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Document Control Desk
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 1999-004-02), SUPPLEMENT 2
FAILURE OF TOP NOZZLE HOLDDOWN SPRINGS

Attached is Supplement 2 to Licensee Event Report No. 1999-004-00, for the Virgil C. Summer Nuclear Station (VCSNS). This report describes the actions taken to correct conditions associated with failures of top nozzle holdown spring screws. This issue is being reported per 50.73(a)(2)(ii).

Should you have any questions, please call Mr. Arnie Cribb at (803) 345-4346.

Very truly yours,

Stephen A. Byrne for SAB

AJC/SAB/dr
Attachment

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 6-30-2001

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Virgil C. Summer Nuclear Station	05000395	1 OF 4

TITLE (4)

Fuel Assembly Top Nozzle Holddown Spring Failure

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
04	13	99	1999	- 004 -	02	04	12	01	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	6	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)							
POWER LEVEL (10)	0	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)		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 Specify in Abstract below or in NRC Form 366A	
		20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)			
		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)	x	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
B	AC		W120	N					

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)

On April 13, 1999, at 2035 with core offload activities in progress, the defueling crew experienced difficulty obtaining full gripper engagement in two fuel assemblies. Subsequent visual inspection showed that one or more of the gripper fingers had not properly engaged the fuel assembly top nozzle. Withdrawal was immediately suspended and the fuel assemblies were returned to a safe location.

The apparent cause of the event was failure of the holddown spring attaching screws. This failure caused the holddown spring clamp to become displaced creating an interference with the fuel handling tools.

On August 24, 1999, SCE&G notified the NRC in letter RC 99-0167 that Westinghouse had not completed the root cause of the failure of the holddown spring attaching screws. The results were expected to be completed after the fall outages and submitted within 30 days after receipt from Westinghouse.

On January 20, 2000, SCE&G notified the NRC in letter RC 99-0230 of the results of the Westinghouse root cause. Westinghouse letter 99CG-G-0046 states "*the primary causal factor for the fractured spring screws is the top nozzle design does not accommodate the variability of Inconel 600, a material susceptible to Primary Water Stress Corrosion Cracking (PWSCC).*"

On October 19, 2000, at 1500, following the offload of the Cycle 12 core, ultrasonic testing (UT), visual, and spring scale inspections confirmed 29 twice burned fuel assemblies had top nozzle holddown spring screws that were failed or degraded, as anticipated. On October 27, 2000, replacement of 24 nozzles on twice burned fuel assemblies planned for reinsertion in the Cycle 13 core was completed.

To minimize the excess energy present at the end of Cycle 13, 12 twice-burned assemblies discharged after Cycle 10 were inspected, qualified and inserted for Cycle 13.

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

PLANT IDENTIFICATION

Westinghouse - Pressurized Water Reactor

EQUIPMENT IDENTIFICATION

Westinghouse manufactured 17x17 Vantage Plus fuel assemblies (twice burned assemblies) - EIIS code: AC

IDENTIFICATION OF EVENT

The initial event was identified by Condition Report (CER) # 99-0542.
This supplement is based on the conditions identified in LER 1999-04-00 and was identified in CER # 00-1494.

EVENT DATE

April 13, 1999

REPORT DATE

April 12, 2001

CONDITIONS PRIOR TO EVENT

Mode 6, core offload in progress

DESCRIPTION OF EVENT

On April 13, 1999, at 1600 with core offload activities in progress for RF 11, while withdrawing fuel assembly M47 from core location B-10, the manipulator crane operator noted that the fuel assembly was not suspended properly. Fuel assembly M47 was the twenty-fourth fuel assembly to be removed from the core. Subsequent visual inspection showed that one or more of the gripper fingers had not properly engaged the fuel assembly top nozzle. Withdrawal was immediately suspended and the fuel assembly was safely returned to the core. At approximately the same time, a previously transported fuel assembly (M24) in the Fuel Handling Building (FHB) could not be successfully latched by the Spent Fuel Handling Tool (SFHT). Work was temporarily suspended on this fuel assembly while the Reactor Building (RB) fuel assembly was successfully placed in a safe storage location.

Prior to offloading the Cycle 12 core for RF 12, visual inspection of the fuel assembly top nozzle spring screws confirmed no clamps or screw heads missing and no severely displaced holddown springs. On October 17, 2000, the core was successfully offloaded with no fuel handling issues. Inspection of the twice burned fuel assemblies began on October 18, 2000. After inspecting 18 fuel assemblies, preliminary results indicated that 18 fuel assemblies had failed or degraded screws. The final UT results, combined with visual and spring scale inspections confirmed that 21 of 24 twice burned fuel assemblies planned to be re-inserted in the Cycle 13 core had failed or degraded holddown spring screws. Additional inspections on 8 twice burned fuel assemblies planned for permanent discharge indicated that screws were failed or degraded. Visual inspections of the once burned fuel assemblies confirmed that there were no unacceptable gaps between the top nozzle clamp and top nozzle collar, indicating that there were no failed holddown spring screws.

Replacement of the 24 nozzles on the twice burned fuel assemblies planned for reinsertion in the original Cycle 13 core design was completed on October 27, 2000.

To minimize the excess energy present in the core at the end of Cycle 13, 4 fresh feed and 8 once burned fuel assemblies were replaced by 12 twice burned fuel assemblies that were previously discharged at the end of Cycle 10. The top nozzles of these twice burned fuel assemblies were inspected visually and the holddown spring screws were inspected using the spring scale technique. Additionally, the holddown spring screws were inspected using a developmental UT technique. These inspections conservatively determined that 8 of the 12 top nozzles contained holddown spring screws that were degraded.

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

DESCRIPTION OF EVENT (continued)

These 8 top nozzles were replaced. Fuel assemblies from this batch were discharged after three cycles of irradiation at the end of Cycle 11, and there was no visible holddown spring screw damage based on the absence of significantly raised clamps.

INTERIM CORRECTIVE ACTIONS

Subsequent inspection of the fuel assemblies during core offload has shown that the holddown spring clamp displacement was limited to the region of fuel that has just completed the second cycle of operation. There were no anomalies observed on the one-cycle or three-cycle fuel.

For RF 11, the manipulator crane gripper was adjusted and verified to be operational for fuel assemblies that had holddown spring clamp displacement. The SFHT was modified to allow the tool to engage a fuel assembly with holddown spring clamp displacement. The proper engagement of both tools was verified via video inspection. Core offload recommenced at 0351 on April 16 and completed at 0715 on April 18, 1999.

CAUSE OF EVENT

The apparent cause of the event is failure of the holddown spring attaching screws. This failure caused the holddown spring clamp to become displaced preventing engagement of the grippers.

Westinghouse has determined the primary causal factor for the fracture of the spring screws is the top nozzle design does not accommodate the variability of Inconel 600, a material susceptible to PWSCC.

ANALYSIS OF EVENT

The visual inspection of the core performed at the time of the first latching problem revealed the existence of a gap between the top nozzle and the spring holddown clamp, which is limited to the region of fuel that has just completed the second cycle of operation. There were no anomalies observed on the one-cycle or three-cycle fuel. It is believed that this gap prevents full gripper engagement by the defueling tool. The apparent cause is failure of spring holddown screws preventing gripper engagement.

At completion of the core offload it has been determined that no first or thrice burnt assemblies were found with lifted clamps.

A Westinghouse safety assessment concluded no safety concerns in the areas of generation of loose parts, reduction of fuel assembly holddown force or LOCA issues exist for startup and continued operation for Core Load 12.

On August 24, 1999, SCE&G notified the NRC in letter RC 99-0167 that Westinghouse had not completed the root cause of the failure of the holddown spring attaching screws. The results were expected to be completed after the fall outages and submitted within 30 days after receipt from Westinghouse.

On January 20, 2000, SCE&G notified the NRC in letter RC 99-0230 of the results of the Westinghouse root cause. Westinghouse letter 99CG-G-0046 states "*the primary causal factor for the fractured spring screws is the top nozzle design does not accommodate the variability of Inconel 600, a material susceptible to Primary Water Stress Corrosion Cracking (PWSCC). The lack of sufficient controls in our material specification contributed to the variability. Variations in assembly practice, notably the uncontrolled use of Neolube, may have contributed in the case of the more difficult to assemble nozzle designs but is believed not to be the primary cause.*"

Prior to offloading the Cycle 12 core, visual inspection of the fuel assembly top nozzle spring screws confirmed no clamps or screw heads missing and no severely displaced holddown springs. On October 17, 2000, the core was successfully offloaded with no fuel handling issues. Inspection of the twice burned fuel assemblies began on October 18, 2000. After inspecting 18 fuel assemblies, preliminary results indicated that 18 fuel assemblies had failed or degraded screws.

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

ANALYSIS OF EVENT (continued)

The final UT results, combined with visual and spring scale inspections confirmed that 21 of 24 twice burned fuel assemblies planned to be re-inserted in the Cycle 13 core had failed or degraded holddown spring screws.

Additional inspections on 8 twice burned fuel assemblies planned for permanent discharge indicated that screws were failed or degraded. Visual inspections of the once burned fuel assemblies confirmed that there were no unacceptable gaps between the top nozzle clamp and top nozzle collar, indicating that there were no failed holddown spring screws.

Replacement of the 24 nozzles on the twice burned fuel assemblies planned for reinsertion in the original Cycle 13 core design was completed on October 27, 2000.

Due to the extension of the Cycle 12 refueling outage to complete the repairs to the 'A' hot leg, the Cycle 13 core was redesigned to minimize the amount of excess energy. The original Cycle 13 design required 68 fresh feed, 65 once-burned and 24 twice burned fuel assemblies. To minimize the excess energy present in the core at the end of Cycle 13, 4 fresh feed and 8 once burned fuel assemblies were replaced by 12 twice burned fuel assemblies that were previously discharged at the end of Cycle 10. The top nozzles of these twice burned fuel assemblies were inspected visually and the holddown spring screws were inspected using the spring scale technique. Additionally, the holddown spring screws were inspected using a developmental UT technique. These inspections conservatively determined that 8 of the 12 top nozzles contained holddown spring screws that were degraded. These 8 top nozzles were replaced. Fuel assemblies from this batch were discharged after three cycles of irradiation at the end of Cycle 11, and there was no visible holddown spring screw damage based on the absence of significantly raised clamps.

ADDITIONAL CORRECTIVE ACTIONS

Corrective action consisted of replacing the top nozzles on the 28 twice-burned fuel assemblies that were reloaded into the Cycle 12 core, and on 32 of the 36 twice burned fuel assemblies that were scheduled for reload into the Cycle 13 core. Westinghouse provided a safety assessment to support startup and continued operation.

Westinghouse has redesigned the top nozzle holddown spring screw by changing the screw material from Alloy 600 to shot peened Alloy 718 to increase the resistance to Primary Water Stress Corrosion Cracking. This design feature has been incorporated in the new fuel assemblies to be loaded in the Cycle 13 core.

PRIOR OCCURRENCES

None