VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

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Dear Sir:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
RESPONSE TO ADDITIONAL INFORMATION
PROPOSED TECHNICAL SPECIFICATION CHANGE
EMERGENCY DIESEL GENERATOR ALLOWED OUTAGE TIMES

By letter dated April 13, 1996, the NRC Staff requested additional information to continue their review of our proposed Technical Specification change for Emergency Diesel Generator Allowed Outage Times. A detailed response to each question, including the corrected Technical Specification pages, is provided in the attachment to this letter.

Should you have any questions or require additional information, please contact us.

Very truly yours,

M. L. Bowling, Manager
Nuclear Licensing and Operations Support

Attachment

cc: United States Nuclear Regulatory Commission
Regional Administrator
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Mr. R. D. McWhorter
NRC Senior Resident Inspector
North Anna Power Station

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ATTACHMENT
RESPONSE THE REQUEST FOR ADDITIONAL INFORMATION
PROPOSED CHANGES FOR EDG ALLOWED OUTAGE TIMES

1. On Page 4 of 10 of Attachment 1 to the licensee's September 1, 1995, letter, Paragraph 4 states: "If the AAC DG, any of the other three EDGs, or off-site power sources become inoperable during the EDG's maintenance inspection outage, the appropriate 72-hour action statement becomes effective." Discuss this apparent conflict with the proposed Technical Specification 3.8.1.1.b.2, which addresses only the inoperability of the AAC DG and the opposite unit's EDGs.

   Response

   The statement "..the appropriate 72-hour action statement" was in error. The statement should read "..the appropriate action statement becomes effective." If, during the emergency diesel generator's (EDG's) proposed preventive maintenance inspection, that unit's operable EDG is determined to be inoperable (i.e., no operable EDGs on that unit) the operator would immediately follow Action "e" of Technical Specification 3.8.1.1 for two inoperable EDGs. This action requires, in part, that at least one of the two EDGs be restored to operable status within two hours or the unit be placed in HOT STANDBY within the next six hours and in COLD SHUTDOWN within the following 30 hours.

2. Proposed Specification 3.8.1.1.b.2 states that the provisions of Specification 3.0.4 are not applicable. The staff is concerned that this proposed statement would allow the plant to startup following a shutdown without all the EDGs operable, which increases vulnerability for a plant configuration such as North Anna. Provide justification for this statement and its use during the period that one EDG is inoperable for extended maintenance or consider withdrawing this specific requested change to the Technical Specifications.

   Response

   The Probabilistic Safety Analysis (PSA) prepared in support of the proposed preventive maintenance inspection indicates that entry into an operational mode or other specified applicable mode as discussed in Technical Specification 3.0.4 does not have a significant risk impact when one EDG is not operable. This is due to the electrical distribution system design and the accident sequences affected by EDG unavailability.

   The electrical distribution system design has four 4160 V emergency buses, two per unit, each with a dedicated EDG. There is also one alternate A.C. Diesel (AAC DG), installed as part of the station blackout (SBO) Rule compliance, which is capable of carrying all loads on any one of the four emergency buses should the bus's dedicated EDG not be available. From a PSA model perspective, the only difference between the EDGs and the AAC DG is the time required to provide power to an emergency bus after off-site power is lost. The EDGs can supply

power within 10 seconds and the AAC DG requires manual alignment for which the analysis conservatively assumes a 60 minute delay. This timing difference makes it possible for the AAC DG to serve as an acceptable substitute during all accident sequences except for loss of coolant accidents (LOCAs) which could potentially result in core damage in less than one hour. The most probable LOCA sequences do not include electrical transients requiring an EDG. The LOCA initiating event frequency is not effected by the unit changing from Hot Standby to full power operation.

The initiating events which are most likely to occur due to a plant startup from a shutdown mode to power operation are main feedwater and electrical transients. Since these transients generally do not progress to core damage in less than 60 minutes, recovery can be adequately accomplished utilizing the AAC DG when an EDG is unavailable due to maintenance and off-site power has been lost to an emergency bus. Technical Specifications preclude mode transition without the two offsite power supply circuits operable. Technical Specifications also require that all appropriate safety equipment be fully operable without reliance on action statements prior to mode changes. The combination of offsite A.C. power supply and one diesel generator (either an AAC DG or EDG) for each emergency bus provides reliability nearly equivalent to normal operating configuration. Therefore, Technical Specification 3.0.4 need not be applicable when an EDG is unavailable due to the proposed preventive maintenance inspection. The utilization of the AAC DG is an acceptable substitute for an unavailable EDG due to the proposed preventive maintenance inspection during mode transition.

The potential for prolonged total loss of offsite power is not significantly increased during unit startup. The Reserve Station Service Transformers (RSSTs) A, B and C are the preferred offsite power source for the emergency buses (1H, 1J, 2H and 2J). RSST A feeds emergency bus 1J, RSST B feeds emergency bus 2H, and RSST C feeds emergency buses 1H and 2J. Since the emergency buses are normally fed from their preferred source, the RSSTs, they do not require transfer of their power source during unit startup. The potential for loss of off-site power to both emergency buses on a given unit is further minimized by the fact that the 34.5 kV and 500 kV buses which feed RSSTs A and B are independent of the 34.5 kV and 500 kV buses which feed RSST C.

During Unit 1 startup, the RSSTs are not normally required to provide power to the station service buses. Unit 1 is equipped with a main generator breaker which allows the Station Service Transformers (SSTs) to be fed from the 500 kV switchyard. The main generator is placed on line by closing the generator breaker which provides normal power to the station service buses. As a result, transfer of the power source for the station service buses is not normally required during Unit 1 startup.

During Unit 2 startup, the station service buses are initially powered from the RSSTs. Once the main generator is on line, the station service buses are transferred to their normal source which are SSTs A, B and C. Each SST is synchronized with its associated RSST and power to the station service bus is transferred to the SST, without interruption, by feeding the bus from both sources

for a short duration. The transfer of station service loads is a manual transfer and is performed one bus at a time, therefore exposure to a loss of offsite power to both emergency buses (loss of more than one RSST) on a given unit is minimized.

A major difference between North Anna Power Station (NAPS) today and in the past is that there are now five diesels available to supply power to four emergency buses, two emergency buses for each unit. In the past, it would have been appropriate to have Technical Specification 3.0.4 applicable when one of the two EDGs assigned to a unit was unavailable due to maintenance. This is because the unit would have been capable of recovering electrical power to only one of its two emergency buses if an EDG were in maintenance. Now that NAPS has the AAC DG Technical Specification 3.0.4 should no longer be applicable when only one of the five diesels is unavailable due to the proposed preventive maintenance inspection. If two of the five diesels are inoperable then the unit should be limited by Technical Specification 3.0.4.

3. On Pages 1-3 of the proposed Technical Specifications for Unit 2, the word "emergency" has been added to the last sentence of Definition 1.12. This change is also applicable to Unit 1 but has apparently not been included in the amendment request. Is this change also requested?

Response

Yes, this change is also requested. The revised Technical Specification page is attached. This change is discussed in general in the Specific Changes Section of our Proposed Technical Specification Change on Page 5 of 10 of Attachment 1.

4. On Page 7 of Attachment 1 to the licensee's September 1, 1995, letter, the last sentence ends with "of that unit." That phrase has apparently not been included in the actual Technical Specifications contained in Attachment 2 to the September 1 letter. Address this apparent conflict.

Response

The conflict was the result of an editorial error. The phrase "of that unit" was intended to be included. The revised Technical Specification pages are attached.

5. As stated in the September 1, 1995, letter from the licensee, the purpose of the requested amendment is to allow an increased outage time during plant power operation for performing a preventive maintenance inspection of an EDG, which would include disassembly of the EDG. The staff is concerned that disassembly of an EDG would subsequently then require pre-operational testing of the EDG (such as full load rejection tests) to be performed following this maintenance while the plant is operating instead of during shutdown, which has been the past practice. In order to resolve this concern, the following should be addressed:

a. What would be the typical and worse-case voltage transients on the 4160-V safety buses as a result of a full-load rejection?

b. If a full-load rejection test is used to test the EDG governor after maintenance, what assurance would there be that an unsafe transient condition on the safety bus (i.e., load swing or voltage transient) due to improperly performed maintenance or repair of a governor would not occur?

c. Using maintenance and testing experience on the EDG, identify possible transient conditions caused by improperly performed maintenance on the EDG governor and voltage regulator. Predict the electrical system response to these transients.

Response

The testing requirements following the proposed preventive maintenance inspection will be the same at power as they are during shutdown. Virginia Power does not anticipate any additional concerns as the result of performing this testing at power. As an example, under our current Technical Specifications, post maintenance testing was successfully completed at power following the recent replacement of an EDG governor.

a. A full-load rejection test is not performed on the EDG. Our Technical Specifications require a load rejection test of 610 kW or greater. The load rejection is performed by paralleling the EDG to the system, adjusting load to the desired value and opening the diesel output breaker. The voltage transient seen by the bus/system is minimal and is bounded by "transients" which occur during normal 4 kV motor starting and stopping.

b. Technical Specifications do not require the performance of a full-load rejection test. A load-rejection test of 610 kW or greater is required as stated in part a. Potential transient conditions associated with improperly performed maintenance on the governor or voltage regulator are discussed in section c.

c. Improperly performed maintenance on the governor or voltage regulator could result in unstable EDG operation. While operating parallel with the system, possible transient conditions would include over or under excitation for voltage regulator problems and overload or reverse power for governor problems. These conditions would result in either an automatic trip of the generator output breaker or require a manual trip of the breaker. Under these conditions the worst case transients expected on the emergency bus would be the result of an increased load (kW or kVAR) on the system either due to a reverse power, under excitation, or a trip of the generator breaker resulting in a full load rejection to the system. The expected load transients associated with an EDG of this size (rated 4063 kVA) are bounded by other normal operating load transients. For example, the transfer of Station Service loads to the Reserve Station Service Transformer (RSST) following a unit trip results in a 20,000 kVA load addition to the RSST for which the system responds adequately. It should be noted that North Anna recently experienced an over

excitation trip of the EDG output breaker with the EDG fully loaded and connected to the system resulting in a rated load reject to the system with no adverse impact on emergency bus voltage.

Verification of stable voltage regulator and governor operation in the single unit mode (with the EDG output breaker open) is performed and the necessary corrections are made prior to connecting the EDG to the emergency bus. Further testing may be performed with the EDG connected to the bus (and the system disconnected) to verify proper voltage response during starting of a large load. Should the voltage regulator or governor become unstable during this testing the bus would be de-energized and would require manual re-connection of the offsite source.

6. Provide the current calculated total core damage frequency (CDF) resulting from all probabilistic safety assessment (PSA) sequences involving station blackout (SBO). Also provide the calculated total CDF from all SBO sequences after accounting for the increase in EDG unavailability due to the extended allowed outage time requested. Provide the instantaneous change in the CDF value for the worst-case plant configuration allowed under the proposed Specification 3.8.1.1.b.2.

Response

The SBO contribution to CDF for North Anna, Unit 1 before the AAC DG installation was determined to be 1.2E-5 per year from a complete solution of the model "NO-AAC". The calculated CDF for SBO sequences is 5.9E-6 per year based on solution of the model "95-JUNE" (i. e., with the AAC DG). When the increase in EDG unavailability due to the proposed preventive maintenance inspection is added to this model, the SBO CDF is 6.5E-6 per year. The calculated increase in CDF associated with the proposed preventive maintenance inspection represents only a small offset (~ 10%) from the reduction in CDF achieved with AAC DG installation. These values can be found on page 23 of the Probabilistic Safety Assessment package. The Virginia Power PSA nomenclature for SBO sequences in these models is T1EE.

Sensitivity studies were performed to estimate the configuration risk assuming different EDGs were inoperable for the proposed preventive maintenance inspection. The instantaneous change in CDF for the worst-case plant configuration allowed under the proposed Specification 3.8.1.1.b.2 is 1.5E-5 when one EDG is inoperable and 1.4E-4 when one EDG and the AAC DG are inoperable. These results are based on a complete solution of the model with zero test and maintenance unavailability for all other equipment.

7. Provide the values for the EDG reliability and availability values used in the PSA analysis to calculate the SBO CDF values requested in Question 6 above. Discuss these values in relationship to any goals associated with the implementation of the maintenance rule and in comparison to actual past

performance of the EDG's at the plant. Also compare the values used in the PSA analysis to the target values committed to for SBO.

Response

The PSA base cases assumed an EDG test and maintenance unavailability of 4.1 days per year while an unavailability of 13.4 days per year was assumed for the case with the proposed preventive maintenance inspection implemented. This corresponds to an EDG availability of 0.989 and 0.963 for the base cases and the proposed preventive maintenance inspection case, respectively. An AAC DG maintenance unavailability of 17.3 days per year was assumed in each case. This corresponds to an availability of 0.953.

The maintenance rule program unavailability performance criterion for all diesels (EDGs and AAC DG) is set based on a combination of maintenance unavailability utilized in the current PSA model and anticipated on-line maintenance requirements. The current maintenance rule availability goal is 0.984 for the North Anna diesels. However, this may change in the future based on diesel maintenance requirements and overall risk goals. As with any risk significant component, the maintenance rule program is designed to track diesel availability. Actual performance of the diesels during 1995 resulted in an availability of 0.995. Thus, the availability value used in the PSA models is consistent with the current maintenance rule availability goal.

The EDG reliability value assumed in the PSA models is 0.986, which corresponds to a fail-to-start probability of 1.43E-2. The AAC DG reliability value assumed in the PSA models is 0.976, which corresponds to a fail-to-start probability of 2.41E-2. The current maintenance rule reliability goal for all of the diesels is 0.990. This is based on "NUMARC Initiatives Addressing Station Blackout at Nuclear Power Plants," NEI 87-00, Appendix D, trigger values. The Virginia Power SBO Rule commitment for diesel reliability is 0.95, as discussed in a letter from Virginia Power to the NRC dated February 10, 1992 (Serial No. 91-738A). The 1995 reliability achieved was 1.000 since there were no diesel failures during the past 100 start atternpts. The PSA model reliability values are lower than the current diesel performance but not as low as the SBO Rule commitment since the maintenance rule performance criterion is an operating goal.

The AAC DG and its auxiliaries are housed in a separate building. In accordance with the SBO rule, the AAC DG building is designed to meet or exceed the requirements of the Uniform Building Code and the Building Official's and Code Administrator's (BOCA) code

8. Proposed Specification 3.8.1.1.b.2 requires that the Alternate A.C. (AAC) Diesel Generator (DG) be demonstrated operable within 14 days prior to the performance of Specification 4.8.1.1.2.f. Bases 3/4.8.1 and 3/4.8.2 state that operability of the AAC DG is defined in administratively controlled station documents. Discuss how

the AAC DG is verified to be operable including verification that it can be connected to the safety bus associated with the EDG undergoing the extended maintenance. Since the staff believes the ability of the AAC DG to be connected to the safety bus should be verified once per shift while in the proposed Specification 3.8.1.1.b.2, the licensee should consider making this commitment.

Response

The AAC DG operability requirements will be located in the North Anna Power Station Technical Requirements Manual (NAPSTRM). The NAPSTRM was evaluated by the NRC for Technical Specification Amendments 187 and 168 for Units 1 and 2 respectively, Relocation Of The Reactor Trip System And The Engineered Safety Features Actuation System Response Time To Controlled Documents, by letter dated August 24, 1994. In that evaluation the NRC stated, in part, that *"Changes to the NAPSTRM, including the addition or relocation of technical requirements, are in accordance with the provisions of Section 6.8 "Procedures and Programs" of the Administrative Controls section of the TS. In addition, all changes, additions, or relocation of technical requirements must satisfy the criteria established in 10 CFR 50.59 "Changes, Tests, and Experiments." Subsequent changes to these limits in the NAPSTRM will be submitted to the NRC as part of the annual report required by 10 CFR 50.59(b) (2).*

Operability testing of the AAC DG will include the following requirements:

1. Verifying the AAC DG support systems are operable by verifying:

   a. The day tank contains greater than or equal to 850 gallons of fuel oil.

   b. The above ground fuel oil storage tank contains greater than or equal to 45,000 gallons.

   c. The starting air tank pressure is greater than 275 psig.

   d. The AAC DG generator battery terminal voltage is within specifications.

   e. All the AAC DG 480 volt and 4160 volt buses are operable.

   f. A sufficient volume of fuel oil can be transferred from the above ground tank to the day tank in order to maintain the AAC DG at a load of 3250 kW.

2. The AAC DG can start and accelerate to 60 ± 1.2 Hz and 4300 ± 100 volts.

3. The AAC DG can be synchronized and loaded to an indicated 3250-3350 kW and be operated for at least four hours (NOTE: For operability testing due to an inoperable EDG for Specification 3.8.1.1.b.2 the AAC DG will be loaded to the applicable safety bus).

4. For operability testing due to an inoperable EDG for Specification 3.8.1.1.b.2 the AAC DGs ability to be connected to the applicable safety bus will be performed once per shift.

9. Additional vulnerability may be created during the extended outage time for an EDG. Discuss how systems, subsystems, trains, components, and devices that depend on the remaining EDG as a source of onsite power are verified to be operable before removing an EDG for extended maintenance. Discuss what positive measures will be taken to preclude subsequent testing or maintenance activities on these systems, subsystems, trains, components, and devices while the EDG is inoperable. This discussion should include consideration of degraded or inoperable balance-of-plant equipment.

   Response

   The North Anna Management safety philosophy does not allow maintenance to be planned and performed concurrently on multiple risk significant equipment unless it is determined to be a risk acceptable combination and outage duration. This safety philosophy ensures that on-line maintenance is appropriately evaluated and executed to ensure plant safety is maintained by limiting risk significant equipment unavailability.

   The North Anna Operations Department tracks the status of all systems, subsystems, trains, components, and devices that may affect the equipment operability through a computer network that is accessible to station personnel. If any system, subsystem, etc., is in a condition such that it is determined to be inoperable then the appropriate entries are made in the computer network declaring that system, subsystem, etc., in "Action" and inoperable. Before any maintenance activities or testing are performed on any other systems, subsystems, etc., it is verified that the proposed configuration is not prohibited by Technical Specifications.

   Currently, North Anna has in place specific guidance, in the form of Administrative Procedures, that address controls placed on the maintenance and testing of structures, systems, or components while the unit is on-line using sound operating judgment and PSA insights. This guidance is not limited to only safety-related structures, systems, or components but also considers any structures, systems, or components (including balance-of-plant equipment) that are risk significant or may affect stable operation of the plant.

   Current Technical Specification 3.0.5 provides a means of limiting the configuration risk of the units when an EDG is unavailable due to the proposed preventive maintenance inspection. This specification requires all equipment powered from the emergency bus associated with the inoperable EDG to be treated as inoperable if the redundant train of safety related equipment becomes inoperable for any reason. When the redundant train becomes inoperable, the Technical Specifications require the unit to be removed from power operation within six hours. This minimizes the time that the unit can remain in any potentially

high risk configuration. No further enhancements to Technical Specifications are necessary to prevent undesirable equipment unavailability configurations.

10. The condition of offsite sources of electrical power prior to and during the extended EDG outage time have additional importance. Discuss what considerations should be given to not performing the extended maintenance when the offsite grid condition or configuration is degraded or when adverse or extreme weather conditions (e.g., high winds, lightning, icing conditions) are expected. Discuss how planning of the extended EDG maintenance should consider the time needed to complete the extended EDG maintenance and the ability to accurately forecast weather conditions that are expected to occur during the maintenance. Discuss what, if any, contingency plans should be developed to restore the inoperable EDG in the event of unanticipated adverse weather or degraded grid conditions occurring which can significantly increase the probability of losing offsite electrical power.

    Response

    The North Anna Management safety philosophy does not allow maintenance to be planned and performed on risk significant equipment during periods when the offsite grid condition or configuration is degraded, or when adverse or extreme weather conditions (e.g., high winds, lightning, or icing conditions) are expected. Administrative controls currently exist that would prevent the initiation of any maintenance activities on Technical Specification required systems, subsystems, etc., or any other risk significant system or systems during periods of electrical system instabilities. These administrative controls also address the possibility of complications due to weather and other external events that may affect electrical system stability or stable plant operations. During periods of EDG unavailability, maintenance activities on the affected EDG are routinely performed on a 24 hour per day basis until the EDG is returned to a fully operable status.

    Although it is not possible to accurately predict weather conditions for the entire 14 day extended outage, North Anna has computer links to the Virginia Power Meteorological Department that includes real time displays (including displays in the North Anna Control Room) of the local and national weather conditions and forecasts from the National Weather Service. Any severe weather warnings from the Virginia Power Meteorological Department are relayed directly to the North Anna Control Room. Additionally, mechanisms are in place to track any tropical storms or hurricanes that would have the potential of adversely affecting stable operation of the North Anna Power Station.

    For any possible long term developing weather conditions that could affect stable operation (i.e., major winter storms or severe weather due to tropical storms or hurricanes), with management direction, actions will be taken to restore the EDG to operable status as soon as practicable. For rapidly developing weather conditions, such as severe thunderstorms, abnormal operating procedures exist that provide direction on compensatory actions to be taken by the station to minimize the potential impact of such storm conditions.