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VICE PRESIDENT AND GROUP EXECUTIVE
NUCLEAR OPERATIONS

April 2, 1981

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Virgil C. Summer Nuclear Station
Docket No. 50/395
SER - Confirming Issue 1.7.13 (1)
Degraded Grid Voltage

Dear Mr. Denton:

The attached change to FSAR Chapter 8 provides the information requested by Mr. Om Chopra regarding degraded grid voltage. This should provide sufficient material to resolve SER Issue 1.7.13 item 1. This material will be included in the next FSAR amendment.

If you have any questions, please let us know.

Very truly yours,

T. C. Nichols, Jr.

RC:TCN:pj

Attachment

CC: V. C. Summer w/o att.
G. H. Fischer w/o att.
T. C. Nichols, Jr. w/o att.
C. A. Price w/att.
D. A. Nauman w/att.
W. A. Williams, Jr. w/att.
R. B. Clary w/att.
A. R. Koon w/att.
A. A. Smith w/att.
H. N. Cyrus w/att.
J. B. Knotts, Jr. w/att.
J. L. Skolds w/att.
B. A. Bursey w/att.
O. S. Bradham w/att.
ISEG
NPCF/Whitaker
File
PRS

E

are established, closes the emergency power source circuit breaker. In the case of a safety injection signal and/or ESF bus undervoltage, the ESF loading sequencer (see Section 7.3.1 for a detailed discussion) trips selected bus loads including all non-class 1E loads. The bus is then reloaded in the sequence shown in Table 8.3-3. Items indicated by zero second loading sequence in Table 8.3-3 are not tripped and, therefore, are immediately loaded when the emergency power source circuit breaker is closed. All other required loads are loaded in sequence by the ESF loading sequencer. | 1

The 7.2 Kv ESF buses are each provided with three loss of voltage relays set at approximately 80 percent of the nominal bus voltage level and three degraded voltage relays set at approximately 91.34 percent of the nominal bus voltage level. Operation of a set of loss of voltage or degraded voltage relays will initiate a diesel generator start, a permissive for EFW turbine pump start, an engineered safety features load sequence operation and a permissive for diesel generator circuit breaker close. These operations occur in a timed sequence as outlined in Table 8.3-5. The logic of the controls are illustrated in Figure 8.3-0a. | 26

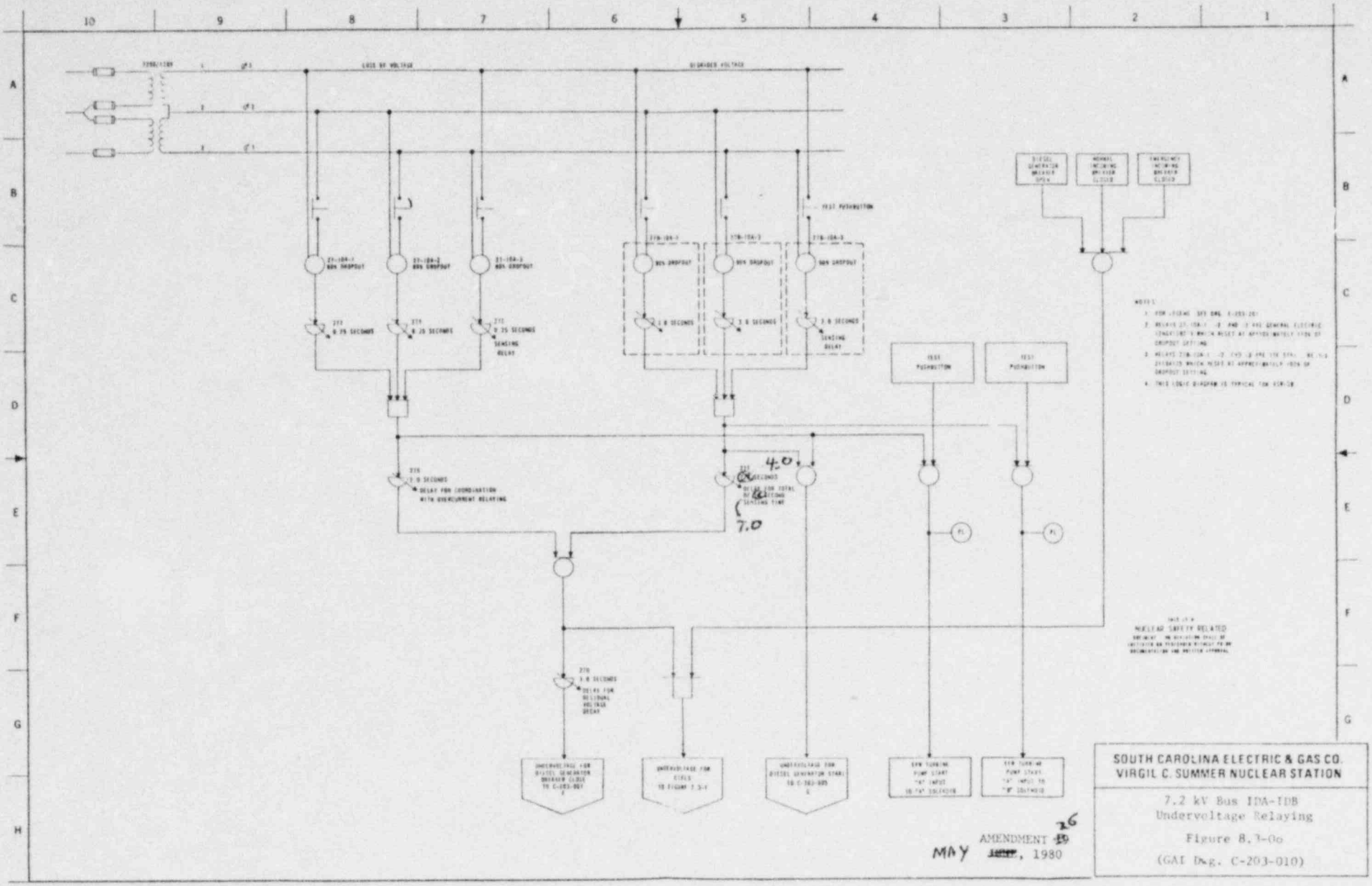
As illustrated in Table 8.3-5 the 7.2 Kv bus circuit breakers are tripped 4 seconds after the diesel generator is started on a degraded voltage condition as compared to 2 seconds for a loss of voltage condition. The delay in tripping for a degraded voltage condition allows the bus to be energized during the time the diesel generator is coming up to speed. Therefore, with the degraded voltage condition the maximum dead bus time is 5 1/2 seconds as compared to a 10.25 seconds dead bus time allowed for a loss of voltage condition. | 24 | 26 | 26

Appendix 8F provides a discussion of the time sequence of equipment operation with a degraded voltage condition coincident with an accident condition. (Appendix to be provided later). When the diesel generators are started and loaded as a result of an undervoltage condition, the ESF | 26

TABLE 8.3-5

Sequence of Operation Following a Loss or Degraded Voltage Condition

Items of Operation	Loss of Voltage Time in Seconds	Degraded Voltage Time in Seconds
Loss or Degraded Voltage Condition	0	0
Diesel Generator Start	0.25	3
Permissive to EFW Pump Start	0.25	3
Initiate ESFLS Operation	2.25	~~10~~ 7
7.2Kv Bus Circuit Breaker Trip	2.25	~~10~~ 7
Permissive to Close Diesel Generator Circuit Breaker	5.25	~~15~~ 10
Diesel Generator Ready to Load (Initiate Block Loading)	10.25	13



SOUTH CAROLINA ELECTRIC & GAS CO.
VIRGIL C. SUMMER NUCLEAR STATION

7.2 kV Bus IDA-IDB
Undervoltage Relaying

Figure 8.3-6o

(GAI Dwg. C-203-010)

AMENDMENT 19 36
MAY ~~JUNE~~, 1980

APPENDIX 8F
STARTING SEQUENCE OF ESF EQUIPMENT FOLLOWING AN ACCIDENT COINCIDENT WITH A DEGRADED VOLTAGE CONDITION

INTRODUCTION

The following study identifies the timed sequence of starting the ESF system equipment for an accident coincident with degraded voltage on the offsite power system. The accidents considered are (1) Loss of Coolant Accident (LOCA) and (2) Main Steam Line Break (MSLB). The study compares the equipment starting times during accident conditions, with a degraded voltage to the starting times assumed in the accident analyses with total loss of voltage. See tables 1 and 2.

DISCUSSION

During these two accident scenarios the diesel generator will start when safety injection is initiated at time zero. A maximum of 10 seconds is then required for the generator to reach the speed and voltage necessary to connect to the ESF buses.

The degraded voltage relays are set to actuate at 91.34% of nominal voltage. If the voltage drops below 80% of nominal, the undervoltage relays will actuate. A time delay of 3 seconds is provided before the degraded voltage relays signal the diesel to allow for voltage dips caused by a large motor starting. However, it should be noted that for these accidents the diesel was started at time zero by safety injection; therefore the signal to start the diesel generated by the degraded voltage relay is duplicative. If the degraded voltage condition persists for 4 more seconds (now a total of 7 seconds), the 7.2 kV ESF buses are cleared. An additional time delay of 3 seconds is then provided to allow residual motor voltage to decay.

CONCLUSION

Under the accidents discussed here, a maximum of 10 seconds is required before the diesel generator can be connected to the ESF buses. However, if there is no accident and a degraded voltage condition exists, a maximum of 13 seconds would be required before the diesel is connected.

TABLE 1

DEGRADED GRID VOLTAGE COINCIDENT WITH LOCA

TIME (Seconds)	DESCRIPTION OF EVENT
0	Degraded voltage condition on 7.2Kv ESF Busses Loss of Coolant Accident (S.I. Signal - Start Diesel Generator signal).
3	Degraded voltage detection signal.
7	Clear 7.2Kv ESF bus (Trip incoming and feeder breakers).
10	Close Diesel Generator breaker. Start load block #1 (Start SI/Charging Pump, Start opening valves).
12 (25.57)-Note 1	SI/Charging Pump at full speed (∿2 sec starting time).
15	Start RHR Pump.
19 (25.57)-Note 1	RHR Pump at full speed (∿ 4 sec starting time).
20	Start S. W. Pump. Start Chilled Water Pump.
22 (25.57)-Note 1	Safety Injection related valves at their final position (12 sec travelling time per FSAR, Section 15.4.2.1.2.1, page 15.4-31).
24.5 (60)-Note 2	S. W. Pump at full speed (∿4.5 sec starting time).
25	Start Component Cooling Pump.
	Component Cooling Pump at full speed (∿4 sec starting time).
30	Start Emergency Feedwater Pump.
35	Start Reactor Building Cooling Units. Start Fuel Handling Building Exhaust Fan.
40	Start S. W. Booster Pump.
42 (60)-Note 3	Emergency Feedwater Pump at Full Speed. (∿12 sec starting time)

TABLE 1 - (Continued)

DEGRADED GRID VOLTAGE COINCIDENT WITH LOCA

TIME (Seconds)	DESCRIPTION OF EVENT
43 (43)-Note 4	Reactor Building Cooling Units at full speed and air flow has reached operating values (8 sec delay from time of starting the fans to the time of having reached operating values of air flow per FSAR, Section 6.2.2.2.2.2, page 6.2-58)
45	Start HVAC Chiller. S. W. Booster Pump at full spped (5 sec starting time per FSAR, Section 6.2.2.2.2.2, page 6.2-59).

NOTES:

1.) Per FSAR Table 15.4-1, page 15.4-96.
2.) Critical case is the requirement to provide cooling water to the Diesel Generator within 1 minute from the time of starting.
3.) Per FSAR, Section 15.4.2.2.2.1, page 15.4-44.
4.) Per FSAR, Section 6.2.1.3.4.3, page 6.2-20a.

TABLE 2

DEGRADED GRID VOLTAGE COINCIDENT WITH MSLB

TIME (Seconds)	DESCRIPTION OF EVENT
0	Degraded voltage condition on 7.2Kv ESF Buss on Main Steam Line Break Accident (S.I. Signal - Start Diesel Generator signal).
3	Degraded voltage detection signal.
7	Clear 7.2 Kv ESF bus (Trip incoming and feeder breakers).
10	Close Diesel Generator breaker. Start load block #1 (Start S1/Charging Pump, Start opening valves).
12 (22)-Note 1	SI/Charging Pump at full speed (∿2 sec starting time).
15	Start RHR Pump.
19 (22)-Note 1	RHR Pump at full speed (∿4 sec starting time).
20	Start S. W. Pump. Start Chilled Water Pump.
22 (22)-Note 1	Safety Injection related valves at their final position (12 sec traveling time per FSAR, Section 15.4.2.1.2.1, page 15.4-31).
24.5 (60)-Note 2	S. W. Pump at full speed (∿4.5 sec starting time),
25	Start Component Cooling Pump.
29	Component Cooling Pump at full speed (∿4 sec starting time).
30	Start Emergency Feedwater Pump.
35	Start Reactor Building Cooling Units. Start Fuel Handling Building Exhaust Fan.
40	Start S. W. Booster Pump.
42 (60)-Note 3	Emergency Feedwater Pump at full speed. (∿12 sec starting time)

TABLE 2 - (Continued)

DEGRADED GRID VOLTAGE COINCIDENT WITH MSLB

TIME (Seconds)	DESCRIPTION OF EVENT
Λ 43 (43)-Note 4	Reactor Building Cooling Units at full speed and air flow has reached operating values (8 sec delay from time of starting the fans to the time of having reached operating values of air flow per FSAR, Section 6.2.2.2.2.2, page 6.2-58).
45	Start HVAC Chiller. S. W. Booster Pump at full speed (5 sec starting time per FSAR, Section 6.2.2.2.2.2, page 6.2-59).

NOTES:

1.) Per FSAR, Section 15.4.2.1.2.1, page 15.4-31.
2.) Critical case is the requirement to provide cooling water to the Diesel Generator within 1 minute from the time of starting.
3.) Per FSAR, Section 15.4.2.2.2.1, page 15.4-44.
4.) Per FSAR, Section 6.2.1.3.4.3, page 6.2-20a.