

UNITED STATES OF AMERICA
 NUCLEAR REGULATORY COMMISSION

OFFICE OF SPECIAL PROJECTS

JAMES G. PARTLOW, DIRECTOR

In the Matter of

TENNESSEE VALLEY AUTHORITY
 (Sequoyah Nuclear Plant)

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Docket Nos. 50-327/328

(10 C.F.R. §2.206)

DIRECTOR'S DECISION UNDER 10 C.F.R. 2.206

INTRODUCTION

On March 24, 1988, Albert K. Bates, on behalf of The Natural Rights Center and certain named individuals (Petitioners), filed a request with the Commission seeking issuance of an immediate emergency order suspending full power operation of the Sequoyah Nuclear Plant pending completion of remedial action. The basis for Petitioners' request is the claimed failure of TVA to meet the requirements of Regulatory Guides 1.9 and 1.108 for emergency diesel generators (EDGs). Specifically, the Petitioners claim that the capacity and performance testing of the EDG system are inadequate to assure protection of public health and safety. To support this claim, the Petitioners rely on letters to the Commission from Mr. Dallas R. Hicks dated February 25 and March 10, 1988, identifying purported deficiencies in the Sequoyah EDGs, and on a report to the staff from NRC's own independent consultant, Dr. Alexander Kusko of Failure Analysis Associates, dated March 8, 1988.

By letter dated March 28, 1988, the Petitioners were informed that their request for relief had been referred to the Director, Office of Special Projects.

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In that letter, the Petitioners were also informed that their request raised no new issues not already considered by the NRC staff and that, therefore, their request for emergency relief was denied.¹ It was further stated in that letter that the remainder of the response to their request, i.e., an examination of the technical adequacy of the EDGs, would be treated as a Petition for enforcement action under 10 C.F.R. §2.206 and that appropriate action on the Petition would be taken in a reasonable time. Notice of receipt of the Petition has been published in the Federal Register, 53 Fed. Reg. 22396 (June 15, 1988).

By letter dated May 18, 1988, Mr. Bates submitted additional questions. Mr. Bates requested that the issues raised by these questions be considered in my response to the March 24th Petition.

The staff has completed its evaluation of the concerns raised by the Petition and the additional questions raised in the May 18th letter. In the course of that evaluation, the NRC staff considered the materials filed by both the Tennessee Valley Authority (TVA) and the Petitioners in the U.S. Court of Appeals during the Petitioners' challenge of the denial of their request for emergency relief. Specifically, the staff reviewed TVA's technical submissions

1 Petitioners filed an appeal of the denial of their request for emergency relief in the U.S. Court of Appeals for the Sixth Circuit on March 30, 1988. On May 16, 1988, the Court of Appeals ruled that the denial of emergency relief was not a final agency action under Honicker v. NRC, 590 F.2d 1209 (D.C. Cir. 1978), cert. denied, 441 U.S. 906 (1979). See Slip. Op. at 4-5.

and Mr. Hicks' letter dated April 6, 1988, responding to those submissions.² For the reasons stated below, the Petitioners' request for an order suspending full power operation of the Sequoyah facility is denied. The enclosure to this Decision contains the questions raised in the May 18th letter and the NRC responses to these concerns.

BACKGROUND

In August 1985, as a result of a number of identified deficiencies in environmental qualification of electric equipment, design change control, and construction practice, TVA elected to shut down Sequoyah Units 1 and 2 until these deficiencies were corrected. In September 1985, the NRC issued a letter in accordance with 10 C.F.R. §50.54(f), identifying a number of issues which the NRC staff required TVA to resolve prior to restart. Among these issues was the Sequoyah design control process. One specific area affected by the allegedly inadequate design control process related to the EDGs. In 1985, both TVA and the NRC had received allegations of various EDG inadequacies including overloading, poor reliability, missing records and calculations, inadequate testing, and deficiencies in maintenance. As a result, beginning in 1986, TVA, as part of its Nuclear Performance Plan, undertook a major effort to address

2 By letter dated June 21, 1988, Douglas R. Nichols, Assistant General Counsel, TVA, requested that the NRC staff consider documents filed by TVA before the Sixth Circuit in reaching its final determination on the Petition. In this regard, Mr. Nichols specifically cited several affidavits which he claimed should furnish an ample factual basis for denying the Petition. The staff has considered these documents in arriving at its determination regarding the Petition.

these issues. Starting in late 1986, the NRC staff reviewed these efforts in detail during its inspections of TVA's electrical calculation program and design baseline verification program. The staff completed its review in March 1988 and, in May 1988, issued a favorable evaluation as part of the Sequoyah Nuclear Performance Plan Safety Evaluation Report, NUREG-1232, Volume 2 (SER), pages 2-23 through 2-28.

DISCUSSION

The Petitioners assert that the Sequoyah EDGs are inadequate to perform their required safety functions. They claim that the EDGs have inadequate capacity and received inadequate performance testing, and that these inadequacies are a consequence of TVA's failure to meet the requirements of Regulatory Guides 1.9 and 1.108. Petitioners state that the failure of this system to meet federal requirements is set out in greater detail in a "Consultant's Report" by Dr. Kusko and in letters to the Commissioners from Mr. Dallas Hicks dated February 25 and March 10, 1988.³ The Petition itself does not provide specifics as to the nature of Petitioners' technical concerns or the alleged deficiencies. Nonetheless, I have tried to summarize the technical issues underlying the general concerns in the documents referenced by the Petitioners and to respond to each individually.

3 Mr. Hicks is a former TVA engineer who was employed by TVA from March 23, 1979 to May 8, 1984.

Capacity

Petitioners first assert that the Sequoyah diesel generator capacity⁴ is inadequate. As stated above, Petitioners have referenced both an NRC consultant's report dated March 8, 1988, by Dr. Kusko, and letters by Mr. Hicks dated February 25 and March 10, 1988, to support their assertions. However, Dr. Kusko's March 8th letter is a preliminary and partial report of his work and should be read in conjunction with his March 25, 1988 and March 28, 1988 letters. Dr. Kusko's March 8th letter does not discuss capacity since Dr. Kusko was retained by the NRC principally to examine voltage performance. Discussion of voltage performance is included with performance testing below. In his March 25, 1988 letter, Dr. Kusko finds that the capacity ratings are appropriate and the loads are within those ratings. The only statement critical of EDG performance in the March 8th letter concerns circuit contactor performance. On March 10, 1988, TVA submitted a revised analysis of circuit contactor pick-up and drop-out, which resolved Dr. Kusko's concerns.⁵ The NRC's review of this analysis is documented in the SER at pages 2-23 through 2-28. I therefore conclude that Dr. Kusko's March 8, 1988, letter, read in conjunction with his later letters and the NRC staff's safety evaluation, does not raise a safety issue requiring any further action by NRC.

4 We interpret the Petitioners' use of the term capacity margin to mean the load carrying capability of the EDGs, which is commonly referred to as capacity in technical literature.

5 Circuit contactors used for connecting electric power to small loads require that the source voltage must not drop below an acceptable minimum value across these contactors, in order to assure their proper function. There was a concern that during large load starting, the system voltage could drop below that minimum and cause contactor misoperation.

With regard to Mr. Hicks' letters, I understand the specific technical issues raised in these documents regarding capacity to be as follows:

- a. TVA's Condition Adverse to Quality Report (CAQR), dated October 1986 (CAQR-SQN-EEB8629R3), identified a condition in the EDG post-accident loading sequence that exceeded the capacity of the EDGs.
- b. Manufacturer's data sheets show an EDG capacity of 4000kW continuous rating which, Mr. Hicks claims, is exceeded at Sequoyah and is in violation of Regulatory Guide 1.9.

With regard to the first issue, TVA discussed the overload problem with the NRC in August 1986 and formally reported the problem in a Licensee Event Report (LER) 87-52 in July 1987. Simply stated, the EDGs are limited in how much load they can assume instantaneously for the five or so seconds while the load is being started. This limit is called the transient load limit which is not addressed in the Regulatory Guide or the related industry standards. Morrison-Knudson (M-K), the EDG manufacturer, has reported to TVA that, for Sequoyah, two separate transient load limits apply. According to M-K, the EDGs have, under most circumstances, a transient load capability of 4951kW. However, during the first three minutes of operation, the EDG superchargers are not fully effective and the EDGs are limited to a transient load limit of 4482kW. The loads cited by Mr. Hicks, which were transient starting loads (as high as 4925kW) that occurred during the first 30 seconds of EDG operation, exceeded 4482kW and were, therefore, deemed unacceptable by TVA and so reported to the NRC in the LER. Thus, at the time Mr. Hicks was employed at TVA, his charges were valid. However, after Mr. Hicks left TVA's employment, TVA resolved this issue by modifying the EDG load sequencing so that these higher

loads occurred after the first three minutes of operation when the transient load limit was 4951kW. The NRC staff reviewed the identified transient load limits and the acceptability of the EDG load sequence modification and found the EDGs acceptable. The staff documented this finding in the SER at pages 2-23 through 2-28. The Petition presents no new information or concerns that change the NRC staff's conclusion that TVA has adequately and acceptably addressed the issue raised in CAQR-SQN-EEB 8629 that was referred to by Mr. Hicks. Therefore, I conclude that the CAQR data cited by Mr. Hicks do not now represent a safety concern.

The second capacity issue raised by Mr. Hicks is that the loading of the EDGs exceeds the 4000kW continuous rating which he asserts to be the only capacity of the machines. Based on this assertion, the Petitioners apparently conclude that EDG capacity is inadequate. The capacity of an EDG is limited by the capacity of the diesel engine or the generator, whichever is lower. Therefore, in determining the adequacy of the Sequoyah EDGs, the NRC examined capacity of both the engine and the generator.

On August 11, 1987, TVA filed a request for amendment of Sequoyah's Technical Specifications for diesel generators. This request sought NRC approval for testing and operation of the Sequoyah diesel generators at a 4400kW (increased from 4000 kW) capacity for continuous operation of 2,000 hours and a 4840kW (increased from 4400 kW) capacity for emergency operation of two hours. In its request, TVA noted that according to the manufacturer's detailed specifications, the diesel engine standing alone had a continuous rating of 4400kW and an emergency rating of 4840kW. However, the emergency rating is only 4482kW for the first three minutes of operation of the diesel

engine while the supercharger is coming up to full capacity. TVA also provided the generator specifications which cited ratings of 5000kVA continuous and 5500kVA emergency rating.

As is standard in the industry, the manufacturer assumed an operating power factor of .8 for the loads. At this power factor, the generator kVA limit translated to kW limits of 4000kW continuous and 4400kW emergency (kW = power factor x kVA). A power factor of .8 is applied for establishing conservative margins in EDGs, when load characteristics are not fully determined during plant construction. However, when installation is completed, an accurate determination can be made of the load power factor, which generally results in higher values, as evidenced in the Sequoyah case. TVA, in its request, noted that the actual power factor of the loads at Sequoyah was .88 and, therefore, the EDGs could operate at power levels well above the 4000 and 4400kW while remaining within both the engine and generator limits. Therefore, TVA requested an amendment of EDG continuous and emergency limits to 4400kW and 4840kW so long as the 5000kVA and 5500kVA generator limits and the three minute engine limitation were simultaneously met.

The NRC reviewed the technical basis for TVA's request and approved the EDG limits in an amendment dated January 7, 1988. The NRC staff also reviewed TVA's calculations of the actual loading of the Sequoyah EDGs and concluded that the loadings of the EDGs were within the limits on capacity as stated in Regulatory Guide 1.9 (position C.2). This analysis is summarized in the SER at page 2-25. The Petition, Mr. Hicks' letters, and Mr. Bates' questions provide no new data or issues that were not considered in the NRC staff's original review nor any basis to change the staff's conclusion. Therefore, I conclude

that the Sequoyah EDGs are operating within appropriate and conservative capacity limits with adequate margins and are not overloaded.

Performance Testing

The second general area of concern expressed in the Petition is the alleged non-conformance with Regulatory Guides 1.9 and 1.108 in performance testing of the EDG system. As set out in his letters, Mr. Hicks' concerns⁶ regarding performance testing can be summarized as follows:

- a. The Sequoyah EDGs have never received the preoperational testing called for in Regulatory Guide 1.108.
- b. The testing that has been conducted demonstrates nonconformance with Regulatory Guide 1.9.
- c. The testing that has been conducted does not completely duplicate the post-accident design loads.

This section will address each of these three issues. Initially, with regard to the Petitioners' first two concerns, it is important to note that failure to comply with a Regulatory Guide does not indicate that the system involved does not meet the applicable NRC requirements contained in a regulation. If a licensee can demonstrate compliance with a Regulatory Guide, it has

6 Mr. Hicks claims in his letter to the Commission dated February 25, 1988: "In withholding information, the senior NRC staff management misrepresented to the Commission the degree and seriousness of the results of the TVA diesel generator testing failures." This claim is unjustified because the staff became aware of allegations of test failures on January 13, 1988 when TVA gave the staff preliminary notification of the test results and informed the Commission on January 20, 1988, that staff members were to be dispatched to the site on January 21, 1988, for a complete briefing by TVA on the diesel generator test results.

demonstrated compliance with the NRC's requirements in that area. However, a licensee may seek to demonstrate compliance with the requirements by means other than those set forth in a Regulatory Guide, if it so chooses. See e.g., Vermont Yankee Nuclear Power Corporation (Vermont Yankee Nuclear Power Station), CLI-74-40, 8 AEC 809, 811 (1974); Porter County Chapter of the Izaak Walton League of America, Inc. v. Atomic Energy Commission, 533 F.2d 1011, 1016 (7th Cir. 1976), cert. denied., 429 U.S. 945 (1976).

With respect to Petitioners' first concern, Regulatory Guide 1.108 was not issued until several years after the Sequoyah application was filed and, therefore, was not addressed in the FSAR. However, the Sequoyah Technical Specifications which were approved by NRC require periodic testing essentially identical to the testing delineated in Regulatory Guide 1.108 which includes both extended full power testing and load sequence testing for the Sequoyah EDGs. This testing was completed at Sequoyah between April and November, 1987. The one substantive difference between the Sequoyah EDG test program and Regulatory Guide 1.108, involving the use of full design loads for testing, is discussed below in response to Concern 3, Design Load Testing. The NRC reviewed the results of the tests and concluded they were conducted in compliance with Regulatory Guide 1.108, notwithstanding that one substantive difference. However, as will be explained below, that difference does not impact the staff's finding that Sequoyah can be operated safely. Therefore, I have concluded that the EDG testing at Sequoyah was acceptable.

The Petitioners' second concern is that, based on test data, the Sequoyah EDGs do not meet the quantitative limits of Regulatory Guide 1.9, paragraph

C.4. A thorough review of the test data by the NRC staff has identified only two areas where the limits are not met.

By way of background, as part of its original application for an operating license filed in December 1973, TVA committed to conform to Safety Guide 9 in its Final Safety Analysis Report (FSAR). This safety guide was subsequently retitled Regulatory Guide 1.9, Revision 0. The fact that Regulatory Guide 1.9 (Safety Guide 9) is cited in the Sequoyah FSAR does not change its status. The FSAR is a formal description of the facility, its design basis, limits of operation and safety analyses (See 10 C.F.R. §50.34(b)). The inclusion of a commitment to conform to a specified Regulatory Guide is no different than a commitment to conform to a specified industry standard or to a methodology or limit spelled out explicitly in the text of the FSAR. In this case, the NRC reviewed TVA's deviations from its commitment to Regulatory Guide 1.9 and found them acceptable.⁷

The first deviation from Regulatory Guide 1.9 is that at the very beginning of the loading sequence, when the EDG circuit breaker closes at time zero, the EDG has not yet reached 95% of rated frequency as specified in the Regulatory Guide. A careful review by the NRC staff of the test data and the control logic of the EDG circuit breaker leads to the conclusion that this

7 10 C.F.R. §50.59(a)(1) provides that changes to the facility or procedures as described in the FSAR may be made without prior NRC approval where such changes do not involve an unreviewed safety question, as defined in Section 50.59(a)(2), or a change in technical specifications. Initially, the determination as to whether a proposed change requires prior NRC approval under Section 50.59 rests with the licensee. However, such a determination is reviewable by the NRC and, if inappropriate, can be the basis for enforcement action.

deviation is a consequence of the breaker control logic scheme used whereby the breaker closes on to the power bus earlier than required and consequently the frequency has not reached its expected value. This review is documented in the SER at page 2-27. However, the EDG frequency continues to increase at a constant rate even as the time zero loads are applied and reaches the allowable range within one second. The NRC concluded in the SER that this deviation was of no safety significance.

The second deviation is that the test data show that after certain load steps, at least one of the EDG's did not recover to $\pm 10\%$ of rated voltage within 60% of each load sequence time interval.⁸ Because of the deviation in voltage recovery, the staff required TVA to provide detailed additional analyses addressing the effects of the voltage deviation on the performance of all safety-related equipment powered by the EDGs. Also, TVA provided detailed analyses of sequence-timer errors and their effect on performance. Based on these analyses, the NRC staff's review (documented in the SER at pages 2-20 and 2-27) determined that the deviation was not safety significant and was acceptable for restart.

The third concern expressed by Mr. Hicks is that the Sequoyah EDGs have not been tested through the loading sequence at full design loads as specified

8 The interval is stated as 40% in Safety Guide 9 but this was relaxed by the NRC staff in Revision 2 of the Guide to 60%. Revision 2 of the Regulatory Guide also included the following qualification: "A greater percentage of the time interval may be used if it can be justified by analysis. However, the load sequence time interval should include sufficient margin for the accuracy and repeatability of the load-sequence timer."

in Regulatory Guide 1.108, Regulatory Position C.2.a.(2).⁹ As stated above, Regulatory Guide 1.108 was not in effect at the time Sequoyah was designed. Sequoyah, like most plants of the same vintage, was not built with full flow bypasses on all safety-related pumps. Full flow bypass capability is necessary to completely simulate post-accident design loads, because pumps draw less power at low bypass flows than at design conditions. Therefore, Sequoyah, like other plants of the same era, cannot conduct full design load tests. Instead, Sequoyah, like those other plants, uses standard calculational methods reviewed by the NRC to predict full load voltage drops during sequencing. TVA's original calculations showed that Sequoyah would meet the design load voltage and frequency drop specifications of Regulatory Guide 1.9, Regulatory Position C.4 (not less than 75% voltage and 95% frequency).

In late 1987, TVA sequence-tested the EDGs. Although the results were within the limits stated in Regulatory Guide 1.9, including the 75% voltage limit, the voltage drop was substantially worse than was predicted by TVA's original calculation. Therefore, the NRC staff directed TVA to undertake the following analyses: (1) determine why voltage drop was worse than calculated, (2) develop more sophisticated calculational methods for predicting more accurately both the test results and the expected voltage drops at design loads, and (3) determine the margins remaining between predicted post-accident

9 Regulatory Guide 1.108, C.2.a.(2) states that the licensee must demonstrate that voltage and frequency remain within required limits. These limits are set out in Regulatory Guide 1.9.

voltage drops and the minimum voltages required to operate the various safety-related equipment powered by the EDGs. TVA submitted these analyses to the NRC by letter dated February 29, 1988. The analyses demonstrate that the predicted voltage drop due to the additional loading on the EDGs will not impair the performance of safety-related equipment. The NRC staff reviewed the TVA analyses and concluded that all safety-related EDG loads would function as designed. The NRC review is documented in the SER at pages 2-23 through 2-28. Based upon this review, I have concluded that TVA has adequately demonstrated that the EDG's are acceptable for safe plant operation and that testing of the Sequoyah EDGs at full design loads is not required in this case.

On the advice of its own consultant, TVA has stated that it will undertake an engineering effort to upgrade the performance of the EDGs over the next two years. Although not required, this effort is desirable to restore the margins believed to have existed when the units were designed. However, I have concluded, for the reasons stated above, that these enhancements, though prudent and desirable in the long term, are not necessary to assure protection of the public health and safety during the period of operation until they are completed.

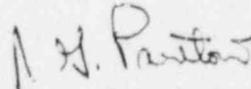
CONCLUSION

For the reasons discussed above, I conclude that the capacity margins and performance testing of the Sequoyah EDGs are adequate to provide reasonable assurance that the public health and safety will be protected. I find no new issues raised by the Petition or the documents which Petitioners reference that

were not addressed in the staff's prior review of the Sequoyah EDGs, or any new information provided that would shed doubt upon the conclusions of the NRC staff. Therefore, the Petitioners' request is denied.

As provided in 10 CFR 2.206(c), a copy of this Decision will be filed with the Secretary for the Commission's review.

FOR THE NUCLEAR REGULATORY COMMISSION



James G. Partlow, Director
Office of Special Projects

Dated at Rockville, Maryland
this 3rd day of August 1988

ENCLOSURE

RESPONSE TO LETTER FROM A. BATES DATED MAY 18, 1988

QUESTION 1. Load Shedding Activities by Reactor Operators: What is the effect of requiring manual load shedding on the EDG power train by the reactor operators during accident conditions? Would operators in actual likelihood divert attention to dropping additional EDG loads if they were in a TMI-like condition (e.g., uncovered and degraded core, inability to stabilize)? What potential for human error is introduced by requiring operators to shed EDG loads manually?

ANSWER.

Load shedding of non-essential loads will be required after the plant has reached steady state load conditions. (See SER pp. 2-25 to 2-26.) As required by the TVA Administrative Instruction (AI-2), Revision 30, dated March 7, 1988, plant operators responsible for effecting the load shedding are not the same operators responsible for monitoring and controlling the course of a postulated core uncover event. Furthermore, this shedding will not be required until approximately two hours following the initial load application on the Emergency Diesel Generators. In the staff's technical judgment, at the time of such load shedding, the plant should be fully stabilized and manual actions for shedding diesel loads will not cause an

QUESTION 1. (Continued)

undue burden on the operators. In the staff's judgment, the potential for human error is minimized by operator training on plant specific Emergency Operating Procedures (see NRC Inspection Reports 50-327/87-61 and 50-328/87-61, dated February 1, 1988 and TVA Abnormal Operating Instruction AOI-35) and human-machine interaction considerations of the Control Room Design (see Safety Evaluation for the Detailed Control Room Design Review transmitted by letter to S. A. White (August 27, 1987)).

QUESTION 2.

What is the actual effect of diminished frequency across the power train? What are the error boundaries on frequency levels calculated in the EDG power train during the first 3 minutes of emergency startup? What might be the effect of timer drift and other factors on this calculation? If the diminished frequency acknowledged by Kusko, Marinos and the preliminary SER were to have a duration of greater than the one second now predicted, what might be the effect on the power train? What might be the effect of the loss of one or more major components due to failure under frequency variance conditions? What would be the effect of the loss of one or more components on the rest of the power train, on containment integrity, on reactor cooling and on control systems?

ANSWER.

Severe reduction in system frequency (in excess of several seconds) during sustained overload conditions in a power system can have undesirable effects in equipment performance when system voltage remains above nominal values. However, small variations in frequency during loading and an expected proportional decrease in system voltage would contribute to maintain appropriate loading on the EDGs and maintain equipment potential overcurrent conditions well within equipment overcurrent protection requirements. Therefore, since only a sustained severe reduction in system frequency can have a potential effect in equipment performance, error boundaries on frequency levels are not critical for the Sequoyah EDGs and no equipment failure can be postulated as a result of the frequency variations experienced.

QUESTION 2. (Continued)

Timer drifts affecting load sequencing have been conservatively accounted for in the TVA calculations transmitted to the NRC staff for review (see letter from R. Gridley, TVA to NRC, dated February 29, 1988). TVA's calculations have demonstrated timer drifts will have no adverse effect on the EDG and equipment performance.

QUESTION 3. If the loss of offsite power coincided with a core-degraded condition already in progress and the air in containment was heavily admixed with unrecombined hydrogen, what could be the consequence of delaying the CSP [Containment Spray Pump] and CSP fan from 30 seconds to 3 minutes? What would be the effect of the CSP delay if the loss of offsite power coincided with a containment fire in progress? What other worst case scenarios might mitigate against resequencing of CSP startup or other EDG loads?

ANSWER.

The NRC staff has determined that, during a postulated degraded core condition, there are provisions for limiting hydrogen concentration in the containment below unacceptable levels. (See SER, NUREG-0011 Supplement No. 6, pages 22-10 to 22-14.) Hydrogen igniters are installed for burning the hydrogen generated during the event and maintain concentrations well below risk levels. In fact, igniter action is not required for at least an hour following containment spray actuation and containment spray performance is not relied upon for hydrogen mixing. (See NUREG-0011, Supplement No. 6, pp 22-19 to 22-20.) Therefore, we conclude that containment spray actuation delay from 30 seconds to 3 minutes has no effect on the hydrogen concentration in containment. The containment recirculation fans actuation times have not been altered from those determined in the plant design basis during initial plant licensing.

QUESTION 3. (Continued)

Further, in the event of loss of offsite power coincident with a containment fire, the containment spray system is not required for suppressing the fire. Independent fire suppression systems are provided in the containment for the suppression of fires.

The staff has not identified any unacceptable credible accident scenarios that might be generated from the delay of containment spray actuation from 30 seconds to 3 minutes.

QUESTION 4. Is it considered good practice in nuclear systems to exceed manufacturers' recommendations regarding voltage and frequency margins because of inherent conservatisms in manufacturers' recommendations or because of inherent conservatisms in other aspects of plant design and safety margins?

ANSWER.

During the design stage, it is not a good practice to exceed manufacturers' recommendations in any equipment performance characteristics. However, it is not an uncommon practice to take credit for conservatisms provided in equipment design when uncertainties in equipment performance requirements are resolved in operating plants. In the case of the Sequoyah Nuclear Plant, TVA, through equipment performance testing and analyses, has demonstrated the capability of equipment to perform its intended function with adequate margin. This performance capability and margin will be periodically demonstrated through the life of the plant by testing, as documented, in the plant technical specifications.

QUESTION 5.

Does the determination by NRC that TVA will be allowed to operate the EDG system at above 110 percent of rated voltage for short duration and outside rated frequency for short duration require an amendment to the operating license because the grant of the license was based upon an application that stated broader margins for both voltage and frequency? If so, when will the license amendment be proposed?

ANSWER.

An amendment to the license is not required to allow TVA to operate the EDG system at above 110 percent of rated voltage for short duration and outside the rated frequency for short duration. As indicated in the enclosed Director's Decision, the Regulatory Guide limits (including the 110 percent limit of rated voltage) are not mandatory. A licensee may utilize alternative methods to demonstrate compliance with performance requirements. TVA has demonstrated through testing and analyses that the performance of equipment will not be impaired as a result of minor deviations in voltage and frequency for short duration in isolated loading sequence steps, and therefore did not involve an unreviewed safety question.

QUESTION 6. When will TVA be required to meet the EDG testing requirements imposed by the January 1988 license amendment?

ANSWER.

TVA has completed the testing requirements imposed by the January 1988 license amendment on increased loading of the diesel generators. The staff review of the increased loading is identified in the staff SER on page 2-26, NUREG-1232, Vol. 2 and further discussed in Mr. Marinos' affidavits. This testing was completed by TVA prior to NRC approval of the amendment request.

QUESTION 7.

The correction of the EDG systems to bring them back into line with the original license requirements has been deferred until the first scheduled refueling of Unit 1. The safe operation of Unit 2's EDG system is dependent upon calculations based on Unit 2 operating alone, without Unit 1. TVA now estimates Unit 1 will be restarted in six months. What additional EDG system modifications will be required prior to bringing Unit 1 to power? What EDG testing will be required of all four diesel generators, working together, prior to restart of Unit 1?

ANSWER.

TVA is required to submit a revised load analysis of the EDGs for staff review prior to restart of Unit 1 at Sequoyah. This submittal has not yet been received by the staff. Upon review of the pending submittal, if it is determined that significant loading and load sequencing modifications have been instituted, additional analyses and/or testing may be required to ascertain the functional integrity of the EDGS and the performance capability of the equipment powered by these units.

QUESTION 8. Mr. Marinos indicated in his affidavit to the Court of Appeals that generators 1A, 1B, 2A and 2B are all wired together in order to share and equalize the emergency loads. What is the effect of this wiring on the frequency and likelihood of common mode failures? Where does TVA's fifth generator fit into this configuration; can it replace any of the four generators, instantly, as needed, or would additional time be required to wire it into the system?

ANSWER.

Mr. Marinos in his affidavits to the Court of Appeals has made no statement that generators 1A, 1B, 2A and 2B are all wired together in order to share and equalize the emergency loads. The generators are not wired together, there is complete train redundancy, and the staff has not identified any common mode failures that can affect redundant trains. There are two redundant trains of power supply and each train has two dedicated diesel generators.

TVA has not requested credit for use of a fifth diesel generator and the staff does not require its presence to meet regulatory requirements. The NRC has determined that the fifth diesel generator is not connected to any safety related power train at Sequoyah and will remain disconnected until a regulatory review is completed, if TVA requests credit for this standby unit.

QUESTION 9. What might be the effect of extreme heat (ambient external temperatures in excess of 105°F) on the EDG capacity and load sequencing margins, and on the ability to operate at greater than or equal to 100 percent of rated voltage for 2 hours?

ANSWER.

The Sequoyah EDG maximum load capacity is based on a design basis external ambient temperature of 97°F and an EDG room temperature of 104°F when the unit is running. This temperature is maintained by two exhaust fans, one of which starts automatically when the EDG starts and the other of which has delay start in the event the first fails to start. In the event that the design basis external temperature is exceeded, TVA is required to maintain the EDG room temperature at 104°F or bring the plant to a safe shutdown mode, as required by plant technical specifications.

Additionally, the NRC has determined that there is no potential single failure in the temperature control systems that can disable both redundant power trains and there is no credible scenario in which the EDGs would be operated at or above 110 percent rated voltage for a sustained period of time, beyond that short duration discussed in response to your Question 5.

QUESTION 10. To what voltage and frequency standard will the EDG system at Sequoyah be held after TVA's first scheduled refueling of Unit 1? Will it return to the standard imposed by the original license (industry standard; Regulatory Guide 1.9) or will be held to a lesser standard as modified by the load reduction measures or other variances introduced at Sequoyah subsequent to 1985?

ANSWER.

TVA will meet all the provisions of Regulatory Guide 1.9 when both nuclear units at Sequoyah are in operation with two minor, temporary exceptions. As indicated in the enclosed Director's Decision, these exceptions are: (1) maximum voltage overshoot at one step of the load sequence exceeds the 110 percent limit and (2) the system frequency is slightly lower than required. As indicated in the Decision, these deviations do not raise a safety concern. However, the long-term corrective action program committed to by TVA in its March 3, 1988 submittal is expected to return the voltage and frequency parameters within the limits described in Regulatory Guide 1.9.