Duke Power
A Duke Energy Company

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September 25, 2003

U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTENTION: Document Control Desk

SUBJECT: Duke Energy Corporation
Catawba Nuclear Station Unit 1
Docket Number 50-413
Licensee Event Report 413/2002-006-01

Attached please find Licensee Event Report 413/2002-006 Revision 1, entitled "Technical Specification Noncompliance - Inoperable Diesel Generator Caused by Inadequate Wire Lug Crimping at Closing Spring Motor Disconnect Switch." This revision is to correct the description of the reactor coolant pump seal replacement project. This revision does not change the original report conclusions that the overall safety significance of this event was determined to be minimal and there was no actual impact on the health and safety of the public. Additionally, the status of the corrective action is updated with this revision.

This Licensee Event Report does not contain any regulatory commitments. Questions regarding this Licensee Event Report should be directed to George Strickland at (803) 831-3585.

Sincerely,

D. M Jamil

Attachment

IE22

Xc w/attachment:

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NRC FORM 366 (7-2001) 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)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Catawba Nuclear Station, Unit 1	05000 413	1 OF 8

4. TITLE
Technical Specification Noncompliance - Inoperable Diesel Generator Caused by Inadequate Wire Lug Crimping at Closing Spring Motor Disconnect Switch

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
06	24	2002	2002	- 006 -	01	09	25	2003	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	1
10. POWER LEVEL	100%

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

20.2201(b)		20.2203(a)(3)(ii)		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)	X	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)	X	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)	

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
G. Strickland, Regulatory Compliance	803-831-3585

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	EK	BKR	B455	Y					

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

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

On June 28, 2002, at approximately 1100 hours, with the unit operating at 100 percent power, during performance of a periodic test, it was discovered that diesel generator 1B output breaker 1ETB-18 would not close. During troubleshooting, the ring lug wiring connection to the motor disconnect switch in breaker 1ETB-18's spring charging circuit was found to be disconnected. The springs in a breaker of this type are charged immediately after the breaker closes. All evidence indicates when the breaker was closed during the previous diesel generator test at approximately 2000 hours on June 24, 2002, the degraded connection finally opened and the springs did not completely recharge. If the charging springs are not fully charged the breaker mechanism is not latched and cannot be closed automatically. Diesel generator 1B was inoperable between June 24, 2002 at 2000 hours until the problem was corrected on June 29, 2002, at approximately 0125 hours, which exceeds the Technical Specification Allowed Outage Time. The root cause of this event is inadequate crimping of the wire in the ring lug connection. Corrective actions include breaker preventive maintenance program enhancements. This event did not adversely affect the health and safety of the public.

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

BACKGROUND

Catawba Nuclear Station Unit 1 is a Westinghouse Pressurized Water Reactor [EIIS: RCT]. The onsite Class 1E AC electrical power distribution system [EIIS: EB] is divided by train into two redundant and independent electrical power distribution subsystems. The AC electrical power subsystem for each train consists of a primary Engineered Safety Feature (ESF) 4.16 kV bus [EIIS: BU] and secondary 600 volt buses, distribution panels [EIIS: PL], motor control centers (MCCs) and load centers. The 4.16 kV essential auxiliary power system physically consists of two independent and redundant 4.16 kV switchgear assemblies [EIIS: SWGR], designated 1ETA and 1ETB. The 4160VAC Essential Auxiliary Power System supplies power to those Class 1E loads required to safely shutdown the unit following a design basis accident. This system is also available to supply power to the 4160VAC Blackout Auxiliary Power System. The 4160 volt essential system is divided into two completely redundant and independent trains designated A and B, each consisting of one 4160 volt switchgear assembly, three 4160/600 volt transformers [EIIS: XFMR], two 600 volt load centers, and associated loads. Normally each Class 1E 4160 volt switchgear is powered from its associated non-Class 1E train of the 6900VAC Normal Auxiliary Power System. Additionally, an alternate source of power to each 4160 volt essential switchgear is provided from the 6900 volt system via two separate and independent 6900/4160 volt transformers. These transformers are shared between the Catawba units and provide the capability to supply an alternate source of preferred power to each unit's 4160 volt essential switchgear from either unit's 6900 volt system. A key interlock scheme is provided to preclude the possibility of connecting the two units together at either the 6900 volt level or the 4160 volt level.

Each train of the 4160VAC Essential Auxiliary Power System is also provided with a separate and independent emergency diesel generator [EIIS: DG] to supply the Class 1E loads required to safely shutdown the unit following a design basis accident. Additionally, each diesel generator is capable of supplying its associated 4160 volt blackout switchgear through a connection with the 4160 volt essential switchgear.

If the diesel generator is being tested (i.e., paralleled to the system) and a Safety Injection Actuation Signal is received by the

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

sequencer, the diesel generator breaker is tripped and the diesel remains running in a standby mode. At this point, the sequencer automatically functions to apply the appropriate loads. Also, if the diesel generator is being tested and a loss of offsite power should occur, the diesel generator will attempt to pick up the load until an instantaneous overcurrent relay trips the diesel generator breaker. At this point the diesel generator will continue to run in a standby mode and the sequencer will initiate load shedding and automatically apply the appropriate loads. Since redundant diesel generators are not tested simultaneously, the other diesel generator would be started via its associated sequencer just as it would for any condition.

Technical Specification Limiting Condition for Operation (LCO) 3.8.1 requires two qualified circuits between the offsite transmission network and the Onsite Essential Auxiliary Power System and two diesel generators capable of supplying the Onsite Essential Auxiliary Power Systems. With one emergency diesel generator inoperable, the following actions are required:

1. Perform SR 3.8.1.1 for the offsite circuits within one hour and once per 8 hours thereafter. Surveillance Requirement (SR) 3.8.1.1 requires verification of correct breaker alignment and indicated power availability for each offsite circuit.
2. Declare the required feature(s) supported by the inoperable diesel generator inoperable when its required redundant feature(s) is inoperable
3. Determine that the operable diesel generator is not inoperable due to a common cause failure or perform SR 3.8.1.2 for the operable diesel generator. SR 3.8.1.2 requires verification that each diesel generator starts from standby conditions and achieves steady state voltage and frequency within prescribed limits.
4. Restore the diesel generator to operable status within 72 hours and within 6 days from discovery of failure to meet the LCO.

This event is being reported pursuant to 10CFR 50.73(a)(2)(i)(B) (any operation or condition prohibited by the plant's Technical Specifications (TS)), and 10CFR50.36(c)(2)(i) (Limiting Condition for Operation (LCO) not met).

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

During the time of this event, Unit 1 was operating in Mode 1, Power Operation. With the exception of the diesel generator breaker discussed in this report, no structures, systems, or components were out of service at the time of this event that contributed to the event.

EVENT DESCRIPTION
(Dates and times are approximate)

Date/Time	Event Description
6/24/02 2000	Twenty-four hour load test of diesel generator 1B was begun. The diesel generator output breaker 1ETB-18 was closed shortly thereafter. This periodic test was completed satisfactorily. There were no alarms or indications of any unusual conditions related to the diesel generator output breaker.
6/28/02 1000	Diesel generator 1B taken out of service for test PT/1/A/4350/15B, Diesel Generator 1B Periodic Test. This inoperability was entered in the Technical Specification Action Item Log.
6/28/02 1100	During performance of PT/1/A/4350/15B, it was discovered that diesel generator 1B output breaker 1ETB-18 would not close onto the bus. Visual inspection of the breaker did not show any obvious problems.
6/28/02 1622	Engineering, Maintenance and Operations personnel developed a troubleshooting plan. Further attempts to close the breaker remotely and locally were attempted and were unsuccessful.
6/28/02 2012	1ETB-18 was removed from the breaker cubicle. It was determined that the charging motor toggle switch was faulty. There was a burnt wire and lug on one of the connections to the

toggle switch. The spring charging motor was confirmed to be operating properly.

A new ring terminal and motor disconnect switch were installed on breaker 1ETB-18. 1ETB-18 was cycled successfully.

6/29/02 0125 Diesel generator 1B was declared operable.

CAUSAL FACTORS

The only failed component found on breaker 1ETB-18 was the ring lug wiring connection at the motor disconnect switch. The motor disconnect switch is in the breaker spring charging circuit. The springs in a breaker of this type are charged immediately after the breaker closes. All evidence indicates that when the breaker was closed at approximately 2000 hours on 6/24/02 the springs started recharging and almost reached full travel. It appears that at this point in time the degraded connection finally burned open and the charging motor stopped running. If the charging springs are not fully charged the breaker mechanism is not latched and cannot be closed. The breaker opening mechanism is separate and therefore there was no problem in opening the breaker at the end of the diesel generator 1B run on the evening of 6/25/02. It is concluded that the diesel generator 1B was inoperable between 6/24/02 at approximately 2000 hours until correction of the problem on 6/29/02 at approximately 0125 hours.

Laboratory examination of the damaged wiring connection concluded that the root cause of the failure was inadequate crimping of the wire within the ring lug barrel by the manufacturer. In cases where inadequate crimped connections exist, a condition known as static heating exists. Through time, the heating stress relieves the crimp increasing the temperature in the crimp area to a point where the heat becomes so hot the insulation burns or melts off and eventually melts the wire.

The breaker 1ETB-18 is a 4160-volt 5HK breaker manufactured by Asea-Brown-Boveri.

Operations personnel periodically inspect the breaker closing mechanism to verify the closing springs are charged. However, it is highly unlikely that this failure could have been detected by this visual

inspection because in this case, it would have appeared that the closing mechanism was properly positioned.

There are approximately 68 similar breakers in use at the site. Review of the operating experience data base for entries related to Asea-Brown-Boveri breakers charging motors and charging springs did not identify any cases with the same results as identified as the root cause of this event.

CORRECTIVE ACTIONS

Immediate:

1. A new ring terminal and motor disconnect switch were installed on breaker 1ETB-18 and the breaker was returned to service.

Interim:

1. This failure was discussed with breaker team technicians and they were requested to specifically inspect wire terminals on all metalclad circuit breakers when performing preventive maintenance work.

2. The diesel generator 1A output breaker was inspected on August 6, 2002 and no abnormal indications were identified.

3. Breaker maintenance procedures were revised to require close inspection of wire terminals during any breaker maintenance activity.

Any future corrective actions will be addressed via the Catawba Corrective Action Program. There are no NRC commitments contained in this LER.

SAFETY ANALYSIS

The Catawba Probabilistic Risk Analysis (PRA) was used to reach the conclusion that the increased risk was not significant.

The conditional core damage probability (CCDP) for the period of the breaker unavailability has been estimated to be approximately 6.4E-07. This CCDP estimate excludes the effects of external events (i.e., fire,

tornado, and seismic). This estimate also considered two important changes to the current base case PRA (Revision 2b).

This estimate also considered 2 important changes to the current base case PRA (Revision 2b). Catawba has been replacing the reactor coolant pump seal packages on the reactor coolant pumps. The new seal packages include a high temperature o-ring material which significantly improves the seal performance when subjected to a loss of seal cooling. The PRA model has been modified for this analysis to reflect the expected improvement in RCP seal performance. Only the stage 1 seal of Reactor Coolant Pump 1D retains the original, non-high temperature o-ring material. The impact of this seal retaining the original material has been evaluated and has been determined to have an insignificant impact on the core damage frequency results. Additionally, the industry experience regarding turbine building flooding shows that maintenance on condenser cooling systems is a major contributor to the flooding events. Because the CNS condenser cooling systems were intact for the time period of interest, a reduction in the turbine building flood frequency by a factor of 0.5 has been assumed in the analysis.

The conditional early containment failure probability (ECFP) has been estimated to be 1.3E-07 for the time period of concern. For the condition that is the subject of this LER, the change in ECFP is an appropriate indicator of the change in the large early release probability. This estimate is arrived at by assuming that the entire change in core damage probability is due to station blackout sequences. A conditional containment failure probability of 0.2 (consistent with NUREG/CR-6595) is applied.

The offsite consequence analyses performed by Duke as part of the PRA program have shown that such a small change in the early containment failure probability has a very small impact on the probability of early fatalities, the quantitative health objective (QHO) for which the LERF is used as a surrogate. The early fatality risk is dominated by sequences such as the interfacing-systems loss of coolant accident (ISLOCA).

The breaker unavailability had only a small impact on the core damage and large early release probabilities.

During the time period that diesel generator 1B was inoperable, there were no cases in which any 'A' train equipment was removed from

service. Therefore, this equipment would have been available if needed during this period.

In conclusion, the overall safety significance of this event was determined to be low and there was no actual impact on the health and safety of the public.

ADDITIONAL INFORMATION

A review of LERs from the last two years found no LERs that involved a similar hardware failure. Catawba Nuclear Station Unit 2 LER 414/00-001 involved inoperability of a diesel generator caused by a failure of 2ETB-18 to close. This was attributed to the existence of loose parts in the control device mechanism that may have interfered with the control device mechanism and prevented the breaker close coil from being energized.

Energy Industry Identification System (EIIS) codes are identified in the text as [EIIS: XX]. This event was reportable to Equipment Performance and Information Exchange (EPIX) Program as EPIX report 367.

This event does not represent a safety system functional failure.

There were no releases of radioactive materials, radiation exposures or personnel injuries associated with this event.