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Early C. Ewing, III
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Waterford 3

W3F1-99-0038
A4.05
PR

March 16, 1999

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

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Reporting of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report (LER) 97-020-01 for Waterford Steam Electric Station Unit 3. This report provides updated details of corrective measures for the condition originally reported on July 3, 1997. The reported condition involves the potential for a fire in certain plant areas to result in concurrent, momentary shutdown or current limiting of both trains of safety related Static Uninterruptible Power Supplies via cable faults. This condition was reported pursuant to 10CFR50.73(a)(2)(v).

Very truly yours,

E.C. Ewing
Director,
Nuclear Safety & Regulatory Affairs

ECE/OPP/rtk
Attachment

cc: E.W. Merschoff (NRC Region IV), C.P. Patel (NRC-NRR),
A.L. Garibaldi, P. Lewis - INPO Records Center,
J. Smith, N.S. Reynolds, NRC Resident Inspectors Office,
Administrator - LRPD

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LICENSEE EVENT REPORT (LER)

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

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If 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.

FACILITY NAME (1)

Waterford Steam Electric Station Unit 3

DOCKET NUMBER (2)

05000 382

PAGE (3)

1 OF 08

TITLE (4)

Potential Safety Related Static Uninterruptible Power Supply (SUPS)
Common Mode Failure

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 NAME	DOCKET NUMBER
06	04	97	97	-- 020 --	01	03	16	98	N/A	05000
									N/A	05000
OPERATING MODE (9)			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
6			20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)	
POWER LEVEL (10)			20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)	
0			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71	
			20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER	
			20.2203(a)(2)(iii)		50.36(c)(1)		X 50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A	
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)			

LICENSEE CONTACT FOR THIS LER (12)

NAME

E.P. Perkins, Licensing Manager

TELEPHONE NUMBER (Include Area Code)

(504)-739-6379

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On June 4, 1997, during Refueling Outage eight (shutdown), while evaluating a plant condition, it was determined that a fire in the switchgear room could potentially result in the momentary loss of both trains of safety related Static Uninterruptible Power Supplies (SUPS). The plant established hourly fire watches in that area in accordance with Fire Protection Program requirements. The apparent cause of the condition was determined to be a combination of 1) the inherent design of the SUPS units and 2) unprotected SUPS associated circuits that are not separated per Appendix R criteria. Other plant areas are affected by the condition. In addition to fire, low probability vulnerability to tornado missile damage exists in one plant area. Corrective measures during Refuel Outage 9 (RF09) include replacement of a SUPS and Operator response procedure enhancement. Post RF09 changes include cable reroutes and color coded breaker panel markings (human factors enhancement). Compensatory measures will continue in the interim. No actual loss of both trains of SUPS units occurred. This condition did not compromise the health and safety of the general public.

**REQUIRED NUMBER OF DIGITS/CHARACTERS
FOR EACH BLOCK**

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	8 TOTAL 2 FOR MONTH 2 FOR DAY 4 FOR YEAR	EVENT DATE
6	9 TOTAL 4 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	8 TOTAL 2 FOR MONTH 2 FOR DAY 4 FOR YEAR	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER EPIX VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	8 TOTAL 2 FOR MONTH 2 FOR DAY 4 FOR YEAR	EXPECTED SUBMISSION DATE

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

REPORTABLE OCCURRENCE

Waterford 3 discovered that a single fire event could potentially result in the momentary shutdown or current limiting of both trains of safety related Static Uninterruptible Power Supplies (SUPS). The condition is reportable in accordance with 10CFR50.73(a)(2)(v) wherein a single event (fire) could cause inoperability of two independent trains and channels of safe shutdown systems. A four hour call was made to the NRC Operations Center reporting the condition on June 4, 1997 at 1624 (Central Standard Time) in accordance with 10CFR50.72(b)(2)(iii)(A) as a condition that alone could have prevented fulfillment of safety function of systems needed for safe shutdown.

INITIAL CONDITIONS

At the time of discovery, Waterford 3 was in operational mode 5.

EVENT DESCRIPTION

Waterford 3 has six safety related SUPS units, two of which were procured from Elgar Corporation (SA & SB) and the other four (MA, MB, MC, and MD) were procured from Solidstate Controls, Inc. (SCI). The Elgar and SCI SUPS units are designed with 10KVA (83 amp @ 120 VAC) and 20KVA (167 amp @ 120 VAC) ratings, respectively. The SUPS units are designed with internal protective features. The SA and SB (Elgar) SUPS units were designed with a fast acting "fault" circuit that shuts off the inverter very rapidly when a fault draws current exceeding 165% of its full load. The Elgar SUPS units will restart approximately 30 cycles after every shutdown until the fault clears. The MA, MB, MC, and MD SUPS units maximum outputs are 120% of the full load.

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Therefore, any fault that exceeds the 120% limit will cause the SCI SUPS units to go into current limiting mode. The subject SUPS units are Class 1E components that supply low noise, uninterruptible, regulated power to Class 1E loads (safety related and safe shutdown).

On June 4, 1997, while conducting Refueling Outage 8 (RF08), it was determined that a fire in the switchgear room could potentially result in the momentary loss of both trains of safety related SUPS units [EF]. The initial review of the condition indicated that the momentary loss of the SUPS units would only affect one train of SUPS. After subsequent Engineering discussions with the SUPS vendors and further reviews, Waterford 3 concluded on June 4, 1997 that the potential existed for a common mode failure (momentary shutdown or current limiting) of both trains of safety related SUPS units. Although the potential SUPS failures would be momentary, the perturbation could be enough to require Operations to manually reset safety loads on multiple SUPS units/ trains. Perturbations could result if a fire were to start in plant areas that have unprotected (non-safe shutdown circuits of concern) cables from various safety related SUPS units, not separated per Appendix R requirements or if the cables were in a plant area susceptible to tornado strike damage. The scenario assumes the cables would fault and the Elgar SUPS would shutdown and restart. Upon restart of the Elgar SUPS, the individual load breakers would trip and isolate the fault. The SCI SUPS units limit current (degrade output voltage) when the resulting fault current and load current exceed the SUPS units capacity to supply power.

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CAUSAL FACTORS

The apparent root cause of the condition is a combination of:

- 1) the lack of recognition of the inherent design of the SUPS units (fast acting) which results in the potential for SUPS units shutting down or shifting to current limiting mode before individual (faulted circuit) load breakers can trip, and
- 2) not subsequently treating the non-safe shutdown cables connected to the SUPS units as associated circuits.

CORRECTIVE MEASURES

Upon identifying the condition, the plant established fire watches in accordance with the Fire Protection Program in the affected areas. Reviews were conducted to identify the areas where the SUPS load cables are routed. Fire watches were established in all of those areas. Hourly fire watches were applicable in all of the areas except the 'Q' deck area, which required a continuous fire watch, since there is no fire detection in that area.

As an interim compensatory measure, continuous fire watches will be required any time transient combustibles are in affected risk significant areas. Continuous fire watches are required, in accordance with the Fire Protection Program for any hot work performed in the affected areas.

Waterford 3 has performed a review of potential safety related SUPS vulnerabilities to common mode failure. Consideration was given to potential common mode failures due

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to fire, flood, moderate energy line break (MELB), high energy line break (HELB), seismic and tornado in applicable plant areas. Results of the reviews indicate that the safety related SUPS units are not vulnerable to common mode failure due to flood, seismic, HELB and MELB. Reviews further indicated that, while there is some potential for common mode failure due to tornado (cables in the 'Q' deck area), engineering calculations demonstrate that the overall probability of damage to the conduits by tornado is very low (1.76×10^{-7}) and is within acceptable limits. The new SUPS replacement eliminates the tornado vulnerability issue for the 'Q' deck area (as well as eliminating fire vulnerabilities in most affected areas).

More details of the review and assessment are provided under separate cover letter (W3F1-97-0172).

Correction of the identified system vulnerability is being addressed by:

1. replacement of a SUPS unit during RR9 (currently in progress). The existing Elgar SUPS 3B-S is being replaced with a new SCI 20 KVA (167 amp) SUPS. The new SUPS is equipped with an automatic static transfer switch which transfers power to the bypass transformer during an overload condition (120% of the inverter rating). The bypass transformer is rated for 30 KVA (250 amp) and can carry a continuous overload capability at 150% of its KVA rating (375 amp). The additional capacity of the new SUPS, coupled with the automatic action of the static transfer switch will correct the problem in most areas by supplying the fault current without degrading the output voltage.

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2. manual Operator action to trip non-essential, unprotected loads that receive power from SUPS 3B-S, via cables that pass through the control room and/or cable vault area during a control room/cable vault fire scenario. Due to the close proximity of cables in those areas, and the impracticality of wrapping and/or separating the cables in those areas, the Operators will isolate the non-essential circuits. The breakers for the circuits involved are all located on one power distribution panel (PDP391), which is located, near the isolation switches for the remote shutdown panel. A simulated walk-thru of the revised procedure (OP-901-502) by Operations supports the conclusion that the additional manual operator actions are insignificant and do not impact the ability to achieve and maintain safe shutdown. Mimic markings will be added to the power distribution panel to reduce the potential for operating the wrong breaker. Evaluations have been performed to determine the impacts of having an operator actuate the wrong breaker. It was determined that operating the wrong breaker would be detected either at the Remote Shutdown Panel or during performance of existing steps in the procedure and the Operators would have sufficient time to correct the discrepancy. The procedure revision is complete.
3. rerouting of some cables. The cables to be rerouted are rad monitor cables that can be relocated with the plant at power. The cables will be rerouted after RF9.

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SAFETY SIGNIFICANCE

The condition does not introduce new failure modes. The impact of the condition is that it could require the Operator to perform additional realignments of some safe shutdown loads that are sensitive to momentary interruptions/dips in voltage. As the fire progresses, unprotected non-safe shutdown cables, fed from the protected train SUPS unit could become involved in the fire. This could result in recurring instances of the race between the individual load breakers isolating the faults and the SUPS units momentarily shutting down (or entering current limiting mode) to clear the faults. Since the unprotected non-safe shutdown cables remain connected to the SUPS buses after transfer of control to the remote shutdown panel, the potential realignments could continue after control has been transferred to the remote shutdown panel. Engineering and Operations have reviewed the safe shutdown loads against wiring diagrams and off-normal procedures to assess the potential impact on safe shutdown and determined that the condition is manageable. The condition would not prevent safe shutdown of the plant. The review was conducted assuming a Control Room / Cable Vault fire, which would be the bounding scenario.

There were no actual safety consequences and implications associated with the condition since no actual fire event was involved. No actual Waterford 3 events have occurred involving a common mode failure of multiple trains of safety related SUPS units. The potential for common mode failure associated with this condition has existed from initial plant startup. The condition did not compromise the health and safety of the general public.

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SIMILAR EVENTS

No similar events were identified.

ADDITIONAL INFORMATION

Energy Industry Identification System (EIIS) Codes are identified in the text within brackets [].