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)
Calvert Cliffs, Unit 1	0 5 0 0 0 3 1 7	1 OF 0 6

TITLE (4)

Inadvertent Engineered Safety Features Actuation Due to Modifications Work

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 5	0 2	8 8	8 8	0 0 2	0 0	0 6	0 1	8 8		0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
	6	20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)	0	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
J.R. Dunn, Engineering Analyst	3 0 1 2 6 0 - 3 9 5 1

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	C O N	V 1 2 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 5-2-88, while Unit I was in mode 6 (Refueling), four unplanned Safety Injection Actuation Signal Actuations were received and initiated by the Engineered Safety Features Actuation System. These four actuations occurred at 1412, 1430, 1455 and 1555. The actuations were the result of the interaction between established system conditions, four plant modifications being performed while the unit was in mode 6, refueling, and a failed connector in the Engineered Safety Features Actuation System.

All affected plant equipment operated correctly.

Corrective Action: Improvements to procedures, planning, and task sequencing will be made for work involving protective systems which can not be depowered during any plant operational mode. Similar connectors to the failed connector will be inspected and caution labels regarding power supplies will be placed on ESFAS cabinets.

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Description

On 5-2-86, while Unit 1 was in mode 6 (refueling), four Safety Injection Actuation Signal (SIAS) actuations were initiated by the Engineered Safety Features Actuation System, (ESFAS) (EIIS-JE). These four SIAS actuations were the result of the interaction of four concurrent modifications associated with the Engineered Safety Features Actuation System. Because the SIAS actuations were the result of different interactions, they will be discussed on an individual basis. The four modifications in progress during the actuations were:

1. Containment Electrical Penetration (EIIS BD-PEN) Replacement;

2. Pressurizer Pressure Transmitter (EIIS JA-PT) Replacement;

3. Diverse Scram System (EIIS JC) Installation Into The Existing Engineered Safety Features Actuation System; and

4. Environmental Qualification Cable Replacement.

A fifth modification, Plant Computer (EIIS-ID) Replacement, was also in progress in Unit 1 at the time of the actuations, rendering any sequential time/events computer printout nonexistent. Time and events are based on interviews with personnel and the Control Room Operator Log. The reactor plant remained stable throughout these events.

Personnel Action

Operator actions were proper.

Failure Information

One equipment failure contributed to this event. Actuations #3 and #4 (discussed in detail in the SEQUENCE OF EVENTS section below) were caused by the failure of an electrical connector. A wire disconnected from a connector pin.

Manufacturer	Model #
Airborne (EIIS-JE CON)	WTB-70SECSY

SEQUENCE OF EVENTS

Actuation #1, 5-2-88 at 1412 (See Figure 1)

1A. Sensor Channels (ZD, ZE, ZF and ZG) of the ESFAS system previously had SIAS Pressurizer Pressure blocked due to plant conditions, mode 6 refueling. SIAS block requires 3 out of 4 logic to receive "permission to block" and manual operator action to insert the block (ref. Figure 1).

1B Sensor Channel ZE of the ESFAS was depowered at 1125 to allow the internal modification of the sensor cabinet for the Diverse Scram System (DSS). Prior to this depowering, a full four out of four sensor channel trip condition existed which was due to actual low sensor channel voltage inputs (pressurizer pressure is low in mode 6). The SIAS actuation was blocked in the AL and BL logic cabinets as stated in item 1A above.

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Following channel ZE depowering, actuation cabinets AL and BL would still be receiving 4 sensor channel trips, three from actual low instrument loop input voltage (channels ZD, ZF and ZG) and one from channel ZE due to the depowered fail safe design. ESFAS was not fully depowered due to the technical specification requiring the load sequencer to be in service for the emergency diesel generator (EIIS EK).

1C. Electrical penetration replacement work had previously removed the old penetrations, replaced them with new ones and the inside containment terminations had been completed. These four penetrations contain the cabling of the four pressurizer pressure transmitters. The Reactor Protective System (RPS) (EIIS JC) channel A, B, C & D shares the same pressurizer pressure transmitter outputs as the ESFAS channels ZD, ZE, ZF and ZG.

1D. Pressurizer pressure transmitter replacement work had previously removed the old transmitters 1-PT-102A through D to allow for the replacement with new transmitters. These four transmitters are the shared input device to both the RPS and ESFAS for pressurizer pressure.

1E. EQ cable replacement work had previously pulled new cable (EIIS JE CBL1) from the transmitters being replaced in item 1D above to the electrical penetration being replaced in item 1C above. The transmitter end of the cable had the conductors secured together to aid in the replacement cable pulling effort.

Two work crews reterminating the field cables outside containment to the new penetrations were final fitting the cables to the penetrations prior to final termination. These crews were located at the ZF and ZG/C and D ESFAS/RPS channel transmitter output penetrations. Upon the fit up of the cables to the penetrations (with the conductors secured together at the transmitter ends) loop current and voltage input went to maximum (see Figure 2) due to the transmitter loops not being depowered. This condition reset the actuation blocking at ESFAS in AL and BL logic cabinets. (Three out of four logic gives permission to block and two out of four logic resets to clear the block.) (Ref. Figure 1)

With the SIAS actuation now unblocked and the two remaining ESFAS sensor channels, ZD tripped due to actual low signal input and ZE tripped due to the fail safe loss of power design, SIAS initiated in channels AL and BL at 1412.

All Engineered Safety Features equipment, which was not out of service due to plant conditions (mode 6) at the time of the SIAS actuation, operated correctly.

1F. Control Room Operators reset the SIAS initiation from ESFAS and reset the sensor channels by dialing down the setpoints. This reestablished the SIAS blocking condition by 1416. During this time the two work crews at the penetrations, listed in item 1E above, had lifted the channel ZF and ZG/C

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and D ESFAS/RPS transmitter leads. This returned channels ZF and, ZG/C and D to the low state. At this time Operations suspected the cause to be related to the work in Sensor Channel ZE in item 1A above. This work was halted. The setpoints of the sensor channels were returned to normal by the Control Room Operator, once the SIAS block was reestablished.

Actuation #2, 5-2-88 at 1430

2A. The two work crews at the penetrations, working the same two transmitter cables as in the 1st actuation at 1412 remained unaware of the effect of their work and reterminated the cables for the final time. This action started the same sequence as in the 1st SIAS actuation i.e., the SIAS blocks cleared due to channel ZF and ZG going high and with channel ZD low and ZE depowered, a two out of four SIAS actuation initiated at 1430.

All Engineered Safety Features equipment, which was not out of service due to plant conditions at the time of the SIAS actuation, operated correctly.

2B. Control Room Operators again reset the SIAS initiation from ESFAS and reestablished the SIAS block by dialing down the sensor channel setpoints by 1437. At this time Operators observed that the input voltages to channel C & D of the RPS were close to a 300% full scale value. This was due to the fact that the final termination had been made at the penetration (See Figure 2).

2C. Operations requested all modification work be ceased and the power supply output slide links for the channel C & D or ZF and ZG pressurizer pressure loops located in the Control Room were opened depowering these instrument loops. This returned these loops to the down scale low value normal for the current plant mode.

2D. At this time, Operations requested that the channel ZE ESFAS sensor cabinet be repowered to return ESFAS to a normal configuration.

Actuation #3, at 1455

3A. In order to safely repower the ZE ESFAS sensor cabinet, the Diverse Scram System modification wiring, which was partially installed, had to be completed at one of the isolation modules (EIIS ZJE OB). The electrician working in the cabinet was cutting tie wraps to route a new cabinet wire for the DSS modifications. A SIAS actuation on actuation channel AL only occurred at 1455.

Unknown to the electrician was the fact that a wire from the connector for the isolator which he was working had pulled off its connector pin.

The power supplies were depowered for the sensor cabinet of Channel ZE where the electrician was working on the DSS modification. Isolation modules located in the sensor cabinets provide isolation between the sensor cabinet

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and the actuation cabinet logic. The isolation modules normally receive power from both the sensor cabinet and the actuation cabinet. Although the sensor cabinet for Channel ZE was downpowered, the output components of the isolation module were receiving power from the still energized actuation cabinet, in this case, channel AL. The affected wire was the +15 volt SIAS logic power from the actuation cabinet. While cutting the tie wraps this loose wire came in contact with a system common wire. This caused a momentary drop on the entire SIAS +15 volt actuation cabinet logic power bus causing the channel AL SIAS actuation. A loss of actuation logic 15 volt power without first removing ESFAS actuation relay 28 volt power will result in actuations.

All A Train Engineered Safety Features equipment, which was not out of service due to plant conditions at the time of the channel AL SIAS actuation, operated correctly.

3B. Operations reset the channel AL actuation at 1459. Although Operators discussed the event with the electrician, the impact of his work (i.e. the loose wire) was not realized at this time.

Actuation #4, at 1555

4A. While continuing to perform the restoration work in order to safely repower the channel ZE sensor cabinets, the electrician performing the work heard the ESFAS relays pickup and noticed the loose wire at the isolation module connector. A SIAS actuation on actuation channel AL only had again occurred at 1555 due to the same reasons as the 1455 actuation.

All A Train Engineered Safety Features equipment, which was not out of service due to plant conditions at the time of the channel AL SIAS actuation, operated correctly.

4B. Operations reset the channel AL SIAS actuation at 1558.

4C. Operations depowered both AL and BL actuation cabinets at 1635 (required entering Tech Spec Action Statement 3.8.1.2b) to allow immediate corrective action which was the retermination of the isolation module wires, to be completed without the danger of further actuations. Subsequently, work was completed without further incident and ESFAS was repowered at 1120 on 5-3-88.

Analysis

There were no significant safety consequences during this event. Because the plant was in mode 6 refueling, the impact on operating equipment was minimal. The event did cause the diesel generators to start and the event could possibly have been more severe in a higher operating mode because of more equipment being effected. However, the system configuration and work which caused the event would not be conducted in higher modes of plant operation. Overall, the safety significance was considered minimal. There have been no similar events.

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Corrective Actions

1. Improvements to work control and scheduling on energized Instrument and Control Circuits will be investigated.

2. A caution statement will be added to Operating Instruction 34, Engineered Safety Features Actuation System, concerning the sensor channel isolator module power interface with the actuation channels.

3. An inspection of similar ESFAS connectors for loose wires has been completed on Unit 1 (no problems found). Unit 2 ESFAS will be inspected during the next outage of sufficient duration.

4. All future modification work involving ESFAS sensor instruments will require the sensor instrument loops to be depowered.

5. Caution labels will be added at appropriate locations on ESFAS sensor cabinets to clarify power interfacing in isolation modules.

Calvert Cliffs, Unit 1
Docket # 05000317
LER # 88-002-00

FIGURE 1

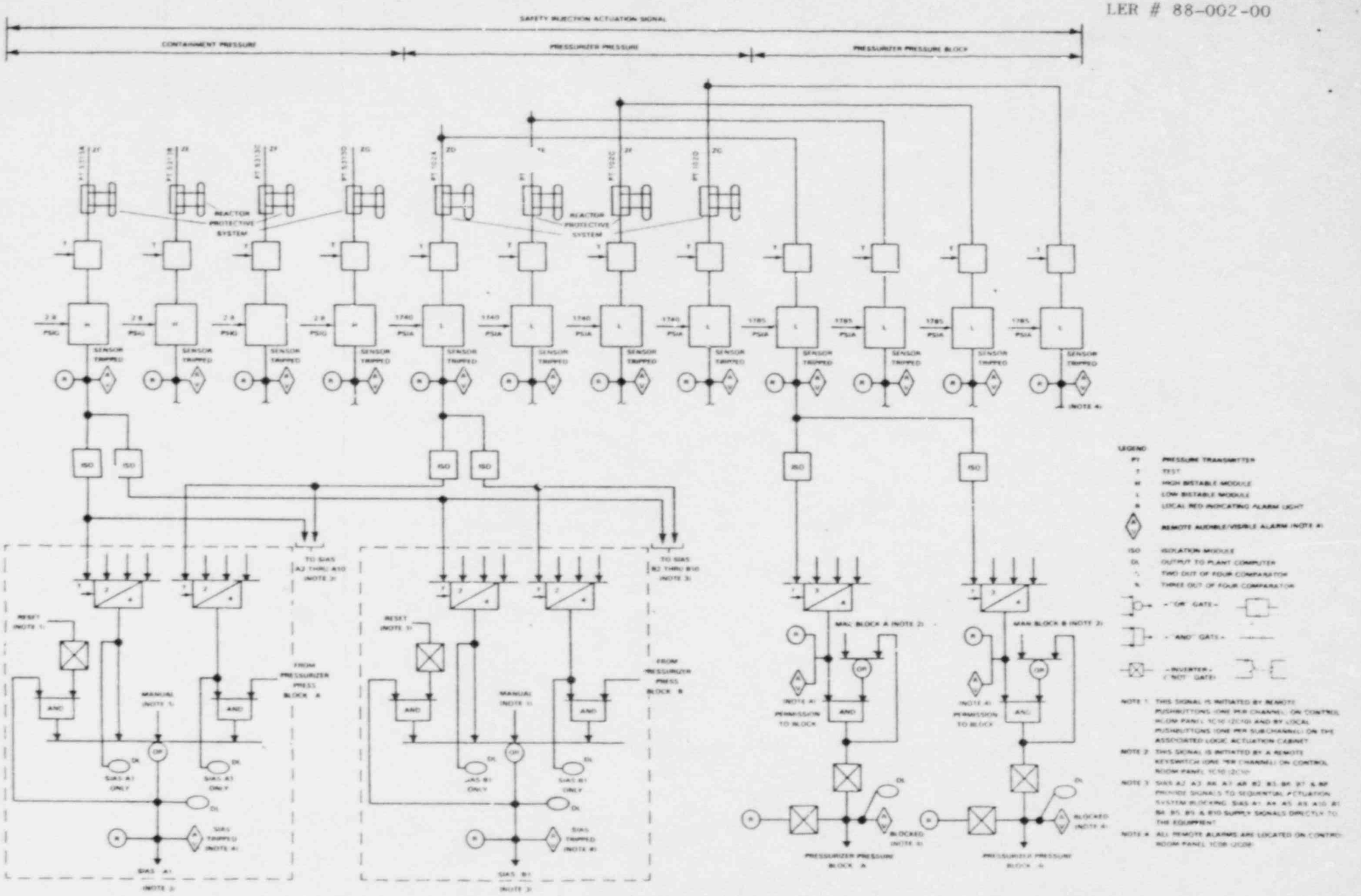

FIGURE 2

Channel ZF/ZG (C/D) Pressurizer Pressure Instrument Loops

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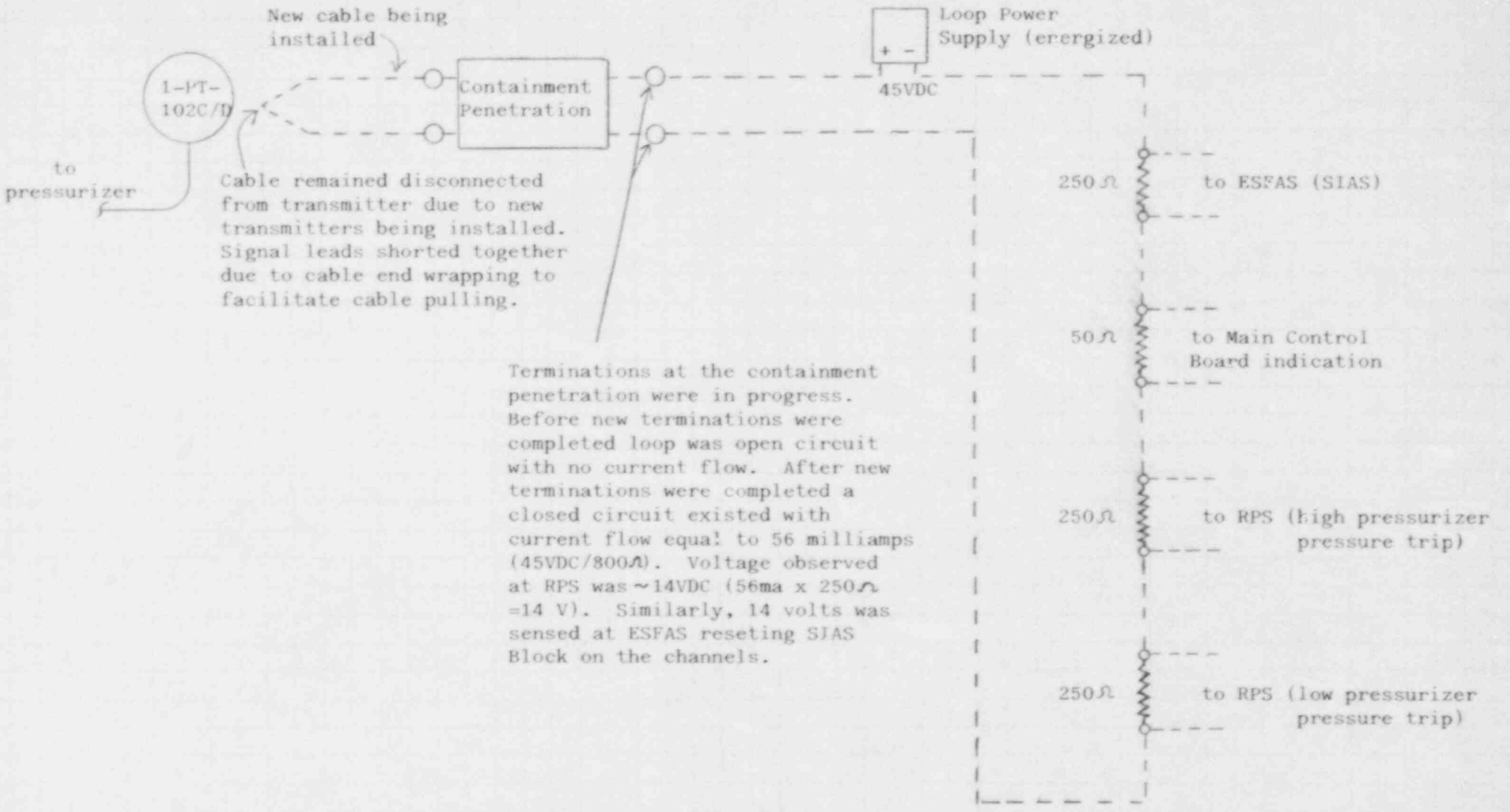

BALTIMORE
GAS AND
ELECTRIC

CHARLES CENTER • P.O. BOX 1475 • BALTIMORE, MARYLAND 21203

NUCLEAR OPERATIONS DEPARTMENT
CALVERT CLIFFS NUCLEAR POWER PLANT
LUSBY, MARYLAND 20657

June 1, 1988

U.S. Nuclear Regulatory Commission
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Docket No. 317
License No. DPR 53

Dear Sirs:

The attached LER 88-02 is being sent to your as required by 10 CFR 50.73.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,

J.R. Lemons
Manager - Nuclear Operations Department

JRL: JRD: njc

cc: William T. Russell
Director, Office of Management Information and Program Control
Messrs: J A. Tiernan
W.J. Lippold

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