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FACIL:50-250 Turkey Point Plant, Unit 3, Florida Power and Light C 05000250
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SUBJECT: LER 94-001-01:on 940119,three surveillance failures were caused by failure of solenoids to change position when de-energized.Changed solenoid valves from de-energize to actuate to energize to actuate configuration.W/940726 ltr.

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JUL 26 1994

L-94-188
10 CFR 50.73

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Re: Turkey Point Units 3 and 4
Docket No. 50-250
Reportable Event: 94-001-01
Failure of Emergency Containment Cooler Component Cooling Water Discharge Solenoid Valve

The attached supplemental Licensee Event Report 250/94-001-01 is being provided voluntarily in accordance with NUREG 1022, Supplement 1, Section 19.1. It reflects the completion of the root cause analysis by the vendor, and the subsequent 10CFR21 notification by that vendor.

If there are any questions, please contact us.

Very truly yours,

T. F. Plunkett
Vice President
Turkey Point Plant

TFP/CLM/cm

enclosure

cc: Stewart D. Ebneter, Regional Administrator, Region II, USNRC
Thomas P. Johnson, Senior Resident Inspector, USNRC, Turkey Point Plant

040028

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
TURKEY POINT UNITS 3 and 4	05000250	1 OF 5

TITLE (4)
Failure of Emergency Containment Cooler Component Cooling Water Discharge Solenoid Valves

EVENT DATE (5)			LER NUMBER(6)			RPT DATE (7)			OTHER FACILITIES INV. (8)	
MON	DAY	YR	YR	SEQ #	R#	MON	DAY	YR	FACILITY NAMES	DOCKET # (S)
01	19	94	94	001	01	xx	xx	94	TURKEY POINT UNIT 4	05000251

OPERATING MODE (9)	1/1
POWER LEVEL (10)	100/100

Other - Voluntary

LICENSEE CONTACT FOR THIS LER (12)

	TELEPHONE NUMBER
C. L. Mowrey, Operating Experience Feedback Engineer/Analyst	305-246-6204

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	NPRDS?	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	NPRDS?
B	BK	FSV	A609	YES					

SUPPLEMENTAL REPORT EXPECTED (14) NO ☐ YES ☐	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
(If yes, complete EXPECTED SUBMISSION DATE)				

ABSTRACT (16)

On January 19, 1994, a failure of SV-4-2924 to fully change position occurred. This resulted in an unsatisfactory Technical Specification surveillance on an emergency containment cooler. SV-4-2924 is a solenoid-operated valve supplying air to operate flow control valves for the component cooling water discharge from the emergency containment coolers. The solenoids are normally energized. There are three of these valve configurations on Unit 3 and three on Unit 4. This was the third failure of this type since November 11, 1993. Two of these three failures have occurred since the frequency of exercising the solenoid valves was administratively changed to once per week after the November 11 failure. One failure occurred on each unit.

All three surveillance failures were caused by failure of the solenoids to change position when de-energized, but at no time were more than one ECC inoperable.

The valve failures were caused by degradation of the lubricant, resulting in increased friction between the disc and seat, which in turn caused incomplete shifting to the de-energized position.

Interim corrective action was to exercise the solenoid valves once per day. Final corrective action was to change the solenoid valves from a de-energize to actuate to energize to actuate configuration.

This condition was reported by the vendor as a 10CFR21 notification on July 7, 1994.

I. DESCRIPTION OF THE EVENT

On January 19, 1994, a failure of SV-4-2924 [EIIS BK: IEEE FSV] to fully change position occurred. This resulted in an unsatisfactory Technical Specification required operability surveillance on the 4C emergency containment cooler [EIIS BK: IEEE FCU]. Valve SV-4-2924 is a solenoid-operated air control valve. There are three of these valve configurations on Unit 3 and three on Unit 4. This was the third failure of this type since the valves were replaced as a group in August and September, 1993. Two of these three failures have occurred since the frequency of exercising the solenoid valves was administratively changed to once per week on November 11, 1993. One failure occurred on each unit.

These solenoid-operated valves supply air to operate flow control valves [IEEE FCV] in the component cooling water [EIIS CC] discharge from the emergency containment coolers (ECCs). The solenoids are normally energized. On a safety injection signal the solenoid valves de-energize to bleed air from a closing cylinder and pressurize an opening cylinder in the valve actuator to force the flow control valve to open and maximize component cooling water flow through the ECC.

All three control valve failures were caused by failure of the solenoids to fully change position when de-energized.

II. CAUSE OF THE EVENT

The cause of this event was equipment failure in that the Nyogel 775A lubricant used in the solenoids was degrading, causing increased friction between the seating surfaces of the solenoid valves.

Valves of the same design, but which are energize-to-actuate, have shown no failures during their use in the inlet valve scheme of the CCW supply to the ECCs.

III. ANALYSIS OF THE EVENT

Licensing Requirements

The licensing basis at Turkey Point assumes the availability of two out of the three ECCs in conjunction with one of two trains of containment spray. This configuration ensures adequate heat removal capability following a loss of coolant accident (LOCA) or main steam line break (MSLB). The ECCs are a full capacity system and are redundant to the containment spray system in terms of the design basis accident containment heat removal capability. In addition, the ECCs are required to maintain containment environmental conditions (pressure and temperature) below the Environmental Qualification Pressure/Temperature profile curves for long term equipment operation.

However, Section 6.4.1 of the Updated Final Safety Analysis Report states that the operation of either of the two containment spray pumps or two of the three ECCs will provide the heat removal capability to maintain post accident containment pressure below the design value.

Analysis of Effects on Safety

The ECCs are an Engineered Safety Feature included in the containment design to mitigate the effect of a LOCA or an MSLB. Each unit is provided with three ECCs. The ECCs are automatically started by the engineered safety features actuation system upon a safety injection (SI) signal. The fan in each ECC starts and the CCW flow control valves open.

A failure of the ASCO solenoid valve would prevent the automatic opening of the ECC component cooling water (CCW) outlet valve. This event could render the ECC incapable of removing heat from the containment atmosphere. Therefore, maintaining the containment environmental qualification (EQ) temperature profile may not be automatically possible, but may require manual action. The exercise of the solenoid valves, as discussed below in the first corrective action, has maintained the operability of the ECCs by improving solenoid reliability. Nonetheless, an evaluation of the potential delay of the effectiveness of the ECCs by manual action was completed.

The effects of 1) a delayed start of the ECCs on the environmental qualification for safety related equipment inside containment, and 2) the use of manual operator actions to provide CCW flow to any affected ECC are evaluated below.

Delayed Start of ECCs Effect on EQ Envelope:

FPL analyses have been performed on the effects of a delayed start of ECCs on the containment EQ temperature profile ("MHA Containment Pressure & Temperature Analysis - no ECCs" and "Engineering Estimate of Containment Response for a Design Basis LOCA with CCW Split Header Configurations"). These analyses conclude that the start of two ECCs can be delayed for 20 minutes after an SI signal initiation without adversely affecting the EQ of any safety related equipment inside containment.

Operator Action to Restore CCW Flow to Affected ECCs:

NRC Generic Letter 91-18 allows the substitution of a manual operator action for an automatic action if the system safety function can be performed without exceeding a safety limit. While EQ criteria are not a safety limit, the use of manual actions to provide CCW flow through an affected ECC would have to be accomplished with no adverse consequences on the containment pressure/temperature profiles. As stated above, the operation of either of the containment spray subsystems or two of the three ECCs will provide heat removal capability to maintain the post accident containment pressure below the design value. Additionally, analyses discussed above have shown that delay of the start of the two ECCs for 20 minutes after SI initiation will not adversely affect the EQ of any safety related equipment inside containment.

These solenoid valves are located within the pipe and valve rooms for each unit in the auxiliary building. Manual action to provide CCW flow to an affected ECC must consider any post accident radiological dose to an operator. Using the guidance of draft NUREG 1465, FPL performed an analysis

to determine the postulated radiological dose rate at the pipe and valve room post accident. The calculation conservatively assumed containment leakage at the maximum design leak rate. The results show that the postulated dose rate in the pipe and valve room would not preclude an operator from performing necessary manual actions, provided that the actions were completed within 10 minutes of the onset of an accident.

Method of Manually Failing Open the CCW return Control Valves:

The ECC outlet valves are butterfly valves with air operated piston actuators. The piston operator does not contain a spring pack, and, therefore, fails as-is. To prevent unnecessarily large CCW flow rates during normal operation, these valves are held closed by their controlling air solenoid valve. The air supply for the valve operation is from the non-safety related instrument air system.

Since the ECC outlet valves must perform the active function of opening to provide cooling water flow to the ECCs during an accident, a safety related failsafe backup air accumulator and air relay valve arrangement is provided to ensure that the ECC outlet valves stroke open on the loss of instrument air pressure. In the event of a solenoid valve failure to reposition during an accident, this backup air supply system would be used to manually fail the ECC outlet control valve open. This is accomplished by isolating the instrument air supply to the affected valve, and bleeding off the remaining instrument air pressure through the associated instrument air pressure regulator's vent valve. This loss of control air pressure causes the air relay valve to shift position, porting the backup accumulator air to open the ECC outlet valve. The specific valve manipulation required to achieve this action is listed in procedure 3/4-OSP-055.1, Emergency Containment Cooler Operability Test.

Probabilistic Risk Assessment:

FPL performed a probabilistic risk assessment (PRA) to assess the impact on plant core damage frequency (CDF) as a result of continuing to operate with the existing solenoid valves but with a dedicated operator to locally open the ECC CCW outlet valves during an accident condition, if necessary. The CDF for the baseline PRA is 6.57E-5/yr while the CDF for the case with a dedicated operator to open the valves is 6.55E-5/yr. The small calculated decrease in risk to the plant is due to the introduction of the recovery action of the operator.

FPL's evaluations show that sufficient time exists for operators to manually open the ECCs' CCW return isolation valves without exceeding any containment pressure or temperature requirements and without exceeding acceptable post-accident operator doses. Therefore, the health and safety of the operators and the public were not adversely affected.

Although these are individual component failures, and at no time were more than one ECC inoperable, FPL has concluded that the commonality of the failure modes may warrant generic interest, and therefore is submitting this voluntary report. In addition, since at least two of the three ECCs were available, and adequate manual action existed to restore any or all which may not have actuated automatically, no substantial safety hazard existed which resulted in a major reduction in the degree of protection provided to public health and safety.

IV. CORRECTIVE ACTIONS

Immediate:

1. Technical Specification 4.6.2.2.a, Emergency Containment Cooling System Surveillance Requirements, state that the emergency containment cooling units shall be demonstrated operable at least once each 31 days. After the failure of a model NPL8342B2E solenoid valve in November of 1993, the frequency of performance of the surveillance test was administratively increased to weekly. Two subsequent tests have failed during the weekly surveillance. Starting January 20, 1994, the solenoid valves were cycled on a daily basis. These daily valve exercises were not full surveillance tests but were intended to demonstrate the functionality of the solenoid valves, and to assess the time dependence of the failure cause. No more solenoid valve failures occurred.

2. A night order and training brief were written, and operator briefings were held, to provide information about assigning a dedicated operator if the ECC CCW return isolation valves failed to reposition upon an actual demand. The dedicated operator would only be stationed if daily exercising of the solenoid valves experienced a failure. The dedicated operator would then be stationed near the pipeways and would respond only when directed by the Response-Not-Obtained section of an Emergency Operating Procedure after a failure of more than one ECC to operate as designed. No failures of the solenoid valves occurred after the daily exercise was initiated.

Long Term:

1. The three failed solenoid valves were returned to ASCO for failure analysis. ASCO determined, in conjunction with the lubricant manufacturer, that degradation of the lubricant increased friction between the disc and seat of the valves, which in turn caused incomplete shifting to the de-energized position. This condition was limited to a specific number of valves, manufactured since November, 1989. ASCO issued a 10CFR21 notification of the condition on July 7, 1994.

2. FPL believes that the failure of the solenoid valves may have been aggravated by the normally energized configuration of the installation. Each of the normally energized solenoid valves has been replaced with normally de-energized valves.

V. ADDITIONAL INFORMATION

The valves failing in the application existing at Turkey Point were ASCO Model NPL8342B2E direct-acting 4-way solenoid valves with factory-applied Nyogel 775A lubricant. The replacement valves are of the same model but are being used in an "energize to actuate" configuration. These valves were manufactured by Automatic Switch Co. (ASCO), 50-60 Hanover Rd., Florham Park, New Jersey, 07932.

EIIS Codes are shown in the format [EIIS SYSTEM: IEEE component function identifier, second component function identifier (if appropriate)].

No conditions such as those discussed above have been the subject of an LER at Turkey Point in the past.