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John L. Skolds
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July 31, 1992

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
LER 92-006 (SSH 920001)
P-21-92-001

Attached is Licensee Event Report No. 92-006 for the Virgil C. Summer Nuclear Station. This report is submitted pursuant to the requirements of 10CFR21.21(c)(3)(ii) and 10CFR50.73 (a)(2)(ii)(B).

Should there be any questions, please call us at your convenience.

Very truly yours,

John L. Skolds

DCH:lcd
Attachment

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NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Virgil C. Summer Nuclear Station	0 5 0 0 0 3 9 5	1 OF 0 4

TITLE (4): Substantial Safety Hazard (Part 21) Report on Feedwater Isolation Valve Actuators

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 NAMES	DOCKET NUMBER(S)
0 7	1 0	9 2	9 2	0 0 6	0 0	0 7	3 1	9 2		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	10CFR21.21(c)(3)
20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
W. R. Higgins, Supervisor, Licensing & Operating Experience	8 0 3 3 4 5 - 4 0 4 2

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	S J	I S V	C 3 1 1	Y					

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 fifteen single-space typewritten lines) (16)

During Refuel 6 (September through November 1991), a plant modification was implemented which replaced the actuators for the Feedwater Isolation Valves (FWIVs). On November 13, 1991, the "C" FWIV failed a post modification test due to a failure of a poppet valve seal in the actuator control assembly. The seals in all FWIVs were replaced with an improved design and the valves returned to service. An evaluation of the defective seal design was completed on July 10, 1992. It concluded that the defect represented a substantial safety hazard and was reportable per 10CFR21.21(c)(3)(ii) and 10CFR50.73(a)(2)(ii)(B).

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Virgil C. Summer Nuclear Station	0 5 0 0 0 3 9 5	9 2	— 0 0 6 —	0 1	0 2 OF 0 4

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

PLANT IDENTIFICATION:

Westinghouse - Pressurized Water Reactor

EQUIPMENT IDENTIFICATION:

Feedwater Isolation Valves (FWIVs) Actuator XVG-1611A, B, and C; EIIS - SJ

The actuator was designed and manufactured by Chicago Fluid Power and was qualified and supplied by Atwood-Morrill.

IDENTIFICATION OF EVENT:

A defect in the actuator of the Feedwater Isolation Valves (FWIVs) created the potential to cause one train of feedwater isolation to fail and created a Substantial Safety Hazard as described in 10CFR21. This potential failure also created a condition which resulted in the plant being outside its design basis and, thus, is reportable per 10CFR50.73.

EVENT DATE: July 10, 1992, at 1600 EDT

REPORT DATE: July 31, 1992

This report was initiated by Substantial Safety Hazard Evaluation Tracking Sheet 920001

CONDITIONS PRIOR TO THE EVENT:

The plant was shut down due to being in its sixth refueling outage. With the exception of this event, all other plant systems functioned normally.

DESCRIPTION OF EVENT:

During Refuel 6 (September through November 1991), a plant modification was implemented to replace the original Anchor Darling hydraulic-pneumatic FWIV actuators with Chicago Fluid Power pneumatic actuators. The replacement actuators were designed and manufactured by Chicago Fluid Power and were supplied and qualified by Atwood-Morrill. This modification was implemented to increase commercial reliability and to comply with recommendations with NRC IEN 85-35.

The new actuators were tested extensively prior to being shipped. This testing was witnessed by SCE&G personnel and consisted of 2000 actuator cycles with simulated valve loads. These tests resulted in five failures related to one or more "poppet" seals. The poppet seals are part of the control valve assembly which controls the opening and closing of the FWIV. The seal failures consisted of a crack in the base of the poppet seal which initiated where the corner of the retaining washer met the seal. The conclusion of these tests was that the failures were a low percentage, five failures out of 2000 cycles with a maximum expected life of 200 cycles, and not indicative of a generic or unacceptable failure.

During post modification testing, the "B" FWIV failed the bleed down test (capability to maintain sufficient pressure for a prescribed duration to close the FWIV within its required stroke time with the air supply isolated). This failure was considered to be an isolated case attributed to normal wear and tear and would cause the actuator to fail in a manner which would cause the valve to close (safe position). Therefore, this failure was determined to be a commercial risk and would not impact safe operation of the plant.

On November 13, 1991, the "C" FWIV actuator failed during post modification testing. The failure was due to a poppet seal in the control valve assembly. All poppet seals in the valve were replaced with new seals of the same design. Subsequently, failures occurred during extended testing. All of these failures were similar to the five failures which occurred during the manufacturer's testing (i.e., a crack in the base of the seal initiating from the inside corner of the poppet seal). Due to these failures, the manufacturer suggested that each new poppet seal be tested prior to installation by twisting and bending the seal by hand while inspecting the inside corner of the seal for cracking. Several new unused seals failed this inspection.

As a result of the above discrepancies, a new seal design was developed using the same material but utilizing a thicker lip and an increased inside corner transition radius. The new seal design was tested successfully and was proven acceptable which allowed the new seal to be placed into service and the FWIVs to be returned to operable status.

CAUSE OF EVENT:

The design of the poppet seal in the FWIV control assembly was inadequate to function reliably under the designed conditions for the valves.

ANALYSIS OF EVENT:

Analysis of Defect

Once the plant was returned to service, the following additional testing and analysis were performed in support of the problem resolution:

1. Comparison of the old design poppet seal properties to the new design poppet seal properties.

Results: The poppet seals were too small to verify the tensile strength of the material. Therefore, a pull test was performed on poppet seals with the lips removed. The results of the new design versus the old were within 2% of each other.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Virgil C. Summer Nuclear Station	0 5 0 0 0 3 9 5	9 2	— 0 0 6	— 0 1	0 4 OF 0 4

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

2. Perform finite element analysis on the original and new poppet seal designs.

Results: The tensile strength specified for the poppet seal material is 1400 psi stress. The maximum stress in the old design was calculated to be 2268 psi. The maximum stress calculated in the new design is 628 psi--much less than the material stress allowable (1400 psi).

In conclusion, the old poppet seals were determined to be inadequately designed for use on the new FWIV actuators. The new design poppet seals are an acceptable design which has been proven both through testing and analysis.

Significant Safety Hazard Determination

10 CFR 21 defines a "basic component" as "...a plant structure, system, component or part thereof necessary to assure (i) the integrity of the reactor coolant pressure boundary, (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition, or (iii) the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10 CFR 100.11." The FWIVs are required to close on demand to provide redundancy to the safety function of feedwater isolation (feedwater control valves and feedwater pump trips also provide a function of feedwater isolation). Failure to isolate feedwater during an event would result in the inability to prevent a reactor restart due to excessive core cooling. Therefore, the FWIVs are required as a redundant component to assure "the capability to shut down the reactor and maintain it in a safe shutdown condition" is met. The defective poppet seals were delivered to Virgil C. Summer Nuclear Station as being capable of performing their design basis function. However, assuming the failure of one or more of the defective poppet seals in conjunction with a single failure of the redundant component, the capability to isolate feedwater could be lost. Therefore, this defect results in a substantial safety hazard.

IMMEDIATE CORRECTIVE ACTIONS:

The poppet seals in all FWIV control assemblies were replaced and tested with newly designed seals. These tests verified the acceptability of the new design and allowed the valves to be returned to service.

ADDITIONAL CORRECTIVE ACTIONS:

The seal defect was analyzed and evaluated as representing a substantial safety hazard. Also, the new seal design was analyzed and determined to adequately meet the design requirements of the valve. This analysis served as a verification of the valve test results.

PRIOR OCCURRENCES:

None