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A Duke Energy Company

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December 20, 1999

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

SUBJECT: Duke Energy Corporation
Catawba Nuclear Station Unit 1
Docket No. 50-413
Licensee Event Report 413/99-016 Revision 0

Attached please find Licensee Event Report 413/99-016 Revision 0, entitled "Operation Prohibited by Technical Specification 3.8.1 and 3.7.8 Due to Inoperable Diesel Generator 1B for Greater than 72 Hours".
Questions regarding this Licensee Event Report should be directed to R. D. Hart at (803) 831-3622.

The only commitments in this Licensee Event Report are those described in the "Planned Corrective Actions" section.

Sincerely,

G. R. Peterson

Attachment

IE22

xc:

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SREC	
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NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION
(6-1998)

LICENSEE EVENT REPORT (LER)

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

APPROVED BY OMB NO. 3150-0104 EXPIRES 06/30/2001

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TITLE (4)

Operation Prohibited by Technical Specification 3.8.1 and 3.7.8 Due to Inoperable Diesel Generator 1B for Greater than 72 Hours

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
									NA	
11	19	99	99	016	00	12	20	99	FACILITY NAME NA	DOCKET NUMBER

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

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)	X 50.73(a)(2)(i)	50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)	50.73(a)(2)(ii)	50.73(a)(2)(x)
	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)	50.73(a)(2)(v)	
	20.2203(a)(2)(iv)	X	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
R. D. Hart, Regulatory Compliance	(803) 831-3622

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
X	EK	65	W290	Y						

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

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

On November 16, 1999 at 0415, with Unit 1 at 100% power, diesel generator (DG) 1B was declared inoperable to perform various maintenance activities. This placed Unit 1 in a 72-hour action statement for DG 1B and Nuclear Service Water System pump 1B. During the post maintenance test of the DG 1B, the DG breaker tripped on overcurrent while attempting to load the DG from the 2500kW plateau to the 4000 kW plateau. DG 1B was shutdown and trouble shooting began. Trouble shooting and repair activities were unsuccessful in restoring operability to DG 1B within 72 hours. A Notice of Enforcement Discretion (NOED) was requested from the NRC so that the completion times of the Required Actions for TS LCO 3.8.1 and 3.7.8 could be extended from the current 72 hours by an additional 48 hours. This was requested to allow necessary repairs and testing activities to be completed. The NRC granted the NOED on November 19, 1999 at 0200. A failure investigation team concluded that the cause of the DG breaker overcurrent trips was improper operation of the DG electronic governor (EGA). The DG 1B EGA was replaced, tested, and DG 1B was declared operable on November 20, 1999 at 2309. The replaced EGA will be sent back to the manufacturer for analysis. The event is being reported as any operation or condition prohibited by TS, 10CFR50.73(a)(2)(i)(B), and TS LCO not met, 10CFR50.36(c)(2).

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

Background

Catawba Nuclear Station Unit 1 is a four loop Westinghouse Pressurized Water Reactor. Unit 1 has two emergency diesel generators (DGs) 1A and 1B [EIIS: EK]. Each DG is utilized as the standby emergency power source for each 4160-volt emergency bus. DGs 1A and 1B are dedicated to busses ETA and ETB [EIIS: EB], respectively. The DGs will start automatically on a safety injection signal or on a bus loss of voltage or degraded voltage signal. Loads will be automatically connected to the bus as required by the respective load sequencer [EIIS: EK]. In parallel operation (i.e., with the DG paralleled to the grid), the electronic governor [EIIS: EK] controls generator load or real output power (watts), and the voltage regulator controls power factor and reactive power output (VARs) from the generator. The speed control is used to increase generator load, and the voltage control is used to increase or decrease reactive power output.

The speed control consists of two pushbuttons used to control the magnitude of the output signal from the Digital Reference Unit (DRU) [EIIS: EK]. The DRU provides a reference signal to the electronic governor. In parallel operation, the magnitude of the DRU reference signal determines the generator load (watts). The electronic governor monitors generator output voltage and current to calculate generator load. Based on generator load and the DRU reference signal, the electronic governor provides a signal to the hydraulic actuator in the mechanical governor to control the amount of fuel supplied to the engine and, thus, maintain constant generator load.

Technical Specification (TS) Limiting Condition for Operation (LCO) 3.8.1 governs AC Sources - Operating for Modes 1, 2, 3, and 4. LCO 3.8.1 requires in part that two DGs be operable. Condition B for this LCO states that with one DG inoperable, the DG must be restored to operable status within 72 hours, in addition to the other Required Actions that must be performed. Condition G states that with the Required Action and associated Completion Time of Condition B not met, the unit must be in Mode 3 within 6 hours and in Mode 5 within 36 hours. The inoperability of DG 1B results in the inoperability of associated Nuclear Service Water System (NSWS) Pump 1B [EIIS: BI]. LCO 3.7.8 requires that in Modes 1, 2, 3, and 4 two NSWS trains be operable. Condition A for this LCO states that with one NSWS train inoperable, the NSWS train must be restored to operable status within 72 hours. Condition B states that with the Required Action and associated Completion Time of Condition A not met, the unit must be in Mode 3 within 6 hours and in Mode 5 within 36 hours.

DG 1B was declared inoperable on November 16, 1999 at 0415 to perform various maintenance activities. This placed Unit 1 in a 72-hour action statement for DG 1B and NSWS pump 1B.

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During the post maintenance test of DG 1B, the DG breaker tripped on overcurrent (50 DGT relay). DG 1B was shutdown and trouble shooting began.

Trouble shooting and repair activities were unsuccessful in restoring operability to DG 1B within 72 hours. Therefore, a Notice of Enforcement Discretion (NOED) was requested from the NRC so that the completion times of the above Required Actions for TS LCO 3.8.1 and LCO 3.7.8 were extended from the current 72 hours by an additional 48 hours, for a total of 120 hours. This was requested to allow necessary repairs and testing activities to be completed. The NRC granted the NOED on November 19, 1999 at 0200 and DG 1B was repaired and declared operable on November 20, 1999 at 2309.

Unit 1 operated in Mode 1, "Power Operation" during this event. No additional structures, systems, or components were out of service at this time that contributed to this event. The event is being reported as any operation or condition prohibited by TS, 10CFR50.73(a)(2)(i)(B), and TS LCO not met, 10CFR50.36(c)(2).

Event Description

11-16-99

0415 DG 1B was declared inoperable for various maintenance activities. Part of these activities involved replacing some of the fuel control rack linkage(s) (heim joints). The heim joints were being replaced with a new style for improved reliability.

1742 During running of DG 1B, the DG breaker tripped on overcurrent (50GDT relay) while attempting to load the DG from the 2500 kW plateau to the 4000 kW plateau. It was noted that DG 1B power was swinging about 200 kW at a load of 4000 kW.

2100 Engineering and Maintenance Technical Support were consulted concerning the unexpected DG breaker trip. Preliminary examination of the trip data indicated a power swing prior to the trip could have been caused by a sticking fuel rack. Heim joint replacements had been performed on the fuel rack mechanism going to several cylinders. Maintenance was instructed to inspect the replacement sites and assure free movement of these joints. Following completion of this work, the Operations performance test (PT) would be performed. Per discussion with Engineering, DG 1A successfully passed its Operability PT upon completion of heim joint replacement. Therefore, no common cause failure was assumed to exist at that time.

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11-17-99

0240 After heim join inspection, the DG 1B operability PT was completed satisfactorily. In order to complete a root cause evaluation of the failure, a decision was made to delay declaring the DG operable until Engineering had a chance to review the test data.

1209 Upon completion of the review of the data from the test, a Failure Investigation Process (FIP) team was initiated to investigate the cause of the unexpected DG breaker overcurrent trip.

1632 New heim joints were obtained from the warehouse and some were observed to have stiff joints. The FIP team surmised that one or more of the heim joints in DG 1B had stiff internals that eventually loosened during the DG load increase section of the operability performance test. A decision was made to remove and reinspect the heim joints in DG 1B.

11-18-99

0300 The heim joint inspection was completed. Three heim joints were replaced. (One was replaced due to sluggish operation and two were replaced due to rough surfaces.)

0420 The DG 1B operability PT was performed. During the test, the DG breaker again tripped on overcurrent (50DGT relay) while the DG was being unloaded at the end of the test during power factor adjustments. The FIP team was called in to investigate.

1200 FIP Team recommended a replacement of the power driven potentiometer (PDP) and the Voltage raise / lower pushbutton. Problems were noted in both of these components during the investigation. Contingency Plans were made for electronic governor replacement in the event that additional testing indicated that the problem was not resolved by these replacements. Consultation with the Vendor indicated that the most likely cause, based upon industry failure data and description of the data obtained from the tests, is the PDP followed by the electronic governor.

2130 A functional test plan was developed to run the DG and exercise the PDP by both increasing and decreasing loads. A PT would follow successful running of the DG indicating confirmation that the PDP was the likely cause of the DG breaker overcurrent trip.

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11-18-99

2310 Following replacement of the PDP and the voltage raise/lower pushbutton, DG 1B was tested. An overcurrent trip of the DG breaker on the 50 DGT relay occurred following a successful full loading of the DG. This occurred as the operator was reducing load on the DG. Station Management was present during test. Regulatory Compliance was requested to setup a conference call with NRC Region II to request a Notice of Enforcement Discretion (NOED).

11-19-99

0200 The NRC granted a NOED covering TS LCO 3.8.1 and TS LCO 3.7.8 (extending the allowable outage time from 72 hours to 120 hours). The NOED allowed additional time to complete repair activities on the 1B DG (replace the electronic governor).

1707 Following review of the data and further consultation with the Vendors involved, a decision was made to replace the electronic governor and have Vendors dispatched to the site to oversee checkout and tuning of the components.

11-20-99

0442 Following replacement installation, the governor was tuned and functionally tested through a DG run and no problems were found.

0900 A Plant Operating Review Committee (PORC) meeting to review PT/1/A/4350/12B, "Diesel Generator 1B Governor and Voltage Regulator Test" was held. This procedure was used to perform the post maintenance testing after DG 1B governor replacement.

1630 PT/1/A/4350/12B was completed satisfactorily. This test is one of the required retests for a governor replacement or adjustment.

2309 Operations completed the DG 1B operability PT and DG 1B was declared operable. Unit 1 exited TS 3.8.1 and 3.7.8.

Causal Factors

A FIP team was formed to determine the cause of the DG overcurrent trip. Based on the available data, the team concluded that the root cause of the DG breaker overcurrent trips was improper operation of the DG electronic governor.

During the investigation the FIP team identified four (4) potential root causes for the overcurrent trips:

1. Fuel Control Rack Linkage (heim joints) [EIIS: EK]
2. Voltage Raise/Lower Pushbutton [EIIS: EK]
3. Power Driven Potentiometer (PDP) [EIIS: EK]
4. Electronic Governor (EGA) [EIIS: EK]

Binding of a fuel control rack linkage assembly may create a condition where the DG output load either does not increase or lags behind the demand signal from the governing system. When the binding linkage assembly becomes free, the engine output load will immediately increase to the value of the demand signal. This rapid increase in load may cause a current increase above the breaker overcurrent trip setpoint.

New heim joints were installed on cylinders 1, 6, 7 and 8 in both the left and right banks during diesel work performed on 11/16/99. The failure occurred on the first start following installation. As a result, the heim joint replacements were initially considered a possible cause of the failures. Subsequent investigation and testing indicated that while the heim joint replacement may have contributed to the breaker overcurrent trips when the DG was run, this was not the root cause.

During parallel operation, the Voltage Raise/Lower pushbutton controls VAR loading on the DG. Prior to the overcurrent breaker trip occurring on 11/18/1999, the voltage regulator was controlling DG voltage as required at varying levels as demanded by the Operations PT. Upon pressing the Voltage Raise Pushbutton to adjust power factor to .95 lagging, a sudden and rapid decrease occurred. A decrease in power factor in such a dramatic fashion is indicative of a large surge in VAR load (and its associated current). Data from the Operator Aid Computer (OAC) confirmed that the VAR load and current had suddenly increased. This would have certainly caused the setpoint of the overcurrent relay (50DGT) to be reached. The only components that physically change in position (in response to operator action) to reduce this setting are the pushbutton itself, and the Voltage Regulator PDP.

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The contacts of the Raise/Lower pushbutton were checked with a voltmeter. The Lower pushbutton operated satisfactorily. The Raise pushbutton appeared to have a slight hesitation between the time the button was released and when the contacts would return to the open position.

The operation of the motor on the PDP is not fast enough to cause the rapid decrease as that seen during the event. However, the sluggish operation was questionable and this pushbutton assembly was replaced. While some of these repairs were in progress, the 50DGT overcurrent relay and the 4 kV DG output breaker were checked and found to be operating properly.

The Power Driven Potentiometer (PDP)(sometimes called a Motor Operated Potentiometer) receives a demand signal from the Voltage Raise/Lower pushbutton to allow the motor to rotate a potentiometer in either the clockwise or counter-clockwise direction. The potentiometer provides an input to the voltage regulator to vary the DC voltage output to the generator field. Testing was performed on the PDP by placing an analog resistance meter across the output. Several small spikes were observed during the process of spanning the potentiometer back and forth. This raised concern that there may have been a problem with this device. Discussions with a vendor expert, confirmed that based on the information given by the operator (dramatic dip of power factor and a surge in VARs), the PDP was a possible cause of the DG breaker trip on overcurrent. The PDP was replaced and a DG test run was conducted. The DG ran satisfactorily at full load, but when the operator was decreasing load, the DG breaker tripped on overcurrent.

The breaker trip that occurred following PDP and voltage raise/lower pushbutton replacement occurred at ~ 4800 kW while reducing load. Traces of data taken when the latest trip occurred were faxed to the vendor. The vendor stated that the input provided indicated problems with the EGA. The vendor was requested to come on site to assist with the work related to the EGA. The station decided to proceed with replacement of EGA and to have it ready for tuning when the vendor arrived. A crew also inspected the current transformer that initiates the 50DGT relay and checked for any wiring connection problems. No problems were found from this inspection. The EGA was replaced and the vendor directed the setup and tuning.

Early on 11/20/99, test equipment was connected to monitor a number of selected parameters in order to observe the response of the new governor. The control system performed well during these runs and the signal oscillations noted on the earlier test equipment traces could not be seen. A variety of DG loading scenarios was executed, including a number of power reductions near the power level where the trips had occurred.

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From the discussions above, it was concluded that the root cause of the DG Breaker overcurrent trips was improper operation of the DG electronic governor. The trips that were captured on the chart recorder exhibited the same increase in EGA output oscillation immediately prior to the trip occurring. Extensive testing confirmed that the overcurrent breaker trips that were occurring when load was being changed no longer occurred with the newly installed EGA.

This event is EPIX reportable. A review of licensee reports for the past twenty-four months indicates no similar events that were reported as LERs. In August 1999, DG 1A experienced load swings during its operability PT. This event was documented in Problem Investigation Process (PIP) C-99-3288. The evaluation of the August 1999 event did not identify a root cause. The DRU on DG 1A was replaced since it was recently installed during the last refueling outage. After the August 1999 event, DG 1A was placed on a bimonthly test interval through October 1999. During this time period, DG 1A has successfully passed its operability PT without any recurrence of the August 1999 event. Therefore, it is believed that the cause of the events is not similar. The replaced EGA on DG 1B is being sent to the manufacturer for analysis. This is being done to ensure that no common cause exists for the improper operation of the EGA. Based on the above, at this time the event is considered not recurring.

Corrective Actions

Immediate

1. After the overcurrent trip of the DG 1B breaker, Operations initiated work request (W/R) 98104891 and PIP C-99-04675.

Subsequent

1. A FIP team was formed to investigate the cause of the DG 1B breaker overcurrent trip. The team investigated several potential root causes and identified improper operation of the EGA as the most probable root cause.

2. The EGA was replaced, setup and tuned. Test equipment was connected to a number of selected parameters to observe the response of the new EGA. Post maintenance testing was completed on DG 1B with no overcurrent trips of the DG 1B breaker occurring. Operations completed their PT and declared the 1B DG operable on November 20, 1999.

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Planned

1. The replaced EGA will be sent back to the manufacturer for analysis. Additional corrective actions will be identified, as necessary, following receipt of any recommendations from the failure analysis report.

Safety Analysis

An evaluation was performed from a probabilistic risk standpoint concerning the extended inoperability of DG 1B and found that the incremental increase in risk would be acceptable. The evaluation was performed with the assumption of no maintenance on the Standby Shutdown System, the Auxiliary Feedwater System, or the Nuclear Service Water System. During the time period that DG 1B was inoperable, DG 1A and the Train A safety related components that rely on DG 1A for onsite AC Emergency power were fully operable and capable of fulfilling their required safety functions.

This event had no effect on the health and safety of the public.