10CFR50.73

SCE&G
A SCANA Company

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

Ollie S. Bradham
Vice President
Nuclear Operations

January 23, 1990

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

Subject: Virgil C. Summer Nuclear Station
Docket No. 50/395
Operating License No. NPF-12
LER 89-011, Revision 1

Gentlemen:

Attached is Revision 1 to Licensee Event Report No. 89-011 for the Virgil C. Summer Nuclear Station. Specifically, the revision identifies the cause of the May 28, 1989, pressurizer safety valve misoperation and supplements the "Additional Corrective Action " section. Additionally, the pressure at which the manual reactor trip was initiated has been revised to 2000 psig. This number is in better agreement with engineering analysis and the Technical Support Center event printout than the 1900 psig previously reported. 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,

OSBradham

O. S. Bradham

EWR/OSB:lcd
Attachment

c: D. A. Nauman/O. W. Dixon, Jr./T. C. Nichols, Jr.
E. C. Roberts
R. V. Tanner
S. D. Ebneter
J. J. Hayes, Jr.
General Managers
C. A. Price
G. J. Taylor
J. R. Proper
R. B. Clary
F. H. Zander
T. L. Matlosz
K. E. Nodland
J. C. Snelson
R. L. Prevatte
J. B. Knotts, Jr.
INPO Records Center
ANI Library
Marsh & McLennan
NSRC
NPCF
RTS (ONO 890047)
Files (818.05 & 818.07)

IE22
1/1

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)
Virgil C. Summer Nuclear Station	0 5 0 0 0 3 9 5	1 OF 0 5

TITLE (4)
Manual Reactor Trip Due to Pressurizer Safety Valve Failure

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	2 8	8 9	8 9	— 0 1 1	— 0 1	0 6	2 7	8 9		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

20.402(b)	20.405(c)	X 50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
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)
W. R. Higgins Supervisor, Regulatory Compliance	8 0 3 — 3 4 5 1 — 4 0 4 2

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
X	A B	R V	C 7 1 0	Y					

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)

At 0252 hours, May 28, 1989, a manual Reactor Trip was initiated following the failure of a Pressurizer Safety Valve. The valve (XVS-8010-C) became unseated causing a rapid depressurization of the Reactor Coolant System. The manual Reactor Trip was initiated at approximately 2000 psig and the safety valve reseated prior to reaching the Safety Injection setpoint of 1850 psig. The Reactor Coolant System pressure recovered and was stabilized at approximately 2000 psig.

During the transient, a condenser steam dump valve failed to close and an operator had to fail the air to the valve for closure.

Pressurizer Safety Valves (XVS-8010-B and C) were replaced and the reactor was restarted at 0049 hours, June 11, 1989. Note: Valve 8010 B was replaced due to minor leakage past the seat.

The Licensee has determined that the reason for the misoperation of XVS-8010-C is that the expected margin between normal operating pressure and the pressurizer safety valve relief setpoint pressure was reduced to zero. It was also determined that the most prevalent factor in this margin reduction was a loop seal discharge. This discharge resulted in a reduced valve setpoint because of the steam medium imposed on the valve. As such, the Licensee is focusing the corrective action plan on the elimination of loop seal capability for the pressurizer safety valves.

NOTE: A subsequent report (LER 89-015 dated September 20, 1989) documents a similar event involving pressurizer safety valve XVS-8010-A. The Licensee has determined that a loss of loop seal was the cause for the misoperation of XVS-8010-A.

Plant Identification

Westinghouse - Pressurized Water Reactor

Equipment Identification

Pressurizer Safety Valve - EIIS - None

Identification of Event

A Pressurizer Safety Valve became unseated causing a rapid decrease in Reactor Coolant System (RCS) pressure. A manual Reactor Trip was initiated at approximately 2000 psig.

Event Date

May 28, 1989

Discovery Date

May 28, 1989

Report Date

June 27, 1989

This report was initiated by Off-Normal Occurrence Report 89-47.

Condition Prior to Event

Mode 1 - 100 percent

Description of Event

At 0252 hours, May 28, 1989, a manual Reactor Trip was initiated following the failure of a Pressurizer Safety Valve. The valve (XVS-8010-C) became unseated causing a rapid depressurization of the Reactor Coolant System (RCS). The manual Reactor Trip was initiated at approximately 2000 psig and the safety valve reseated prior to reaching the Safety Injection setpoint of 1850 psig. The RCS recovered and was stabilized at approximately 2000 psig.

Indication of a possible safety valve problem had been noted at 0024 and 0034 hours upon intermittent actuation of the "Pressurizer Safety Valve Open" annunciator on the Main Control Board and changes in the Safety Valve tailpipe temperature. Instrument and Controls (I&C) personnel were requested to install multichannel recorders on the Pressurizer Safety Acoustic Monitor to aid the operators in determining the extent of the problem. During the installation of the recorder, two additional events occurred at 0133 and 0206 hours. At 0252 hours, the fifth event occurred which resulted in the depressurization of the RCS and the initiation of a manual Reactor Trip. The previous

events had produced no corresponding decrease in RCS pressure or increase in the Pressurizer Relief Tank pressure and temperature.

During the transient, a condenser steam dump valve failed to close and an operator had to fail the air to the valve for closure.

Cause of Event

The Licensee has performed a Root Cause Analysis and has determined that the basic reason for the misoperation of XVS-8010-C is that the expected margin of 250 psi (10 percent) between the normal operating pressure and the safety valve setpoint pressure was reduced to zero. The Licensee has divided the contributing factors in this margin elimination into two categories: 1) valve-specific factors, and 2) non valve-specific factors. Of the 10 percent margin reduction, the analysis has quantified approximately 6.6 percent, and has identified factors which contribute to the remaining margin but cannot be quantified.

The valve-specific contributing factors are those factors which have been tested and analyzed for XVS-8010-C. These valve-specific contributing factors, which make up approximately 6 percent of the eliminated 10 percent margin, are: 1) loop seal discharge and 2) setpoint variations. While the analysis was performed specifically for XVS-8010-C, the factors identified are expected to be generic to all safety valves, but the numerical results are unlikely to be duplicated .

The first valve-specific factor contributing to the margin reduction is the loss of loop seal on the valve. A test was performed on XVS-8010-C to measure the pressure where valve leakage exceeded condensation into the loop seal. This test, which is a slow pressure increase ramp test performed on the test stand, is important because it specifies the pressure at which loop seal discharge occurs. For XVS-8010-C, this pressure was found to be 118 psig (4.7 percent) below the setpoint pressure of 2485 psig.

The second valve-specific factor identified by the Licensee is the setpoint variation which XVS-8010-C exhibits when the valve body temperature is increased. A setpoint reduction of 22 psig (1 percent) was measured during a steam soak test using the Setpoint Verification Device (SPVD) with the loop seal in place. This setpoint change is due to valve stem motion as the valve body temperature increases. This setpoint reduction may not be evident when the valve setpoint is established under ambient operating conditions.

The two valve-specific factors identified above combine for a reduction in setpoint of 5.7 percent. This agrees with other testing on XVS-8010-C which shows the valve has a lower lift pressure (in excess of 150 psig) when exposed to steam rather than water. Once the loop seal is lost, the valve is exposed to steam. Since a steam medium on the valve results in a setpoint change of approximately 6 percent (150 psig), this value is used in quantifying the setpoint change. The 4.7 percent from loop seal discharge and the 1.0 percent from setpoint variations are included in the 6 percent.

The second category in which the Licensee has divided the contributing factors for the valve misoperation is the "non-valve specific category." This category contains the factors which depend on components other than the pressurizer safety valves. These

factors, therefore, will impact all of the pressurizer safety valves. In this category, only one factor, instrumentation calibration, can be quantified as to its effects on the setpoint reduction. Instrumentation calibration checks of "As Found" conditions after the event and subsequent evaluations have resulted in a best estimate that the pressure control instrumentation may have been a maximum of 0.6 percent low in indication/control. A 0.6 percent loss of setpoint margin is therefore attributed to pressure instrumentation calibration.

Other non-valve specific contributing factors identified as having a potential for resulting in a setpoint margin loss but which could not be quantified are:

1. Loss of clearance between the tailpipe flange and mounting plate.

   By analyzing the deformation of the irregular flame cut surfaces of the mounting plate where the plate contacted the tailpipe flange, stress levels in the valve body were calculated to be 4,925 psi. Although this stress level is only approximately 18 percent of allowable, some disc-to-nozzle misalignment probably resulted. The non-symmetrical pattern of degradation of the disc and nozzle seating surfaces identified during valve disassembly also confirm that some misalignment was present.

2. Elevated temperature of the valve body due to the insulation configuration results in body expansion that can reduce the setpoint by moving the spring compressed disc in a direction to reduce spring compression of the disc-to-nozzle.

3. A correlation of indicated tailpipe temperature variations with pumping the Pressurizer Relief Tank has been made. Recent close monitoring indicates a direct correlation between pumping the tank and minor temperature excursions on the tailpipe of a leaking safety valve. The exact cause of this pattern has not been identified, and at this time it appears to be only a minor contributor.

4. Hydrogen concentrations in the pressurizer vapor space.

   Preliminary information indicates concentrations of H2 which may alter the thermal characteristics of the valve. Hydrogen concentrations in the vapor space impact the condensation rate into the loop seal, the leak tightness of the valve (H2 vs. water/steam), the control response of the pressurizer heater/spray controls, and other chemical degradation effects.

To summarize, the reason for the misoperation of XVS-8010-C is that the expected margin between normal operating pressure and the safety valve relief setpoint pressure was reduced to zero. Several contributing factors in the margin elimination for XVS-8010-C have been identified. Approximately 6 percent of the 10 percent reduction has been attributed to the difference in setpoint between steam and water. This difference occurred on XVS-8010-C when the loop seal was discharged. Because loop seal discharge and the resulting impact of the water/steam difference is the most impacting of the quantifiable factors, the Licensee is focusing the corrective action plan on the loop seal system. The factors identified are expected to be applicable to all safety valves. The numerical results are expected to be slightly different for each valve.

Analysis of Event

The safety significance of this event was moderate in that if the safety valve had not seated following the Reactor Trip, the Safety Injection System would have been challenged.

Immediate Corrective Action

Immediate corrective action taken was the initiation of the manual Reactor Trip. The operators monitored RCS pressure and were prepared to initiate Safety Injection. Plant parameters were monitored and the plant was stabilized in Mode 3 at a reduced operating pressure of approximately 2000 psig. The plant was subsequently taken to Mode 5 for removal and replacement of the safety valves XVS 8010 B and C.

Additional Corrective Action:

The Licensee has temporarily installed temperature detectors on the pressurizer safety valves to facilitate monitoring of the valve body inlet temperatures. The Licensee has issued a special instruction detailing the monitoring of these temperatures and the initiation of a plant shutdown should a valve body inlet temperature reach 450°F.

NOTE: As the result of a subsequent pressurizer safety valve misoperation on August 25, 1989, noted in LER 89-015, the Licensee has revised the shutdown temperature to 390°F. Additionally, at 350°F action will be taken to develop a plan for plant shutdown taking into account, among other variables, the rate of change of temperature. The Licensee's management and the Resident NRC Inspector will be notified when the safety valve temperature reaches 350°F.

The Licensee intends to: 1) modify the pressurizer safety valves' internals for steam application, and 2) eliminate loop seal capability on the pressurizer safety valves. This modification is scheduled for the fifth refueling outage (currently scheduled to begin March 23, 1990) and is contingent upon receiving the required materials in time for implementation.

Safety valves XVS-8010-B and C were replaced with spare valves. Valve 8010-B was replaced because it was experiencing minor leakage past the seat. Setpoints for all three safeties were verified in Mode 3 prior to restart.

Troubleshooting identified that the malfunction of the condenser steam dump valve was attributed to the current/pressure convertor being out of adjustment. Adjustments were made and the valve satisfactorily tested and declared operable.

Prior Event

None