February 27, 2003

MEMORANDUM TO: Allan G. Howe, Chief
Project Directorate II-2
Division of Licensing and Project Management, NRR

/RA/

FROM: David C. Trimble, Chief
Operator Licensing and Human Performance Section
Equipment and Human Performance Branch
Division of Inspection Program Management, NRR

SUBJECT: EVALUATION OF THE HUMAN FACTORS ENGINEERING INFORMATION PROVIDED BY BROWNS FERRY NUCLEAR PLANT (BFN) – UNITS 1, 2, AND 3 – LICENSE AMENDMENT - ALTERNATIVE SOURCE TERM (TAC#'S MB5733, 5734, 5735)

The Equipment and Human Performance Branch, Operator Licensing and Human Performance Section (IOHS), has reviewed Tennessee Valley Authority's (TVA) July 31, 2002, request for amendment to licenses DPR-33, DPR-52, and DPR-68 that supports the full scope application of an Alternate Source Term (AST) methodology for BFN Units 1, 2, and 3. Specifically, TVA requests revision to the licensing and design basis to reflect the application of AST methodology on Units 1, 2, and 3 and approval of associated Technical Specification (TSs) changes which are justified by the AST analyses. By letter dated December 9, 2002, the licensee provided additional information related to the July 31, 2002, submittal and containing information relevant to crediting of operator actions.

The IOHS input to the staff's Safety Evaluation is attached. IEHB concludes that the information provided by the licensee in support of crediting manual actions supports the proposed change, for Units 2 and 3. Approval of crediting manual actions for Unit 1 is deferred until information is provided to the staff describing the human factors engineering design details of the Unit 1 main control room and local control stations. If you have questions related to this evaluation, please contact James P. Bongarra, Jr., at 301-415-1046 (jxb@nrc.gov).

Attachment: As stated

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EVALUATION OF
THE HUMAN FACTORS ENGINEERING INFORMATION
PROVIDED BY
BROWNS FERRY NUCLEAR PLANT (BFN) – UNITS 1, 2, AND 3 IN SUPPORT OF
A LICENSE AMENDMENT FOR ALTERNATIVE SOURCE TERM
(TAC#'S MB5733, 5734, 5735))

1.0 INTRODUCTION AND BACKGROUND

By letter July 31, 2002, Tennessee Valley Authority (TVA), the licensee for Browns Ferry (BFN) Units 1, 2 and 3, submitted a License Amendment Request for the application of an Alternate Source Term (AST) methodology for BFN Units 1, 2, and 3. Specifically, TVA requests revision to the licensing and design basis to reflect the application of AST methodology on Units 1, 2, and 3 and approval of associated Technical Specification (TSs) changes which are supported by the AST analyses. By letter dated December 9, 2002, the licensee provided additional information related to the July 31, 2002 submittal, which is relevant to crediting operator actions.

In its AST analyses, the licensee evaluated four design basis accidents (DBA) that could potentially result in main control room or off-site doses: Loss of Coolant; Main Steam Line Break; Refueling; and Control Rod Drop accidents. The licensee indicated that its analyses demonstrated that the post- accident control room and off-site doses remained within regulatory limits using the AST methodologies. TVA indicated that it would implement the AST through revising applicable Technical Specifications (TS) and the Updated Final Safety Analysis Report (UFSAR). Of the proposed changes resulting from implementing the AST, the TS and UFSAR changes that reflect revised requirements regarding the use of the Standby Liquid Control (SLC) System to buffer the suppression pool preventing iodine re-evolution following a postulated DBA LOCA are the changes that involve crediting manual actions and addressed in this portion of the staff's safety evaluation. TVA also indicated that, since the three units share a common refueling floor, the completed AST radiological dose analysis for the refueling accident is valid for all of the units. Since Unit 1 is currently shutdown, the remaining three AST analyses were performed for Units 2 and 3 but not for Unit 1. The licensee indicated that it will verify that the required analyses for the three remaining accidents are completed before Unit 1 restart and submit them for NRC review and approval. TVA also indicated that it expects that the Unit 1 analyses will provide identical results as Units 2 and 3 and therefore requested that the NRC grant the amendment and TS change for Unit 1.

2.0 Evaluation

2.1 Evaluation Criteria

The staff"s review criteria are based on an adaptation of existing NRC review guidance for human factors engineering as found in: NUREG-800, "Standard Review Plan" (draft for comment, 2003); NUREG-0711, Rev.1, "Human Factors Engineering Program Review Model" (2002); NUREG-0700, Rev.2, "Human- System Interface Design Review Guideline, (2002); Information Notice (IN) 97-78, "Crediting of Operator Actions in Place of Automatic Actions and Modifications of Operator Actions, Including Response Times" (1997); NUREG-1764, "Guidance for the Review of Human Actions, Draft Report for Comment" (2002); Regulatory Guide (RG)1.174, "An Approach To Using Probabilistic Risk Assessment In Risk-Informed Decisions On Plant-Specific Changes To The Licensing Basis" (1998); Regulatory Guide (RG) 1.177, "An

Approach for Plant-Specific, Risk-Informed Decision Making: Technical Specifications" (1998); Information Notice (IN) 91-18, "Information to Licensees Regarding Two Inspection Manual Sections On Resolution of Degraded and Non-Conforming Conditions and on Operability" (1991).

2.2 Evaluation

In its July 31, 2002 submittal, the licensee indicated that, as a result of using AST, the LOCA analysis takes credit for minimizing the re-evolution of elemental iodine from the suppression pool, which is strongly dependent upon suppression pool pH. The licensee's analysis assumed that sodium pentaborate (SPB) was injected by SLC within several hours of the onset of a LOCA to control suppression pool pH. TVA indicated that its conservative modeling of the primary containment cabling results in the production of a large amount of hydrochloric acid. The licensee assumed in its analysis a minimum of 4000 gallons of $\geq$8% by weight injectable SPB solution in SLC to ensure that the minimum suppression pool pH remains at or above 7.0 for thirty days post LOCA. This pH satisfies the conditions for inhibiting the release of the chemical form of elemental iodine from the containment. It is expected that the initial effects on post accident suppression pool pH come from rapid fission product transport and the formation of cesium compounds which would result in increasing the suppression pool pH. However, the cesium compounds are not credited in the long-term pH analyses and the determination of the final (30 day) pH value. As radiolytic production of nitric acid and hydrochloric acid proceed, and these acids are transported to the pool over the first few days of the event, the pH in the pool would become more acidic. It was also determined that the calculated required quantity of SPB was in excess of the current TS limit so, the licensee proposed changing TS 3.1.7, "Standby Liquid Control System (SLC)," to accommodate the new quantity.

In its July 31, 2002 submittal, the licensee described that, in using the AST, the SLC system will be credited for limiting radiological dose following design basis recirculation pipe break LOCA involving fuel damage. The current design function of the SLC system is to provide a backup method, independent of control rods, to make the reactor subcritical over a full range of operating conditions. Initiating the SLC System following fuel damage to control suppression pool pH is a new operator action during a DBA LOCA response. In the event of core damage large enough to release substantial quantities of fission products into the drywell, high drywell radiation alarms will result. High radiation indicative of fuel failure would be sensed by two radiation monitors in the drywell and two monitors in the pressure suppression chamber. Upon reaching a high radiation level, the "Drywell/Suppr Chamber Radiation High" annunciator on panel 9-7 in the main control room would alert the operator to the fuel damage. The Alarm Response Procedure will direct the operator to initiate SLC System injection based on the high radiation alarm. The licensee indicates that the operational response procedures will be revised to include instructions to manually initiate the SLC System injection at 2 hours following the accident initiation, with completion of injection of an adequate volume and content of SPB within several hours, ensuring that the suppression pool pH remains at or above 7.0 for 30 days. In its December 9, 2002 letter, the licensee further explains the relationship between the

instructions to initiate the SLC System provided in the revised Alarm Response Procedure and revisions that will be made to the plant's emergency operating procedures to address SLC System actuation under the condition of high drywell radiation.

The licensee explains that initiating the SLC System is accomplished from the main control room with a simple keylock switch manipulation. The switch itself is located on control room panel 9-5 and actuating this switch is the only action necessary to initiate injection of the SPB into the reactor vessel. The new SLC System function to control suppression pool pH does not involve any change to the actions needed to be performed to initiate SLC System injection. The operators have indication in the main control room of proper SLC System operation. During this postulated LOCA event, plant operators will be responding to the event using plant emergency operating procedures. The licensee states that there is adequate time available for SLC System initiation during these events and that immediate initiation of the SLC System is not vital since the analysis allows for initiation two hours after the onset of the accident. Operators are familiar with operation of the SLC System as a result of their training in addressing Anticipated Transients Without Scram (ATWS) events and, the licensee states that operators will also be given training specific to this new application of the SLC System.

3.0 Conclusion

The staff concludes that the information included in the Browns Ferry Nuclear Plant (BFN) – Units 1, 2, and 3, License Amendment for Alternate Source Term request, related to crediting of operator actions, supports the proposed change. However, approval of crediting manual actions for Unit 1 is deferred until information is provided to the staff describing the human factors engineering design details of the Unit 1 main control room and local control stations. Therefore, IOHS concludes that the proposed change is acceptable for Units 2 and 3 only.