

TECHNICAL EVALUATION REPORT
ON THE
HIGH WINDS, FLOODS, TRANSPORTATION AND OTHER (HFO) EXTERNAL EVENTS
PORTION OF
THE BROWNS FERRY NUCLEAR POWER STATION UNIT 1
INDIVIDUAL PLANT EXAMINATION FOR EXTERNAL EVENTS

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HIGH WINDS, FLOODS, TRANSPORTATION AND OTHER (HFO)
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THE BROWNS FERRY NUCLEAR POWER STATION UNIT 1 IPEEE SUBMITTAL**

1.0 INTRODUCTION

The Browns Ferry Nuclear Power plant consists of three similar units, owned and operated by TVA. Each unit is a BWR 4 reactor with a Mark I containment, with a thermal power rating of 3293 Mwt, and an electrical output of 1098 Mwe. The plant is situated on North Wheeler lake at the Tennessee River, thirty miles west of Huntsville, Alabama. Unit 1 received its operating license on December 20, 1973, Unit 2 on August 2, 1974, and Unit 3 on August 18, 1976. The units are not built to the 1975 Standard Review Plan (SRP) criteria. The IPEEE submittal, dated July 24, 1995, includes an analysis of high winds, floods, transportation and other external events (HFO) for all three units.

2.0 HIGH WINDS

The licensee evaluated the plant relative to the 1975 SRP criteria. The tornado design basis is for a maximum tornado velocity of 300 mph, while the 1975 SRP calls for a 360 mph tornado. The plant design basis did not, as is stated in the 1975 SRP, include the effects on the plant of tornado-generated missiles resulting from the vertical wind speed.

A walkdown of the plant was performed. The walkdown of the plant did not reveal any vulnerabilities which remained after analysis; the walkdown included the additional structures and components built since the operating license was obtained. The walkdown addressed the concerns of Information Notice 95-03, Supplement 1, and in particular addressed the concern of failures of non-safety structures and equipment resulting in the failure of safety-related structures, systems, or components. The assessment found that no such failures of safety-related structures, systems, or components would occur.

The submittal states that the frequency of a Browns Ferry structure being hit by a tornado with a wind velocity greater than 300 mph is $1.08\text{E-}8$ per year, and references a calculation which is said to justify this value. However, using NUREG/CR-4461, rev. 1 (J.V. Ramsdell, "Tornado Climatology of the Contiguous United States", April 2005), one obtains $1\text{E-}7$ per year. Nevertheless, even though the estimate given in the submittal is optimistic, relative to NUREG/CR-4461, rev. 1, the estimate of $1\text{E-}7$ per year from NUREG/CR-4461, rev. 1, still is below the NUREG-1407 screening criteria of $1\text{E-}6$ per year.

Tornado-generated missiles were evaluated. Areas of the plant not protected against tornado missiles (Control Bay door number 484, diesel generator air intake above elevation 595, and exhaust stacks above elevation 602) have a low frequency of being hit by a tornado missile (for each, less than $1\text{E-}7$ per year). The effect of missiles generated by vertical wind velocity on the vulnerable structures (roof slabs of Diesel Generator building and Control Bay, fuel storage pool) were evaluated, and the structures were found to have adequate strength.

Conclusions on High Winds Analysis

In general, within the scope of this review, the staff finds that the licensee appears to have met the intent of Generic Letter 88-20, with respect to high winds.

3.0 FLOODS

NUREG-1407 requested that the latest probable maximum precipitation (PMP) criteria published by the National Weather Service should be used; these criteria are published in Hydrometeorological Reports (HMR) 51 and 52, for the Eastern U.S. Generic Letter (GL) 89-22 notes that these reports provide PMP estimates for drainage areas as small as 1 square mile and for durations as small as 5 minutes. The submittal used HMR 56, which was not reviewed; it is specific for TVA, and was published in 1986. The licensee, in a response dated Jan 31, 1999, to a request for additional information (RAI), noted that HMR 56 uses the revised precipitation data from HMR 52, and addresses the concerns of GL 89-22.

The submittal concludes that the Browns Ferry Plant Facilities design is robust in relation to the 1975 SRP criteria for floods. The staff finds that the licensee appears to have met the intent of GL 88-20, with respect to floods, including the PMP event.

4.0 TRANSPORTATION AND NEARBY FACILITY ACCIDENTS

The IPEEE submittal gives a brief description of the licensing bases with regard to transportation and nearby facility accidents, as given in the Browns Ferry Updated Final Safety Analysis Report (UFSAR); the information in the UFSAR was updated to represent information through the year 1992. This information was supplemented by information given in a January 29, 1999 response to an RAI. The response included Calculation ND-Q0000-940024, "Chemical Release Due to a Barge Accident," which, in addition to the type of accident mentioned in the title, also addresses other transportation and hazardous materials accidents as well as aircraft crashes. Given the information in the IPEEE submittal, and the response to the RAI, the staff finds that the licensee has met the intent of Generic Letter 88-20 with respect to transportation and nearby facility accidents.

5.0 GENERIC SAFETY ISSUE (GSI) RESOLUTION

GSI-103, Design for Probable Maximum Precipitation

The submittal used HMR-56 instead of HMR-51 and HMR-52 to determine the PMP. However, as noted above, the precipitation data in HMR-56 is consistent with that of HMR-52, and adequately addresses GSI-103, for BFN1.

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. Several of these issues involve HFO events.

- Dam Integrity and Site Flooding

Failure of the Wheeler Dam was addressed in the IPEEE submittal on HFO events, on p. 5-33, and it was concluded that failure of the dam would result in the need to shut down the Browns Ferry plant; it could be maintained indefinitely in a safe shutdown condition. As noted on p. 5-24 of the IPEEE submittal on HFO events, failure of the Guntersville Dam upstream of the plant, if it occurred at the most unfavorable time, would lead to a flood crest no greater than elevation 563.5 ft, including wind effects. The probable maximum flood level for the plant is 572.5 ft, and the safety-related structures are protected against all flood conditions up to elevation 578 ft (see p. 5-34 of the IPEEE submittal on HFO events). The licensee, in their response to an RAI on seismically-induced external flooding (see p. 7 of the January 29, 1999, response), noted that the probable maximum flood for the Browns Ferry site considered failure of the earth sections of Fort Loudoun, Watts Bar, Chickamauga, Nickajack, and Guntersville Dams upstream. The staff considers this issue resolved for BFN1.

- Site Hydrology and Ability to Withstand Floods

The licensee's IPEEE submittal includes an analysis of external floods, consistent with NUREG-1407 guidelines. As already noted under GSI-103, the PMP event was adequately addressed. The staff considers this issue resolved for BFN1.

- Tornado Missiles

Since the effects of tornado missiles were adequately considered in the IPEEE submittal, and no vulnerabilities were found, the staff considers this issue resolved for BFN1.

- Severe Weather Effects on Structures

Since the effects of high winds and floods were adequately considered, and no vulnerabilities were found, the staff considers this issue resolved for BFN1.

- Design Codes, Criteria, and Load Combinations

Since the IPEEE submittal presents an adequate analysis of HFO events, and no vulnerabilities were found, it can be inferred that the Category I structures have adequate capacity for HFO events. The staff considers this issue resolved for BFN1.

- 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. Since no vulnerabilities were found, the staff considers this issue resolved for BFN1.

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

One of the MSRP issues, "Effects of Flooding and/or Moisture Intrusion on Non-Safety Related and Safety-Related Equipment," is related to the HFO analysis. Since the licensee satisfactorily

addressed the external flooding issue, including consideration of the PMP event, the licensee has adequately addressed the aspect of this issue related to external flooding.

6.0 PLANT VULNERABILITIES AND IMPROVEMENTS

The licensee found no vulnerabilities by performing the IPEEE for BFN1. The licensee did not identify any improvements.

7.0 CONCLUSIONS

The process the licensee has used for the analysis of HFO events is judged adequate to identify risk-significant accident sequences and plant vulnerabilities, and found no vulnerabilities. The staff finds that the licensee has met the intent of Supplement 4 to Generic Letter 88-20, with respect to HFO events. Therefore, the generic issues identified in the body of this report were addressed satisfactorily, and may be considered resolved for BFN1.