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U. S. Nuclear Regulatory Commission
Washington, DC 20555

Gentlemen:

Subject: VIRGIL C. SUMMER NUCLEAR STATION
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
LICENSEE EVENT REPORT (LER 2001-003-00)
MANUAL REACTOR TRIP DUE TO TWO RODS FAILING TO RESPOND TO A WITHDRAWAL DEMAND

Attached is Licensee Event Report (LER) No. 2001-003-00, for the Virgil C. Summer Nuclear Station (VCSNS). The report describes a manual reactor trip initiated during low power physics testing due to two control rods that remained fully inserted following a withdrawal demand.

This is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A).

Should you have any questions, please call Mr. Melvin Browne at (803) 345-4141.

Very truly yours,

Stephen A. Byrne

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Attachment

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NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

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Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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)

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TITLE (4)

Manual Reactor Trip due to Two Rods Failing to Respond to a Withdrawal Demand

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
03	01	01	2001	003	00	04	25	01	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	2	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)							
POWER LEVEL (10)	000		20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)
			20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)
			20.2203(a)(1)		50.36(c)(1)(i)(A)	X	50.73(a)(2)(iv)(A)		73.71(a)(4)
			20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)
			20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER
			20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		Specify in Abstract below or in NRC Form 366A
			20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
			20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)		
			20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)		
			20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
M. N. Browne, Mgr., Nuclear Licensing & Operating Experience	(803) 345-4141

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
	RC	ROD		NO					

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

At 0017 hours on March 1, 2001, operations personnel initiated a manual reactor trip when two control rods remained fully inserted during control rod withdrawal. All systems functioned as designed following the trip.

While in the process of low power physics testing and trouble shooting a misaligned Shutdown Bank "B" control rod (G-9), the rods were fully inserted into the core. After the step counters and rod control system were reset, Shutdown Bank "B" was withdrawn. At this time, it was discovered that two rods had not moved with 14 steps demanded. The shutdown bank was reinserted into the core, and a manual trip was initiated. The two rods that did not move were G-9 and L-5, both in Shutdown Bank "B".

The cause was determined to be the result of demanding control rod insertion beyond the fully inserted position (000 steps). This, in conjunction with geometric factors, placed the control rods in a position where the movable grippers would not properly engage to lift the rod when the lift coil energized. Multiple attempts to lift the control rods caused the spring at the top of the control rod assembly to re-position the control rods and allowed the movable grippers to engage.

An evaluation performed by Westinghouse documented that the negative stepping of the control rods had no adverse impact on the geometric or frictional characteristics of the control rods. The temporary misalignment did not affect the critical design function of the control rod mechanisms.

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

PLANT IDENTIFICATION

Westinghouse - Pressurized Water Reactor

EQUIPMENT IDENTIFICATION

Control Rod System, Shutdown Bank "B" - EIIS - AA

IDENTIFICATION OF EVENT

Operations personnel initiated a manual reactor trip at 0017 hours on March 1, 2001. The decision to trip the plant was made when two control rods remained fully inserted during withdrawal of Shutdown Bank "B".

EVENT DATE

March 1, 2001 - This event is documented in Condition Evaluation Report (CER) 01-0296.

REPORT DATE

April 25, 2001

CONDITIONS PRIOR TO EVENT

Plant Start-up - Mode 2 (Startup physics testing in progress)

DESCRIPTION OF EVENT

At 0017 hours on March 1, 2001, operations personnel initiated a manual reactor trip when two control rods remained fully inserted during withdrawal of Shutdown Bank "B" control rods. All systems functioned as designed, following the plant trip.

On February 28, 2001, control rod worth measurements were being performed as part of the zero power physics test program. The worth of the reference bank, Shutdown Bank "B", was being measured by diluting the bank into ~36 steps. The remaining worth of the bank was to be measured by inserting the bank to 000 steps and withdrawing the bank to the critical rod height. As the bank was inserted to 000 steps, an additional step of insertion demand occurred. As the bank was being withdrawn, rod G-9 remained inserted. The reactor was maintained critical with Shutdown Bank "B" at ~42 steps with rod G-9 fully inserted, while troubleshooting activities were performed.

Rod G-9 was successfully withdrawn from the fully inserted position to the new Shutdown Bank "B" critical rod height. As part of the troubleshooting activities, the control rods of Shutdown Bank "B" were realigned by demanding Shutdown Bank "B" to insert ~5 steps beyond an indicated 000 steps to assure all rods were fully inserted. The rod step counters and rod control system were reset and Shutdown Bank "B" was withdrawn. Control rods G-9 and L-5 remained fully inserted, with the rest of the bank at ~14 steps. Shutdown Bank "B" was reinserted to 000 steps, and a manual reactor trip initiated.

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

CAUSE OF EVENT

The cause was determined to be the result of demanding control rod insertion below zero steps. This negative insertion, in conjunction with geometric factors, placed the control rods in a position such that the movable grippers would not properly engage to lift the rod when the lift coil energized.

An evaluation of the condition concluded that there is no indication that the rod control circuitry or motor-generator sets operation were causal factors because the rods stepped as expected when not fully inserted. With the condition only occurring at rod bottom, it is most likely that a mechanical interference existed between the Control Rod Drive Mechanism (CRDM) latches and the drive shaft. With the rods on bottom, there is no positive alignment between the lands in the drive shaft and the latches. Under rare circumstances following a stepping demand below zero steps, the position of the rod can allow either set of latches to engage the top surface of a drive rib.

Under this circumstance, the latches can become wedged in place and held there by friction due to the upward load resulting from compression of the spring in the Rod Cluster Control Assembly (RCCA) hub, even during subsequent step commands. This would lock the rod on bottom until the latches become free, possibly due to introducing additional motion or vibration into the mechanism.

ANALYSIS OF EVENT

Observations:

- Both G-9 and L-5 were left fully inserted when rod withdrawal was demanded.
- Once withdrawn, both rods stepped as expected.
- Prior to this incident, there were no reported problems with the movement of the rods during plant testing including rod drop testing.

If the CRDM latches engage the top surface of a rib instead of a groove, they would slightly compress the spring under the RCCA hub. This slight compression provides the force that binds the latches against the drive rod rib. However, the amount of spring compression is much less than the full stroke permitted by the RCCA design. Therefore, the RCCA, the fuel assembly, and the drive rod would not be damaged by the spring compression.

Furthermore, the load between the latches and the drive rod rib are small compared to the dynamic loads imparted during rod stepping. Consequently, there is no damage or degradation to either the drive shaft or the latch assembly. As long as the rod is shown to be movable during operation above zero steps, the assumptions on rod operability in the safety analysis are still valid.

The critical design function of the control rods is to fall into the core on a reactor trip signal. This is accomplished by the removal of power to the grippers on the drive rods allowing gravity to pull the rods into the core given the proper geometrical and frictional characteristics. The action of negative stepping did not have any effect on the geometric or frictional elements in the control rod / fuel assembly relationship. The temporary binding of the control rod did not have any adverse effect on the CRDM or the RCCA. Trouble shooting activities have confirmed that the subject control rods are fully capable of performing their function.

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

INTERIM CORRECTIVE ACTIONS

When it became apparent that more than one control rod remained fully inserted after a withdrawal demand, Shutdown Bank "B" rods were driven in to 000 steps and the reactor manually tripped. Troubleshooting was performed and Westinghouse was consulted.

Operations issued Station Order SO 01-02, "Control Rod Insertion Below Zero Steps," to provide immediate guidance on control rod manipulations. Control and shutdown rods should not be inserted past 000 steps.

ADDITIONAL CORRECTIVE ACTIONS

Reactor Engineering has revised Reactor Engineering Procedure (REP) 103.001, "Control Rod Worth Measurement," to caution against inserting the control and shutdown rods beyond 5 steps. This procedure is performed during low power physics testing.

PRIOR OCCURRENCES

None