



**FPL**

10 CFR § 50.73  
L-2006-233

OCT 13 2006

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

Re: Turkey Point Unit 3  
Docket No. 50-250  
Reportable Event: 2006-007-00  
Date of Event: May 3, 2006  
Age-Related Capacitor Failure Causes One Low Pressurizer Pressure Protection Channel  
to be Inoperable

The attached Licensee Event Report 50-250/2006-007-00 is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(i)(B) to provide notification of the subject event.

If there are any questions, please call Mr. James Connolly at (305) 246-6632.

Very truly yours,

Terry O. Jones  
Vice President  
Turkey Point Nuclear Plant

Attachment

cc: Regional Administrator, USNRC, Region II  
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

*IE22*

# LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory 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 and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@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 an 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.

1. FACILITY NAME Turkey Point Unit 3	2. DOCKET NUMBER 05000250	3. PAGE 1 OF 5
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4. TITLE  
Age-Related Capacitor Failure Causes One Low Pressurizer Pressure Protection Channel to be Inoperable

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
5	3	2006	2006	- 007 -	00	10	13	2006	FACILITY NAME	DOCKET NUMBER
										05000
										05000

9. OPERATING MODE 1	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)									
10. POWER LEVEL 100	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)						
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)						
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)						
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)						
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)						
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)						
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)							
<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER							
<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A							

12. LICENSEE CONTACT FOR THIS LER

NAME Paul F. Czaya – Licensing Engineer	TELEPHONE NUMBER (Include Area Code) 305-246-7150
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13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	JC	CAP	Cutler-Hammer	Y					

14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR

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

On May 3, 2006, during the performance of a surveillance test one of three channels of the low pressurizer pressure protection instrumentation was found out of specification and inoperable. The instrument logic is two-out-of-three. It was subsequently determined through evaluation that channel 1 was most likely inoperable from March 6, 2006 until subsequently repaired after the May 3, 2006 surveillance test. An age-related failure of a power supply filter capacitor for comparator module PC-3-455E caused excessive noise in the channel and the output fuse for comparator PC-3-455B to blow during a reactor pressure change when the comparator setpoint was reached. Corrective action included the replacement of comparator module PC-3-455E and the blown fuse for comparator PC-3-455B. A subsequent surveillance test was satisfactorily passed. A Hagan module replacement program has recently been approved and will be implemented in phases. Since the other two low pressurizer pressure instrumentation channels remained operable to ensure the required functions of safety injection (SI) and SI block were met, the safety significance of this event is very low due to the reduced redundancy and susceptibility to a single failure.

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

**DESCRIPTION OF THE EVENT**

At the time of the event, Turkey Point Unit 3 was operating in Mode 1 at 100% power. Unit 4 was also in Mode 1 at 100% power.

On May 3, 2006, during the performance of plant procedure 3-SMI-041.10 (Unit 3 Pressurizer Protection Loops Analog Test), comparator PC-3-455A trip voltage was found out of specification. The as found condition was recorded as 4.693 Vdc and the acceptance criteria is 4.53 to 4.55 Vdc. The remaining comparators in the loop were also checked and found to be out of specification. Additionally, comparator PC-3-455B was found to have a blown output fuse [EIS: JC, FU] and PC-3-455E exhibited high AC ripple (2.68 mVac) at its setpoint. The acceptance criterion for ripple is less than 1mVac.

Troubleshooting was performed and comparators PC-3-455A and PC-3-455B were both found to be outside Technical Specification (TS) allowable values. The trip setpoint of comparator PC-3-455A was 2423 psig while the maximum allowable value is 2403 psig. The trip setpoint of comparator PC-3-455B was 2020 psig while the maximum allowable value is 2018 psig. The bi-stables were left in the tripped position for channel 1 rendering the two-out-of-three trip logic a one-out-of-two trip logic. The source of noise was determined to be from comparator PC-3-455E. This comparator was replaced, the blown fuse for comparator PC-3-455B was replaced and plant procedure 3-SMI-041.10 was completed satisfactorily. The event was self evident in that surveillance test acceptance criteria were not met.

Condition Report (CR) 2006-13427 was initiated to evaluate the event. The evaluation concluded that the fuse was likely to have blown on March 6, 2006 during plant depressurization in preparation for a refueling outage. Therefore, one of three channels (channel 1) of pressurizer [EIS: AB, PZR] low pressure protection instrumentation was inoperable from March 6, 2006 until repaired subsequent to the performance of the surveillance test on May 3, 2006. The prior surveillance test had been satisfactorily passed on February 10, 2006.

After evaluation on August 17, 2006, this event was determined to be reportable in accordance with 10 CFR 50.73(a)(2)(i)(B).

**BACKGROUND**

To ensure reactor [EIS: AC] low pressure protection, redundancy is provided in the protective instrumentation system, i.e., a two-out-of-three low pressurizer pressure reactor trip logic and a two-out-of-three low pressurizer pressure safety injection (SI) logic.

The pressurizer protection circuitry consists of three identical analog loops. Each loop has its own associated power supply [EIS: JC, RJX]. Additionally, the components within the loop each have their own power supply. These loops receive inputs from field devices and use four comparators to determine if these inputs are within established setpoints. If an input is determined to be outside of a setpoint, the comparator trips and changes the state of its associated output relays [EIS: JC, RLY]. Comparator PC-3-

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455B provides a trip signal to the SI Block Enable logic. This logic enables operators to manually block an SI when pressurizer pressure drops below 1990 psig and disables the block when pressure is above 2000 psig. Comparator PC-3-455E trips to provide an SI signal when pressurizer pressure drops below 1730 psig. The output relay contacts for both comparators are connected in a two-out-of-three coincidence logic.

**CAUSE OF THE EVENT**

The cause of the event is an age-related failure of the +15V filter capacitor for comparator PC-3-455E, which opened thereby imposing excessive noise into the instrument loop. This caused other comparators to fail the calibration check.

The instrument loop noise most likely caused the output relays to chatter when pressurizer pressure reached the comparator setpoint during reactor pressure changes. The relay chatter was sufficient to blow the output fuse due to repeated coil [EIS: JC, CL] inrush current.

**ANALYSIS OF THE EVENT**

The failed comparator (PC-3-455E) was bench-tested to determine the cause of failure. The comparator +/- 15V power supplies were evaluated as a potential cause. The -15V power supply was measured to be -14.99 Vdc with 0.52 mVac of ripple, which was satisfactory. The +15V power supply was measured to be +12.78 Vdc with 4.89 Vac of ripple, which was unsatisfactory. The out of specification power supply was then further analyzed and the results indicated that the filter capacitor had failed open.

Comparator PC-3-455B provides an SI block permissive. The comparator trips at 2000 psig decreasing and enables SI to be blocked during reactor shutdowns. This comparator drives two output relays that are normally de-energized. When pressurizer pressure decreases below 1990 psig or increases above 2000 psig the output relays change state.

Research revealed that the same output fuse for comparator PC-3-455B had been discovered to be blown during performance of a different surveillance test (3-PMI-041.69, Pressurizer Pressure Protection Set I P-3-455 Calibration), on March 11, 2006. The fuse was replaced and the surveillance test performed satisfactorily. A condition report was not initiated at that time. Therefore, an evaluation of the blown fuse was not performed earlier.

With new comparator PC-3-455E installed, the problem was not repeatable. Therefore, the high noise problem with comparator PC-3-455E caused the fuse to blow. The most likely cause is high noise from the comparator causing the output relays to chatter when pressure increased to the comparator setpoint during a reactor pressure change. The chatter would cause repeated inrush current sufficient to blow the fuse. The output fuse is a 3/8 amp fuse and the comparator drives two output relays.

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The failed component was an electrolytic capacitor that was 18 years old. This type of component degrades with time and fails on average after approximately 12 years. These components are monitored for observable signs of degradation, such as excessive ripple and/or drift, which are known precursors to failure.

Turkey Point does not currently have a Hagan module replacement program. The current strategy is to perform the quarterly surveillance procedure and monitor ripple and drift. If the ripple is found to be high or it drifts outside the setpoint, the module is refurbished and the capacitor is replaced as part of the process. This method has been effective in finding degraded components before failure occurs.

The module (PC-3-455E) was refurbished in 1993 with a 5 year old capacitor. At the time of the refurbishment, Turkey Point did not have knowledge of the electrolytic capacitor age issue. As such, installing a 5 year old capacitor was an accepted practice.

**Reportability**

A review of the reporting requirements of 10 CFR 50.72 and 10 CFR 50.73 and NRC guidance provided in "Event Reporting Guidelines, 10 CFR 50.72 and 10 CFR 50.73 (NUREG-1022, Rev. 2)" was performed for the subject event. As a result of this review, the event is reportable as described below.

Part 50.73(a)(2)(i)(B) of Title 10 CFR states that the licensee shall report "Any operation or condition which was prohibited by the plant's Technical Specifications except when:

- (1) The Technical Specification is administrative in nature;
- (2) The event consisted solely of a case of a late surveillance test where the oversight was corrected, the test was performed, and the equipment was found to be capable of performing its specified safety functions: or
- (3) The Technical Specification was revised prior to discovery of the event such that the operation or condition was no longer prohibited at the time of discovery of the event."

All comparators in the channel 1 pressurizer low pressure protection analog loop were out of calibration during a surveillance test on May 3, 2006. One comparator (PC-3-455B) was found to have a blown fuse. Channel 1 of the low pressurizer pressure protection logic would not have tripped within the TS allowable value and was therefore inoperable. TS Table 3.3-2, Section 1.d requires that an inoperable channel be tripped within 6 hours of discovery.

The evaluation in CR 2006-13427 determined that channel 1 was inoperable since March 6, 2006 until repair after discovery on May 3, 2006. Since the channel was not placed in the tripped condition within 6 hours from the time it became inoperable (even though it was not known to be inoperable at that time), this event is reportable as a condition prohibited by the TSs and is reportable in accordance with 10 CFR 50.73(a)(2)(i)(B). The event does not meet the three exceptions for reporting under this criterion. It is reportable since the required action was not taken within the required time.

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**ANALYSIS OF SAFETY SIGNIFICANCE**

Based on the analysis described below, it is concluded that the health and safety of the public were not affected by this event.

The failed filter capacitor for comparator PC-3-455E caused channel 1 of low pressurizer pressure instrumentation to be inoperable. The instrumentation consists of three redundant channels in a two-out-of-three trip logic. Since only one channel was inoperable during the period 3/6/2006 to 5/3/2006, the other two channels were available to ensure the protection functions of SI initiation and SI block were met, if needed. Therefore, the increase in risk was very small due to the reduced redundancy and susceptibility to a single failure.

**CORRECTIVE ACTIONS**

1. The blown fuse was replaced in comparator PC-3-455B. Comparator PC-3-455E was replaced with a refurbished module and tested satisfactorily.
2. A project to replace Hagan modules has been approved. Installing the new modules from a different manufacturer will address the issue of component age degradation. The module replacement will occur in phases.

**ADDITIONAL INFORMATION**

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

**FAILED COMPONENTS IDENTIFIED:** Capacitor: Cutler-Hammer Model 8844K6

**SIMILAR EVENTS:** Turkey Point has experienced occasional Hagan module component failures. Failures have not resulted in any other reportable conditions during the last four years.