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DENTON,H.R. Office of Nuclear Reactor Regulation
REID,R.W. Operating Reactors Branch 4

SUBJECT: Forwards summary of events involving partial or total loss of offsite power to facilities & responses to NRC questions, per NRC 800505 ltr.

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June 4, 1980

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

Attention: Mr. R. W. Reid, Chief
Operating Reactors Branch No. 4

Re: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Sir:

With regard to Mr. Reid's letter of May 5, 1980 concerning the adequacy of offsite power systems at nuclear power plants, attached is a summary of events involving partial or total loss of offsite power to the Oconee Nuclear Station. Also included for each event are the answers to the questions transmitted by that letter.

Very truly yours,

William O. Parker, Jr.

SRL:scs
Attachment

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A. Partial Losses Offsite Power Sources

I. On December 19, 1973 prior to Unit #3 initial startup, an error was made during a test of the Unit #3 7KV electrical trip relaying resulting in a partial loss of offsite power to Unit #2.

1. How many circuits to the offsite network are normally available and how many were lost during the event?

Attachment A.1 illustrates the Oconee Nuclear Station 525-230KV Switching Station. The red and yellow buses of the switchyard can be energized from a variety of sources which then can be tied into each of Oconee's three units through the unit's main and auxiliary transformer (ex. to unit #1 through transformers 1 and 1T) or through the unit's startup transformer (ex. to unit #1 through CT1). Usually any of the offsite transmission lines connecting either the 230 or 525KV switchyard buses are available as normal offsite power sources. An exception to the sources considered offsite and shown on attachment A.1 are the two hydroelectric generating units of Keowee which is considered an onsite power source.

During this event the 230KV red switchyard bus isolated from the station (Units #1,2,3) and the yellow switchyard bus isolated from unit #2 startup transformer only. This resulted in unit #2 without one of two normal sources of offsite power. Units #1 and #3 retained all normal offsite power.

It should be noted that each Oconee startup bus can be tied to an adjoining unit through disconnect switches for a backup emergency power source.

2. What was the cause of the event?

This event was caused by improper testing of lockout relays due to not using the correct procedures. During the test the trip circuits for PCB-25 and 26 were defeated. When a lockout relay was actuated to test the tripping of PCB-25 and 26, breaker failure relays (not defeated) picked up and caused the isolation of the 230KV switchyard red bus as described above.

3. Why did the other lines not fail when some did fail?

The design scheme which caused the red bus to isolate to protect against breaker failure also provided that both the red bus and yellow bus would not isolate conjunctively due to one breaker failure. No offsite transmission lines into the switchyard failed.

4. Was any voltage increase or decrease experienced just prior to or during the outage? If so, please give details, voltages reached, affects, etc.?

No

5. Was any frequency decay experienced just prior to or during the outage? If so, please give details, lowest frequency reached, decay rate, affects on equipment operation, etc.

A noticeable frequency decay did not occur.

6. How long was power unavailable from the circuit?

15 minutes

II. On July 18, 1979 an electrical disturbance caused by lightning occurred on the Flint Black line away from the station and the switchyard. The Flint Black breaker at North Greenville developed a phase to ground fault about 14 msec. after it tripped in response to the lightning. The North Greenville fault did not clear for about 0.32 sec. causing voltage changes at Oconee and causing unit #2 to trip due to tripping of the unit #2 Reactor Coolant Pump power monitor input to the Reactor Protection System. An actual loss of power did not occur.

1. How many circuits to the offsite network are normally available and how many were lost during the event?

Refer to the first paragraph of A.I.1.

No offsite circuits were lost during this event.

2. What was the cause of the event?

Since the North Greenville red bus did not isolate for 0.32 sec. after the initial ground fault occurred voltage degradation of sufficient magnitude at Oconee caused the reactor coolant pump power monitors to trip. This caused the reactor to trip which in turn caused a turbine-generator trip. When the unit #2 generator lockout relays 86GA and 86H tripped, a signal was sent to the switchyard to trip PCB #23 and PCB #24.

3. Why did the other lines not fail when some did fail?

There were no failed lines during this transient event. This event was caused by several compounding circumstances which for the short period of time effected only the power pump monitors on the reactor coolant pumps of unit #2. Unit #3 was shutdown at the time, thus its reactor coolant pumps were not running. Unit #1 was in hot standby.

4. Was any voltage increase or decrease experienced just prior to or during the outage? If so, please give details, voltages reached, affects, etc.

As a result of events at North Greenville and on the Flint Black line, both buses of the 230KV switchyard at Oconee experienced a voltage drop. The magnitude and duration of the voltage drop were as follows:

Phase	% of Normal Voltage	Duration of Drop (in msec.)
x	≃ 95	≃ 200
y	≃ 78	≃ 367
z	≃ 95	≃ 200

5. Was any frequency decay experienced just prior to or during the outage? If so, please give details, lowest frequency reached, decay rate, affects on equipment operation, etc.

A noticeable frequency decay did not occur.

6. How long was power unavailable from the circuit?

The voltage transient during this event lasted 0.32 seconds which was long enough for the reactor coolant pumps power monitor to initiate a reactor and turbine-generator trip.

B. Loss of all Offsite Power Sources

I. On January 4, 1974 a spurious signal in a multiconductor cable between the station and the 230KV switchyard actuated solid-state breaker failure relays in the switchyard resulting in total isolation of the 230KV switchyard. Onsite emergency power was available from both of Keowee Hydroelectric units to the 4160 volt standby bus of Oconee 1,2 & 3 through the underground feeder. The 525KV switchyard through the unit #3 main output transformer no. 3 and auxiliary transformer #3T could have provided emergency power if needed to Units 3 and 2.

1. How many circuits to the offsite network are normally available and how many were lost during the event?

Refer to the first paragraph of A.I.1.

During this event the entire Oconee 230KV switchyard was lost leaving only Keowee Hydro and the Oconee 525KV switchyard (through transformers #3 and 3T) to provide emergency power.

2. What was the cause of the event?

This event was caused by a spurious signal being induced into multiple circuits of a multi-conductor cable connecting the station with the switchyard. The induced voltages in the cable conductors initiated the actuation of several breaker failure relays in the switchyard. Since these breaker failure relays were associated with breakers connected to both the yellow and red buses, these buses were tripped.

3. Why did the other lines not fail when some did fail?

All 230 KV switchyard sources remained energized even though they were isolated from the 230KV Oconee switchyard.

This event occurred due to induced spurious voltages into the multi-conductor cable resulting in multiple breaker failure relay actuation. To prevent any future occurrences of this type interposing relays were installed to provide isolation from spuriously induced voltages. Also, individual shielded cables were run for each circuit as an added measure of protection.

4. Was any voltage increase or decrease experienced just prior to or during the outage? If so, please give details, voltages reached, affects, etc.

The only voltage fluctuations experienced were the spurious voltages induced into the multi-conductor cable.

5. Was any frequency decay experienced just prior to or during the outage? If so, please give details, lowest frequency reached, decay rate, affects on equipment operation, etc.

No

6. How long was power unavailable from the circuit?

Less than one hour.