

June 28, 2007

Mr. William R. Campbell
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: BROWNS FERRY NUCLEAR PLANT, UNIT 1 - CLOSEOUT OF
GENERIC LETTER 88-20, SUPPLEMENT 4, CONCERNING INDIVIDUAL
PLANT EXAMINATION OF EXTERNAL EVENTS FOR SEVERE ACCIDENT
VULNERABILITIES (TAC NO. MC5729)

Dear Mr. Campbell:

This letter is to inform you that the Tennessee Valley Authority (TVA, the licensee) has addressed those actions necessary for the Nuclear Regulatory Commission (NRC) to complete the review of the Browns Ferry Nuclear Plant Unit 1 response to Generic Letter (GL) 88-20, Supplement 4, Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities. As stated in the GL, the NRC staff's evaluations are intended to obtain reasonable assurance that the licensee has adequately analyzed the plant design and operations to discover instances of particular vulnerability to core damage or unusually poor containment performance given a core damage accident. Further, the NRC believes the conclusions drawn from the IPEEE regarding changes to the plant systems or components are adequate. The consideration included both quantitative measures and nonquantitative judgment.

TVA's response to GL 88-20, Supplement 4, is composed of several submittals over the last 12 years covering high winds, floods, transportation and other HFO events; seismic including qualification of equipment; and a fire induced vulnerability evaluation (FIVE). The NRC staff's review concluded that the licensee's process was capable of identifying the most likely severe accidents and vulnerabilities related to seismic and HFO events associated with these issues, and that the licensee applied comparable methods to assess potential vulnerabilities as was applied by other plants in the 1990s. Therefore, the NRC concludes that IPEEE process for seismic and HFO events meets the intent of GL 88-20, Supplement 4.

However, since the 1990s, the technical basis for recognized fire-related issues has been strengthened. In particular, based upon testing and additional discussions with industry, Regulatory Issue Summary 2004-03, "Risk-Informed, Approach for Post-Fire Safe-Shutdown Circuit Inspections," Revision 1, identified fire-induced spurious actuation issues that hold the potential to be of high-risk significance. Although meeting the intent of the GL, the NRC staff identified that the technique used by TVA for the Unit 1 fire IPEEE was not adequate to address the recently identified concerns with post-fire safe shut-down circuit analysis spurious actuations. This is a generic industry issue, which the NRC is working to resolve along with industry. Therefore, the NRC staff finds that the licensee's fire IPEEE submittal meets the intent of Supplement 4 of the GL, in the context of the information available at the time of the GL. This conclusion is not intended as an approval or endorsement of any material related to

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fire for purposes other than those associated with meeting the intent of Supplement 4 to GL 88-20.

The NRC's staff's safety evaluation on the IPEEE is enclosed. If you have any questions or concerns, feel free to contact Ms. Eva Brown at (301) 415-2315.

Sincerely,

/RA/

Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-259

Enclosure:

1. Safety Evaluation on Unit 1 IPEEE
2. Technical Evaluation Report on for Seismic portion
3. Technical Evaluation Report for HFO portion

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Letter to W. Campbell dated 06/28/2007

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GENERIC LETTER 88-20, SUPPLEMENT 4, CONCERNING INDIVIDUAL
PLANT EXAMINATION OF EXTERNAL EVENTS FOR SEVERE ACCIDENT
VULNERABILITIES (TAC NO. MC5729)

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STAFF EVALUATION
OF
BROWNS FERRY NUCLEAR PLANT, UNIT 1
INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS

ENCLOSURE 1

SAFETY EVALUATION RELATED TO
SUPPLEMENT 4 OF GENERIC LETTER 88-20
INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS
TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT, UNIT 1
DOCKET NO. 50-259

1.0 INTRODUCTION

On June 28, 1991, the U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 88-20, Supplement 4 (with NUREG-1407, Procedural and Submittal Guidance for an Individual Plant Examinations of External Events (IPEEE) for Severe Accident Vulnerabilities) requesting all licensees to perform an IPEEE to identify plant-specific vulnerabilities to severe accidents and to report the results to the Commission, together with any licensee-determined improvements and corrective actions. The IPEEE submittal for the Browns Ferry Nuclear Plant (BFN), Unit 1, consisted of several parts, submitted at different times. On July 24, 1995, Tennessee Valley Authority (TVA, the licensee), submitted the IPEEE high winds, floods, transportation and other external events (HFOs) portion of the analysis, for Units 1, 2, and 3. On October 7, 2004, TVA submitted the combined USI A-46/IPEEE relay evaluation report (Unresolved Safety Issue (USI) A-46, "Seismic Qualification of Equipment in Operating Plants"). On January 14, 2005, TVA submitted the Unit 1 seismic IPEEE report and the Unit 1 IPEEE fire induced vulnerability evaluation.

The NRC staff contracted with Sandia National Laboratories to conduct a screening review (a review for completeness and reasonableness) of the fire portion of the licensee's IPEEE submittal. The seismic and HFO portions of the IPEEE submittal were reviewed by the NRC staff.

Based on a screening review of the IPEEE submittal to assess the adequacy of information needed, the NRC staff sent a request for additional information (RAI) to TVA on October 26, 2005. On February 2, 2006, TVA provided its response of the RAI. After reviewing the TVA's response to the RAI, the NRC staff sent a second RAI on May 1, 2006, seeking additional information in the fire analysis. On June 30, 2006, TVA provided the NRC staff with its response to the second RAI.

2.0 TECHNICAL EVALUATION

Unit 1 consists of a General Electric boiling-water reactor with Mark I containment. Unit 1 has a licensed power rating of 3293 MWt. Commercial operation of Unit 1 began on August 1, 1974. The Unit 1 site is located on the north shore of Wheeler Lake in north Alabama. It is approximately 10 miles southwest of Athens, Alabama, and 10 miles northwest of Decatur, Alabama.

Core Damage Evaluation

Seismic

Unit 1 is binned in the 0.3g focused-scope category of NUREG-1407. The design basis earthquake (DBE) spectrum for Unit 1 is represented by a Housner shaped spectrum anchored to 0.20g peak ground acceleration (pga). The licensee evaluated the seismic risk for Unit 1 by using the Seismic Margins Assessment (SMA) methodology as given in Electric Power Research Institute (EPRI)-NP-6041. Because of the nature of the evaluation method used, a seismic core damage frequency (CDF) was not calculated. The licensee states that the high confidence of low probability of failure (HCLPF) capacities of all components on the safe-shutdown equipment list (SSEL) are at least equal to the review level earthquake (RLE) pga of 0.3g. The technical evaluation report (TER) on the seismic portion of the IPEEE (ML071720186) finds that the licensee's estimate of plant HCLPF appears reasonable. Therefore, the NRC staff notes that Unit 1 has an HCLPF capacity close to the RLE pga of 0.3g, and does not have a vulnerability with respect to seismic CDF.

The NRC staff identifies one weakness in the Unit 1 seismic IPEEE and notes that the success paths selected do not include any high pressure injection system (reactor core isolation system and high pressure core injection system), and the automatic initiation circuitry of the low pressure systems.

High Winds, Floods, Transportation, and Other (HFO) External Events

These events were screened out in a manner consistent with the guidance given in NUREG-1407, and a contribution to the core damage frequency was not obtained.

Dominant Contributors

Seismic

Because an SMA approach was used, CDF contributions from dominant sequences were not obtained. Bounding calculations showed that, the HCLPF capacity of all items on the SSEL exceeded 0.3g pga. The licensee did not discover any components in Unit 1 that have HCLPF capacities less than 0.3g.

Fire

According to the Unit 1 IPEEE fire submittal, among the dominant fire locations, the licensee identified the control room, 4kV shutdown board rooms, and cable spreading room, with contributions to the CDF for each room ranging up to 7.0E-07 per year.

HFO

By the nature of the screening approach used by the licensee, dominant contributors were not obtained.

Assessment of Licensee's Determination of Dominant Contributors

The seismic analysis was an SMA; it is, therefore, not possible to determine the dominant contributors to the seismic core damage frequency. The licensee did not discover any components in Unit 1 that have HCLPF capacities below 0.3g. The NRC staff requested the HCLPF calculations for various components. The NRC staff's review of the calculations determined that the results appeared to be reasonable.

The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for the NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe-shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

The licensee's HFO evaluation appears to be consistent with the guidance given in NUREG-1407, and the NRC staff determined that no severe accident vulnerabilities were overlooked in the licensee's HFO analysis for Unit 1.

Containment Performance

Seismic

Containment performance for seismic events is discussed in Section 9 of the seismic IPEEE report. In accordance with the guidance given in NUREG-1407, a walkdown was performed to evaluate any possible unusual conditions, such as spatial interactions or unique penetration configurations. Relay chatter, which could cause containment isolation system failures by containment system actuations, was evaluated. No vulnerabilities with respect to containment integrity were found by the licensee.

Fire

The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for the NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire

safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

HFO

The NRC staff finds that the screening criteria given in Chapter 5 of NUREG-1407 are met. Therefore, no containment performance analysis is required.

Generic Safety Issues (GSIs)

As a part of the IPEEE, a set of generic and unresolved safety issues (USI A-45, GSI-131, GSI-103, GSI-57), and the Sandia Fire Risk Scoping Study (FRSS) issues were identified in Supplement 4 to GL 88-20 and its associated guidance in NUREG-1407 as needing to be addressed in the IPEEE. The NRC staff's evaluation of these issues is provided below.

1. USI A-45, "Shutdown Decay Heat Removal Requirements"

The licensee performed an acceptable SMA for Unit 1, and found that the HCLPF for the components in the SSEL will essentially meet the pga of 0.3g associated with the RLE, given the plant modifications performed for USI A-46. Therefore, with high confidence, the components in the SSEL will perform successfully, given the RLE seismic event. The NRC staff finds that there are no decay heat removal vulnerabilities for seismic events.

Similarly, the licensee's HFO analysis for Unit 1 would identify any vulnerabilities associated with loss of decay heat removal initiated by HFO events. No vulnerabilities were found.

Given that the process used by the licensee is capable of finding decay heat removal vulnerabilities, and no vulnerabilities were found, The NRC staff concludes that USI A-45 is resolved for Unit 1 seismic and HFO events.

The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for the NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe-shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

2. GSI-131, "Potential Seismic Interaction Involving the Movable In-Core Flux Mapping System Used in Westinghouse Plants"

Unit 1 is a General Electric boiling-water reactor, and, therefore, this issue is not applicable.

3. GSI-103, "Design for Probable Maximum Precipitation (PMP)"

This issue concerns itself with the fact that the National Weather Service has developed new PMP criteria, which give higher rainfall intensities over shorter time intervals and smaller areas than had previously been considered. Section 2.4 of NUREG-1407 requests that licensees assess the effects of these new PMP criteria in terms of onsite flooding from flood runoff and site ponding, and in terms of greater roof ponding. More information on this issue is given in GL 89-22. The licensee pointed out that Hydrometeorological Report HMR-56, used in the Unit 1 IPEEE, addresses the concerns of GSI-103.

On the basis that the licensee's treatment of the PMP event is consistent with the guidance provided in Section 6.2.2.3 of NUREG-1407, and on the basis that no vulnerabilities were found, the NRC staff considers that GSI-103 is resolved for Unit 1.

4. GSI-57, "Effects of Fire Protection System Actuation on Safety-Related Equipment"

Inadvertent actuation of fire suppression equipment could be initiated as a result of a seismic event. NUREG-1472, which presents the regulatory analysis for GSI-57, concludes that the dominant risk contributor associated with inadvertent fire protection system actuation is seismic actuation of the fire protection system.

Seismic actuation of the fire protection system is discussed in Section 8.2.1.2 of the IPEEE fire submittal for Unit 1. It is noted in this section of the IPEEE submittals that fire suppression damage evaluations have been made as part of the Appendix R analysis. This analysis concluded that spurious discharge of water from fire suppression systems will have no adverse impact on the safe-shutdown capability of the plant.

The NRC staff finds that the licensee's GSI-57 evaluation is adequate and would likely have found any vulnerabilities if they existed. No vulnerabilities were found. Therefore, the NRC staff considers this issue resolved for Unit 1.

5. Fire Risk Scoping Study (FRSS) Issues

Several of these issues are also GSIs, which are discussed separately. These generic issues include GSI-57, discussed above; GSI-148, "Smoke Control and Manual Fire Fighting Effectiveness," and GSI-147, "Fire-Induced Alternate Shutdown/Control Room Panel Interactions." The FRSS issues are discussed in Section 8.2 of the IPEEE fire submittal for Unit 1. The licensee's analysis followed the guidance given in the FIVE methodology.

The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for the NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

Other Generic Safety Issues

In addition to those safety issues discussed above that were explicitly requested in Supplement 4 to GL 88-20, four generic safety issues were not specifically identified as issues to be resolved under the IPEEE program; thus, they were not explicitly discussed in Supplement 4, to GL 88-20 or NUREG-1407. However, subsequent to the issuance of the GL, the NRC evaluated the scope and the specific information requested in the GL and the associated IPEEE guidance, and concluded that the plant-specific analyses being requested in the IPEEE program could also be used, through a satisfactory IPEEE submittal review, to resolve the external events of these four safety issues. The following discussions summarize the NRC staff's evaluation of these safety issues for Unit 1.

1. GSI-147, "Fire-Induced Alternate Shutdown/Control Room Panel Interactions"

The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the Generic Letter. The basis for The NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

2. GSI-148, "Smoke Control and Manual Fire-Fighting Effectiveness"

The NRC staff finds that the licensee's IPEEE fire analysis has addressed smoke control and manual fire-fighting effectiveness. Therefore, the NRC staff considers that GSI-148 resolved for Unit 1 fire events.

3. GSI-156, "Systematic Evaluation Program (SEP)"

The SEP issues are a set of issues associated with plants that were licensed prior to the time the 1975 Standard Review Plan was issued.

- Settlement of Foundations and Buried Equipment

Supplement 5 to GL 88-20 states that soil-related failures need not be evaluated for focused-scope plants.

- Dam Integrity and Site Flooding

The licensee addressed failure of the Wheeler Dam in the HFO IPEEE submittal and noted that failure of the dam would result in the need to shut down Unit 1, which could be maintained indefinitely in a safe-shutdown condition. The licensee also noted that if failure of the Guntersville Dam upstream of the plant occurred at the most unfavorable time, it would lead to a flood crest no greater than elevation 563.5 feet, including wind effects. The probable maximum flood level for the plant is 572.5 feet, and the safety-related structures are protected against all flood conditions up to elevation 578 feet. In a response to an RAI on seismically-induced external flooding, the licensee noted that the probable maximum flood for the BFN considered failure of the earth sections of Fort Loudoun, Watts Bar, Chickamauga, Nickajack, and Guntersville Dams upstream.

- Site Hydrology and Ability to Withstand Floods

The IPEEE HFO analysis for Unit 1 includes a satisfactory screening analysis of external floods, consistent with NUREG-1407 guidelines. The licensee has also satisfactorily addressed the PMP event (see GSI-103 discussion, above).

- Industrial Hazards

The IPEEE submittal, together with the January 29, 1999, response to an RAI (HFO Question 2) presents an adequate analysis of these hazards, consistent with NUREG-1407 guidelines, for Unit 1.

- Tornado Missiles

The effects of tornado missiles appear to have been satisfactorily considered in the HFO analysis, as is discussed in the TER on the HFO portion of the Unit 1 IPEEE (ML071720197).

- Severe Weather Effects on Structures

The effects of high winds and floods were satisfactorily analyzed in the HFO section of the IPEEE submittal for Unit 1.

- Design Codes, Criteria, and Load Combinations

The NRC staff finds that the IPEEE submittal presents a satisfactory analysis of seismic events and HFO events for Unit 1 and concluded that the Category I structures at Unit 1 have adequate capacity.

- Seismic Design of Structures, Systems, and Components (SSCs)

The NRC staff finds that the seismic IPEEE submittal for Unit 1 presents a satisfactory analysis of seismic events, and found no vulnerabilities; therefore, the NRC staff finds that the seismic design of SSCs is adequate at Unit 1.

- Shutdown Systems and Electrical Instrumentation and Control Features

The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for The NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

Based on the overall results of the IPEEE submittal review, the NRC staff finds that the licensee's process is capable of identifying potential vulnerabilities associated with GSI-156 for seismic and HFO areas.

4. GSI-172, "Multiple System Responses Program (MSRP)"

- Effects of fire protection system actuation on non-safety-related and safety-related equipment

The NRC staff finds that the licensee's evaluation is adequate and considers this issue resolved for Unit 1.

- Seismically-induced fire suppression system actuation

The NRC staff finds that the licensee's evaluation is adequate and considers this issue resolved for Unit 1.

- Seismically-induced fires

This is an FRSS issue. Seismically-induced fires were addressed in the seismic capability walkdowns performed as part of the seismic IPEEE for Unit 1.

- Effects of hydrogen line rupture

Ruptures of hydrogen lines were not discussed in the submittal. However, it is noted in Section 8.2 of the seismic IPEEE submittal for Unit 1 that during the seismic walkdowns obvious sources of combustion were subjectively evaluated. This would include hydrogen lines. As for nonseismically induced failures of hydrogen lines, the licensee followed the FIVE methodology to perform the fire hazards evaluation at Unit 1. The NRC staff considers this issue resolved for Unit 1.

- The IPEEE-related aspects of common cause failures associated with human errors

This issue refers to whether the treatment of human errors in an external-event-initiated accident sequence properly takes into account the impact of the external event on human actions.

The IPEEE seismic analysis for Unit 1 used the seismic margins approach and, as such, does not explicitly treat human error. According to the guidance given in Section 3.2.5.8 of NUREG-1407, success paths should be chosen based on a screening criterion applied to nonseismic failures and needed human actions, and the failure modes and human actions should be clearly identified and have low enough probabilities to not affect the seismic margins evaluation. The licensee identified the operator actions necessary for safe-shutdown after an earthquake, and estimated the associated human errors probabilities. The licensee judged the human error probabilities sufficiently low so as not to affect the seismic margins assessment. The NRC staff considers this issue resolved for Unit 1 seismic events.

The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for The NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

- Non-safety-related control system/safety-related system dependencies

As far as the IPEEE is concerned, this issue reduces to that of seismically induced spatial and functional interactions, an MSRP issue discussed below, and GSI-147, on fire-induced alternate shutdown and control room panel interactions. Therefore, the NRC staff also considers this issue resolved for Unit 1 seismic events. As discussed previously for GSI-147, The NRC staff also concludes that the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for The NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations. The NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

- Effects of flooding and/or moisture intrusion on nonsafety related and safety-related equipment

Flooding from external floods is discussed in the HFO portion of the IPEEE (see Section 5.2); The NRC staff evaluation is given in the TER on the HFO portion of the IPEEE submittal. Flooding from the actuations of fire protection systems is a GSI-57 issue, and is discussed under that heading. Seismically induced flooding is discussed below, under "Seismically induced flooding."

- Seismically induced spatial and functional interactions

Seismically induced spatial interactions were addressed by the licensee in the seismic walkdowns, and are discussed in Section 5.4 of the IPEEE seismic submittal for Unit 1. Functional interactions are incorporated in the SSEL.

- Seismically induced flooding

Seismically induced flooding was addressed in the seismic capability walkdowns performed as part of the seismic IPEEE, and is discussed in Section 5.4 of the IPEEE submittal for Unit 1.

- Seismically-induced relay chatter

The licensee's relay chatter evaluation is discussed in Section 2.8 of the TER on the seismic portion of the IPEEE submittal. For a focused scope plant, if low-seismic-ruggedness relays are discovered during the USI A-46 reviews, the relay review should be expanded to include relays outside the scope of USI A-46, but within the scope of the

IPEEE. The Relay Evaluation Report notes that there are no potential relay outliers identified (including both the USI A-46 relays, and all relays examined for the IPEEE). This item is resolved for Unit 1.

- Evaluation of earthquake magnitudes greater than the safe shutdown earthquake (SSE)

The licensee used a seismic margins approach with a 0.3 pga RLE. Earthquake magnitudes greater than the SSE are included because the RLE pga is higher than the SSE (or DBE) pga of 0.2g.

Based on the overall results of the IPEEE submittal review, the NRC staff considers that the licensee's process is capable of identifying potential vulnerabilities associated with GSI-172 at Unit 1 for seismic and HFO areas.

Unique Plant Features, Potential Vulnerabilities, and Improvements

The licensee did not define the term vulnerability, but used the term in the fire IPEEE submittals for Unit 1. The licensee states that there were no significant vulnerabilities with respect to fire. The licensee states that no plant weaknesses were found in the HFO analysis, which is equivalent to stating that there are no plant vulnerabilities with respect to HFO events. In the seismic IPEEE submittal, the licensee stated that the plant HCLPF value was essentially the RLE, which implies the plant has no vulnerabilities with respect to seismic events. However, the NRC staff identified one weakness in the Unit 1 seismic IPEEE, namely, the success paths selected do not include any high pressure injection system and the automatic initiation circuitry of the low pressure systems.

The licensee stated that some plant improvement did take place as a result of the seismic IPEEE process. The licensee identified issues related to anchorage design, maintenance, housekeeping, and seismic interaction that required design change notices or work orders. These items will be resolved as part of the USI A-46 program. During the seismic-induced fire walkdown screening evaluation, the licensee determined that batteries on the emergency lighting battery rack in the cable spreading room lacked end restraints, side restraints, and spacers between batteries. The licensee states that it will complete corrective actions for the emergency lighting battery racks located in the Unit 1 cable spreading room prior to the restart of Unit 1.

Even though the licensee identified no fire vulnerabilities, the licensee noted that Division 1 and 2 related switchgear are located within 3 to 4 feet of each other. Oil-filled transformers exist that have potential for causing severe fires. The licensee notes that plant training should continue to ensure that the fire brigade members remain cognizant of the oil-filled transformer hazard.

3.0 CONCLUSIONS

On the basis of the above findings, the NRC staff notes that the IPEEE seismic and HFO results are reasonable given the Unit 1 design. The specific GSIs discussed in this Safety Evaluation (SE) related to seismic and HFOs are considered resolved by the NRC staff. GSI-57 and GSI-148 are also considered resolved. Therefore, the NRC staff concludes that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe

accident vulnerabilities related to seismic and HFO analyses, and therefore, that the Unit 1 IPEEE seismic and HFO submittals have met the intent of Supplement 4 to GL 88-20.

The NRC staff also concludes that the licensee's resolution of GSIs related to fire that are discussed in this SE, and the licensee's fire IPEEE process meets the intent of GL 88-20, Supplement 4, in the context of the technical information available at the time of the GL. The basis for the NRC staff's conclusion is that Unit 1 applied comparable methods to assess potential vulnerabilities, as were applied by other plants during their fire IPEEE evaluations.

However, the NRC staff concludes that the technique applied by Unit 1 is inadequate to assess the significance of a potentially important issue, post-fire safe-shutdown circuit analysis spurious actuations. The NRC staff recognizes that much has been learned in the area of post-fire safe-shutdown circuit analysis spurious actuations since the publication of the GL. The NRC staff and industry are developing an approach to evaluate the generic issue, post-fire safe-shutdown circuit analysis spurious actuations. The resolution of this generic issue will apply to Unit 1 as it does to other nuclear power plants. Due to the circuit analysis spurious actuation issue in the Unit 1 fire IPEEE, the NRC staff's review of this fire IPEEE should not be construed as approval for use in any other regulatory applications.

BROWNS FERRY NUCLEAR PLANT

William R. Campbell, Jr.
Tennessee Valley Authority
cc:
Mr. Ashok S. Bhatnagar
Senior Vice President
Nuclear Generation Development
and Construction
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Preston D. Swafford
Senior Vice President
Nuclear Support
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Walter M. Justice II
Interim Vice President
Nuclear Engineering & Technical Services
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Brian O'Grady, Site Vice President
Browns Ferry Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Decatur, AL 35609

General Counsel
Tennessee Valley Authority
ET 11A
400 West Summit Hill Drive
Knoxville, TN 37902

Mr. John C. Fornicola, General Manager
Nuclear Assurance
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Bruce Aukland, Plant Manager
Browns Ferry Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Decatur, AL 35609

Mr. Masoud Bajestani, Vice President
Browns Ferry Unit 1 Restart
Browns Ferry Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Decatur, AL 35609

Mr. Robert G. Jones, General Manager
Browns Ferry Site Operations
Browns Ferry Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Decatur, AL 35609

Mr. Larry S. Mellen
Browns Ferry Unit 1 Project Engineer
Division of Reactor Projects, Branch 6
U.S. Nuclear Regulatory Commission
61 Forsyth Street, SW.
Suite 23T85
Atlanta, GA 30303-8931

Ms. Beth A. Wetzel, Manager
Corporate Nuclear Licensing
and Industry Affairs
Tennessee Valley Authority
4X Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

Mr. William D. Crouch, Manager
Licensing and Industry Affairs
Browns Ferry Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Decatur, AL 35609

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
Browns Ferry Nuclear Plant
10833 Shaw Road
Athens, AL 35611-6970

State Health Officer
Alabama Dept. of Public Health
RSA Tower - Administration
Suite 1552
P.O. Box 303017
Montgomery, AL 36130-3017

Chairman
Limestone County Commission
310 West Washington Street
Athens, AL 35611

Mr. Robert H. Bryan, Jr., General Manager
Licensing and Industry Affairs
Tennessee Valley Authority
4X Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801