NMC
Committed to Nuclear Excellence

Kewaunee Nuclear Power Plant
Operated by Nuclear Management Company, LLC

NRC-03-043

10 CFR 50.73

April 28, 2003

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

KEWAUNEE NUCLEAR POWER PLANT
DOCKET 50-305
LICENSE No. DPR-43
REPORTABLE OCCURRENCE 2003-002-00

In accordance with the requirements of 10 CFR 50.73, "Licensee Event Report System," the attached Licensee Event Report (LER) for reportable occurrence 2003-002-00 is being submitted. The report discusses failure of the "B" Train Emergency Diesel Generator to start while the "A" Train diesel was out of service for maintenance. The start failure resulted in declaring an Unusual Event Emergency Class, and initiating a plant shutdown required by the Technical Specifications. The diesel start failure occurred as a result of faulty contacts in the diesel start circuitry.

This letter contains no new commitments and no revisions to existing commitments.

Thomas Coutu
Site Vice-President, Kewaunee Plant

GIH

cc INPO Records Center
US NRC Senior Resident Inspector
US NRC, Region III

Attachment

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IE22

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information 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 Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@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 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.

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)

Shutdown Initiated - Diesel Generator Failed Start Test - Unusual Event – Caused by Start Relay 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
2	26	2003	2003	-- 002 --	00	04	28	2003	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	N
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)

	20.2201(b)		20.2203(a)(3)(ii)	X	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)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Gary I Harrington – Compliance	(920) 388-8559

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	EK	2	C612	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 15 single-spaced typewritten lines) (16)

On 2/26/2003, with the plant operating at 100% power, Nuclear Management Company (NMC) personnel reported that a plant shutdown was initiated according to Technical Specifications (TS) and an Unusual Event (UE) had been declared. The shutdown was initiated and UE declared after the "B" Train Emergency Diesel Generator (EDG) failed to start while the opposite, "A" Train, EDG was out of service for maintenance. TS require that when an EDG is out of service the opposite train diesel must be tested daily. When the daily start of the "B" EDG was attempted, it failed to start. The TS action statement to shutdown the plant was initiated. The diesel failed to start due to an insulating oxide layer on a single set of contacts associated with one of the diesel start circuit time delay relays. The plant power reduction began at 0107. The faulty relay was replaced and the diesel was satisfactorily retested at 0624. The plant back-down was halted at ten percent power. The plant did not reach a shutdown condition. The UE was based on the Kewaunee emergency classification criterion of both EDGs being unable to be connected to and supply power to the emergency safeguards power buses. The UE was exited at 0656 following the "B" diesel generator being returned to service. The increased core damage probability associated with diesel generator B being out of service for 27.75 hours was calculated using the Kewaunee probabilistic risk assessment model to be 4.38E-7, which is considered a very low risk in the Significance Determination Process. This value was calculated assuming average test and maintenance unavailabilities for all other components.

This report describes a safety system functional failure.

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

DESCRIPTION

On 2/26/2003, with the plant operating at 100% power, at 0102, Nuclear Management Company (NMC) personnel reported that a plant shutdown was initiated according to Technical Specifications (TS) and an Unusual Event (UE) had been declared. The shutdown was initiated and UE declared after the "B" Train Emergency Diesel Generator (EDG)[DG][EK] failed to start while the opposite, "A" Train, EDG was out of service for maintenance. Repairs were completed on the "B" EDG before a plant shutdown was completed and the UE was exited at 0656.

On 2/25/03 at 0239 the "A" Train EDG was removed from service to perform scheduled periodic maintenance. According to TS 3.7, "Auxiliary Electrical Systems," Section 3.7.b.2, "One diesel generator may be inoperable for a period not exceeding 7 days provided the other diesel is tested daily to ensure OPERABILITY and the engineered safety features associated with this diesel generator are OPERABLE."

On 2/26/03 at 0017 the daily start attempt for the "B" Train EDG failed. Trouble shooting revealed an electrical open in the start circuit. This was traced to a single set of contacts in one of the diesel start circuit time delay relays [2]. A failure analysis of the relay contacts showed that an insulating layer of oxidation had formed on the contact surfaces. A point to note is that the "B" diesel was started before the "A" diesel was removed from service on 2/25/03. This previous start was successful.

Subsequent to the EDG start failure, actions were initiated to begin shutting down the plant in accordance with the requirements of TS. In addition, a review of the Emergency Plan Implementing Procedures (EPIPs) was conducted. This review confirmed that the plant was in an "Unusual Event." In accordance with EPIP-AD-02, "Emergency Class Determination, Chart E Loss Of Power," the UE was declared at 0022. Prior to beginning the "A" EDG maintenance it was recognized that if the "B" Train diesel was to be found inoperable while the "A" Train diesel was out of service for maintenance, a UE would be in effect.

The plant power reduction began at 0107. The faulty relay was replaced and the diesel was satisfactorily retested and returned to service at 0624. The plant back-down was halted at ten percent power. The plant did not reach a shutdown condition. The UE was terminated at 0656. The "A" train EDG maintenance was completed and the diesel returned to service at 0010 on 2/27/03 and the plant was returned to full power operation at 0642 on 2/28/03.

The relay that failed during the diesel test was installed under a design change (DCR 2965) in 1998. The DCR replaced a Square D Model EMD8253241 with an Agastat E7000 series relay. The EMD relay was replaced due to continuing routine calibration problems attributed to aging.

CAUSE OF THE EVENT

Two root causes were identified for this event:

1. The time delay relay, cranking cutout relay (CCR), was found to have an insulating layer of silver/copper oxide on its contact surfaces. The oxide layer was caused by arcing across the contacts as they opened the circuit path that energized the engine start relay (ESR). The contacts of the CCR

were not rated for the arcing voltage and current transient that resulted from the energy dissipation of the coil of the ESR as it was de-energized.

2. Engineering design personnel responsible for replacing the CCR under DCR 2965 did not take into consideration the transient nature of the ESR relay when it was de-energized. Common engineering practice was applied when they considered the contact ratings of the new relay in comparison to the original relay.

Significant contributing factors were:

- Documentation of the maximum specified inductive inrush current of the Agastat E7000 series relay was less than adequate. Available vendor information did not list any inductive or inrush current ratings. It was assumed that the nuclear qualified E7000 series Agatsat relay was better than the prior two series of Agastats (series 2400 and 7000). Since Agastats had been considered to be a "standard" for timing circuits and could be used in relay logic, the use of the E7000 series was considered acceptable.

- The contact current ratings of the original CCR and the E7000 series Agastat relay appeared to be equivalent. The original CCR contacts had both a resistive and inductive rating of 0.5 amp, and had operated successfully in the ESR circuit. The new E7000 series Agastat was considered to be as good as the 2400 series Agastat. The 2400 series allowed an inductive inrush current up to five times the normal operating (i.e., resisitive) load. The E7000 was considered to be able to handle five times the 0.25 amp unit analyzed normal operating load @ 138 VDC or 1.25 amps for an inductive inrush current.

- The DCR design description and safety review did not analyze or document inductive or inrush currents of the circuits where the new E7000 series Agastat contacts were being installed. Additionally, the second level review did not consider this potential failure or analyze for transient conditions.

ANALYSIS OF THE EVENT

This event is being reported under 10CFR50.73(a)(2)(ii)(B), operation in an unanalyzed condition. The immediate notifications were made as 10CFR50.72(1)(i), Declaration of an Emergency Class, when the UE was declared, and 10CFR50.72, the initiation of a shutdown required by TS. There was no common failure between the diesels.

In addition to reporting this event as an unanalyzed condition, it is also being reported as a safety system functional failure according to the definition provided by NEI 99-02.

The increased core damage probability associated with diesel generator B being out of service for 27.75 hours was calculated using the Kewaunee probabilistic risk assessment model to be 4.38E-7, which is considered a very low risk in the Significance Determination Process. This value was calculated assuming average test and maintenance unavailabilities for all other components.

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

CORRECTIVE ACTIONS

Immediate corrective actions were to replace the affected relay and verify a similar condition did not exist with the opposite train diesel. The failed relay was also sent to an independent engineering lab for failure analysis. The results of the analysis are described above. Interim and long-term corrective actions are as follows:

1. After completion of each diesel run, monitoring has been performed to verify the continuity of contacts of the CCR relay in each diesel engine ESR relay circuit. Continuing this action will ensure availability and operability of the diesels for any future demand. This action is interim until circuit modifications are completed.

2. Modify the diesel engine ESR relay circuits to prevent arcing across contacts 1-5 of relay CCR. Evaluate the addition of continuous indication of ESR relay circuit continuity on each diesel engine.

3. Re-analyze, monitor if required, and modify as needed, those relay circuits that are susceptible to similar failure as established by an extent of condition determination.

4. Evaluate modifying the Fleet Modification Procedure Design Input Checklist (Part B) and Design Review Checklist to add an input and review to check each design for failure modes and effects under transient conditions. This input would be added to each discipline, since the transient analysis needs to be established for each engineering method. As an alternative, this transient analysis requirement could be added to Nuclear Engineering Procedure (NEP), NEP 4.8, Design Considerations, as a Kewaunee specific requirement.

5. Provide continuing training to engineering design personnel, through the modification design training module, to consider failure modes and effects that can arise from transient analysis of modified systems structures and components.

SIMILAR EVENTS

None