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U. S. Nuclear Regulatory Commission  
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Gentlemen:

Subject: VIRGIL C. SUMMER NUCLEAR STATION  
DOCKET NO. 50-395  
OPERATING LICENSE NO. NPF-12  
LICENSEE EVENT REPORT (LER 1999-005-01)  
ENGINEERED SAFETY FEATURES (ESF) COMPONENTS  
POTENTIALLY OUTSIDE THE DESIGN BASIS OF THE PLANT

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Attached is Revision 1 to Licensee Event Report No. 1999-005-00, for the Virgil C. Summer Nuclear Station (VCSNS). This report describes a potential condition for exceeding the VCSNS Plant Design Basis due to operator timeline issues, related to the semi-automatic swap-over of certain Engineered Safety Features (ESF) components. This issue is being reported per 50.73(a)(2)(ii).

Should you have any questions, please call Mr. Philip Rose at (803) 345-4052.

Very truly yours,

Stephen A. Byrne

PAR/SAB/dr

Attachment

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IE22

# LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Virgil C. Summer Nuclear Station	DOCKET NUMBER (2) 05000395	PAGE (3) 1 of 6
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TITLE (4)  
Engineered Safety Features (ESF) Components Potentially Outside the Design Basis of the Plant

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 NAME	DOCKET NUMBER
04	12	1999	1999	-- 005	-- 01	09	07	2000	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9) 6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)				
POWER LEVEL (10) 0%	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)	
	20.2203(a)(1)	20.2203(a)(3)(i)	X 50.73(a)(2)(ii)	50.73(a)(2)(x)	
	20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71	
	20.2203(a)(2)(ii)	20.2203(a)(4)	50.73(a)(2)(iv)	OTHER	
	20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	Specify in Abstract below or in NRC FORM 366A	
20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)			

LICENSEE CONTACT FOR THIS LER (12)

NAME M. N. Browne Manager, Nuclear Licensing & Operating Experience	TELEPHONE NUMBER (Include Area Code) (803) 345-4141
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COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

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 15 single-spaced typewritten lines) (16)

While performing FSAR verification reviews and SSEI preparations, Virgil C. Summer staff identified a question regarding operator actions during various accident scenarios. Design Engineering personnel received information from Operations on February 16, 1999, regarding the swap-over from the RWST to the Reactor Building recirculation sump. Procedure EOP 2.2, Transfer to Cold Leg Recirculation, allowed draindown of the RWST to the empty alarm level (6%), if the semi-automatic swap-over failed to occur for one train of ECCS. During subsequent review of the consequences, it was determined that the resulting plant configuration was not analyzed and potentially outside the design basis of the plant due to additional water inventory.

On 8/07/2000, follow-up evaluations related to this issue were completed. Through these evaluations, it has been discovered that while the physical design requirements of the RWST are satisfied, the assumed operator actions and response times, as detailed in FSAR Section 6.3.2.6 for completing the swap-over to cold leg recirculation from the ECCS injection phase cannot be demonstrated.

The timeline provides for automatic and manual actions to complete the semi-automatic swap-over once the lo-lo level (18%) is reached in the RWST, and assures the ECCS pumps are guaranteed a source of borated water. The timeline in the FSAR states that the necessary actions can be completed in approximately 2 minutes, while timed simulator runs take significantly longer.

Changes to the station Emergency Operating Procedures will be made to assure there will always be sufficient water to keep the core cool and protect the pumps from cavitation. Additional corrective actions are also being evaluated.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

**PLANT IDENTIFICATION**

Westinghouse - Pressurized Water Reactor

**EQUIPMENT IDENTIFICATION**

EIIS Code:	IP	XVX09339-SS	PASS Sample Return Valve
	IJ	XVD06242A-ND	RB Sump Isolation Valve
	WD	XVD07126-WL	RCDT Vent Valve
	AB	XVD08047-RC	PRT Vent Valve
	CB	XVT08112-CS	Seal Return Valve
	KN	XVX09364C-SS	SG Sample Valve
	BP	XVT08871-SI	Accumulator Vent Valve
	IM	ITE00430	C Loop WR RCS Temperature
	IJ	ILT01970	RB Sump Level
	BQ	XVG08706A/B-RH	Charging Pump Suction from RHR Valves
	BP	XVG08809A/B	Low head Safety Injection pumps suction valves from the RWST
	BE	XVG03001A/B	Reactor Building Spray pumps suction valves from the RWST

**IDENTIFICATION OF EVENT**

This report is based on the initiation of Non-Conformance Notice (NCN) 990483. Engineered Safety Features (ESF) components were determined to be potentially outside the design basis of the plant due to equipment qualification issues. During an engineering review of the consequences of a draindown of the RWST to the RWST empty alarm level (6%), it was determined that the resulting RB flood level exceeded the previously established flood plane elevation of 418' - 5 3/8". NCNs were generated based on RB walkdowns and reviews, which identified potentially affected components that were within the new higher flood plane.

This revision is based on the evaluation of operator timeline simulator studies performed in association with Revision 0 to this LER. Based on the time to complete required actions for the semi-automatic swap-over of RWST to Reactor Building recirculation sump, there is a discrepancy with the documented timeframe in the FSAR, Section 6.3.2.6. This discrepancy was identified in condition report CER 99-1026 on August 7, 2000.

**EVENT DATE**

April 12, 1999. This is the date that it was determined that the plant was potentially outside the design basis and NCN 990483 was initiated.

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**REPORT DATE**

May 12, 1999 Revision 0 / September 7, 2000 Revision 1

**CONDITIONS PRIOR TO EVENT**

Mode 6 – Refueling Operations (0%) / Mode 1 – Power Operations (100%)

**DESCRIPTION OF EVENT**

While performing FSAR verification reviews and SSEI preparations, Virgil C. Summer (VCSNS) staff identified a question regarding operator actions during various accident scenarios. Design Engineering personnel received information from Operations on February 16, 1999, regarding the swap-over from the RWST to the Reactor Building (RB) recirculation sump. EOP 2.2, Transfer to Cold Leg Recirculation, allowed draindown of the RWST to the RWST empty alarm level (6%), if the semi-automatic swap-over failed to occur for one train of ECCS. During subsequent review of the consequences of this event, it was determined that the resulting plant configuration was not analyzed and potentially outside the design basis of the plant. RB flood elevation calculations were revised based on no operator action prior to the RWST empty alarm level. The revised RB flood level exceeded the previously established flood plane elevation of 418' - 5 3/8". Engineering RB walkdowns and reviews identified potentially affected components, which fell below the newly calculated flood plane.

On 8/07/2000, follow-up evaluations related to this issue were completed. Through these evaluations, it has been discovered that while the physical design requirements of the RWST are satisfied, the assumed operator actions and response times, in conjunction with the applicable instrument uncertainties, as detailed in FSAR Section 6.3.2.6 for completing the swap-over to cold leg recirculation from the ECCS injection phase, cannot be demonstrated.

The timeline provides for automatic and manual actions to complete the semi-automatic swap-over once the lo-lo level (18%) is reached in the RWST, and assures the ECCS pumps are guaranteed a source of borated water. The timeline in the FSAR states that the necessary actions can be completed in approximately 2 minutes, while timed simulator runs take significantly longer.

**CAUSE OF EVENT**

The revised RB flood level calculation exceeded the previously established flood plane level of 418' - 5 3/8". ESF components qualified for the LOCA steam environment, but not qualified for submergence, were affected.

The cause of the timeline discrepancy is unknown; however, it is suspected that the timeline as stated in the FSAR was never validated and is based on approximate actuation times of the equipment. Present operation standards of deliberate, self and peer checked actions add time to such evolutions. It is not apparent that such human factor considerations were incorporated into the timeline documented in the FSAR.

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**ANALYSIS OF EVENT**

EOP 2.2, Transfer to Cold Leg Recirculation, allowed draindown of the RWST to the RWST empty alarm level (6%), if the semi-automatic swap-over failed to occur for one train of ECCS. An engineering review of the consequences of this event determined on April 12, 1999, that the resulting plant configuration was not analyzed and potentially outside the design basis of the plant due to additional water inventory. RB flood elevation calculations were revised based on no operator action prior to the RWST empty alarm level. The revised RB flood level exceeded the previously established flood plane elevation of 418' - 5 3/8". NCNs were generated based on RB walkdowns and reviews, which identified potentially affected components that were within the new higher flood plane. Additional engineering review determined that certain Engineered Safety Features (ESF) components qualified for the LOCA steam environment, but not qualified for submergence, were affected. The engineering review further determined that the flooding level within the RB during a design basis event would not lead to unacceptable consequences. The RB would be isolated to ensure offsite doses remained within 10 CFR Part 100 limits. Core cooling would be maintained. Changes made to the plant during Refueling Outage 11 were completed to address 10 CFR 50.49 requirements.

The current licensing basis states that swap-over can be completed with a reserve of RWST inventory above the critical vortexing limit. This is based on the following assumed operator actions as described in FSAR Section 6.3.2.6.

"Action 1: Verify that the RHR and spray system suction valves from the Reactor Building recirculation sumps are open and close the RWST to RHR and spray system suction valves (1 minute).

Action 2: Close the valves in the 10 inch crossover leg between the RHR discharge lines (30 seconds).

Action 3: Open the RHR to Charging pump suction valves (30 seconds)."

This timeline cannot be met by plant operating staff under the current licensing basis due to other actions and expectations required. This means that the equipment manipulations cannot be completed within the time it takes for the RWST to reach the empty alarm setpoint. An existing Justification for Continued Operation (JCO) has been supplemented to support operation while corrective action is being determined and implemented. The JCO is documented in Condition report CER 99-1026.

The JCO demonstrates that, with the use of Reactor Building pressure credit, the swap-over from cold-leg injection to cold-leg recirculation can be completed with the current version of EOP 2.2, Transfer to Cold-Leg Recirculation, with instrument uncertainty prior to the activation of the empty alarm, without vortexing at the suction of the ECCS pumps.

**Vortexing**

A 1/4 scale test was performed to determine the vortexing characteristics of the RWST. The result shows that at the full design flow of 13,850 gpm (large break LOCA without single failure), an air-inducing vortex would not occur before the RWST reached a level of 4.6%; the current empty alarm is set at 6%. Operators are directed by procedure to protect the ECCS pumps from cavitation by securing them once the empty alarm is received. This condition is outside our licensing basis, the swap-over should be completed before the empty alarm is received.

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Reactor Building Pressure Credit

Calculations have been developed to determine the minimum expected pressure profile in the Reactor Building during a Loss of Coolant Accident and to determine the minimum required Reactor Building pressure, such that the RHR and spray system are fed from the recirculation sumps and not the RWST. This value is 3.8 psig. This critical minimum pressure is sustained for at least 23.3 minutes (with 40 degree F Service Water and RWST water) after the initiation of the semi-automatic swap-over (18% RWST level – lo-lo level minus instrument uncertainty).

This means that the RHR and spray system pumps will preferentially take suction from the recirculation sumps for these 23.3 minutes even though their respective RWST suction valves remain open. Because of this, the maximum inventory loss from the RWST would be due to two Charging pumps for 23.3 minutes. This equals approximately 19,805 gallons or a 3.9% decrease in level. Therefore, as long as the operator can complete the swap-over actions of one train in the single failure case before the Reactor Building pressure decreases below 3.8 psig (23.3 minutes after lo-lo level is reached), the licensing basis intent of completing the swap-over before vortexing is met with the Reactor Building pressure credit.

Recorded Timelines

Verification of the timeline for this condition has been performed and has determined that for the worst case single failure (loss of a specific DC supply bus) the swap-over was completed in 22 minutes and 10 seconds, and that the simulator did reflect the Reactor Building pressure credit of providing preferential sump feed. This is consistent with the conclusions made regarding Reactor Building pressure credit. Since the swap-over was successfully completed in less than 23 minutes after initiation of the semi-automatic swap-over, then with the Reactor Building pressure credit assumption, VCS meets the intent of the licensing basis.

A JCO performed for the RB flooding issue (Rev 0 to this LER) has been supplemented with regard to showing that cold leg swap-over can be completed with current operator actions without vortexing.

The no-failure (maximum outflow) case timeline is 12 minutes, 35 seconds and provides ample margin to protect the ECCS pumps against vortexing, which meets the intent of the licensing basis. This case also requires the Reactor Building pressure credit to assure a success path.

**INTERIM CORRECTIVE ACTIONS**

1. The design basis maximum possible RB Flood level has been established based on the contents of the RWST draining into the RB down to the EOP 2.2, RWST empty termination point (i.e., No operator action prior to the RWST empty alarm level). This results in an elevation of approximately 419.524'.
2. All affected components were verified to be or moved above 420' elevation, with the exception of the components listed below. These components were analyzed to have acceptable consequences for Cycle 12

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XVD06242A RB Sump Isolation - cable  
XVD07126 RCDT Vent - cable, limit switch, & hermetic connector  
XVD08047 PRT Vent - cable, limit switch, & hermetic connector  
XVT08112 Seal Return - motor operated valve & cable  
XVX09364C SG Sample Valve - solenoid and hermetic connector  
XVT08871 Accumulator Vent - cable, limit switch, & hermetic connector

3. The engineering review of the interim corrective actions concluded that even if the components are flooded; their function would be met, and containment integrity, off site dose limits, and core cooling would be maintained.

Changes to the Emergency Operating Procedure (EOP 2.2) that provides guidance to the operators during this scenario, will be made and verified to assure the necessary swap-over actions can be completed before vortexing could occur without taking credit for Reactor Building pressure. The EOP revision will be completed prior to the end of Refueling Outage 12, scheduled to end November 11, 2000.

**ADDITIONAL CORRECTIVE ACTIONS**

1. Modifications for RF 12:

The following components, although judged acceptable for Cycle 12, will be moved up to establish a flood level of 420' based on the entire contents of the RWST draining into the RB:

XVD06242A Move the splice box for the RB Sump Isolation Valve  
XVD07126 Move the RCDT Vent Valve and splice box  
XVD08047 Move the PRT Vent Valve and splice box  
XVT08112 Move the RCP Seal Return Valve and pull box  
XVX09364C Move the RCS Loop "C" Sample Valve  
XVT08871 Move the Accumulator Test Valve and splice box  
ITC01970 Move the hermetic connector for the RB Sump Level Transmitter

2. A procedure will be established prior to the next EOP validation (no later than August 31, 1999) to provide for a formal process of validating assumptions defined in a Design Basis & License Basis analysis. EOP validation process will define the set of Single Failures included in the scenario and a method of capturing the timeline as a record. This procedure, OAP 101.3, Timeline Verification of Required Operator Actions, was issued August 18, 1999.

VCSNS is evaluating if additional corrective action is required. This determination will be documented in CER 99-1026.

**PRIOR OCCURRENCES**

None