



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 43

FACILITY LICENSE NO. DPR-33

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNIT NO. 1

DOCKET NO. 50-259

Introduction

On September 19, 1978, we issued Amendment No. 41 to Facility Operating License No. DPR-33 which permitted TVA to operate Browns Ferry Unit No. 1 (BF-1) with one recirculation loop out of service for the remainder of the current fuel cycle (cycle 2) but with the restriction that power level be limited to a maximum of 50% of licensed power. Power was limited to 50% of full licensed power by the new Technical Specifications due to lack of an acceptable analysis of the locked pump rotor accident for one loop operation. Our SER issued with the Technical Specification changes gave the bases for acceptability of the 50% power limit. That SER also discussed the bases for a restriction that power could not exceed 68% of full licensed power until further information regarding the inadvertent pump startup transient analysis was provided.

Summary

We have reviewed the TVA submittal of September 28, 1978, requesting deletion of the above described power restrictions. We find it acceptable to remove both of the power restrictions on the bases discussed below, provided that the maximum power level not exceed 82% of full licensed power for the reasons discussed below.

Evaluation

One Pump Seizure Accident

TVA has submitted results of calculations for the pump seizure accident assuming one loop operation (submittal of September 28, 1978). These calculations utilized the standard, conservative, plant specific inputs that were used for the transients and accidents that were analyzed for the latest BF-1 reload (Amendment 35 issued January 10, 1978).

LPDR These calculations utilized the General Electric REDY code to model the transient behavior of the reactor core. No model changes were made to the code for this use. The code is currently used for reload transient analyses performed for BF-1 and other BWRs. Pump seizure was simulated in the same

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acceptable manner as for previously performed pump seizure analyses with two pump operation (the method results in the pump stopping completely in less than one revolution). Appropriate input changes were made to, reflect operation with one recirculation loop. Although a review is currently in progress concerning continued acceptability of the REDY code for analysis of pressurization transients, this transient is characterized as a loss-of-flow event. REDY code results are currently accepted for such analyses.

REDY results were input into the General Electric SCAT02 code which calculates thermal margin (Minimum Critical Power Ratio, MCPR). This code was not modified in any way for this purpose. SCAT02 is currently used and accepted for BF-1 and other plant transient analyses that are performed for reload submittals.

Two sets of initial conditions were analyzed (power-flow initial conditions equal to 75% power - 58% flow and 82% power - 56% flow). These conditions represent, respectively: (1) the maximum flow possible through the core (allowing for backflow through the idle jet pumps) due to one pump operation with power corresponding to that flow from the highest (105%) power-flow load line; and (2) an even higher power for the same one pump operation (core flow is 2% lower due to increased flow resistance in the core due to added voiding at the higher power). We find these assumed initial conditions acceptable since they conservatively bound the highest power operation possible under one loop operation conditions.

The analyses indicate that the following sequence of events occurs: the operating pump seizes and external recirculation loop flow goes very rapidly to zero; core flow continues due to momentum effects and buoyancy effects; as momentum is dissipated, core flow will decrease; as core flow decreases, voiding in the core will increase; increased voiding will reduce core thermal power due to the feedback effect from the negative void coefficient; and finally, the core will reach a new equilibrium power and flow determined by the natural re-circulation characteristics of the core, with no flow in the external recirculation loop (flow will be up through the core, driven by buoyant force as water is heated and boiled in the core, then down through the internal jet pumps, then repeat). Steam produced will continue to go out the main steam line to the turbine/condenser system, then back to the reactor through the feedwater system. Water level in the core will first increase due to the increased voiding, then will decrease as core power decreases and stored heat is removed, but the level fluctuations are not severe enough to trip (scram) the reactor on either high or low water level. Neutron flux decreases due to the void feedback so no high flux scram occurs. Pressure does not reach the high pressure scram point (in fact, pressure decreases) since no isolation occurs and steam continues flowing to the turbine while steam production decreases as power decreases. Thus, no reactor scram is anticipated from any signal.

During the above sequence of events, the MCPR does not go below the Safety Limit MCPR, which is set to insure lack of any significant fuel damage. Therefore, we conclude that no significant fuel damage will occur, and therefore the acceptance criteria is met for this accident (i.e., that releases remain below a small fraction of the requirements stated in 10 CFR Part 100).

On the basis of the above described plant specific analyses which have been provided, we conclude that the 50% power limit previously imposed on BF-1 for single loop operation for the remainder of the present cycle can be increased to 82% power, the maximum power level for which the consequences of the pump seizure accident have been demonstrated to be acceptable.

Inadvertent Cold Loop Startup Transient

TVA has closed the suction valve on the disabled loop and has locked out and tagged power to that valve and to the disabled loop's recirculation pump. In addition, TVA has stated that "the brushes have been lifted from the recirculation pump M-G set and will not be reinstated until the next refueling outage. Replacement of the brushes takes several hours and could not be performed without authorization." Therefore, we consider unplanned startup of the idle loop to be incredible during the remainder of the present cycle. Furthermore, the discharge valve (whose internal failure and partial closure caused the loop's shutdown) cannot be repaired until the unit is shut down at end-of-cycle. Therefore, planned loop startup will not occur during the remainder of the present cycle, and the attendant slight possibility of utilizing improper procedures during such a planned startup, and inadvertently introducing cold water suddenly into the primary system, will be avoided.

On the above stated bases we conclude that the occurrence of this transient is not credible during the remainder of the present cycle, and we find it acceptable to delete the 68% maximum power restriction for one loop operation stated in our previous SER.

Monitoring of Safety Margins for One Loop Operation

Our previous SER, issued with Amendment No. 41, stated the bases for acceptability of the BF-1 MAPLHGR limits that will be observed during the remainder of this cycle for one loop operation. Those limits conservatively account for the unavailability of one of the plants recirculation loops by assuming no credit for coastdown flow from the unavailable loop following a LOCA. We therefore conclude that operation with one loop out of service, with the reduced limits, does not result in any decrease in overall plant safety margins, i.e., that the reduced limits acceptably account for the reduction in plant equipment that is available.

The plant is required to monitor compliance with the MAPLHGR limits every 24 hours. The process computer prints out a quantity called MAPRAT, which is the ratio of the current (measured) MAPLHGR to the current MAPLHGR calculated limit. This is done every 2 hours for the 6 locations in the core that are closest to the limit. Values greater than 1.0 thus indicate a violation. The process computer has been programmed to assume the reduced limits that have been approved for one loop operation when calculating MAPRAT. We find the above described method of monitoring compliance with the MAPLHGR limits to be easy to monitor and acceptable.

We do not believe that overall plant safety margins have been decreased as stated in the first paragraph above. We note that we have previously approved operation of BF-1 at higher power levels with the same method and frequency of monitoring for compliance with the MAPLHGR limits. Since safety margins has not been degraded by operation with a single loop, we find the method of monitoring equally to be acceptable for one loop operation.

Environmental Consideration

We have determined that this amendment does not authorize a change in effluent types or total amounts nor an increase in power level authorized by the license and will not result in any significant environmental impact. Having made this determination, we have further concluded that this amendment involves an action which is insignificant from the standpoint of environmental impact and pursuant to 10 CFR §51.5(d)(4) that an environmental impact statement, negative declaration, or environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability of consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

Dated: September 29, 1978