-J11-003 was recommenced at approximately 1900 after the scram evaluation report determined no safety concerns existed. Between 1958 and 2041, rod 22-31 was again withdrawn (this time to its full out position) and then inserted per STI-J11-003 for the partial core shutdown margin verification. The rods' movement and indication were normal.

The spike on the IRMs was again attributed to "noise" and grounding bus fluctuations possibly originating from housekeeping activities in the area of the IRM preamplifiers [AMP]. When the scram occurred, all rods inserted as designed, including rod 22-31. This is evident by the fact that upon resetting the scram, its rod position indicated "00" (full in). The cause of the improper control rod position indication was traced to an RCIS Probe Data Receiver Card. It was discovered that an incorrect revision circuit board (Rev. 7 vice Rev. 8) had been installed sometime after June 1983. The vendor (General Electric; Part No. 195B9031AAG2) issued the Rev. 7 card (for installation following a design change) in error. A modification should have been made to the board upgrading it to Revision 8 altering the boards function. Subsequent testing determined that during certain conditions, (ie. rods scrambled, RCIS position bypassed) the Revision 7 board produced indications similar to those observed during the scram. However, with the correct Revision 8 circuit board installed, all normal RCIS indications were noted.

On April 2, 1986 during a review of the existing IRM ground configuration, it was discovered that IRM preamplifier enclosures B/F and C/G were not grounded in accordance with reference drawings. Instead of being grounded directly to the building ground bus, the enclosures were grounded to a steel structure which in turn was grounded to the building ground bus. The cause of the incorrect grounding was indeterminate. On April 4, the IRM

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preamplifier cabinet grounds were correctly grounded to the building ground bus.

On April 20, 1986 at 1328, another single channel RPS actuation occurred due to IRM spiking causing an upscale trip of IRM "G". Prior to the event, the RPS shorting links were removed, no core alterations were in progress and all control rods were fully inserted. Spikes were also observed on IRMs A, E, C, D and H. No appreciable changes in neutron flux were identified on SRMs. At 1334, the SDIV high level was bypassed and the RPS trip reset at 1335.

The IRM spikes were again attributed to electrical noise caused by grounding bus fluctuations.

IRMs are designed to provide neutron flux information during the reactor startup and heatup operations from the upper portion of the source range to the lower portion of the power range. The IRM system detects conditions that could lead to local fuel damage and provides trip signals which are used to prevent such damage. The system consists of eight identical neutron detection channels (A-H). The noise problem exhibited in the IRMs would not have detracted from its' ability to monitor neutron flux levels and transmit the necessary signals to the required protection and monitoring instrumentation. The problem could, however, cause unnecessary plant scrams during startup evolutions. An RPS trip signal is initiated when the IRM reaches 120/125 of scale for any scale selected. Once the plant enters Mode 1 ("Run") at >5% reactor power, the IRM trip function is bypassed in the RPS circuitry and the problem would not have affected further plant operations, consequently, the safety significance of these events was minimal.

The following additional corrective actions have been or will be taken to prevent IRM noise (also see LER 86006):

- 1) All cleaning and housekeeping activities which could generate electrical noise have been temporarily suspended in the penetration and IRM preamplifier rooms.
- 2) A walkdown of the IRM signal cable from the control rod drive room to the preamplifiers and on to the Control Room area was conducted by a technician keying a hand held radio. The IRM meters were observed for disturbances during this evolution but none were identified.
- 3) Although not related to the cause of this event, ONI-71 "Reactor Scram" has been revised to provide additional guidance to operators for determining control rod positions following a scram.

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- 4) A check of the IRM cabling was conducted to verify that the IRM signal and multiconductor cables were grounded at the Control Room IRM drawers only. This activity determined that five IRM channels were partially grounded in locations other than the IRM drawer. After cleaning various cable connections, these partial groundings were eliminated.
- 5) The IRM signal cables were walked down to verify that no discontinuities were present in the metallic conduit. In several locations, ground straps between the flexible conduit and the rigid conduit were not present. These straps have been repaired. The cause of the discontinuities was indeterminate.
- 6) In locations where little or no cable shielding existed (e.g. inside containment penetration housings) IRM cabling was temporarily shielded to provide added protection from electrical noise. The results of this action will be evaluated to determine if this shielding should be installed permanently.
- 7) A search through the Control Room Logs was performed to determine if an occurrence common to each event existed. None was identified.
- 8) Time Domain Reflectometer (TDR) readings have been performed on IRM cabling. Three IRMs were found to have abnormalities in the traces. Two problems were attributed to poor cable connections. These connector problems have been repaired. The third abnormality was evaluated as a cable problem at the containment penetration. A spare cable in the penetration has been utilized in place of the present cabling.
- 9) Each IRM preamplifier housing has been electrically isolated from its respective cabinet. This has reduced noise introduced at the IRM preamplifiers.
- 10) An evaluation was conducted of the Control Room grounding system. To date, several pieces of equipment have been relocated on the ground bus, resulting in a significant reduction in ground bus circulating currents. In addition, elimination of ground loops is underway for IRM/SRM power supplies.

To prevent further problems with installation of incorrect circuit boards, the vendor (General Electric) has modified their component supply system to ensure that component alterations which result in functional differences now receive a new assembly drawing number. They have also verified no similar problems existed with components issued for safety related applications. In addition, safety related components now issued to the field from the warehouse are individually verified for proper application by Engineering.

Energy Industry Identification System Codes are identified in the text as [XX].