NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

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

TITLE (4)

Auto Start of Diesel Generators During Generator PCB Troubleshooting

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 5 0 0 0
0 1	2 2	8 5	8 5	—	0 0 7	—	0 0	0 2	2 1	8 5		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)			
1		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 1 4		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X 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)	50.72(b)(2)(ii)
		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
Roger W. Ouellette, Assistant Engineer - Licensing	7 0 4 3 7 3 - 7 5 3 0

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 January 22, 1985, at 1405:35 hours, Diesel Generators 1A and 1B started on a Blackout signal (undervoltage on the 4160V essential switchgear). During the troubleshooting of Generator Power Circuit Breaker 1B, a Zone B Lockout initiated inadvertently, causing B Train incoming feeders on all 6900V Switchgear to trip, and all four tie breakers to close. Present design allows an instantaneous undervoltage condition to be detected on the essential buses before the tie breaker closes to restore normal voltage. Therefore, this incident is classified as a Design Deficiency. Automatic closure of the tie breakers immediately restored normal voltage to the essential buses, and load shedding did not occur.

At the time of the incident, Unit 1 was in Mode 1 (Power Operation) at 14% thermal power, with the main generator off-line. This incident is reportable pursuant to 10 CFR 50.73, Section (a)(2)(iv), and 10 CFR 50.72, Section (b)(2)(ii).

IE22

The 6900V Normal Auxiliary Power (EPB) System distributes power to plant auxiliary equipment. It also serves as a normal power supply to the 4160V Essential Auxiliary Power System. Each 6900V bus (1TA, 1TB, 1TC, 1TD) has two normal incoming breakers. The incoming breakers associated with each bus are provided with an undervoltage relay connected to the associated bus section. These relays operate to trip the associated breaker when the switchgear voltage falls below 5175V. As the incoming breaker trips open, the tie breaker closes to allow the de-energized section of the bus to be fed from the other incoming breaker.

The Essential 4160V System consists of two Diesel Generators and two switchgear assemblies (1ETA and 1ETB). The voltage on each switchgear is monitored by 3 instantaneous undervoltage relays. A 2-out-of-3 undervoltage signal (3675V) on either essential bus will start the associated Diesel Generator.

The Unit 1 Main Power (EPA) System's primary function is to generate and tramsmit power to the Transmission System while simultaneously supplying the EPB System. The EPA System contains two Generator Power Circuit Breakers, GPCB 1A and GPCB 1B. Each GPCB has associated transformer and generator side disconnects 1AT and 1AG for GPCB 1A, and 1BT and 1BG for GPCB 1B. A Train of EPA is tied to the switchyard through PCB's 17 and 18, while B Train of EPA is tied to the switchyard through PCB's 14 and 15.

The EPA System has numerous relaying schemes that serve to protect the generator, the step-up and auxiliary transformer, and output circuits to the 230KV switchyard. These protective schemes will promptly initiate clearing of electrical faults and conditions that may be detrimental to equipment. This will be done while maintaining as much of Unit 1's equipment as possible. The GPCB's make it possible to isolate the generator and each of its two independent output feeder circuits from each other. This arrangement permits the protective relaying on Unit 1 to be divided into three distinctive zones of protection designated as Zone G, Zone A, and Zone B. The relaying in each protective zone is designed to clear that zone while leaving the other zones in service.

On January 22, 1985, at 0210 hours, while personnel were attempting to place the generator on-line, GPCB 1B failed to close. GPCB 1A was then used to connect the generator to the Transmission System. After being on-line for 40 minutes, the generator was taken off-line, and the exciter field breaker was opened. The turbine was later reset and placed in the chest warming mode at 0429 hours. Work Request 140130PS was written at 0409 hours to investigate and repair the cause of GPCB 1B not closing.

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

At 0930 hours, a crew began troubleshooting the breaker. They attempted to close the breaker remotely from the Control Room without success. After this, GPCB 1B controls were placed in local control. The crews attempted to close the breaker locally without success. They decided to close the breaker manually, and then to demonstrate that the breaker would trip by use of the local trip push button. Prior to closing the breaker manually, the DC power was removed from the breaker while closing it.

At 1405:35:065 hours, when the last phase of GPCB 1B was closed manually, a Zone A lockout occurred, which tripped GPCB 1A and GPCB 1B. GPCB 1A was already tripped, but GPCB 1B could not trip due to the fact that the control power had been removed and the breaker controls were in local (all auto-trips are blocked in local control). Since GPCB 1B could not trip, a breaker failure was detected by the circuitry, which initiated a Zone B lockout. The Zone B lockout caused switchyard PCB's 14 and 15 to trip, the incoming B train feeders to each 6900V switchgear to trip, and each tie breaker to close. However, after breaker 1TD-5 (Incoming B train feeder to 1TD) tripped at 1405:35:295 hours and before breaker 1TD-7 (Bus 1TD tiebreaker) closed at 1405:35:350 hours to re-energize the B train section of the bus feeding 1ETB switchgear, the undervoltage relays on 1ETB detected a loss of voltage condition. This actuated the Train B Blackout Relay at 1405:35:346 hours, thus initiating a Diesel Generator 1B start signal. Four milliseconds after the blackout relay actuated, breaker 1TD-7 automatically closed. The associated section of bus 1TD re-energized, also re-energizing bus 1ETB. Since the loss of voltage on 1ETB was not sustained for the 8 second test period, Diesel Generator 1B did not load.

At 1405:35:365 hours, 1TA-7 (Bus 1TA tiebreaker) closed in order to re-energize the B train section of 1TA switchgear. However, this closure caused the A train section of 1TA to experience a momentary voltage decrease. Since the A train section of 1TA was feeding 1ETA switchgear, 1ETA under voltage relays also detected a loss of voltage. This actuated Train A Blackout Relay at 1405:35:436 hours, thus initiating a Diesel Generator 1A start signal. The normal voltage returned to 1TA in 67 milliseconds and, therefore, returned normal voltage to 1ETA switchgear. Since the loss of voltage on 1ETA was not sustained for the 8 second test period, Diesel Generator 1A did not load.

At 1406 hours, another related event occurred. The turbine stop valves, control valves, and combined intercept valves opened, thereby rolling the turbine. The turbine reached a speed of 1500 rpm before it was manually tripped approximately 16 minutes later.

At 1406:27 hours, the crew, who was still unaware of the events that had taken place, re-energized the DC control power to GPCB 1B and succeeded in tripping the breaker via the local trip pushbutton.

After the turbine was tripped, recovery from the incident continued. The Diesel Generators were shutdown, and Zone B and G Lockouts were reset. Also, switchyard PCB's 14 and 15 were closed, and 6900V switchgear incoming and tie breakers were returned to normal alignment.

CONCLUSION

The undervoltage relays on 1ETA and 1ETB are instantaneous relays. On an undervoltage signal, these relays will actuate their Blackout Logic and start their associated Diesel Generator. For the case involving undervoltage on 1ETB, under voltage was sensed before the 6900V Tie Breaker had time to close to restore normal voltage. For the case involving undervoltage on 1ETA, a momentary voltage dip on the 6900V switchgear was sensed by 1ETA undervoltage relays before the voltage had time to return to normal. Therefore, this incident is classified as a Design Deficiency. One other incident at Catawba has been experienced as a result of the instantaneous undervoltage relays on the essential buses and was reported in LER 413/84-31-00 dated January 15, 1985.

Catawba's currently installed instantaneous relays cause false starts of the Diesel Generators and unnecessary wear and tear on the Diesel. Station Problem report SPR #CNPR00120 was issued on November 13, 1984, for Catawba to replace the instantaneous relays with time delay relays.

Other problems were identified as a result of this incident. The circuits on both GPCB's are designed such that if the exciter field breaker is open, if neither of their associated MOD handles are in the safe position, and if the GPCB is closed, a loss of exciter Zone G Lockout will result. The situation that existed at the time of the incident was that the exciter field breaker was open and both 1BT and 1BG MOD's were in the auto position. The crews involved, unaware of the consequences of the situation, manually closed GPCB 1B. Procedures were not used on this job because the GPCB's and control are non-safety related.

Also occurring automatically during this incident was an attempted Turbine roll to rated speed when GPCB 1B was closed. The Electrohydraulic Control (EHC) System circuitry is designed such that if a GPCB is closed while either associated switchyard Unit PCB is closed, the EHC System detects that the generator is connected to the Transmission System if the turbine is reset. Since this situation existed, the turbine selected rated speed and attempted to roll towards 1800 rpm to prevent the generator from motoring. This problem could have been prevented if the turbine was tripped at the time GPCB 1B was closed. However, since the Generator was not actually tied to the Transmission System since the MOD's were open, another design problem is evident.

Another minor problem identified was several computer points failing to alarm. When an undervoltage signal was received on 1ETA switchgear, only event recorder point ER336 (ETA undervoltage phase Y) alarmed. Event recorder points ER335 (ETA undervoltage phase X) or ER337 (ETA undervoltage phase Z) did not alarm.

At least one of these should have alarmed because the Diesel will not start unless 2-out-of-3 phases detect undervoltage. Per Transmission relay setting sheets, Y phase ETA undervoltage setting was slightly lower than Z or X phase undervoltage settings. Thus, X and Z phase points should have actuated. Also, when all B train incoming feeders to 6900V switchgear tripped, event recorder point ER255 (TB incoming Fdr frm Xfmr T1B open) did not alarm.

CORRECTIVE ACTION

1. The 6900V Tie Breaker Circuitry operated to return the voltage on bus 1ETB to normal.

2. As soon as voltage was returned to normal from the momentary voltage decrease on the A train side of 1TA, the voltage on bus 1ETA returned to normal.

3. Turbine was tripped manually from a speed of 1500 rpm.

4. Diesel Generators 1A and 1B were shutdown manually.

5. Zone B and G Lockouts were reset.

6. Plant electrical system was aligned to normal.

7. Section was added to Operator Training Lesson Plan explaining consequences of closing a GPCB with either associated Unit PCB closed and the turbine reset.

8. An Operator Update will be issued that re-emphasizes the need to have associated MOD handles in the SAFE position if a GPCB is to be worked on. Also, to be included in the update is how the EHC System is interlocked with the GPCB's.

9. Identify completion of Nuclear Station Modification to replace the undervoltage relays on the 4160V essential switchgear.

10. A copy of this report will be routed to appropriate personnel for training purposes.

11. A work request will be initiated to investigate and repair the faulty event recorder points.

12. The problem associated with EHC circuitry will be reviewed and any necessary corrective action will be taken.

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

SAFETY ANALYSIS

The Diesel Generators automatically started on a loss of voltage signal on the essential buses. On a sustained loss of voltage on 1ETA or 1ETB, the associated 4160V essential and blackout buses would have load-shed and the associated Diesel Generator output breaker would have closed to restore normal voltage to the bus. The associated bus would have then reloaded and powered safety related equipment. No other safety related equipment, or the unit itself, was affected by this incidnet.

The health and safety of the public were not affected by this incident.

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February 21, 1985

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

Subject: Catawba Nuclear Station, Unit 1
Docket No. 50-413

Gentlemen:

Pursuant to 10 CFR 50.73 Section (a) (1) and (d), attached is Licensee Event Report 413/85-07 concerning the auto start of diesel generators during generator PCB troubleshooting. This event was considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

H. B. Tucker/RWO

Hal B. Tucker

RWO:slb

Attachment

cc: Dr. J. Nelson Grace, Regional Administrator
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