CP&L
A Progress Energy Company

James Scarola
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AUG 1 6 2001

SERIAL: HNP-01-112
10CFR50.90

United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING
REQUEST FOR LICENSE AMENDMENT
REVISION TO TECHNICAL SPECIFICATION 3/4.8.1 – A.C. SOURCES-OPERATING

Dear Sir or Madam:

By letter dated December 14, 2000, Carolina Power & Light Company (CP&L) submitted a proposed license amendment for a revision to the Technical Specifications (TS) for the Harris Nuclear Plant (HNP). The proposed amendment revises the TS concerning the Emergency Diesel Generator (EDG) found in TS 3/4.8.1. Specifically, HNP proposes to revise Surveillance Requirement (SR) 4.8.1.1.2.f.7, the 24-hour EDG endurance run, by removing the restriction to perform the test during shutdown conditions. The purpose of the proposed change is to provide HNP with greater flexibility in optimizing outage schedules and the use of resources while still protecting the health and safety of the public and station personnel. Approval of this proposed amendment has the potential for reducing outage critical path time, resulting in significant cost savings.

By letter dated June 13, 2001, NRC staff issued a request for additional information (RAI) on the EDG 24-hour run license amendment request for HNP. Enclosure 1 to this letter provides CP&L's response to the staff's RAI.

This additional information does not affect the conclusions of either the 10 CFR 50.92 evaluation or the Environmental Considerations submitted as part of CP&L's December 14, 2000 letter.

CP&L requests that the proposed amendment be issued by October 1, 2001 to support Refueling Outage 10, which is scheduled to commence on September 22, 2001. CP&L further requests that the proposed amendment be issued such that implementation will occur within 60 days of issuance to allow time for orderly incorporation into copies of the Technical Specifications.

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Please refer any questions regarding this submittal to Mr. John Caves at (919) 362-3137.

Sincerely,

James Scarola

James Scarola

ONW/onw

James Scarola, having been first duly sworn, did depose and say that the information contained herein is true and correct to the best of his information, knowledge and belief, and the sources of his information are employees, contractors, and agents of Carolina Power & Light Company.

Darlene S. Yarborough
Notary (Seal)

My commission expires: 2-21-2005

DARLENE S. YARBOROUGH NOTARY *** PUBLIC HARNETT COUNTY, NC

c: Mr. J. B. Brady, NRC Sr. Resident Inspector
Mr. Mel Fry, Director, N.C. DENR
Mr. N. Kalyanam, NRC Project Manager
Mr. L. A. Reyes, NRC Regional Administrator

ENCLOSURE 1 TO SERIAL: HNP-01-112

SHEARON HARRIS NUCLEAR POWER PLANT
NRC DOCKET NO. 50-400/LICENSE NO. NPF-63
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REVISION TO TECHNICAL SPECIFICATION 3/4.8.1 – A.C. SOURCES – OPERATING

NRC Question 1:

The December 14, 2000 amendment request states that the Harris Nuclear Plant (HNP) design of the EDG circuitry includes a direct trip of the EDG output breaker when an EDG is in the test mode and a loss of offsite power (LOOP) is detected by the LOOP relay, and a direct trip of the bus cross tie breaker on the detection of a LOOP. It states that this design provides the most direct indicator of a LOOP. A LOOP relay is typically an undervoltage relay that senses safety bus voltage. With an EDG under test connected to the safety bus in parallel with the offsite power source, an undervoltage on the offsite system will result in substantial current flow from the EDG as the EDG attempts to regulate the bus voltage. Such a situation could occur following a trip of the HNP EDG if it is providing voltage support to the grid. Please explain how the LOOP relay can prevent potential damage to the EDG from overcurrent following a low switchyard voltage. Also explain how the LOOP relay will actuate on a LOOP if the EDG is supporting the safety bus voltage.

CP&L Response to Question 1:

Background Information

The LOOP relay discussed in the December 14, 2000 license amendment request is not the emergency bus undervoltage relay at HNP. Due to an identified design deficiency reported in LER 96-023, a modification (ESR 97-00005) was performed in 1997 to improve protection of the Emergency Diesel Generators and Emergency Power System during EDG testing. This was done to bring HNP into conformance with FSAR Section 8.3.1.1.2.8(e) which states that upon receipt of a LOOP during the D/G test mode:

1. Trip the offsite breaker feeding the ESF bus and the D/G breaker if closed.
2. The D/G remains running and governor control transfers to isochronous mode from droop mode.
3. Load shed all breakers from the ESF buses except the 6.9kV breaker feeding 480V power center 1A2-SA and 1B2-SB.
4. Close D/G breaker upon attaining normal voltage and frequency.
5. Connect ESF loads as required, in sequence.

Since the "EDG in test" LOOP protection circuitry at that time did not meet the above requirements, it was modified by ESR 97-00005 as follows (Train A is used for discussion purposes):

1. LOOP detection is now accomplished by Relay CR1/1748 instead of the 6.9kV emergency bus undervoltage relay. Relay CR1/1748 actuates upon:

   - both incoming line breakers (from the Unit Auxiliary Transformer (UAT) and Startup Transformer (SUT)) to the 6.9kV Balance of Plant (BOP) Bus are open, or
   - the incoming line breaker from the SUT is open and a main generator lockout occurs.

The main generator lockout relay trip initiates the transfer of power from the UAT breakers to the SUT breakers. If the SUT power source is not available, as monitored by switchyard breaker position and SUT transformer lockout relays, then transfer will not occur and the SUT breaker remains open.

2. Actuation of Relay CR1/1748 while the associated EDG is in test and paralleled with offsite power will cause:

   - immediate trip of the EDG output breaker
   - immediate trip of the 6.9kV emergency bus incoming line breaker
   - actuation of the emergency bus undervoltage relays and control logic (since both the EDG and offsite sources have been disconnected by the first two items) resulting in load shedding and initiation of bus loading via the Emergency Load Sequencer

Since the CR1/1748 relay is non-safety related, credit is taken for Operator action (per Plant Procedure OP-155) in the event of relay logic failure. Operator training was performed. ESR 97-00005 contains a "failure modes and effects" evaluation, which was submitted for NRC review by letter dated April 29, 1997. Use of a non-safety related relay to perform a safety related function and use of Operator action as a backup was reviewed by the NRC (as part of License Amendment 72), since this was a deviation from existing licensing commitments. A true LOOP should also be detected by the undervoltage relaying on the other train, thus providing another indication to the Operators.

Response to First Part of Question 1

Please explain how the LOOP relay can prevent potential damage to the EDG from overcurrent following a low switchyard voltage.

The response to this question will consider both LOOP (loss of offsite power) and DGV (degraded grid voltage) scenarios.

Loss of Offsite Power (LOOP)

The design of the LOOP protection circuitry for the emergency power system and emergency diesel generators was modified in 1997 via ESR 97-00005. The previous design was to utilize

emergency bus undervoltage relays to detect a LOOP. It was discovered that this protection scheme was not adequate to protect the EDG while operating in the "test mode" and paralleled to the off-site power source, and was reported via LER 96-023. Consequently the design was changed to utilize "LOOP relays" CR1/1748 (Train A) and CR3/1748 (Train B) which provide more direct identification of an actual LOOP condition. The emergency bus undervoltage trip was left intact as well. The LOOP relay (Relay CR1/1748 for Train A) immediately trips the EDG output breaker and the incoming line breaker of the associated emergency bus upon detection of a LOOP. The conditions indicating a LOOP and thus actuating the CR1/1748 relay are either:

a. both of the incoming line breakers to the upstream 6.9kV BOP bus (from the UAT and SUT) open or

b. the incoming line breaker to the upstream 6.9kV BOP bus (from the SUT) is open and the main generator lockout relay actuates.

This results in immediate isolation of the EDG and separation of the emergency power system from the offsite source. The emergency bus undervoltage relays will then actuate initiating load stripping and subsequent load sequencing upon automatic re-closure of the EDG output breaker.

It is highly unlikely that the LOOP would be caused by loss of the HNP 230kV switchyard (instead of by tripping of the incoming line breakers to the 6.9kV BOP bus) since the HNP 230kV switchyard consists of seven transmission lines serving a double bus with a "breaker and a half" scheme. Thus, even a switchyard bus fault would not result in a LOOP. However, if this unlikely event were to occur, the response of the emergency power system and emergency diesel generator protection would be as described below for a DGV scenario.

It is recognized by ESR 97-00005, FSAR Section 8.3.1.1.2.8 and plant procedure that operator action may be required to trip the EDG output breaker in the event that the automatic circuitry does not respond correctly. The EDGs are supplied with an overload alarm set to annunciate at approximately 118% (800 Amps) of the EDGs 680 Full Load Amperage (FLA) rating. (Reference Calculation E2-0017.07). The overload alarm is an inverse time current (51) device. Also, there are generator stator temperature alarms. Therefore, the Operators will be aware of any overload conditions. Due to the size of the generator, overloads can be tolerated for a considerable length of time without causing damage. Also, as previously stated, the original protection via the emergency bus undervoltage relays is still operable. In the event of a true loss of offsite power where the emergency bus incoming line breaker and EDG output breaker fail to trip, it is likely that the additional load on the EDG will cause the 51V voltage controlled overcurrent relay to trip the EDG breaker. The pickup of the overcurrent unit for the 51V relay is set below the EDG Full Load Amperage (FLA) rating, while the undervoltage element is set approximately 87% of 6900v (Reference Calculation E2-0017.06).

Degraded Grid Voltage (DGV)

In the event switchyard voltage degrades to below nominal levels, the reaction of the EDG protective circuitry depends upon the severity of the degraded voltage condition. For conservatism, it is assumed that the switchyard voltage degrades to a level just above that required to actuate the bus undervoltage relays (approximately 70% of nominal voltage). This would be a very unlikely event since switchyard voltage is mainly controlled by the HNP main generator voltage regulator. In this situation, the "LOOP relays" will not actuate; however, the original emergency power system and emergency diesel generator protective features will provide some level of protection. It is expected that this scenario would cause an overload severe enough such that the EDG voltage regulator could not maintain the voltage at the preset level (6900v). If the voltage drops to approximately 6000v or lower with the EDG output current greater than 59% of rating, the EDG 51V (voltage controlled overcurrent) relay would actuate tripping the EDG breaker. Subsequently the emergency power system undervoltage and degraded grid voltage relays would actuate tripping the incoming line breaker and initiating load shed.

It is recognized by ESR 97-00005, FSAR Section 8.3.1.1.2.8 and plant procedure that operator action may be required to trip the EDG output breaker in the event that the automatic circuitry does not respond correctly. The EDGs are supplied with an overload alarm set to annunciate at approximately 118% (800 Amps) of the EDGs 680 FLA rating. (Reference Calculation E2-0017.07). The overload alarm is an inverse time current (51) device. Also, there are generator stator temperature alarms. Therefore, the Operators will be aware of any overload conditions. Due to the size of the generator, overloads can be tolerated for a considerable length of time without causing damage. The EDG is also equipped with a 51V (voltage controlled overcurrent) protective relay. The primary purpose of this protective relay is to prevent EDG damage during "close in faults". However, the voltage setpoint of the 51V was purposely set high (approximately 6000v) such that this relay would provide some level of overload protection while the EDG is in test. If the emergency bus voltage falls below 6000v during the postulated switchyard degraded voltage condition, then the 51V relay will trip the EDG output breaker if the load current is greater than 59% of the EDG full load rating. It is recognized in the 51V setpoint calculation (E2-0017.06) that if the voltage does not decay to a level to trip the breaker, Operator action may be required. This potential failure to automatically isolate the emergency power system and trip the EDG output breaker during a switchyard degraded voltage event is "bounded" by the Failure Modes and Effects Analysis (FMEA) performed for ESR 97-00005 where item 1 assumes failure of the LOOP relay to respond as designed. The use of the non-safety related LOOP relay and taking credit for Operator action as a "backup" along with the FMEA were reviewed by the NRC in support of License Amendment 72. Various plant procedures provide precautions to ensure that the Operator is aware of conditions which could potentially result in overloading the EDG. For example, OP-155, Section 4.0 "Precautions and Limitations" includes:

18. Do not operate more than one EDG in parallel with offsite.

19. If off-site frequency or voltage is unstable, to prevent a possible EDG overload condition, an EDG shall not be paralleled with off-site power.

24. If a loss of offsite power (LOOP) occurs while an EDG is paralleled to the grid, the emergency bus incoming line breaker and EDG output breaker should automatically trip open which will leave the diesel running unloaded. The EDG output breaker should then automatically re-close and the sequencer start to load. If the EDG output breaker fails to open, operator action is required to manually open the breaker.

26. If an EDG is operating in parallel with off-site power and the off-site power reliability or performance becomes questionable, disconnect the EDG from the offsite power source.

27. Unless the EDG is operating in an emerg ency and must remain operating, do not exceed the full load diesel limits established in the operating log. ....

28. Do not exceed the continuous and overload ratings. .....

Response to Second Part of Question 1

Also explain how the LOOP relay will actuate on a LOOP if the EDG is supporting the safety bus voltage.

See the response above to the first part of Question 1 for a discussion of how the LOOP relay detects a loss of offsite power. Since additional circuitry was added by ESR 97-00005, primary detection of a LOOP is not via the emergency bus undervoltage relay. Instead, detection of a LOOP is based upon the position of the incoming line breakers of the upstream BOP bus. Therefore, the condition of the emergency bus voltage and potential operation (or mis-operation) of the emergency bus undervoltage relay will not impact response of the LOOP detection circuitry.

NRC Question 2:

The amendment request indicates that the HNP probabilistic safety analysis (PSA) model results are not affected by the EDG 24-hour run in any particular mode of operation because it is treated as available due to its ability to separate from the test mode. As indicated in the previous question and acknowledged in your submittal, a disturbance of the offsite power grid may result in the loss of the EDG. Conducting the test at power creates the potential that these grid disturbances (including the post-plant-trip switchyard undervoltage discussed above) could result in loss of the EDG during a grid-related operating transient when the EDGs might be needed. This risk potential for EDG unavailability should be evaluated, including the revised reliability impact on test and standby unavailability, considering the comparative reliability of the EDG in standby mode versus reconfiguration when in test in the HNP PSA and the results used to support this amendment. Additionally, the change in core damage frequency (delta CDF) and large early release frequency (delta LERF) (Regulatory Guide (RG) 1.174) as well as the incremental conditional core damage probability (ICCDP) and the incremental conditional large early release probability (ICLERP) (RG 1.177) should be evaluated considering the proposed new test mode.

CP&L Response to Question 2:

As shown in the response to Question 1, the design of the EDG and control circuits will allow it to properly function to supply emergency loads in the event it is called upon to do so while the 24-hour run is in progress. The intent of the 24-hour run, which is to demonstrate the ultimate load carrying capability of the EDG, is met whether the test is conducted with the unit operating or shut down. In order to perform its safety function while operating should a LOOP occur, a protective relay must function and the EDG output breaker must open. These potential failure modes are offset by the fact that the EDG is already running. The EDG fail to start probability is 7.1E-3. The probability of typical relay actuation failure is on the order of 1E-5 in the PSA model, and the probability of a breaker failing to open is 1E-3. The relay failure should be recoverable by immediate operator action as described in the response to question 1. The resulting failure probability of the relay and EDG output breaker, combined with the failure of the operator to take action, is judged to be considerable lower than the EDG fail to start probability (7.1E-3). Therefore, it is more likely that the EDG would fail to start while in standby than the protective relay failing to actuate. Thus there is no negative impact to risk when the EDG is operating for testing compared to its normal standby status, and the delta CDF, delta LERF, ICCDP, and ICLERP are zero.

As stated under "Basis for the Proposed Change" on page E1-2 of Reference 1, HNP currently performs a monthly 1-hour (minimum) run of the EDG in parallel with the offsite source during power operation of the plant to meet Technical Specification Surveillance Requirement 4.8.1.1.2.1.5. The protective features for the EDG and distribution system will be the same for the proposed 24-hour run (performed every 18 months) as they now are for the existing monthly 1-hour (minimum) run. The only difference between the existing monthly 1-hour run and proposed 18 month 24-hour run will be the duration of the run (24 hours vs. 1 hour). In actuality,

the monthly test consists of an average of 3-hours of run time per month for a total of approximately 54 hours of run time per 18 month period with the EDG in parallel with offsite power during power operation of the plant. Changing the 24-hour test to allow the test to be performed during any plant operating mode will just increase the "exposure period" for operation of the EDG in parallel with offsite power during power operation from 54 hours run time per 18 month period (existing) to 78 hours run time per 18 month period (proposed). Therefore, if the level of protection for the EDG and emergency power system is adequate for the existing monthly test, it will be just as adequate for the proposed 18 month test. (Note that this design has been evaluated by the NRC in support of HNP Amendment No. 72 dated May 8, 1997.)