CATEGORY 1

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9803060257 DOC.DATE: 98/02/25 NOTARIZED: NO DOCKET #
FACIL:50-269 Oconee Nuclear Station, Unit 1, Duke Power Co. 05000269
50-270 Oconee Nuclear Station, Unit 2, Duke Power Co. 05000270
50-287 Oconee Nuclear Station, Unit 3, Duke Power Co. 05000287
AUTH.NAME AUTHOR AFFILIATION
MCCOLLUM,W.R. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION
Document Control Branch (Document Control Desk)

SUBJECT: Forwards response to request for addl info on plant emergency power sys.

DISTRIBUTION CODE: A001D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 11
TITLE: OR Submittal: General Distribution

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD2-2 LA	1	1	PD2-2 PD	1	1
	LABARGE,D	1	1			
INTERNAL:	ACRS	1	1	FILE CENTER 01	1	1
	NRR/DE/ECGB/A	1	1	NRR/DE/EMCB	1	1
	NRR/DRCH/HICB	1	1	NRR/DSSA/SPLB	1	1
	NRR/DSSA/SRXB	1	1	NUDOCS-ABSTRACT	1	1
	OGC/HDS2	1	0			
EXTERNAL:	NOAC	1	1	NRC PDR	1	1

C A T E G O R Y 1 D O C U M E N T

NOTE TO ALL "RIDS" RECIPIENTS:
PLEASE HELP US TO REDUCE WASTE. TO HAVE YOUR NAME OR ORGANIZATION REMOVED FROM DISTRIBUTION LISTS OR REDUCE THE NUMBER OF COPIES RECEIVED BY YOU OR YOUR ORGANIZATION, CONTACT THE DOCUMENT CONTROL DESK (DCD) ON EXTENSION 415-2083

TOTAL NUMBER OF COPIES REQUIRED: LTTR 14 ENCL 13

Duke Power
A Duke Energy Company

Duke Power Company
A Duke Energy Company
Oconee Nuclear Site
P.O. Box 1439
Seneca, SC 29679

(864) 885-3107 OFFICE
(864) 885-3564 FAX

W. R. McCollum, Jr.
Vice President

February 25, 1998

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
Response to Request for Additional Information
on the Oconee Emergency Power System

In a letter dated July 8, 1996, the NRC issued for comment draft reports from the Office of Nuclear Reactor Regulation (NRR) and the Office for Analysis and Evaluation of Operational Data (AEOD). These draft reports contained analyses and recommendations regarding the testing, operation, design and reliability of the Oconee emergency power system and Standby Shutdown Facility (SSF). As requested in the July 8, 1996, NRC letter, Duke Energy reviewed the NRR and AEOD draft reports for accuracy and to determine a disposition for each recommendation.

In a meeting with the NRC on September 19, 1996, Duke Energy presented its understanding of the open issues and recommendations from the NRC draft reports, along with Duke Energy's plan for disposition of the issues. During the meeting, the NRC clarified Duke Energy's understanding of several of the open issues. A written response to the open issues and recommendations was provided by Duke Energy in a letter dated October 31, 1996.

In a letter dated January 26, 1998, the NRC requested additional information concerning the response provided by Duke Energy on October 31, 1996. Attachment 1 contains Duke Energy's response to the NRC's request for additional information.

In the response to Question 4, Duke commits that the acceptance criteria section of the Keowee emergency start test will be revised to clarify the upper bound design limit. No other commitments, beyond the commitment

A001

mentioned above, are contained in the response to the NRC's request for additional information.

If there are any questions regarding this submittal, please contact Michael Bailey at (864) 885-4390.

Very truly yours,

W. R. McCollum, Jr., Site Vice President
Oconee Nuclear Station

MEB

Attachment

cc:

L. A. Reyes, Regional Administrator
Region II

M. A. Scott, Senior Resident Inspector
Oconee Nuclear Site

D. E. LaBarge, Project Manager
NRR

REQUEST FOR ADDITIONAL INFORMATION
DUKE ENERGY CORPORATION
OCONEE NUCLEAR STATION ELECTRICAL DISTRIBUTION SYSTEM

Questions 1 - 4 are follow-up questions to responses in Duke Energy's letter dated May 22, 1997:

Question 1

The response to question 2 indicates that, depending on the type of start and speed of the Keowee unit during the start, the gate limit is 0 percent, 25 percent, 50 percent, or 100 percent. It is not clear, however, what hardware establishes these limits. From other documentation the staff has seen, it appears that a partial shutdown solenoid and a gate limit motor set the limits. The partial shutdown solenoid appears to establish the 25 percent and 50 percent limits when the solenoid is respectively deenergized and energized. Does the gate limit motor set the other limits? Briefly describe how this, or other hardware, interfaces with the governor during the course of emergency and normal starts to change the gate limits.

Response 1

The question asks the following:

A. Does the gate limit motor set the 0 percent and the 100 percent limits?

B. Briefly describe how this, or other hardware, interfaces with the governor during the course of emergency and normal starts to change the gate limits.

In response to part A of the question, the following information is provided.

A. The gate limit motor sets the 100 percent gate limit; however, the gate limit motor does not set the 0 percent gate limit. During normal operation, the gate limit motor sets the gate limit at about 50 percent. During an emergency start, the gate limit motor sets the gate limit at 100 percent. It should be noted that during emergency operation the gates only need to be opened to approximately 20 percent to supply Oconee's emergency loads. Shutdown and partial shutdown solenoids control the gate position during shutdown sequences, startup sequences, and for the brief time between 52 and 122 rpm during emergency starts. Typically, the gate limit motor sets the gate limit at either 50 or 100 percent with the shutdown and partial shutdown solenoids overriding the gate limit setting temporarily. The shutdown and partial shutdown solenoids temporarily set the gate limit at 25 and 0 percent respectively.

At other hydroelectric stations, the gate limit motor runs back to set (below 0 percent) in order to have the gate limit at 0 percent prior to a unit start. In the Duke Energy letter dated May 22, 1997, the response that was provided was incorrect in stating that the gate limit was 0 percent at t=0. The gate limit mechanism is at the 0 percent gate limit position (held by the shutdown solenoid); however, the gate limit motor does not set the gate limit at that point. The shutdown solenoid overrides the 50 percent gate limit and places the gate limit mechanism in the 0 percent position. As soon as the shutdown solenoid is energized, the gate limit is released to the partial shutdown solenoid setting of 25 percent. When a generator breaker closes, the gate limit is released to the gate limit motor control setting (approximately 50 percent for normal starts, 100 percent for emergency starts)

In response to part B of the question, the following information is provided.

B. When the emergency start signal is received, the emergency start relay contacts close. When the unit has reached about 122 rpm, a speed switch contact closes. The speed switch contact closure energizes the gate limit motor to raise the gate limit to 100 percent, or in other words, to remove the limit.

Parallel to the above circuit, there is a control circuit which activates if the Keowee unit master start relays are energized and indicates that the Keowee unit is on. In addition, a circuit input for the Keowee unit being at a dead stop is provided. If the Keowee unit is on and the gates are closed as indicated by a gate position auxiliary relay, or the unit is at a dead stop and the gate limit switch indicates the gates are less than about 50 percent open, the gate limit motor drives the gate limit mechanism to about 50 percent. This circuit works in the reverse direction also. If the gates were greater than approximately 55 percent open, the gate limit motor would run the gate limit mechanism to about 50 percent. The purpose of the circuit is to establish the gate limit at about 50 percent upon shut down of the Keowee unit.

There is another parallel circuit which allows operation of the gate limit motor in the Keowee control room. Finally, manual control of the gate limit motor can be performed at the governor actuator cabinet.

There are two methods to set the gate limit mechanism to a given position. One method is through the gate limit motor and the other is by the shutdown and partial shutdown solenoids. The gate limit shaft has a rod which connects to the gate limit shaft. This rod is moved down when the solenoids are energized, and up when the solenoids are de-energized. When the rod moves down, the gate limit mechanism is raised which effectively raises the gate limit. When the rod moves up, the gate limit mechanism is lowered which decreases the gate limit. The solenoids and their mechanism are connected to the gate limit motor and its mechanism by pinned levers.

When the Keowee unit is at rest, the gate limit mechanism is at approximately 0 percent. Initially on a normal start, the shutdown solenoid is energized and the gates are not open. The shutdown solenoid energizes to allow the gate limit mechanism to raise to approximately 25 percent as determined by the still de-energized partial shutdown solenoid. As soon as the overhead generator output breaker closes and the speed is greater than 122 rpm, the partial shutdown solenoid energizes and the gate limit is released to approximately 50 percent. If the overhead generator output breaker was closed and the Keowee unit was below 52 rpm (this should not happen due to the synchronization relays), the partial shutdown solenoid would be energized to release the gate limit so the Keowee unit would speed up. As soon as the Keowee unit reached 52 rpm, the partial shutdown solenoid would be de-energized and the 25 percent gate limit mechanism position would restrict gate movement until the Keowee unit reached 122 rpm. As the Keowee unit is loaded, it may be necessary for the operator to increase the gate limit mechanism position to about 60 percent to allow enough gate opening to match the normal operating load. When the Keowee unit is shut down, the de-energized shutdown solenoid drives the gate limit mechanism to the 0 percent position to drive the gates closed. The de-energized partial shutdown solenoid also drives the gate limit mechanism down, but the shutdown solenoid drives it further. Once the Keowee unit has stopped rotating, the gate limit motor lowers or raises the gate limit to approximately 50 percent. However, the gate limit mechanism is held in the 0 percent position by the shutdown solenoid.

For an emergency start, the gate limit mechanism is at approximately 0 percent. Upon energizing the emergency start relays, the shutdown solenoid is energized. At the same time, the partial shutdown solenoid is energized and releases the gate limit mechanism to about 50 percent. When the Keowee unit reaches approximately 52 rpm, the partial shutdown solenoid is de-energized. This drives the gate limit mechanism to about 25 percent. When the Keowee unit reaches 122 rpm, the partial shutdown solenoid is energized which releases the downward force on the gate limit mechanism. At the same time, the gate limit motor is energized providing a raise signal which is continuous for the gate limit motor. Thus, the gate limit mechanism goes to 100 percent. When the Keowee unit is no longer needed for emergency loads and the emergency start signal is reset, the gate limit motor holds the gate limit at 100 percent until the Keowee unit stops rotating at which time the gate limit motor lowers the gate limit mechanism to about 50 percent. At this point, the shutdown sequence is the same for normal operation.

For an emergency start for an operating Keowee unit, the gate limit is at the setting required for generation, about 60 percent. When the emergency start relays are energized, the Keowee unit is already above 122 rpm, so the gate limit motor drives the gate limit mechanism to 100 percent. The partial shutdown solenoid stays energized since the speed is above 122 rpm.

Question 2

The response to question 2, Part 2b, states that the acceptance criteria for the Keowee monthly technical specification start test (PT/0/A/0620/09) is 57 to 63 Hz. This is ± 5 percent of the nominal frequency. Regulatory Guide 1.9 specifies a frequency of ± 2 percent. Why is ± 2 percent not specified for the frequency in this surveillance? Are all the electrical equipment qualified for ± 5 percent steady state frequency?

Response 2

Keowee frequency is verified to be ± 5 percent of rated frequency upon reaching steady state after a start to assure electrical equipment parameters are not exceeded. Electrical equipment is manufactured to operate continuously with a frequency variance of ± 5 percent in accordance with standard manufacturing guidelines, for example NEMA MG-1. Electronics and other electrical equipment which require a more restrictive frequency variance, are supplied by an inverter or a regulated power supply.

In order to ensure that the frequency variance of the emergency power supply is acceptable, Regulatory Guide 1.9 restricts diesel generator frequency to ± 5 percent of rated when a load is added. To assure that this frequency variance is maintained, the diesel generator is required to recover to ± 2 percent of rated frequency before the next load is sequenced onto the diesel generator. The Keowee units do not add load with a load sequencer in the manner which is discussed in Regulatory Guide 1.9. The Keowee units block load all Oconee loads and accelerate until the Keowee units reach steady state frequency, which is verified to be ± 5 percent of rated frequency. Since no loading sequence occurs, a recovery to ± 2 percent of rated frequency is not verified.

Question 3

The response to question 2, Part 2e, indicates that there are three emergency power switching logic tests, one for each Oconee unit; and of these, one test starts Keowee from a dead stop, while the other two tests start Keowee from grid generation. It is stated that the tests are all basically the same. Explain how all the tests are basically the same. If only a dead stop or grid generation start is performed on a particular unit, is the unit-specific switching logic tested in all modes, or is this logic independent of the initial condition of the Keowee units? Briefly explain.

It is also stated in the response that PT/1/A/0610/01J results in a black run of the associated Keowee unit instead of a black start. A black run of a Keowee unit does not result in a test of the Keowee field flash capability when the charger is unavailable and the dc system is only supported by the battery. It is also not clear if these tests challenge (test) the automatic transfer capability of the Keowee 1X and 2X switchgear in the manner they would be required to operate for various loss of offsite power scenarios that would require their operation. Discuss how the field flash and automatic transfer capabilities are routinely tested to demonstrate their required operation during various loss of offsite power scenarios.

Response 3

Each Oconee unit is required by Technical Specifications to periodically simulate an emergency power transfer from the normal source to the start up source and the standby source in order to assure proper operation. The Emergency Power Switching Logic tests for each Oconee unit perform this verification. A loss of power is simulated to assure that the Emergency Power Switching Logic transfers the Oconee units to the appropriate power source. Keowee emergency start initiation from each Oconee unit's Emergency Power Switching Logic is also verified. This part of the three Emergency Power Switching Logic tests are the same and are independent of the initial condition of the Keowee units.

The differences in the Emergency Power Switching Logic tests verify the different operation of the Standby Bus feeder breakers (SK and SL), which are shared by all Oconee units. One Oconee unit's test verifies the transfer of the power source from Lee to the underground power path if power from Lee is lost. One Oconee unit's test verifies proper closing of the SK breakers when Oconee is supplied by a Keowee unit started from a dead stop. One Oconee unit's test verifies that the SK breakers will trip and close on the load rejection of a generating Keowee unit aligned to the underground power path.

Although the Keowee units are demonstrated to start and operate during the Oconee units' Emergency Power Switching Logic tests, the ability of the Keowee units to load reject, or maintain proper voltage or frequency is not required to be verified. The required surveillances of the Keowee units are performed by other Technical Specification surveillances which were discussed in the response to Question 2 in Duke Energy's letter dated May 22, 1997.

There are two tests which currently include the black run of a Keowee unit. The Oconee Unit 1 Emergency Power Switching Logic Function Test, PT/1/A/0610/01J, includes the black run of the Keowee unit that is aligned to the underground power path. The Degraded Grid and Switchyard Isolation test, PT/0/A/0610/022, includes the black run of the Keowee unit aligned to the overhead power path. In the past, the black start capability of the underground Keowee unit was verified by the above two procedures. There are presently no periodic tests which include the black start of the Keowee units. The ability of the Keowee units to start and run with no AC power available has been demonstrated by several one-time tests. The most recent black start test was performed on January 16, 1998. The capability of the Keowee batteries to provide sufficient energy to flash the generator field and start a Keowee unit with no AC voltage available is verified annually by IP/1,2/A/0400/011, Keowee Hydro Station 125 Vdc Instrument and Control Battery Bank No. 1, 2 Service Test and Annual Surveillance.

The black run of a Keowee unit will challenge, but not verify, the transfer of the Keowee unit's auxiliary power system. The automatic transfer of the auxiliary power system for both Keowee units is verified annually by PT/0/A/2200/009, Keowee Hydro Station Auxiliary Power Transfer Surveillance.

Question 4

The response to question 9 states that the upper bound for the Keowee Air Circuit Breaker (ACB) reclosure timers is 23 seconds, which is consistent with the maximum required time for the Keowee units to be available to deliver emergency power. Should 23 seconds, therefore, be specified as the upper bound in the annual Keowee emergency start test?

Response 4

The annual Keowee emergency start test verifies that the ACB reclosure timers are within ± 0.3 seconds of their setpoints. The timers that are used in the ACB reclosure timer application were designed to operate within these limits. During the annual Keowee emergency start test, Oconee expects to find the ACB reclosure timers within this acceptable range.

If the as-found time is beyond the expected range during the annual Keowee emergency start test, a procedure discrepancy would be initiated in accordance with NSD-704 and engineering would be involved as directed by the test procedure to determine if there were an operability question (i.e. a reclosure timer is found above the upper design bound of 23 seconds). The Oconee corrective action program would be initiated to resolve and document the possible equipment problem and operability, if necessary.

It is prudent for Oconee to continue to verify the more restrictive tolerances for these timers. In addition, the acceptance criteria section of the surveillance test will be revised to clarify the upper bound design limit.

Question 5

In the NRR Draft Report, the staff was concerned that the demand frequencies of components such as relays, for which plant-specific data were calculated by combining all components of the same type into a type code, range from daily (for system grid generation) to quarterly to every refueling outage. Ideally, all components in the same group or type code should have the same or similar periodic testing frequencies. At Keowee, some components that are only challenged every refueling outage are applied the same failure probability as components that are demanded daily. Therefore, the staff concluded in the NRR Draft Report that the results of the generic data sensitivity study are more robust than the base case. In its response dated October 31, 1996, Duke Energy agreed that for an ideal and precise characterization of the reliability of a component, the failure rate data should come from identical components with identical operating, service, testing, and maintenance conditions. Duke Energy also stated that the generic data sources contain no statement of limitations for using the data for any specific test frequency or class of equipment. The staff believes that the purpose of gathering plant-specific data is to understand what kind of failures are contributing to the plant-specific failure data, how they occur, and when they occur. Analysis of plant-specific data allows the analyst to determine whether a set of similar components of one type should be statistically modeled as one population.

In Table E3 of the Keowee Probabilistic Risk Assessment (PRA), Duke Energy identified 12 components that are demanded during an emergency operation with a black start but not during normal operation and are tested less than every week, including ACBs 3 through 8. Duke Energy stated (in the October 31, 1996, submittal) that the Keowee PRA data base had been reviewed and only one failure of an infrequently test/demanded component was identified.

In the Augmented Inspection Team (AIT) report dated July 30, 1997, several ACB failures involving ACBs 7 and 8 (Section E.2.2.b.2 of the AIT report) were listed. The AIT concluded, based on its review of the historical data, that fuse and circuitry design interactions may have contributed to breaker failures.

The staff requests that Duke Energy discuss this discrepancy. Since it appears that failure data for the X and Y relays for these ACBs were quantified using pooled data (as described in Tables C.1-3 and C.1-5), the staff requests that Duke Energy requantify the applicable basic events for ACBs 5, 6, 7, and 8 using plant-specific data specific to the ACBs.

Response 5

The intent of identifying failures of the infrequently demanded components was to determine if there appeared to be an unusually high failure rate among this population. This review considered those components which are demanded only during the emergency starts. The failure identified for the October submittal (relay 52-1TD) was the only failure of a component from this population. Our selection of the phrase "infrequently demanded/tested component" was in this case not intended to mean the same population that was described in the sensitivity study. In the sensitivity study, the "infrequently demanded/tested component" terminology was applied to any component that was demanded less than weekly. The failures of ACB-7 and 8, which were identified in the AIT report, were not included as failures in the October submittal because they were not considered part of the component population that consists of components only demanded during emergency starts. The issue has become confused because the same terminology was applied to two different populations of components in the two different evaluations.

The difficulty in generating a plant-specific number for the failure rate on these less frequently demanded components is the lack of statistical significance due to the small amount of data which is generated. Considering the X and Y relays of ACBs 5 through 8, the data collected for the Keowee PRA identified 0 failures in 24 demands. This is clearly insufficient data on which to estimate a plant-specific failure rate. Bayesian updating the generic failure rate (1.9E-04/demand) with this evidence produces an updated failure rate of 1.7E-04/demand for these relays versus the value of 3.3E-05/demand calculated for all relays in the Keowee PRA. Use of the failure rate of 1.7E-04/demand instead of 3.3E-05/demand for the X and Y relays of ACBs 5 through 8 results in no increase in the calculated Keowee failure probability since the relay failure probability is one-to-two orders of magnitude below other failure modes included in the breaker reliability model.