**George A. Lippard**
*Vice President, Nuclear Operations*
803.345.4810

SCE&G®
A SCANA COMPANY

December 22, 2017

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

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS), UNIT 1
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
LICENSEE EVENT REPORT (LER 2017-005-00)
AUTOMATATIC REACTOR TRIP DUE TO MAIN TURBINE TRIP

Attached is Licensee Event Report (LER) 2017-005-00, for the Virgil C. Summer Nuclear Station. This report describes the automatic reactor trip on turbine trip caused by a loss of Digital Control System (DCS) power to all three Main Feedwater Pumps. This report is submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A).

Should you have any questions, please call Mr. Michael S. Moore at (803)345-4752.

Very truly yours,

For
George A. Lippard

BAB/GAL/wk
Attachment

| | | | |
|---|---|---|---|
| c: | K. B. Marsh | S. A. Williams | Marsh USA, Inc. |
| | S. A. Byrne | Resident Inspector | PRSF (RC-17-0171) |
| | J. B. Archie | L. W. Harris | Maintenance Rule Engineer |
| | N. S. Carns | Paulette Ledbetter | NSRC |
| | J. H. Hamilton | J. C. Mellette | RTS (CR-17-05860) |
| | G. J. Lindamood | ICES Coordinator | File (818.07) |
| | W. M. Cherry | K. M. Sutton | |
| | C. Haney | INPO Records Center | |

# LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/)



| 1. FACILITY NAME | 2. DOCKET NUMBER | 3. PAGE |
|---|---|---|
| V.C. Summer Nuclear Station, Unit 1 | 05000 395 | 1 OF 3 |

**4. TITLE**

AUTOMATIC REACTOR TRIP DUE TO MAIN TURBINE TRIP

| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO. | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER 05000 |
| 11 | 07 | 2017 | 2017 - | 005 - | 00 | 12 | 22 | 2017 | FACILITY NAME | DOCKET NUMBER 05000 |

| 9. OPERATING MODE | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)* | | | |
|---|---|---|---|---|
| 1 | ☐ 20.2201(b) | ☐ 20.2203(a)(3)(i) | ☐ 50.73(a)(2)(ii)(A) | ☐ 50.73(a)(2)(viii)(A) |
| | ☐ 20.2201(d) | ☐ 20.2203(a)(3)(ii) | ☐ 50.73(a)(2)(ii)(B) | ☐ 50.73(a)(2)(viii)(B) |
| | ☐ 20.2203(a)(1) | ☐ 20.2203(a)(4) | ☐ 50.73(a)(2)(iii) | ☐ 50.73(a)(2)(ix)(A) |
| | ☐ 20.2203(a)(2)(i) | ☐ 50.36(c)(1)(i)(A) | ☑ 50.73(a)(2)(iv)(A) | ☐ 50.73(a)(2)(x) |
| **10. POWER LEVEL** | ☐ 20.2203(a)(2)(ii) | ☐ 50.36(c)(1)(ii)(A) | ☐ 50.73(a)(2)(v)(A) | ☐ 73.71(a)(4) |
| | ☐ 20.2203(a)(2)(iii) | ☐ 50.36(c)(2) | ☐ 50.73(a)(2)(v)(B) | ☐ 73.71(a)(5) |
| | ☐ 20.2203(a)(2)(iv) | ☐ 50.46(a)(3)(ii) | ☐ 50.73(a)(2)(v)(C) | ☐ 73.77(a)(1) |
| 100 | ☐ 20.2203(a)(2)(v) | ☐ 50.73(a)(2)(i)(A) | ☐ 50.73(a)(2)(v)(D) | ☐ 73.77(a)(2)(i) |
| | ☐ 20.2203(a)(2)(vi) | ☐ 50.73(a)(2)(i)(B) | ☐ 50.73(a)(2)(vii) | ☐ 73.77(a)(2)(ii) |
| | | ☐ 50.73(a)(2)(i)(C) | ☐ OTHER Specify in Abstract below or in NRC Form 366A | |

**12. LICENSEE CONTACT FOR THIS LER**

| LICENSEE CONTACT | TELEPHONE NUMBER *(Include Area Code)* |
|---|---|
| Michael Moore, Manager Nuclear Licensing | (803) 931-5042 |

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU-FACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|
| B | EE | INVT | C782 | N | B | SJ | ISV | A391 | Y |

| 14. SUPPLEMENTAL REPORT EXPECTED | 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
|---|---|---|---|---|
| ☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☑ NO | | | | |

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

At 1957 on November 07, 2017, VCSNS Unit 1 was operating in Mode 1 at 100% reactor power when a turbine trip caused an automatic reactor trip. All systems responded as expected, with the exception of 'B' Steam Generator Feedwater Isolation Valve (FWIV) XVG1611B-FW. This valve did not appear to automatically close and was slow to indicate closed from the Main Control Board, however this did not complicate the response. All Control Rods fully inserted and all Emergency Feedwater (EFW) pumps started as required. The Operating crew stabilized the plant, which remained in Mode 3 with decay heat removal via the Steam Dump system to the Main Condenser.

The cause of the turbine trip has been determined to be a loss of Digital Control System (DCS) power to all three Main Feedwater Pumps (FWP), which was caused by the failure of Non-Safety Related Inverter XIT5905.

| 1. FACILITY NAME | 2. DOCKET NUMBER | 3. LER NUMBER: YEAR | SEQUENTIAL NUMBER | REV NO. |
|---|---|---|---|---|
| V.C. Summer Nuclear Station, Unit 1 | 05000- 395 | 2017 | - 005 | - 00 |

NARRATIVE

1.0 EVENT DESCRIPTION

At 1957 on November 07, 2017, VCSNS Unit 1 was operating in Mode 1 at 100% power and experienced an automatic reactor trip. All systems responded as expected, with the exception of 'B' Steam Generator Feedwater Isolation Valve (FWIV) XVG1611B-FW. This valve did not indicate closed from the Main Control Board despite the FWIV signal being automatically provided. The operator attempted to close the valve using manual switch manipulation however this was not immediately successful. The valve indicated closed approximately 30 seconds after the manual manipulation. There was no impact to plant operation as a result of the 'B' FWIV failing to close.

All Control Rods fully inserted and all Emergency Feedwater pumps started as required. Feedwater (FW) to the 'B' steam generator (S/G) was automatically isolated by the FW Flow Control Valve and the FW Bypass Valve. All EFW flow responded to provide feedwater to the S/Gs. The Operating crew stabilized the plant, which remained in Mode 3 with decay heat removal via the Steam Dump system to the Main Condenser.

The cause of the turbine trip was determined to be a loss of DCS power to all three Main Feedwater Pumps, which was caused by the failure of Non-Safety Related Inverter XIT5905. Inverter XIT5905 was subsequently placed in "Bypass" to provide power from the Alternate AC source.

The Reactor was returned to Mode 1 and the Breaker was closed on November 10, 2017 at 0720.

2.0 EVENT ANALYSIS

Turbine Trip

The loss of power to the DCS was a result of a failure of Non-Safety Related Inverter XIT5905. The loss of power to the DCS cabinets caused a trip of all three FWPs. When all three FWPs are lost this causes an automatic turbine trip. Since the station was operating at greater than 50% power the automatic turbine trip resulted in a reactor trip.

Maintenance was performed on the XIT5905 inverter earlier in the day prior to the trip. The touchscreen, microprocessor stack on the control board, and the inverter gate driver card were replaced. Troubleshooting performed after the trip found that the recently serviced inverter output waveform was abnormal when viewed on an oscilloscope. The abnormal wave shape lead to the unsuccessful static switch transfer to the alternate source of power. This condition was confirmed by reinstallation of the old card and observing that the inverter section output now exhibited proper symmetry. The observed waveform of the alternate source also had excellent symmetry.

Following the trip, Inverter XIT5905 was left in Bypass Mode, which closes a switch contact to directly supply the output of XIT5905 from the Alternate AC source. The replacement Inverter Gate Drive card will be installed during Refueling Outage 24 (RF-24). Inverter XIT5905 will be returned to normal service following the post maintenance testing.

Feedwater Isolation Valve

When a reactor trip input is received, the P-4 interlock of the Engineered Safety Features Actuation System should close the main feedwater valves on T avg below "low T avg setpoint". This did not occur immediately after receiving a feedwater isolation signal.

NARRATIVE

The FWIV, XVG1611B-FW, indicated closed approximately 30 seconds after manual manipulation of the switch.

An investigation determined that the 'B' FWIV operator air valve assembly was found to have the pilot seat seal on the 'A' train solenoid valve dislodged and a poppet valve seal dislodged. When energized, the 'A' train solenoid valve removes the air supply to the poppet valves, allowing 560 psig air to 'B' FWIV operator thus holding the 'B' FWIV open. When the 'A' train solenoid is de-energized, air supply is provided to the poppet valves, shuttling the poppets to another position, and closing the 'B' FWIV. The poppet valves are located within the air valve assembly.

A work order was generated to repair the 'A' train solenoid valve (pilot seat seal) and the air valve assembly (poppet valve seal) for the 'B' FWIV. The pilot seat seal within the 'A' train solenoid valve was dislodged due to internal pressure built up in the plunger during pilot seat seal installation and normal heat cycling. A new plunger was used during the repair of the 'A' train solenoid. The air valve assembly and solenoid were reinstalled and the 'B' FWIV was retested with no leakage.

3.0 SAFETY SIGNIFICANCE

An evaluation was performed to determine the core damage frequency and large early release frequency impact of a turbine trip and subsequent reactor trip caused by a failure of Inverter XIT5905. The 8b PRA model was used with nominal values for maintenance. A 6.18% increase in Core Damage Frequency and a 7.04% increase in Large Early Release Frequency was observed. A review of the cutsets show that these increases are from the increase in the percent turbine trip initiation event. The modeled failure to isolate XVG01611B-FW does not show up in the results. The impact from this plant trip is not "greater than green".

4.0 PREVIOUS OCCURRENCE

No previous occurrence within the last three years.

5.0 CORRECTIVE ACTIONS

Work Order 1705755 Step 005 was created to repair and test Inverter XIT5905 during the next refueling outage (RF-24). A root cause evaluation is being performed under CR-17-05908. Corrective actions will be determined after this is finalized.