



South Carolina Electric & Gas Company
P.O. Box 88
Jenkinsville, SC 29065
(803) 345-4040

John L. Skolds
Vice President
Nuclear Operations

February 11, 1993
Refer to: RC-93-0040

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

Gentlemen:

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS)
DOCKET NO. 50/395
OPERATING LICENSE NO. NPF-12
LER 93-001 (ONO 930004)

Attached is License Event Report No. 93-001 for the VCSNS. This report is submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv).

Should there be any questions, please call us at your convenience.

Very truly yours,

John L. Skolds

CAC:smd
Attachment

c: O. W. Dixon
R. R. Mahan
R. J. White
S. D. Ebnetter
G. F. Wunder
General Managers
Marsh & McLennan
B. C. Williams
T. L. Matlosz
L. D. Shealy

K. W. Woodward
S. R. Hunt
J. W. Flitter
L. J. Montondo
NRC Resident Inspector
J. B. Knotts Jr.
INPO Records Center
NSRC
RTS (ONO 930004)
File (818.05 & 818.07)

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LICENSEE EVENT REPORT (LER)

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ABSTRACT (Limit to 1400 space, i.e., approximately fifteen single-space typewritten lines) (16)

At approximately 0854 on January 12, 1993, the reactor tripped from 100% power on positive flux rate on all four power range channels. With no work being performed on generator protective relays or in the switchyard, a generator backup auxiliary time delay relay spuriously actuated and opened the transformer high side oil circuit breaker (OCB 8902). When it opened, the generator was left supplying only the balance of plant (BOP) busses through the generator breaker. The instantaneous loss of load caused a rapid generator speed increase which resulted in bus frequency increasing to approximately 62.5 hertz. The reactor coolant pumps (RCP), powered from the BOP busses, increased reactor coolant system (RCS) flow. The increased flow caused a reduction in core differential temperature, which increased core water density. This, combined with the large negative moderator temperature coefficient at end of life, caused a neutron flux increase and a reactor trip occurred.

The reactor protection system responded as designed. When the generator breaker opened with OCB 8902 already open, there was no backfeed available to the BOP busses and they were deenergized. At 1039 the BOP busses were reenergized. "A" RCP was started at 1113 terminating natural circulation of the RCS.

The cause of the spurious actuation of the generator backup auxiliary time delay relay is unknown; however, the auxiliary time delay relay, along with another relay of the same type, and the generator backup protection relays that feed a signal to the auxiliary time delay relay were replaced.

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104

EXPIRES 8/31/85

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TEXT (If more space is required, use additional NRC Form 365A a) (17)

PLANT IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

EQUIPMENT IDENTIFICATION:

Distance Relay, EIIIS System Code - EL
Direct Current (DC) General Electric (GE)
Timing Relay, Type SAM14B15A

IDENTIFICATION OF EVENT:

At the time of trip, Operations personnel observed annunciator alarms for OCB 8902 opening and power range positive flux rate. When the generator breaker opened approximately 30 seconds later, the BOP busses deenergized and the RCS entered a natural circulation condition. The plant was stabilized in Mode 3 and remained in natural circulation until a review determined the cause of the loss of the BOP busses.

EVENT DATE: January 12, 1993REPORT DATE: February 11, 1993

This report was initiated by Off-Normal Occurrence report 93-004.

CONDITIONS PRIOR TO THE EVENT:

Mode 1, 100% reactor power

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DESCRIPTION OF EVENT:

On January 12, 1993, the reactor was in Mode 1 at 100% power. With no input from any generator backup protective relay, an auxiliary timing relay spuriously actuated and energized the trip coils on the transformer high side oil circuit breaker (OCB 8902). When it opened, the generator was left supplying the balance of plant (BOP) busses through the generator breaker. The instantaneous loss of load caused the generator to rapidly increase speed which resulted in bus frequency increasing to approximately 62.5 hertz. The reactor coolant pumps (RCP), energized by the BOP busses, increased their speed. A reactor trip occurred from 100% power on positive rate of all nuclear instrumentation power range channels approximately 0.7 seconds after OCB 8902 opened.

CAUSE OF EVENT:

The cause of the OCB opening has been attributed to the spurious actuation of a generator backup auxiliary time delay relay (21GX-2 relay). This relay had a target, although none of the generator backup protection relays that provide an input to 21GX-2 had targets. Both OCB trip coils received a valid signal. The only relays that can provide this signal are lockout relays and the generator backup protection circuit relays. There were no targets on any lockout relays and none required manual resetting by the operator, therefore, the conclusion was reached that 21GX-2 had spuriously actuated.

The cause of the reactor trip was positive flux rate, which occurred 0.7 seconds after OCB 8902 opened. The instantaneous loss of generator load caused a rapid turbine generator speed increase due to the now large mismatch of steam in the turbine versus electrical load (house loads). Since the RCPs are energized from the BOP busses, they correspondingly increased their speed due to the electrical frequency changes.

This increase in RCP speed is directly proportional to an increase in RCP flow. The increase in RCP flow caused a reduction in the core differential temperature. This resulted in an effective increase in the average core water density. Virgil C. Summer Nuclear Station was approaching the end of core life and had a correspondingly large negative moderator temperature coefficient. The combination of the above caused a flux increase transient and resulted in a reactor trip.

The cause of the loss of power to the BOP Busses is as follows. The 7.2 kilovolt bus design includes the ability to automatically transfer from normal incoming power to the emergency power under certain conditions. In order to have an emergency transfer, both the OCB 8902 and the generator breaker must open together. This condition will send a trip signal to the normal incoming breaker. The emergency incoming breaker will then close if the normal breaker is starting to open, the high side OCB has been open for less than 15 cycles, and no electrical faults are present on the emergency power source. Since OCB 8902 was open for far longer than 15 cycles, approximately 31 seconds before the generator breaker opened, there was no signal for the BOP busses to automatically transfer.

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TEXT (if more space is required, use additional NRC Form 365A (1/117))

ANALYSIS OF EVENT:

This report is being submitted pursuant to the requirements of 10CFR50.73(2)(a)(iv). Notification to the NRC Operations Center via the Emergency Notification System was made at 0956 hours on January 12, 1993, per the requirements of 10CFR50.72(b)(2)(ii).

A post trip review did not identify any unacceptable performance of safety systems. The Engineered Safety Features systems busses remained energized throughout the event. All safety systems in operation continued to function as required. The only automatic actuation of Engineered Safety Features systems were the motor driven emergency feedwater pumps, which started on the loss of all main feedwater pumps as the BOP busses lost power.

A review determined that the BOP bus response to the opening first of OCB 8902 and then the generator breaker was as designed. At 1039 the BOP busses were reenergized. One RCP was started at 1113 terminating natural circulation of the RCS.

A review of other plant performance following the trip determined that equipment response was as expected. A review of the historic data for the power range and intermediate range instruments did indicate a rise in flux immediately prior to the trip.

Operations, computer services, and Westinghouse personnel investigated the power range positive flux rate trip. The conclusion reached was that this trip during the transient was expected.

No main steam safety valves or power operated relief valves (PORV) actuated. Some secondary relief valve operations during the reactor trip transient and subsequent PORV operations to maintain RCS temperature resulted in a release of gaseous effluents. Calculations performed in accordance with the offsite dose calculation manual determined that the release was 0.063 milliRem (<0.9% of allowable releases/quarter).

IMMEDIATE CORRECTIVE ACTIONS:

Following the reactor trip, the operating shift placed the plant in a stable condition in accordance with Emergency Operating Procedure (EOP) 1.0, "Reactor Trip/Safety Injection Actuation," and EOP-1.1, "Reactor Trip Recovery." Natural circulation was verified by the operating shift. Maintenance, Engineering, and Relaying personnel investigated the relay actuation. A preliminary evaluation of the event revealed that there was no work ongoing with the 21GX-2 relay or any other relays. No ground detection work was in progress at the time of the OCB opening. The switchyard oscillograph showed that no pre-fault condition existed in the switchyard busses or main transformer. The OCB oil was sampled, but no contaminants were found.

Relays that would send input signals to both OCB trip coils were found to be lockout relays and relays associated with the generator backup protection circuit. Lockout relays actuate a target and mechanically lock the relay in, both of which require to be

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manually reset. No lockout relay actuated that could have resulted in opening OCB 8902. With the exception of the 21GX-2 relay, no other generator backup protection relays were found to have actuated.

The 21GX-2 relay is located in the generator backup protection circuit. One target was actuated, so the investigation focused on it. Because the time delay circuit target was not in, but only the relay actuation target, a ground search on the relay cables and the OCB trip bus was performed. No grounds were found. The calibration of the 21GX-2 relay was checked and found to be within tolerances. The 21GX-2 relay and all other generator backup protection relays were functionally tested satisfactory. Finally; the 21GX-2 relay, an additional relay of the same type, and the relays that provide an input to them were replaced.

ADDITIONAL CORRECTIVE ACTIONS:

A lessons learned feedback to operations has been initiated by Virgil C. Summer Nuclear Station. Lessons learned on the loss of power will be used in reviewing emergency operating procedures and abnormal operating procedures. This procedure review will be completed by September 1, 1993.

PRIOR OCCURRENCES:

None.