Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-19-032

March 13, 2019

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, and 50-296

Subject: **Proposed Technical Specifications (TS) Change TS-510 - Request for License Amendments - Maximum Extended Load Line Limit Analysis Plus - Supplement 8, Additional Operator Training Information**

References:

1. Letter from TVA to NRC, CNL-18-002, "Proposed Technical Specifications (TS) Change TS-510 - Request for License Amendments - Maximum Extended Load Line Limit Analysis Plus," dated February 23, 2018 (ML18057B276)

2. Letter from NRC to TVA, “Browns Ferry Nuclear Plant - Request for Additional Information Regarding Maximum Extended Load Line Limit Analysis Limit Plus License Amendment Request (EPID: L-2018-LLA-0048),” dated November 20, 2018 (ML18312A427)

3. Letter from TVA to NRC, CNL-18-139, “Proposed Technical Specifications (TS) Change TS-510 - Request for License Amendments - Maximum Extended Load Line Limit Analysis Plus - Supplement 3, Responses to Requests for Additional Information,” dated December 14, 2018 (ML18348B156)

4. Letter from TVA to NRC, CNL-19-011, Proposed Technical Specifications (TS) Change TS-510 - Request for License Amendments - Maximum Extended Load Line Limit Analysis Plus - Supplement 6, Additional Operator Timing Results,” dated January 16, 2019 (ML19016A435)

By the Reference 1 letter, Tennessee Valley Authority (TVA) submitted a request for a Technical Specification (TS) amendment (TS-510) to Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68 for Browns Ferry Nuclear Plant (BFN) Units 1, 2, and 3,

respectively. The proposed amendment allows operation in the expanded Maximum Extended Load Line Limit Analysis Plus (MELLLA+) operating domain and use of the Detect and Suppress Solution - Confirmation Density (DSS-CD) stability solution. During their technical review of the LAR, the Nuclear Regulatory Commission (NRC) identified the need for additional information. The Reference 2 letter provided, in part, NRC Requests for Additional Information (RAIs) related to human factors. In References 3 and 4, TVA provided the responses to these NRC RAIs. In the response to NRC APHB RAI-3, TVA provided specific crew times for performing initial operator actions for an Anticipated Transient Without Scram (ATWS). The Enclosure to this letter provides information related to an NRC green finding issued for the failure of four of 15 BFN operating crews during their 2018 annual simulator scenario examinations and the impact on initial operator actions for an ATWS.

TVA has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the NRC in the Reference 1 letter. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the supplemental information in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed license amendment. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter to the Alabama State Department of Public Health.

There are no new regulatory commitments associated with this submittal. If there are any questions or if additional information is needed, please contact Mr. Michael A. Brown at (423) 751-3275.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 13th day of March 2019.

Respectfully,

E. K. Henderson
Director, Nuclear Regulatory Affairs

Enclosure: Impact of Operating Crew Failures During 2018 Annual Simulator Scenario Examinations on Initial Operator Actions for an Anticipated Transient Without Scram

cc:
NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
State Health Officer, Alabama Department of Public Health

ENCLOSURE

Impact of Operating Crew Failures During 2018 Annual Simulator Scenario Examinations on Initial Operator Actions for an Anticipated Transient Without Scram

During 2017 and 2018, Browns Ferry Nuclear Plant (BFN) Operations, Operations Training, Extended Power Uprate (EPU), and Reactor Engineering personnel developed an optimized set of initial operator actions to be taken for Anticipated Transients Without Scram (ATWS). The optimized operator actions supported the implementation of EPU, and no additional changes are required for implementation of Maximum Extended Load Line Limit Analysis Plus (MELLLA+). Following development of the initial actions, extensive simulator training was provided to the licensed operators, followed by evaluation and timing. The evaluation and timing showed consistent performance across the licensed operators with times well below the times assumed in the MELLLA+ ATWS analyses.

During the 2018 Licensed Operator Requalification (LOR) annual simulator scenario examinations (LOR Cycle 5), four of 15 simulator crews failed the examination by failing to successfully perform a critical task during a simulator scenario. This failure rate resulted in a finding with a safety significance of Green, as documented in NRC Inspection Report 2018-004 for BFN.

In accordance with procedures, a simulator examination report, including an examination summary and analysis, is required at the completion of the examination cycle. A Self-Assessment (SA) was performed by BFN Operations and Operations Training personnel to provide this report. The SA evaluated the results of the entire operating examination for all crews and for each individual operator (not just the four operating crew failures) to determine deficiencies and learning opportunities. This process allows a detailed evaluation and documentation of overall operator and crew performance and is leveraged to develop future training for the operational staff. The SA identified performance deficiencies and learning opportunities. Not all of the performance deficiencies identified in the SA (and reflected in NRC Inspection Report 2018-004) contributed to the four operating crew failures. The performance deficiencies identified in the SA, both those contributing to operating crew failures and those not contributing to operating crew failures, will be used to maximize continuous improvement in operator performance.

In order to evaluate the four operating crew simulator scenario examination failures, and to determine the specific causes of the failures, a Performance Analysis (PA) was performed by BFN Operations and Operations Training. The causes for the failures were identified as inattention to detail, misjudgment, and knowledge. The PA identified that there were no programmatic training deficiencies that resulted in a knowledge/skill issue. The PA was presented to and approved by the BFN LOR Curriculum Review Committee on December 18, 2018. Following the failures, all four operating crews were successfully remediated in accordance with procedures. This remediation included an instructor-led review of the actions resulting in the failure, simulator training with instructor critique, and re-examination. The re-examination involved a minimum of two scenarios developed using the same criteria as the initial examination.

The PA identified that inattention to detail was the cause of two of the four operating crew failures and contributed to a third failure. Numerous alarms are received by operating crews during simulated events. Crew members are expected to evaluate alarms that are received and to prioritize response for those alarms with higher safety importance. Two failures occurred when important alarms were received by the crews but were not evaluated, and therefore not addressed, leading to the inadvertent actuation of the Automatic Depressurization System in one case (Crew 5A failure) and failure to close Main Steam Isolation Valves with simulated high steam line radiation in the other case (Crew 5C failure).

Inattention to detail contributed to a third failure when the crew (Crew 2C), during a low power ATWS scenario, did not recognize that low pressure injection systems were capable of injection to the reactor pressure vessel (RPV). This occurred when emergency depressurization was re-initiated, with subsequent injection occurring prior to being authorized; misjudgment was also considered to be a contributing cause for this failure. The crew, having initially started an emergency depressurization with an ATWS, halted the emergency depressurization when the crew misjudged the availability of low pressure injection systems. This misjudgment was eventually corrected and emergency depressurization was re-initiated leading to the inattention to detail error. This ATWS scenario was at low power, less than five percent reactor thermal power, and the initial operator actions for an ATWS were not required to be performed.

The fourth operating crew (Crew 2B) failure occurred as a result of a knowledge gap. The Crew 2B Senior Reactor Operator (SRO) misapplied an override step in the Emergency Operating Instruction flowchart during an ATWS. After the crew successfully performed the initial operator actions for the ATWS, including termination of RPV injection and injection of Standby Liquid Control (SLC) within the times assumed in the MELLLA+ ATWS analyses, the SRO received a report that reactor power was below the downscale setpoint. With this report of changing plant conditions, the SRO's knowledge gap resulted in his misapplication of an override step, and he directed injection to the RPV prior to RPV water level reaching the level required to minimize core inlet subcooling, resulting in a failed critical task.

Four Training Needs Analysis evaluations were conducted to address the four operating crew failures. These Training Needs Analyses are intended to identify training that would be beneficial for the training program to address, or prevent, performance deficiencies. In addition to the remedial training provided to the operating crews involved with the failures, the Training Needs Analyses identified that simulator training scenarios targeting the specific causes of the failures would be developed and presented to all licensed operators in LOR training in 2019.

None of the critical task failures that led to the four operating crew failures during the simulator scenario examinations were directly related to the ATWS initial operator actions. The initial operator actions for an ATWS are a very specific set of actions. These initial operator actions have been placed on a "hard card" attached to the front of the reactor control panel, allowing easy access by the Reactor Operator. These actions are a series of specific steps taken during an ATWS and do not require evaluation, interpretation, or judgement. As a result, these initial operator actions for an ATWS are not subject to potential errors from inattention to detail, misjudgment, or knowledge gaps, which were identified as the specific causes of the four operating crew failures. These initial actions were extensively presented, practiced, evaluated, and timed during 2018 LOR training. As reflected in Table 1, BFN ATWS Actions Timing Data - Licensed Operator Requalification 2018, the four operating crews that failed the 2018 annual simulator scenario examinations during LOR Cycle 5 successfully performed ATWS initial operator actions within the times assumed in the MELLLA+ ATWS analyses before and after the simulator scenario examination failures, i.e., in LOR Cycle 2 and in LOR Cycle 6, respectively. Based on the above information, it is concluded that no relationship exists between the four operating crew failures during the 2018 annual simulator scenario examinations and the ability for the operators to perform the initial operator actions during an ATWS.

In addition, the initial operator actions for an ATWS will continue to be presented in LOR. The minimum coverage required by the LOR program is that each operator will receive training in ATWS actions once per year. Also, operators are evaluated with simulator examinations at least every other training cycle. Crew performance resulting in failure would be entered into the TVA Corrective Action Program and the crew would be disqualified until remediated and re-examined in accordance with plant procedures. Performance deficiencies not resulting in failure would be documented in the crew post-examination debrief and entered into the operator performance database and may also result in an operator performance improvement plan, which would result in additional training and evaluation. These actions ensure that the operators will be trained and evaluated in the initial ATWS actions, and any performance deficiencies will be identified and corrected.

Table 1 BFN ATWS Actions Timing Data - Licensed Operator Requalification 2018

Crew	**Time to Commence Reactor Water Level Reduction by Reducing Feedwater Flow Following Recognition of ATWS (seconds)**		**Time to Initiate Standby Liquid Control System Following Recognition of ATWS (seconds)**	
	Turbine Trip with Bypass (TTWB)/LOR Cycle 2	Dual Recirculation Pump Trip (2RPT)/LOR Cycle 6	TTWB/LOR Cycle 2	2RPT/LOR Cycle 6
Group 0	42.00	N/A*	61.75	N/A*
Group 1A	30.25	43.25	24.75	26.50
Group 1B	17.25	39.75	21.75	59.75
Group 1C	38.00	29.25	70.75	42.75
Group 2A	54.00	29.00	42.50	31.50
Group 2B	**46.75**	**24.75**	**42.75**	**32.00**
Group 2C	**21.50**	**13.25**	**37.50**	**23.50**
Group 3A	38.50	22.50	38.00	15.00
Group 3B	37.50	25.50	30.50	40.75
Group 3C	53.00	30.75	51.00	46.75
Group 4A	57.75	28.50	46.75	42.00
Group 4B	29.00	38.25	33.00	45.75
Group 4C	24.25	25.25	35.25	29.75
Group 5A	**52.75**	**20.25**	**44.00**	**28.25**
Group 5B	60.45	11.75	62.95	16.50
Group 5C	**47.00**	**28.50**	**61.75**	**31.50**
Average Time (seconds)	**40.62**	**27.37**	**44.06**	**34.15**

* During 2018 LOR Cycle 6 training, in which this data was obtained, there was no Group 0. This group, consisting of Operations Management and staff, attended training with various other groups during the training cycle.