NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Sequoyah, Unit 2	0 5 0 0 0 3 2 8	1 OF 0 4

TITLE (4) Reactor Trip Signals Generated From Electromagnetic Interference Caused By Welding Activity Adjacent To Source Range Nuclear Instrument Cabling

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)
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0 2	1 2	8 9	8 9	— 0 0 1 —	0 0	0 3	0 9	8 9		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): 6

POWER LEVEL (10): 0 0 0

☐ 20.402(b)	☐ 20.405(c)	XX 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 (AREA CODE)
T. K. Phifer, Plant Reporting Section	6 1 5 8 4 3 - 7 5 8 5

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) XX NO

EXPECTED SUBMISSION DATE (15): MONTH / DAY / YEAR

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

At 0021 EST, on February 12, 1989, unit 2 Nuclear Instrumentation System (NIS) source range (SR) channel N-31 received a spike of sufficient magnitude to actuate the high-flux trip bistable and generate a reactor trip signal. Unit 2 was in mode 6 at the time of the event, although no core alterations were in progress. At 0030 EST and again at 0039 EST, channel N-31 spiked high enough to generate two more reactor trip signals. These spikes were of a nature which could not have been caused by an actual increase in neutron flux. The unit 2 assistant shift operations supervisor attempted to identify the source of the interference and found welding in progress in the Auxiliary Building by the component cooling water system heat exchangers. Although the actual voltage source could not be located for this event, it is well documented that welding can cause sufficient electromagnetic interference (EMI) to generate a reactor trip signal on SR instrumentation. The root cause of the SR spiking is attributed to the susceptibility of the NIS design to electrostatic, electromagnetic, and frequency interferences. Therefore, it is concluded that the occurrence of these events had no significant adverse affect on the health and safety of the general public. Reduction of SR trip signals caused by noise will require long-term system hardware changes to reduce system susceptibility to noise interference. This will be accomplished by the upgrade of the existing Westinghouse NIS with Gamma-Metrics equipment.

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FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Sequoyah, Unit 2	0 5 0 0 0 3 2 8	8 9	— 0 0 1	— 0 0	0 2 OF 0 4

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

DESCRIPTION OF EVENT

On February 12, 1989, at 0021 EST with unit 2 in mode 6 (0-percent power, 0 psig, 92 degrees F), a reactor trip signal was generated by the reactor protection system (EIIS Code JC) from the source range (SR) nuclear instrument (EIIS Code IG) high-neutron flux trip.

At 0021 EST, on February 12, 1989, unit 2 Nuclear Instrumentation System (NIS) SR channel N-31, received a spike of sufficient magnitude to actuate the high-flux trip bistable (100,000 counts per second) and to generate a reactor trip signal. Unit 2 was in mode 6 (refueling) at the time of the event, although no core alterations were in progress. At 0030 and again at 0039, channel N-31 spiked high enough to generate two more reactor trip signals. Prior to this event, fuel movement had been suspended due to the fuel transfer system being out of service. The unit 2 operators concluded that the signals were not the result of an actual neutron flux increase due to a normal reading on channel N-32 and the abnormal shape of the spike on channel N-31. The unit 2 assistant shift operations supervisor (ASOS) identified a potential source of the interference as welding in progress in the Auxiliary Building, which is common to both Sequoyah units, on elevation 714 by the component cooling water system (CCS) (EIIS Code CC) heat exchangers. The welders stopped work, and as a preplanned sequence, struck an arc to check the effect on NIS SR instrumentation. Only very small spikes occurred on channel N-31 and slightly larger spikes were noted on channel N-32, but these were not large enough to cause a reactor trip signal. The ASOS also noted that personnel were changing the eddy current probe for steam generator No. 4 activity inside the unit 2 containment at the time of the event.

CAUSE OF EVENTS

The SR high-flux reactor trip signals that occurred on February 12, 1989 were caused by noise induced into the unit 2 SR channel N-31 cabling that resulted in exceeding the high-flux reactor trip setpoint monitored by the reactor protection system (RPS). The noise was apparently caused by welding at a high frequency in the vicinity of the unit 2 SR cabling.

The root cause of the SR spiking is attributed to the high noise susceptibility of the NIS design to electrostatic, electromagnetic, and radio frequency interferences. The SR is particularly sensitive to noise interference because it has a low-level pulse signal that is transmitted over long lengths of cabling--from the detectors mounted in containment to the preamplifier mounted outside containment and on to the nuclear instrument cabinet located in the main control room.

Although the actual voltage source could not be located for this event, it is well documented that welding can cause sufficient electromagnetic interference (EMI) to generate a reactor trip signal on SR instrumentation. Even such devices as heat guns (when operated in close proximity to the detector cables) have been shown to cause some affect on the SR channels.

ANALYSIS OF EVENT

This report is submitted pursuant to the requirements of 10 CFR 50.73, paragraph a.2.iv, as a condition that resulted in an automatic actuation of the RPS. The NRC Operations Center was notified of the reactor trip signals on February 12, 1989, at 0351 EST pursuant to 10 CFR 50.72, paragraph b.2.ii.

The RPS is provided with a SR high flux reactor trip signal to ensure that a controlled power increase into the "power range" is maintained. The SR trip is provided to ensure the operators maintain control of the reactor power increase during a startup by monitoring the reactor neutron count rate and generating a reactor trip signal when required. This is implemented by two SR excore detectors and backed up by two intermediate-range excore detectors that monitor the core neutron level. If either detector provides a signal to the RPS that is above the setpoint limit (manually blocked for a controlled power increase), a reactor trip will occur to shutdown the reactor. During these events, however, the SR signal was not a result of a high neutron count rate, but a result of noise induced in the SR cabling of sufficient magnitude to exceed the reactor trip setpoint. Reactor trip breaker actuation did not occur during these events because they were already open. The reactor trip logic responded correctly by providing a reactor trip signal as the noise induced in the cabling exceeded the trip setpoint. Therefore, it is concluded that the occurrence of these events had no adverse affect on the health and safety of the general public.

CORRECTIVE ACTION

Immediate operator action was to confirm the trip signal was not the result of neutron monitoring. Subsequent operator actions were to suspend any suspect welding activities in the containment and initiate troubleshooting to locate the noise source.

Interim recurrence control was a small adjustment of the discriminator operating bias point for the SR channel to a higher setting to provide greater discrimination against unwanted background noise and gamma signals while still ensuring proper neutron flux monitoring. This change allows for greater channel reliability by reducing relative noise susceptibility. Additionally, due to noise problems on both SR channels during previous unit outages, coupling capacitors were added between the preamplifiers and ground to eliminate increased noise levels occurring during outages. Design change request 3078 was written to insulate the SR cable/detector from the source/intermediate range detector housing. The existing design has the SR and intermediate-range outside cable shields tied together at the detectors and at the instrument drawers in the control room. This results in a ground loop and a system that is more susceptible to noise.

Reduction of SR trip signals caused by noise will require long-term system hardware changes to reduce system susceptibility to noise interference. This

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Sequoyah, Unit 2	0 5 0 0 0 3 2 8	8 9	— 0 0 1	— 0 0	0 4 OF 0 4

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will be accomplished by the upgrade of the existing Westinghouse NIS with Gamma-Metrics equipment. This upgrade is scheduled during the cycle 4 outages for both units. Although the Gamma-Metrics NIS is being installed to meet Regulatory Guide 1.97 postaccident monitoring requirements, its installation should reduce many of the problems caused by noise interference. These problems should be mitigated because the Gamma-Metrics equipment offers enhanced system design features by employing techniques to minimize system noise susceptibility.

ADDITIONAL INFORMATION

There have been three previously reported occurrences of reactor trip signals generated from SR detectors as a result of EMI - SQRO-50-327/82131, /88019 and /88022.

COMMITMENTS

Reference LER 327/88019 for installation of the Gamma-Metrics system.

0191R

TENNESSEE VALLEY AUTHORITY

Sequoyah Nuclear Plant
Post Office Box 2000
Soddy-Daisy, Tennessee 37379

March 9, 1989

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

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE DPR-79 - LICENSEE EVENT REPORT (LER) 328/89001

The enclosed LER provides details concerning a nuclear instrumentation source range (SR) reactor trip signal generated by electromagnetic interference from welding activity adjacent to SR cabling. This event is reported in accordance with 10 CFR 50.73, paragraph a.2.iv.

Jerry Patrick for
S. J. Smith
Plant Manager

Enclosure
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NRC Inspector, Sequoyah Nuclear Plant

IE22
1/1