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DUKE POWER

December 5, 1991

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

Subject: Catawba Nuclear Station
Docket No. 50-414
LER 414/91-14

Gentlemen:

Attached is Licensee Event Report 414/91-14, concerning UNIT 2 ESF ACTUATION DUE TO ESSENTIAL BUS UNDERVOLTAGE CONDITION.

This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

W. R. McCollum
Station Manager

ken:LER-NRC.WRM

xc: Mr. S. D. Ebneter
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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Catawba Nuclear Station, Unit 2	0 5 0 0 0 4 1 4	1 OF 0 6

TITLE (4)

Unit 2 ESF Actuation Due To Essential Bus Undervoltage Condition

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)
											N/A	0 5 0 0 0
1 1	0 5	9 1	9 1	—	0 1 4	—	0 0	1 2	0 4	9 1		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)			
0		20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
0		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
R.C. Futrell, Compliance Manager	8 0 3 8 3 1 - 3 6 6 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)		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 November 5, 1991, at 2300 hours, Unit 2 was in No Mode (Defueled). An Engineered Safety Feature (ESF) actuation occurred as a result of an undervoltage signal generated on A Train 4160V essential bus (2ETA). The undervoltage condition was caused when one of the fuseholder connection stabs of the Undervoltage Relay Potential Transformer (PT) did not make contact with the essential bus. Subsequent Investigation revealed that the connection stab had been bent as a result of a loose PT fuseholder. The loose fuseholder was determined to be caused by improper removal of fuses from the PT fuseholder. This incident is attributed to a Management Deficiency, inadequate training provided for personnel performing high voltage fuse removal. Management will re-evaluate the issue concerning Operations' responsibility of high voltage equipment manipulation at Catawba. Corrective action will include resolution of the responsibility issue, procedure enhancement and development, and additional training.

BACKGROUND

The 4160V Essential power [EIIS:EB],(EPC), system supplies power to those Class 1E loads required to safely shut down the unit following a design basis accident. This system is also available to supply power to the 4160 Blackout Auxiliary Power System.

The 4160V essential system is divided into two completely redundant and independent trains designated A and B, each consisting of one 4160 volt switchgear assembly, three 4160/600 volt transformers, [EIIS:XFMR] two 600 volt load centers, and associated loads.

Normally the Unit 2, A train, Class 1E 4160 volt switchgear, 2ETA, is powered from its associated non-Class 1E train of the 6900VAC Normal Auxiliary Power System through normal Feeder Breaker [EIIS:BRK] 2ETA3. Additionally, an alternate source of power to each 4160 volt essential switchgear is provided from the 6900 volt system via two separate and independent 6900 4160 volt transformers. This source is provided through Alternate Feeder Breaker [EIIS:BRK] 2ETA4. These transformers are shared between units and provide the capability to supply an alternate source of preferred power to each unit's 4160V essential switchgear from either unit's 6900V system. A key interlock scheme is provided to preclude the possibility of connecting the two units together at either the 6900 volt level or the 4160 volt level.

Each train of the 4160V Essential Auxiliary Power System is also provided with an independent emergency diesel generator [EIIS:GEN] to supply the Class 1E loads required to safely shut down the unit following a design basis accident. This source is supplied through standby Diesel Generator (D/G) Breaker (2ETA18). Additionally, the diesel generator is capable of supplying its associated 4160 volt blackout switchgear through a connection with the 4160 volt essential switchgear.

The 4160V essential buses are provided with two levels of undervoltage protection to monitor bus voltage. Each level is provided with a separate set of three under voltage relays [EIIS:RLY] which are utilized in a two-out-of-three logic scheme.

The first level undervoltage relays are set to drop out if the voltage falls below 84.1% of normal bus voltage (4160V) and remains there for approximately 10 cycles. The 10 cycle time delay prevents false diesel starting due to power system transients. The voltage setpoint was selected such that relay operation will not be initiated during normal motor [EIIS:MO] starting; however, these relays will detect loss of voltage and initiate action in a time frame consistent with the accident analysis.

The second level provides degraded voltage protection and is set to operate for voltage less than 90%. This second level employs two time delays: the first

(40 seconds) establishes the existence of a sustained degraded voltage condition and provides an annunciator [EIIS:ANN] alarm in the control room; the second (10 minutes) permits corrective operator action prior to separating the Class 1E and offsite power systems. These relays receive power through potential transformers (PT) which monitor the bus voltages. The PT's are located in 2ETA19 in flip down drawers. The PT's contain primary fuses that isolate the PT from the essential bus. The PT fuseholder has a "knife type switch" connection stab that contacts the bus via a "female type" connection. Alignment of the connection stab into the female connection is necessary to assure proper bus contact.

The Diesel Generator Load Sequencing [EIIS:EK],(EQB), system (sequencer) functions to automatically energize the necessary blackout loads in a definite progressive sequence. When the sequencer is actuated by a 2/3 phase undervoltage condition (blackout condition) on the 4160V essential bus, the diesel engine is immediately started. An 8.5 second testing period verifies whether or not the 2/3 UV condition is actually the result of a sustained loss of voltage or from a transient voltage dip. If normal voltage parameters have been re-established at the end of the testing period, the sequencer will revert to its normal standby status. The diesel will continue to run unloaded until manually shut down. If the loss of voltage is sustained, the 4160V incoming breaker is tripped at 8.5 seconds, the 4160V essential and blackout busses are load shed and the D/G breaker closed when the diesel engine reaches 95% rated speed and the busses mentioned have been load shed for one second. Blackout required loads will then be automatically placed in service by the sequencer.

The Control Room Area Ventilation [EIIS:UC],(VC) system is designed to maintain the environment in the Control, Equipment and Cable Rooms within acceptable limits for the operations, maintenance, and for uninterruptible safe occupancy during post accident shutdown. The system consists of two separate and redundant trains of ventilation. During a blackout condition, the train in service continues to run. Then, after eleven seconds, the Air Handling Unit (CR-AHU) fan and Pressure Filter Train (PFT) fan of the idle train is sequenced on to start.

The VC system will continue in this condition until the sequencer is reset and "sequencer latch" is reset at 1CRA-ECP-1 and 2CRA-ECP-1. When reset, the previously idled train CR-AHU and PFT fan stops.

EVENT DESCRIPTION

On November 4, 1991, Unit 2 was in Refueling Outage 2EOC-4. The status of the unit was No Mode (Defueled). Diesel Generator 2A had been tagged out for maintenance. The A train 4160 Essential Power Bus, 2ETA, had been de-energized by Operations to allow Power Delivery personnel to perform Doble testing of the 2ETA Bus Potential Transformers (PT) in cubicle 2ETA19. As part of the electrical isolation for this work, the PT flip down drawers were opened and the PT fuses removed by Operations. This is currently a standard practice when working on switchgear bus or any bus with this type of PT.

On November 5,1991, Power Delivery performed the Doble Test of the PT's per procedure IP/0/A/2400/01/AE (Doble Testing). Upon completion of the Doble Testing, Operations began restoring 2ETA to service per procedure OP/2/A/6350/01, Enclosure 4.5 (2ETA Isolation and Return to Service). Restoring 2ETA to service included replacing the fuses in the appropriate PT cubicle (Steps 2.14.1 thru 2.14.3) and racking in and closing the appropriate breaker (Steps 2.15 and 2.16).

Once the breaker was closed to restore power, the undervoltage relays then sensed an undervoltage condition on the essential bus and alerted the Control Room personnel via annunciator indication. Control Room personnel then followed appropriate response procedures. The Operator at the Controls (OATC) attempted to contact the Nuclear Operator Specialist (NOS) to stop the restoration process, but was unsuccessful. The NOS, not aware of the undervoltage alarm in the Control Room, continued the restoration sequence of Enclosure 4.5. Specifically, Step 2.18 was completed which restored power to the 2A Diesel Generator (D/G) load sequencer [EIIS:EK],(EQB). Once this was accomplished, the alternate feeder breaker properly tripped open and the blackout sequence actuated. As a result of the blackout signal, the Control Room Area Ventilation (VC) system, automatically started the idle train Pressure Filter Train (PFT) fan and the Control Room Air Handling Unit (CR-AHU) fan as required. Since Unit 2 was in No Mode (Defueled) at the time of the actuation, diesel generator (D/G) 2A had been tagged out of service for maintenance and did not start. Other equipment that would normally be required to be sequenced on was either tagged out of service or powered from Unit 1 sources.

Due to the ESF actuation caused by the 2ETA blackout, the four hour notification to the NRC was made as required per Reporting Procedure RP/0/B/5000/13, NRC Notification Requirements.

The subsequent investigation by Operations of this actuation revealed that the cause of the undervoltage condition was that one of the PT connections that feeds the voltage signal to the relays was not in contact with the ETA bus, thus creating the undervoltage condition. The connection stab was found to be bent.

Work Request 495880PS was initiated to have IAE inspect and repair the bent connection stab.

CONCLUSION

Subsequent IAE inspection of the other Unit 2 ETA PT fuseholders revealed that some of the PT fuseholder stabs had become loose and could turn slightly on the bolt that secures the fuseholder to the PT.

The looseness of the fuseholder has a potential to cause misalignment of the male connection stab to its female connection when making contact with the bus. This misalignment can cause the bending of the stab due to a poor entry angle

into the female contacts or striking the plastic material surrounding the female contact. The bent connection stab in 2ETA19 was repaired and all other loose stabs identified in 2ETA3 and 2ETA19 were tightened by IAE.

The loose fuseholder connection stabs were determined to be the primary cause that led to the bent stab and subsequent failure to engage into the female connection. Further, the loose fuseholders were determined to be attributable to improper removal of the PT fuses from the PT fuseholders.

The ideal method of removing fuses would be to pull straight up and have both ends of the fuse disengage simultaneously. This would cause no twisting action on the holder and the single bolt that secures it in place. However, it was determined that the method commonly used by operators to remove these fuses is to remove one end by pulling straight up on one end of the fuse, then continue to hold on to that end of the fuse and pull and twist the fuse out of the other end of the holder.

This incident has been attributed to Management Deficiency, less than adequate training given to Operations personnel in the proper methods of removing PT fuses from the cubicles. Management will re-evaluate Operations' responsibility of high voltage equipment manipulation at Catawba. Currently management is in the process of resolving this issue to clearly define the responsibility of high voltage equipment manipulation. This unresolved issue has essentially delayed the development of required training and procedures needed to safely and effectively manipulate high voltage equipment. This item will be given management attention in order to resolve this issue.

Also, to assure all the bolts that secure the fuseholder to the PT are tight, Power Delivery will include a step in the Doble Testing procedure (IP/0/A/2400/01/AE) to inspect and tighten the fuseholder when Doble Testing is performed. Also, in order to prevent this type of inadvertent ESF actuation from recurring, Operations will include a step in the 2ETA Isolation and Return to Service procedures (OP/1/A/6350/01, OP/2/A/6350/01 Enclosure 4.5) to verify appropriate essential bus voltage prior to restoring control power to the related load sequencers.

In addition, the Unit 1 A and B Train PT fuseholders and the Unit 2 B Train PT fuseholders will be inspected during the next refueling outage.

An Operating Experience Program (OEP) review was performed to determine if any similar incidents had occurred due to Management Deficiency, improper training given. This review did not reveal any similar incidents, therefore it is not a recurring problem.

CORRECTIVE ACTION

SUBSEQUENT

1) The 2A D/G sequencer was reset.

2) VC train was returned to normal operation.

3) Work Request 495880PS was initiated to repair the bent fuseholder connection stab in 2ETA cubicle 19. It was also used to inspect the other Unit 2 A train PT fuseholder connections.

PLANNED

1) Procedure IP/0/A/2400/01/AE will be revised to include a step to have power delivery inspect and tighten the bolts that secure the PT fuseholder during each Doble Test.

2) Procedure OP/1/A/6350/01 and OP/2/A/6350/01 will be revised to include a method to verify appropriate bus voltage prior to energizing the related load sequencers.

3) The PT fuseholders for Unit 1 A & B train and Unit 2 B train essential bus will be inspected during the next refueling outage.

4) Management will re-evaluate Operations' responsibility for higher voltage equipment manipulation, then provide enhanced training, procedure development, and address the associated control issues.

5) An Operations Technical Memo will be issued to inform Operations personnel of the importance of proper alignment of the Potential Transformer (PT) connection stab during the PT power restoration process.

SAFETY ANALYSIS

During this incident, Unit 2 was in No Mode. (Defueled). An undervoltage signal was generated as 2ETA was being restored to service which caused the ESF action to occur. Due to the status of the unit, required equipment that is normally powered by 2ETA was either tagged out of service for maintenance or powered via Unit 1 (shared) sources. As a result, the related actuation involved only the Control Room ventilation system which responded as designed. The B train 4160V Essential Power System remained operable throughout this event.

The health and safety of the public were unaffected by this incident.