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January 19, 2010

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

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION UNIT 1 (VCSNS)
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
LICENSEE EVENT REPORT (LER 2009-003-00)
Potential Loss of Residual Heat Removal System Safety Function In Mode 4 Due To An Unanalyzed Condition

The enclosed Licensee Event Report (LER) No. 2009-003-00, for the Virgil C. Summer Nuclear Station Unit 1 (VCSNS) is being submitted pursuant to 10CFR50.73(a)(2)(ii)(B), 10CFR50.73(a)(2)(v)(B) and 10CFR50.73(a)(2)(vii)(B). This report describes the potential for operating in an unanalyzed condition due to loss of the Residual Heat Removal (RHR) system, therefore, preventing the fulfillment of its safety function.

This document does not contain any Regulatory Commitments. Should you have any questions, please call Bruce Thompson at (803) 931-5042.

Very truly yours,

Shawn Zaland For

Jeffrey B. Archie

JMG/JBA/gr
Attachment

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NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)	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 Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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.

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4. TITLE
Potential Loss of Residual Heat Removal System Safety Function In Mode 4 Due To An Unanalyzed Condition

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	20	2009	2009	- 3 -	0	01	19	2010	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE: 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 Specify in Abstract below or in NRC Form 366A
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER *(Include Area Code)*
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

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 11/20/09, VCSNS determined that there was a potential for operating in an unanalyzed condition due to loss of the safety function of the Residual Heat Removal (RHR) system. VCSNS determined that under certain conditions flashing could occur in the RHR system while in Mode 4. The resulting steam voids could prevent the RHR system from fulfilling its safety function during the injection and recirculation phase of a Loss Of Cooling Accident (LOCA). The condition represents a safety system common cause failure that would affect both trains of RHR in Mode 4 only and is reportable under 10 CFR 50.73(a)(2)(ii)(B), 10 CFR 50.73(a)(2)(v)(B), and 10 CFR 50.73(a)(2)(vii)(B).

The apparent cause of this condition was the failure to consider the most limiting boundary conditions when calculating the temperature limit to preclude flashing of the RHR system. Corrective actions consisted of the reanalysis of the limiting temperature to manage system flashing and the revision of operating procedures.

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NARRATIVE

I. EVENT DESCRIPTION

The Residual Heat Removal (RHR) system serves three functions in Mode 4. RHR provides heatup and cooldown capabilities for normal plant startup/shutdown, low temperature overpressure protection, as well as an injection and recirculation Emergency Core Cooling System (ECCS) function. VCSNS utilizes RHR relief valves for low temperature overpressure protection prior to decreasing below 300 degrees F. Per Technical Specification 3.5.3, during Mode 4 one train of ECCS is also required to be operable to provide core cooling in the event of a Loss Of Cooling Accident (LOCA).

In the early 1990s, it was recognized that when the RHR system was aligned to the RCS and operating in the cooldown mode, the suction piping could flash to steam when the system was realigned to the RWST in ECCS injection mode. This issue was the subject of NSAL 93 004, "RHRS Operation as Part of the ECCS During Plant Startup." To address the issue a temperature limit of 250 degrees F was established for the suction piping to ensure the RHR pump operability. Procedures were revised to place the operable RHR pump in PULL-TO-LOCK to prevent the pump from automatically starting on a safety injection signal and drawing high temperature RCS water into the RHR suction piping whenever RCS temperature was greater than 250 degrees F.

In the fall of 2009, Westinghouse issued NSAL 09 8, "Presence of Vapor In Emergency Core Cooling System/Residual Heat Removal System in Modes 3/4 Loss-of-Coolant Accident Condition." A review of the NSAL recommendations, site calculation, and operating procedures identified a potential for operating in an unanalyzed condition due to possible loss of the RHR system safety function. The temperature limit to manage flashing as addressed in NSAL 09 8 was conservatively determined to be less than or equal to 200 degrees F rather than 250 degrees F during realignment to the Refueling Water Storage Tank (RWST) or Reactor Building Sump.

A review of the last three years of RHR system operation determined that the system was vulnerable for 4.8 hours. In 2006, for Refueling 16 the plant was vulnerable in Mode 4 decreasing for 2.6 hours with no hours ascending. In 2008, for Refueling 17 the plant was vulnerable in Mode 4 decreasing for 2.1 hours and 0.1 hours ascending. The plant did not enter Mode 4 other than during the planned refueling outages. Vulnerability is characterized as the time when the protected train RHR pump was not in PULL TO LOCK between 250 and 200 degrees F.

II. EVENT ANALYSIS

Loss of RHR due to flashing and void formation challenges or prevents the safety function of the system thus placing the plant in an unanalyzed condition and is reportable per 10 CFR 50.73(a)(2)(ii)(B), 10 CFR 50.73(a)(2)(v(B), and 10 CFR 50.73(a)(2)(vii)(B).

The apparent cause of this condition was the failure to consider the most limiting boundary conditions when calculating the temperature limit to prevent flashing in the RHR system. The presence of vapor during a LOCA condition in Modes 3 and 4 has been a generic industry issue (GL-2008-01) and the subject of two Nuclear Safety Advisory Letters (NSAL-93-004 and NSAL-09-8). Knowledge of the key safety consideration associated with these events has evolved. Given the evolution of this industry issue, two causes contributing to this event are: VCSNS's original RHR system design and system operating guidance provided by Westinghouse were deficient, and the VCSNS did not fully understand the full scope of the issue when first evaluated in the early 1990s.

A review of the VCSNS calculation performed in 1993, indicated that the calculation was technically accurate for the conditions considered. The calculation was performed in response to an input request from Operations for the "plant specific temperature that can result in flashing at the suction of the RHR pumps when aligned to the RWST" as described in Abnormal Response Guideline (ARG)-2 for Shutdown LOCA. This calculation also addressed the concerns in NSAL-93-004. The ARG information, however, gave little information on explicit boundary conditions to be considered. NSAL-09-8 recommended the most limiting boundary conditions to include the use of the pump suction header elevation as opposed to the lower pump suction inlet elevation and lower RWST levels to cover Small Break Loss Of Cooling Accident (SBLOCA) scenarios where RHR pump start may be delayed. The failure to consider these more limiting boundary conditions resulted in the non-conservative temperature limit of 250 degrees F.

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NARRATIVE

III. SAFETY SIGNIFICANCE

A review of the RHR system operation for the past three years determined that the total time the system was vulnerable was 4.8 hours. A Probabilistic Risk Assessment (PRA) evaluation of the risk associated with a LOCA and no protected train (loss of both RHR trains) resulted in a Core Damage Frequency (CDF) of less than 1E-07 per year. In the event that the RHR system became inoperable, abnormal and emergency procedures exist that provide guidance to restore core cooling. Per operating procedures a charging pump would be aligned to the RWST with additional water supplied by the Reactor Makeup Water Supply System. Additionally, the steam generators would be available with Emergency Feedwater providing a heat sink to aid in decay heat removal.

IV. CORRECTIVE ACTIONS

Immediate corrective actions were taken prior to the plant shutdown for RF18 due to the operating experience generated by the industry. Procedures were revised to ensure one dedicated train of RHR remained protected until Mode 5 entry (less than 200 degrees F). This approach ensured that the fluid in the protected train of RHR remained at or near ambient (~100 degrees F) conditions with no potential of flashing if the system was required to perform its ECCS function in Mode 4. The protected train concept was achieved by maintaining the protected pump in PULL-TO-LOCK until RCS temperature is less than or equal to 200 degrees F. This allowed the system to meet its safety function in accordance with Technical Specifications 3.5.3.

A formal calculation of allowable RHR water temperatures have since been completed and the results have been incorporated into VCSNS procedures to ensure RHR system remains operable for its ECCS safety function in Mode 4.

V. PREVIOUS OCCURRENCES

No previous occurrences or similar events have been identified for VCSNS.