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)
Fort St. Vrain, Unit No. 1	0 5 0 0 0 2 6 7	1 OF 0 8

TITLE (4)
REACTOR SCRAM ON UNDERVOLTAGE WHILE PERFORMING CN-2191

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)
0 2	0 3	8 7	8 7	— 0 0 3	— 0 1	0 3	1 9	8 7	N/A	0 5 0 0 0
										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)	0 0 0	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
Mark A. Joseph, Technical Services Supervisor	AREA CODE 3 0 3 6 2 0 - 1 2 0 3

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	
X	E K	E N G	C 1 7 0	Y							

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 February 3, 1987 with the reactor shutdown and cooled down for Environmental Qualification work, simultaneous load shedding on 480 VAC Bus 2 and Bus 3 was inadvertently initiated, causing 1B diesel generator to automatically start and a Plant Protective System (PPS) automatic reactor scram actuation on undervoltage. Prior to the actuation, all control rods were fully inserted in the core, the Reactor Mode Switch (RMS) was in the "OFF" position and the scram contactors were deenergized; therefore the scram actuation affected the logic and alarm circuitry only. These events are being reported herein pursuant to 10CFR50.73(a)(2)(iv).

The cause of the simultaneous load shedding of 480 VAC Bus 2 and Bus 3 is attributed to the inadvertent energization of the load shedding relay for Bus 3 while testing the load shedding relay on Bus 2 during Functional Test FT-2191-5 for modifications authorized by Change Notice CN-2191. The undervoltage scram was caused by the failure to restore voltage to two-out-of-three essential buses within the required 30 seconds. This was caused by the failure of "C" engine on 1B diesel generator to start with 1A diesel generator out of service. An extensive investigation has not determined the root cause of the failure of "C" diesel engine to start on demand. The operability of 1B diesel generator will be demonstrated as described in Fort St. Vrain Upgrade Technical Specification 3/4.8.1, Diesel Generator Requalification Program, prior to declaring it operable for the purpose of Technical Specification compliance.

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BACKGROUND:

Essential electric loads required to ensure an orderly shutdown and continued maintenance of the plant in a safe condition are powered from three 480 VAC essential buses. Under normal conditions, load center transformers, rated at 4160 VAC to 480 VAC 3 phase, 60 Hertz, are utilized to supply each of the 480 VAC essential buses (Refer to Figure 1). Protection under degraded voltage conditions is provided for the essential power system by the use of undervoltage relays to produce appropriate action corresponding to the degree of voltage degradation.

On a complete loss of 480 VAC essential bus voltage caused by the loss of all outside power, a set of inverse time delay undervoltage relays set at 328 volts (68.3% of 480 volts nominal) and arranged in two-out-of-three logic per bus will be tripped. Loss of voltage on two-out-of-three 480 VAC essential buses will:

1. Trip all three main power circuit breakers (252TR1, 252TR2, and 252TR3)

2. Start the emergency diesel generators

3. Load shed all three essential buses

4. Close both diesel generator breakers (252DG1A and 252DG1B) and sequence loads onto Bus 1 and Bus 3.

Essential Bus 2 is automatically connected to the 480 VAC essential bus which will be energized first by a diesel generator. Essential Bus 2 is interlocked so it will automatically connect to only one of the other two 480 VAC essential buses at a time. The capability exists to manually tie all three essential buses together if only one diesel generator is operating.

Each essential bus has three additional undervoltage relays set at 288 volts (60% of 480 volt nominal), arranged in two-out-of-three logic per bus and connected to a 30 second time delay. Should power not be restored on two-out-of-three of the 480 VAC essential buses before the 30 second time delay, a reactor scram will automatically be initiated.

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

EVENT DESCRIPTION:

On February 3, 1987, Results engineers were performing Functional Test FT-2191-5 on redundant load shedding relays CR-9260 and CR-9261 following their replacement per Change Notice CN-2191. These relays will independently trip the feeder breaker for 480 VAC essential Bus 2 and various circuit breakers on all three 480 VAC essential buses as part of the overall load shedding process. The tie breaker between Bus 2 and Bus 3 (252BT32) was closed prior to the start of the Functional Test to ensure that Bus 2 would remain energized from Bus 3 when the feeder breaker to Bus 2 (252TR2) was tripped. FT-2191-5 was to be performed by removing the 125 VDC feed wires from each relay to be tested, applying an external 125 VDC source directly to the relay coil and verifying that the proper load shedding actions take place when the relay coil is energized (Refer to Figure 2).

At approximately 1735 hours, when the Results Engineer applied the external 125 VDC source to the relay coil of CR-9260, Bus 2 and Bus 3 feeder breakers (252TR2 and 252TR3) tripped, simultaneously deenergizing both Bus 2 and Bus 3, thus completing the undervoltage relay logic for a loss of all outside power. 1A diesel generator had previously been cleared out for maintenance, and could not start. 1B diesel generator successfully started on 'D' engine. 'C' engine failed to start, thus prohibiting 1B diesel generator output breaker (252DG1B) from automatically closing and re-energizing essential Bus 2 and Bus 3. Both engines on a diesel generator must be running for the generator output breaker to automatically close. The failure of Bus 2 and Bus 3 to be re-energized within 30 seconds completed the undervoltage relay logic for an automatic reactor scram actuation from the Plant Protective System (PPS) to the scram contactors. The scram contactors at the time of the undervoltage scram actuation were already in a tripped condition with all control rods fully inserted. The Reactor Mode Switch (RMS) was in the "OFF" position, therefore the scram contactors could not be reset or returned to a non-tripped condition. The automatic scram actuation from the PPS affected only the associated logic and alarm circuitry.

Results Engineers successfully performed FT-2191-5 on CR-9261 subsequent to the unsuccessful test on CR-9260.

"C" diesel engine was inspected following the failure to start. No deficiencies were identified which would have prevented the engine from successfully starting. 1B diesel generator was tested at 0300 hours on February 4, 1987, and performed satisfactorily. Subsequent weekly surveillance test runs and operability checks of 1B diesel generator have all been satisfactory.

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

Automatic and manual starts of "C" and "D" diesel engines were performed on March 4, 1987, for the purpose of investigating the failure of "C" diesel engine. The undervoltage automatic start relays for 1B diesel generator and associated wiring were visually inspected. No deficiencies were identified, all components functioned as designed.

1B diesel generator was removed from service for annual preventive maintenance and modification work on March 6, 1987, following the completion of preventive maintenance and modifications on 1A diesel generator. This preventive maintenance required the replacement of 1 turbo-charger, 1 air-start system, all injectors, and the oil and filters on each engine. In addition to the routine maintenance, the governor for "C" diesel engine was removed and tested by the vendor (Woodward Governor), and the clutch position switches were replaced as authorized by CN-2463. The "As Found" condition of all components inspected was carefully noted and evaluated. Although several minor deficiencies were noted, no deficiencies were identified which would unequivocally cause the failure of "C" diesel engine.

CAUSE DESCRIPTION:

Personnel Error

The Results Engineer performing the Functional Test inadvertently allowed the 125 VDC feed wire previously disconnected from CR-9260 to momentarily contact the external 125 VDC power source while CR-9260 was energized. CR-9262 was the only relay that picked up as a result of this momentary contact.

The root cause of the failure of "C" diesel engine to start on demand remains unknown.

SAFETY ANALYSIS:

At the time of this event the reactor had been shutdown and cooled down for approximately 8 months. Decay heat calculations performed with procedure CMG-4 have determined that the reactor can withstand a 30 day complete Loss Of Forced Cooling (LOFC) before reaching limiting operating temperatures. At no time during this event was forced cooling actually interrupted.

Five separate sources of outside power are tied to the Fort St. Vrain electric distribution system. The on site emergency AC power source consists of two independent diesel generator units powered by four diesel engines. Any two of the four diesel engines can be utilized to provide the necessary electric power for the minimum essential equipment required for safe reactor shutdown. During this event only one diesel engine started, however, adequate time was available to troubleshoot and repair 'C' diesel engine, or return 1A diesel generator to service if necessary.

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In the event of the complete failure of the 480 VAC essential bus load shedding and load sequencing logic, the capability exists to perform manual load shedding and to manually start the diesel generator sets. The capability to manually energize required safe shutdown cooling equipment has been previously analyzed and is described in FSAR Sections 8.2.3.5, 8.2.5.1, and in the following paragraph in FSAR Section 8.2.3.3.1:

> "If the automatic load sequencing system fails, it is possible for an operator to manually load the generators with the essential loads necessary for safe reactor shutdown. This option further improves the overall reliability of the standby power supply because the HTGR plant can withstand some short-time loss of core circulation without damage that might prevent further cool down from taking place."

The Alternate Cooling Method (ACM) described in FSAR Section 8.2.8 is available to safely shut down the reactor in the event of the permanent loss of both diesel generator sets and all sources of outside power.

CORRECTIVE ACTION:

Results personnel have been instructed to properly insulate wires removed from circuits during testing to prevent inadvertent circuit actuations in the future.

The operability of 1B diesel generator will be demonstrated as described in Fort St. Vrain Upgrade Technical Specification 3/4.8.1, Attachment 2 to Table 4.8.1-2, Diesel Generator Requalification Program. Seven consecutive successful demands without a failure will be required to declare the diesel generator operable for the purpose of Technical Specification compliance.

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

FIGURE 1

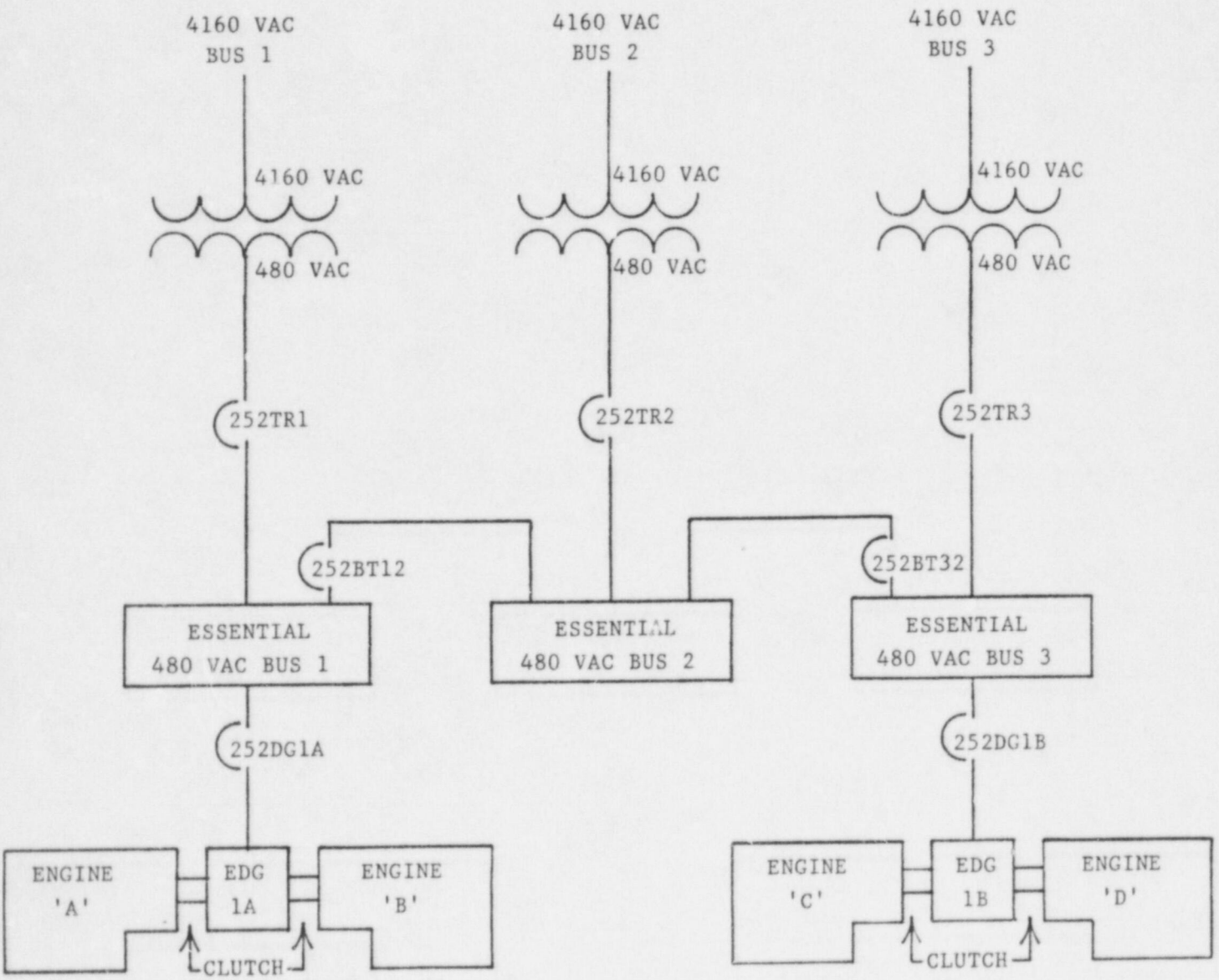

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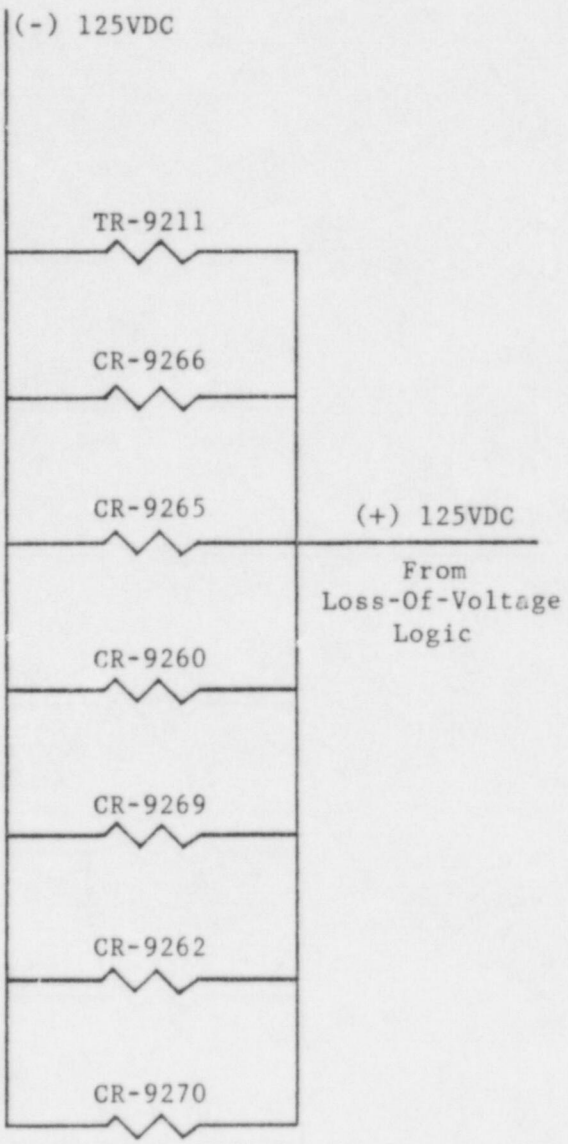
FIGURE 2



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

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R.O. WILLIAMS, JR.
VICE PRESIDENT
NUCLEAR OPERATIONS

March 19, 1987
Fort St. Vrain
Unit No. 1
P-87111

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

Docket No. 50-267

SUBJECT: Licensee Event Report 87-003, Supplemental Report

REFERENCE: Facility Operating License No. DPR-34

Gentlemen:

Enclosed please find a copy of Licensee Event Report No. 50-267/87-003, Supplemental Report, submitted per the requirements of 10 CFR 50.73(a)(2)(iv).

If you have any questions, please contact Mr. M. H. Holmes at (303) 480-6960.

Sincerely,

R. O. Williams, Jr.
Vice President,
Nuclear Operations

Enclosure

cc: Regional Administrator, Region IV, NRC
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