Thomas D. Gatlin
Vice President, Nuclear Operations
803.345.4342

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A SCANA COMPANY

August 3, 2012

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 2012-001-01)
CORE EXIT THERMOCOUPLES & REACTOR WATER LEVEL INDICATION SYSTEM INOPERABLE DUE TO AN INADEQUATE MAINTENANCE PROCEDURE

Attached is Licensee Event Report (LER) No. 2012-001-01 for the Virgil C. Summer Nuclear Station Unit 1. This revised report describes a condition where Core Exit Thermocouples and Reactor Water Level Indication System would not be operable for accident monitoring. This report is submitted in accordance with 10 CFR 50.73(a)(2)(i)(B).

This letter and attached LER contain no new commitments and no revisions to existing commitments.

Should you have any questions, please call Bruce Thompson at (803) 931-5042.

Very truly yours,

Thomas D. Gatlin

TS/TDG/jw
Attachment

c: K. B. Marsh
S. A. Byrne
J. B. Archie
N. S. Carns
J. H. Hamilton
R. J. White
W. M. Cherry
V. M. McCree
R. E. Martin
NRC Resident Inspector
M. N. Browne
P. Ledbetter
J. C. Mellette
EPIX Coordinator
K. M. Sutton
INPO Records Center
Marsh USA, Inc.
R. J. Schwartz
NSRC
RTS (CR-11-01807)
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PRSF (RC-12-0116)

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NRC FORM 366 (10-2010) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2013

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

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

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4. TITLE

Core Exit Thermocouples & Reactor Water Level Indication System Inoperable due to Inadequate Maintenance Procedure

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
01	17	2012	2012	- 1 -	1	08	03	2012	FACILITY NAME	DOCKET NUMBER
										05000

9. OPERATING MODE

1

10. POWER LEVEL

100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☑ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
Bruce Thompson, Manager Licensing, Virgil C. Summer Nuclear Station Unit 1	(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
D	IP	TI		N	D	IP	LI		N

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)*

On January 17, 2012, a past operability analysis determined that Core Exit Thermocouples (CETCs), which are required by Technical Specification 3.3.3.6 for accident monitoring, were inoperable. Additional engineering analysis completed on June 6, 2012, determined that the Reactor Water Level Indication System (RVLIS) (required by Technical Specification 3.3.3.6) was also inoperable.

At the end of Refuel (RF) 18, Control Rod Drive Mechanism (CRDM) Cable Bridge hold-down bolts were not installed following reactor reassembly. Had there been a Loss of Coolant Accident (LOCA) during the subsequent cycle, movement of the bridge could have resulted in damage to the Core Exit Thermocouple (CETC) cables and tubing for the Reactor Water Level Indication System (RVLIS) which would have resulted in loss of monitoring capability. This condition was not discovered until the beginning of RF-19.

An Apparent Cause Evaluation (ACE) determined the cause of the missing hold-down bolts was an inadequate station procedure for Reactor Vessel reassembly.

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NARRATIVE

PLANT IDENTIFICATION
Westinghouse – Pressurized Water Reactor

EQUIPMENT IDENTIFICATION
Control Rod Drive Mechanism (CRDM) Cable Bridge

Core Exit Thermocouples (TI)
Channel A
ITEs 2, 4, 9, 12, 13, 15, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 35, 39, 41, 42, 45, 46, and 47

Channel B
ITEs 1, 3, 5, 6, 7, 8, 10, 11, 14, 16, 17, 18, 20, 30, 34, 36, 37, 38, 40, 43, 44, 48, 49, 50, and 51

Reactor Water Level Indication System (LI)
Channel A
ILT-1311/ILI-1311, ILT-1312/ILI-1312

Channel B
ILT-1321/ILI-1321, ILT-1322/ILI-1322

IDENTIFICATION OF EVENT
At the beginning of Refuel (RF) 19, Virgil C. Summer Nuclear Station (VCSNS) contract employees attempted to raise the CRDM Cable Bridge using VCSNS Maintenance Procedure GMP-100.007, "Maintenance Support for Refueling." When preparing to lift the Cable Bridge, the crew noted that none of the twenty-four (24) hold-down bolts that were supposed to be removed, per the procedure, were installed. The discovery was entered into the VCSNS Corrective Action Program under CR-11-01807, and the subsequent investigation determined that the hold-down bolts were not installed at the end of RF-18. The evaluation for past operability (completed on January 17, 2012), determined that, had there been a Loss of Coolant Accident (LOCA), the CRDM Cable Bridge could have moved enough to damage the Core Exit Thermocouple (CETC) cables and resulted in a loss of core exit temperature monitoring capability. Additional analysis concluded that tubing for the Reactor Water Level Indication System (RVLIS) could have also been damaged during a LOCA and may have resulted in a loss of Reactor Vessel water level monitoring capability. This condition was a violation of Technical Specification 3.3.3.6, "Accident Monitoring Instrumentation," since the required number of CETCs per core quadrant per channel and the required number of Reactor Vessel Water Level Indicators per channel would not have been available during a postulated LOCA.

EVENT DATE
January 17, 2012

REPORT DATE
Initial - March 16, 2012
Revision - August 3, 2012

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CONDITIONS PRIOR TO EVENT
Mode 1, 100% Power

DESCRIPTION OF EVENT
Each refueling outage, 24 hold-down bolts are removed when the CRDM Cable Bridge is raised to support Reactor Vessel Head removal. On April 18, 2011, a VCSNS contract crew attempted to raise the CRDM Cable Bridge using Maintenance Procedure GMP-100.007. When the crew was performing Step 7.2.4.A , "REMOVE bolts which hold bridges to support," it was noted that none of the 24 hold-down bolts were installed. The discovery was documented in the VCSNS Corrective Action Program under CR-11-01807. An Apparent Cause Evaluation (ACE) was performed to determine why the hold-down bolts had not been installed at the end of RF-18. The ACE determined the cause was an inadequate procedure because it did not require verification or documentation of bolt installation during CRDM Cable Bridge reassembly.

On January 17, 2012, VCSNS personnel completed the past operability analysis that determined the CETCs required for accident monitoring were inoperable. The analysis determined the CETCs would have been inoperable if a LOCA had occurred during station operation during the period the CRDM Cable Bridge hold-down bolts were not installed because the CRDM Cable Bridge would have been free to pivot upward, damaging cable connections at the plug boards.

Upon completion of further engineering analysis, VCSNS personnel determined that RVLIS was inoperable because tubing for the system could be damaged (during a postulated LOCA) if the CRDM Cable Bridge lifted due to the LOCA and then fell back down on its support structure causing the structure to fail. This past operability analysis was completed on June 6, 2012.

CAUSE OF THE EVENT
The ACE was conducted to identify why the CRDM Cable Bridge hold-down bolts were not reinstalled during RF-18. The ACE identified that Maintenance Procedure GMP-100.007 was inadequate because Step 7.4.20(G), "Bolt Cable Bridge sections to floor supports," did not require verification or documentation of the installation of the support bolts.

VCSNS performed an extent of condition evaluation that included review of similar refueling activities which require unbolting of components. The applicable procedures were reviewed to ensure they require appropriate verification of removal and reinstallation of bolting.

No additional instances of procedure inadequacy were identified.

ANALYSIS OF EVENT
Design Calculation DC0316F-002, "Reactor Building CRDM Missile Shield Design," provides an analysis of the movable CRDM Cable Bridge loading for LOCA pressure transient and Operating Basis Earthquake (OBE)/Safe Shutdown Earthquake (SSE) events. The calculation evaluates the potential movement of the CRDM Cable Bridge should one of these events occur. The movement of the Cable Bridge determines the affect on the cables running through the bridge or any other plant equipment. No other accidents were deemed to have a credible impact on the CRDM Cable Bridge loading.

Normal Operation
During normal operation, the absence of the hold-down bolts would not impact the ability of the CRDM Cable Bridge to perform its function. No external forces are exerted on the bridge; therefore, the bridge and cables running inside it would remain undamaged.

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ANALYSIS OF EVENT (continued)

Seismic Event

The seismic load used in DC0316F-002 is 0.5g vertical based on the station's design basis earthquake (DBE) values. The acceleration required to lift the CRDM Cable Bridge is 1g; therefore, the 0.5g vertical acceleration calculated for a DBE would not be sufficient to lift the bridge. The bridge rests on a lateral support beam located beneath the bridge. The bolts are not necessary for any forces encountered in the downward direction.

Based on this analysis, the absence of the hold-down bolts would not have a negative effect on the CRDM Cable Bridge during a design basis seismic event.

LOCA

The calculated upward force on the CRDM Cable Bridge at the bolt locations due to a LOCA is 49.9 kips. This force is generated by assuming the reactor coolant flashes to steam at the worst-case location of the leak. Without the hold-down bolts installed, the CRDM Cable Bridge would be free to pivot up towards the cables plugged into the fixed plug boards. The exact amount of upward movement was not determined; however, it was assumed to be significant since the calculated force from the LOCA is much more than the downward force from the weight of the bridge. Based on this analysis, it is assumed that the CRDM Cable Bridge would move sufficiently to damage the cable connections at the plug boards. Additional analysis determined the CRDM Cable Bridge could fall back down on its support structure with enough force to cause the structure to fail and potentially damage tubing for the RVLIS.

During a seismic event, the absence of the hold-down bolts does not impact the Reactor Vessel, Reactor Coolant System integrity, or any reactor trip/accident mitigation equipment because the CRDM Cable Bridge would remain affixed to the vertical concrete wall by the pivot shafts and would therefore be capable of fulfilling anti-falldown requirements. During a LOCA scenario, the uplift force on the CRDM Cable Bridge is assumed to result in a loss of the cable connections. Also, the CRDM Cable Bridge could fall back down with enough force to cause its support beam to fail and potentially damage the nearby RVLIS sensing line.

Risk significance is determined by evaluating the impact of a condition on Core Damage Frequency (CDF) and Large Early Release Frequency (LERF). The impacts of the potential configuration documented in this revised LER (loss of CRDM power, Control Rod position indication, CETC indication, and RVLIS indication during LOCAs) is not risk significant. Losses of CRDM power and Control Rod position indication are not important since the resulting insertion of all control rods is the desired response following a LOCA. The CETC and RVLIS instrumentation provide no control function. No operator actions evaluated in the Probability Risk Analysis (PRA) credit the CETCs or RVLIS indication as cues. Additionally, radiation monitors would provide indication if an event had progressed to core damage.

The CETCs and RVLIS are not credited in the PRA model because these indications are redundant to reliable equipment and are therefore unimportant to CDF and LERF. The CETCs and RVLIS are also used when determining the need to enter the Severe Accident Mitigation Guidelines (SAMGs), which are used to mitigate severe accidents that have already proceeded to core damage, so there is no impact on CDF (ie, core damage has already occurred if the event progresses to the point this instrumentation is needed). The mitigation is intended to reduce the amount of radioactive material available for release as well as reduce the volume released. Note that the definition of LERF (one containment volume in one hour

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ANALYSIS OF EVENT (continued)

within four hours of vessel breach) does not include the amount of radioactive material released. SAMG actions are not credited in the PRA model because the uncertainty of accomplishing them within four hours of vessel breach limits their reduction of the LERF calculation. For these reasons, this condition is not risk significant.

CORRECTIVE ACTIONS

The CRDM Cable Bridge hold-down bolts were re-installed prior to startup from RF-19. To prevent a recurrence of this event, Maintenance Procedure GMP-100.007 was revised to add a verification step for installing the hold-down bolts. The completion of this step must be documented and verified on page 2 of 2 of Attachment II, "DATA SHEET FOR REFUELING AND RECOVERY FROM REFUELING."

PRIOR OCCURRENCES

A search was conducted within the station's Corrective Action Program using search criteria for "CRDM" and "missing bolts." No prior events were identified related to the CRDM Cable Bridge.