December 30, 1988

Docket No. 50-260

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Mr. Oliver D. Kingsley, Jr.
Senior Vice President, Nuclear Power
Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Dear Mr. Kingsley:

SUBJECT: TEMPORARY EXEMPTION FROM 10 CFR PART 50, APPENDIX A - GENERAL DESIGN CRITERION 17 FOR BROWNS FERRY NUCLEAR PLANT, UNIT 2

By letter dated December 15, 1988, you requested a temporary exemption from the requirements of 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 17 regarding electrical cable independence for Browns Ferry, Unit 2.

Based upon the evaluation of your submittal, we have concluded that your request for a temporary exemption from 10 CFR Part 50, Appendix A is appropriate and acceptable, as stated in the enclosed Exemption. This Exemption is effective upon date of issuance. The Exemption has been forwarded to the Office of the Federal Register for publication. The staff's supporting Safety Evaluation is also enclosed.

Sincerely,

Original signed by
B. D. Liaw for

Suzanne Black, Assistant Director
for Projects
TVA Projects Division
Office of Special Projects

Enclosures:
1. Exemption
2. Safety Evaluation

cc w/enclosures:
See next page

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
TENNESSEE VALLEY AUTHORITY	)	Docket No. 50-260
	)	
(Browns Ferry Nuclear Plant, Unit 2)	)	

EXEMPTION

I.

The Tennessee Valley Authority (TVA or the licensee) is the holder of Operating License No. DPR-52 which authorizes operation of Unit 2. This license provides, among other things, that Unit 2 is subject to all rules, regulations, and Orders of the Commission now or hereafter in effect.

Browns Ferry (BFN), Unit 2, is a boiling water reactor (BWR) at the licensee's site located near Decatur, Alabama.

II.

By letter dated December 15, 1988, the licensee requested a temporary exemption from the requirements of 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 17 concerning electrical cable independence of electric power systems for BFN 2. As relevant to the licensee's request, GDC 17 requires that "...The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independent, redundancy, and testability to perform their safety functions assuming a single failure...." The requested exemption would be temporary for Browns Ferry, Unit 2 and would permit movement of fuel back into the reactor vessel and hydrostatic testing. Compliance with GDC 17 will be achieved prior to Unit 2 restart.

III.

During a recently completed program review of BFN electrical cable separation, TVA has concluded that electrical separation criteria as defined in GDC 17 have not been met in a number of instances in safety-related systems.

This review was initiated as a result of conditions identified by various other review programs (e.g., cable ampacity and drywell penetration modifications) being performed as part of the BFN restart effort. These conditions were first reported to the NRC in a Licensee Event Report dated October 22, 1988. By letter dated November 10, 1988 TVA committed to completing the discovery phase of the program and to correct the problems identified in support of fuel loading. By letter dated December 15, 1988 TVA stated that the first phase of the program identified approximately 250 discrepancies with GDC 17 electrical cable separation criteria for BFN. These discrepancies were evaluated for impact on systems required to be operational during fuel reload operations. TVA has determined that postulated electrical failures resulting from improper cable separation during refueling activities are highly improbable and do not pose an undue risk to the health and safety of the public. The licensee requested that fuel reload be permitted while TVA makes its best effort to complete all necessary work in the shortest time as reasonably possible without impacting plant safety.

BFN 2 has been shutdown for over four years. Consequently, the decay heat power output from the fuel is extremely low (i.e., less than 0.4 MW for the entire Unit 2 fuel pool) and the only fission product remaining in any significant quantity is Krypton 85 (Kr 85). During fuel reload and other activities leading to restart of the Unit 2 reactor, the following measures

must be assured: (1) the fuel must be maintained cool, (2) the fuel must remain covered with sufficient water to ensure shielding for personnel on the refuel floor, and (3) in the event of fuel damage, the offsite and control room dose must be maintained within the guidelines established by 10 CFR Part 20.101 and 10 CFR Part 100.11.

The potential adverse effects due to the electrical cable separation discrepancies have been evaluated for credible events which would exist during reload and hydrostatic testing activities. The licensee has stated that based upon the analysis there are no common mode failures that could affect all of the cables with separation problems. Since the plant is shutdown with extremely low decay heat and with adequate cooling water in the fuel pool and reactor vessel, the potential for environmental extremes (i.e., harsh environments) from loss-of-coolant accidents (LOCA) and/or high energy line breaks is extremely low. Extensive fire related failures are not anticipated based on existing fire prevention/detection features and interim compensatory measures. These fire prevention/detection measures are either in place or to be implemented by TVA before fuel reload. Raceways in the safety-related buildings are designed to survive seismic events without damage to required equipment; therefore, the potential for common mode failures from a seismic event is extremely low. The staff has also reviewed the potential for individual cable failure which could have an impact within the affected systems.

Due to the extremely low decay heat of the Unit 2 fuel, the time available for the plant staff to respond to transients is very long. Therefore, considering the low likelihood of an isolated electrical failure occurring

because of improper cable separation, the diverse means and sources of water which the plant has to respond to the events (i.e., availability of RHR Service Water, Feedwater, and Control Rod Drive System Water) and the slow development of transients in the plant's current configuration, the licensee has concluded and the staff concurs that there is sufficient means to maintain the reactor core covered during fuel reload and during the time after reload until restart of Unit 2.

In the event that, during the time when the vessel head is removed and the cavity is flooded, active cooling for the water in the reactor vessel pool and/or spent fuel pool were lost (i.e., residual heat removal and fuel pool cooling systems), the licensee indicates it will take in excess of 40 days for the water to boil down to the TS limit for minimum shielding height (8-1/2 feet) above the top of the fuel. Based on the guidance in Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," a period of 30 days is considered an adequate period of time to evaluate a situation of this nature (e.g., loss of cooling source) and to take corrective actions. Thus, the loss of active fuel pool cooling because of improper electrical cable separation does not represent a threat to nuclear safety.

To conservatively assess the potential impact on offsite doses, the consequences of a potential fuel handling accident concurrent with a failure to isolate secondary containment were evaluated by the licensee. The evaluation concluded that the site boundary and low population zone two hour doses are on the order of one hundred times lower than the limits specified in the BFN FSAR and NUREG-0800 and are thus on the order of one thousand times less than the 10 CFR Part 100.11 limits. A similar evaluation was conducted of the resulting

control room operator dose consequences following a fuel handling accident. This analysis showed that the control room dose was on the order of 300 times lower than the 10 CFR Part 20.101 limits.

After fuel reload, the reactor vessel head will be installed in order to perform reactor vessel hydrostatic testing. This will involve pressurizing the reactor vessel and pressure boundary. During this test the control rods will remain inserted, and therefore, the reactor will not produce any power or increase fission product inventory. Following placement of the head on the vessel, the fuel in the vessel is isolated from the heat sink provided by the fuel pool. While in this configuration, the fuel in the vessel is cooled by the shutdown cooling mode of the Residual Heat Removal System. During hydrostatic testing, three potential accident scenarios were evaluated by the licensee: (1) loss of active cooling to the water in the vessel, (2) inadvertent draining of the vessel, or (3) a LOCA during vessel hydrostatic testing.

Based upon a TVA/NRC telephone conference call, this evaluation determined that in the event of total core uncovery concurrent with loss of core cooling capability, it would take at least eight to ten hours before the fuel temperature would reach the point (2?00°F) at which fuel damage is assumed to occur. Because of the extended time frame of this transient and since TVA will maintain required systems available for reactor water injection, core reflood for mitigating this postulated event can be accomplished in a timely manner such that fuel damage and subsequent fission product release will be prevented. In addition, it will be TVA's operational philosophy during fuel load and restart that there will be as much equipment available as is possible to provide additional fuel cooling and/or water injection to the vessel.

The staff has reviewed the potential accident scenarios discussed above. We conclude that postulated electrical failures due to improper cable separation are highly improbable and do not pose undue risk to public health and safety.

Accordingly, the Commission has determined that pursuant to 10 CFR 50.12, this exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. The Commission further determined that special circumstances, as provided in 10 CFR 50.12(a)(2)(v), are present justifying the exemption; namely, that the exemption would provide only temporary relief from the applicable regulation and the licensee or applicant has made good faith efforts to comply with the regulation.

This exemption would provide BFN with only temporary relief from compliance with specific separation requirements of GDC 17 for those electrical cable separation discrepencies only recently identified by the BFN Electrical Separation Program. BFN is making good faith efforts to comply with the regulations and has implemented a two phase program to: (1) ensure that the electrical cable configuration meets the BFN separation criteria committed to by the licensee in the BFN FSAR and evaluate any identified discrepancies for their impact on systems required to be operable for Unit 2 fuel reload, and (2) complete the program prior to Unit 2 restart. Completing the subject modifications prior to restart will bring BFN, Unit 2 (and common) systems in compliance with GDC 17.

Accordingly, the Commission hereby temporarily grants the exemption from the requirements of 10 CFR Part 50, Appendix A, General Design Criterion 17.

In light of this determination and as reflected in the Environmental Assessment and Notice of Finding of No Significant Environmental Impact prepared pursuant to 10 CFR 51.21 and 51.32 (December 29, 1988, 53 FR 52880), it is determined that the intended action will have no significant impact on the environment.

A copy of the licensee's request for exemption dated December 15, 1988, and the Safety Evaluation dated December 30, 1988, related to this action, are available for public inspection at the Commission's Public Document Room, 2120 L Street, N.W., Washington, D.C., and at the Local Public Document Room located at Athens Public Library, South Street, Athens, Alabama 35611.

This Exemption is effective upon issuance.

Dated at Rockville, Maryland this 30 day of December 1988.

FOR THE NUCLEAR REGULATORY COMMISSION

James G. Partlow, Director
Office of Special Projects

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENCLOSURE 2

SAFETY EVALUATION BY THE OFFICE OF SPECIAL PROJECTS

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT UNIT 2

DOCKET NO. 50-260

1.0 INTRODUCTION

During a recently completed program review of Browns Ferry Nuclear Plant's (BFN) electrical cable separation the Tennessee Valley Authority (TVA) has determined that electrical separation criteria have not been met in a number of instances in safety-related systems. This condition was found to affect portions of the 125 VDC, 120/208 VAC, 250 VDC and 480 VAC electrical systems and could result in the loss of both trains of a safety-related system if an electrical fault resulted in damage to the power or control cables for both trains.

By letter dated November 10, 1988, TVA committed to completing the discovery phase of the BFN electrical separation program and to correct the problems identified in support of fuel loading for BFN Unit 2. During a meeting on November 30, 1988 and by letter dated December 2, 1988, TVA provided the NRC staff with an evaluation of the overall impact on the operability of the systems required for fuel load and restart. TVA has determined that postulated electrical failures resulting from improper cable separation during refueling activities before restart are highly improbable and do not pose an undue risk to the health and safety of the public and that the required modif-ications to correct the separation deficiencies can, therefore, be deferred beyond fuel load without impacting plant safety. TVA has also committed to correct the separation deficiencies affecting BFN Unit 2 and common systems before restart.

2.0 EVALUATION

During the review of the electrical cable issues at BFN, it was determined by TVA that electrical cable separation criteria have not been met in a number of instances in safety-related systems. TVA's review included an evaluation of raceway routings of over 1300 electrical cables to ensure conformance to the separation criteria as described in the BFN Final Safety Analysis Report, Section 8.9, and TVA's system design criteria. The general cable routing criteria for raceway systems are:

A. Electrical circuits of redundant divisions shall be physically separated, and separation shall be maintained for the entire routing, and

B. Non divisional cables can be routed with one division provided the non-divisional cable is not subsequently routed with the redundant division.

During the meeting of November 30, 1988, referenced above (see meeting summary "Browns Ferry Cable Separation", dated December 2, 1988), TVA presented the technical assessment and nuclear safety impact of the lack of cable separation for certain safety systems upon BFN Unit 2 fuel loading. As requested by the NRC staff, TVA provided a detailed written evaluation by letter dated December 2, 1988. This evaluation provides the basis for TVA's conclusion that the cable routing modifications can be deferred until after BFN Unit 2 fuel load but before restart.

BFN Unit 2 has been shutdown for over four years. TVA has stated that the decay heat from the fuel is less than 0.4 MW for the entire Unit 2 fuel pool which currently contains the used fuel bundles for the upcoming fuel cycle. TVA has concluded that it would take more than 40 days for the water to boil down to the Technical Specifications limit for minimum shielding height of 8.5 feet without any addition of water to what currently exists in the reactor vessel pool. Therefore, a loss of the residual heat removal and/or spent fuel pool cooling systems could be tolerated and an adequate period of time to evaluate a situation of this nature would be available. TVA has also stated that since there is extremely low decay heat and cooling water in the fuel pool that there is no possibility of harsh environments occurring from loss of coolant accidents and/or high energy line breaks. The staff agrees with TVA in that, since there currently exists a low decay heat level and a 40 day supply of water for core cooling and shielding, that a disabling electrical fault due to improper cable separation in the residual heat removal and/or spent fuel pool cooling systems would not create an undue threat to nuclear safety in terms of maintaining the fuel cool or providing shielding to refueling floor personnel.

TVA has stated that due to the current four year shutdown of BFN, the only fission product remaining for release considerations in any significant quantity is Krypton 85 (Kr 85). In the unlikely event of fuel damage, the offsite and control room doses must be maintained within the guidelines established by 10 CFR 20.101, 10 CFR 50, Appendix A, and 10 CFR 100.11.

To conservatively assess the potential consequences on offsite and control room doses, TVA has evaluated the potential consequences of a fuel handling accident concurrent with failures of secondary containment, Standby Gas Treatment System (SGTS), and, for the control room dose calculation, the Control Room Emergency Ventilation System (CREVS). The evaluation for the offsite dose was conservatively based on a 1.5 year fuel decay (rather than 4 years of decay) and resulted in an estimated site boundary and low population zone 2 hour doses of approximately 100 times lower than the BFN FSAR limits and 1000 times less than the 10 CFR limit. Similarly, the evaluation of the control room operator dose, which was conservatively based on 2 years fuel decay time, indicated a dose on the order of 300 times lower than the 10 CFR limits.

Since TVA has conservatively demonstrated that the fuel handling accident release doses are well within the regulatory limits without secondary containment, SGTS, and/or the CREVS, for the present fuel decay time, the staff concludes that a postulated disabling electrical fault in these systems due to improper cable separation would not create an undue risk to the public health and safety.

TVA plans to reload the reactor core into the vessel and install the vessel head in preparation for hydrostatic pressure testing (hydro) and eventual power operation. Following placement of the vessel head, the reactor core is isolated from the large mass of fuel pool water. TVA has evaluated the potential loss of the residual heat removal RHR system or a LOCA during vessel hydro in this configuration and has concluded that in the event of total core uncovery concurrent with a loss of the RHR system it would take several hours before fuel damage would occur. Because of the extended period of time before fuel damage for this transient, and in recognition of the actual short period of time needed for vessel hydro (approximately 48 hours), the staff concludes that, in the unlikely event of this accident, that TVA would have adequate time to initiate core reflood and prevent fuel damage.

TVA has also considered the possibility of valves spuriously actuating due to electrical faults in power and/or control cabling. Specifically, valves connected to the reactor vessel or spent fuel pool would be of concern since their spurious opening could provide a drain path. TVA has reviewed all of the piping systems connected to the reactor vessel and spent fuel pool and has determined that these systems contain a minimum of two valves in series. Therefore, two or more "hot shorts" would be required to create an electrical fault induced draining of the reactor vessel or spent fuel pool. Since the staff does not consider two or more "hot shorts" to be a credible event, accidental draining of the reactor vessel or spent fuel pool via spurious valve actuation from an electrical fault due to improper cable separation is highly improbable and, therefore, need not be considered here.

TVA has committed to maintain existing fire prevention/detection features at BFN Unit 2 and to provide compensatory measures where necessary before commencement of fuel loading. TVA has also stated that there are no common mode failures affecting the cables, therefore, the only credible failure mode is an individual cable failure for which the potential consequences have been discussed above.

Therefore, based on the above discussion and the evaluation provided by TVA, the staff concludes that a postulated electrical failure resulting from improper cable separation during the BFN Unit 2 upcoming refueling activities does not pose an undue risk to nuclear safety or the health and safety of the public and, therefore, the deferral of modifications to correct the electrical separation deficiencies until after fuel load but before restart is found to be acceptable.

3.0 CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of this evaluation will not be inimical to the common defense and security nor to the health and safety of the public.

Principal Contributor: T. Rotella

Dated: December 30, 1988