50-458

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 17, 1996

Mr. John R. McGaha, Jr.
Vice President Operations
Entergy Operations, Inc.
River Bend Station
P. O. Box 220
St. Francisville, LA 70775

SUBJECT: RIVER BEND STATION, UNIT 1 - INDIVIDUAL PLANT EXAMINATION (IPE) INTERNAL EVENTS

Dear Mr. McGaha:

Enclosed is our Staff Evaluation (SE) of the River Bend Station, Unit 1, IPE submittal for internal events and internal flood. Also included with the SE are our contractors' Technical Evaluation Reports (TERs). These reports are being issued to document our findings and conclusions.

A "Step 1" review was performed which examined the IPE results for the Entergy Operations, Inc. (EOI), "reasonableness" considering the design and operation of River Bend. The staff employed Science and Engineering Associates, Inc., Concord Associates, and Scientech Inc., to review the front-end analysis, human reliability analysis, and back-end analysis, respectively, of the IPE submittal. Their TERs are attached as Appendices A, B, and C, respectively, to the SE. The contractor TERs have been reviewed by the IPE "Senior Review Board" (SRB) as part of our quality assurance process. The SRB is comprised of the NRC staff and consultants at Sandia and Brookhaven National Laboratories with PRA expertise. The NRC project manager and resident inspector also attended the SRB review meeting.

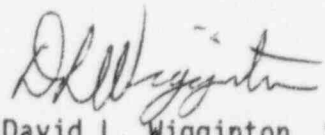
EOI reported in the submittal a core damage frequency (CDF) of 1.6E-5/reactor-year from internally initiated events, including the contribution from internal floods. The contribution from internal flooding is about 2E-8/reactor-year. The River Bend CDF compares reasonably well with that of other BWR 6 plants. Station blackout contributes 86%, transients 8%, loss of offsite power 4%, and transient induced loss of coolant accident 2%. The most important contributors to the estimated CDF that appear in the top sequences include loss of offsite power, and failures of the diesel generators, the reactor core isolation cooling (RCIC) system, and the standby service water (SSW) system.

EOI defined a vulnerability as any functional sequence with a CDF exceeding IE-4/reactor year. Based on this definition, EOI did not identify any vulnerabilities. Plant improvements, however, were identified and were implemented. EOI states in its responses to the staff's questions that the implemented station blackout-related improvements reduced the total CDF from

internal events from 1.6E-5/reactor-year to 3.6E-6/reactor-year and reduced the station blackout contribution from 86% to 4%. EOI did not report what sequences comprise the revised CDF.

Based on the "Step 1" review, we conclude that EOI has met the intent of Generic Letter 88-20.

Sincerely,



David L. Wigginton, Senior Project Manager
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Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosure: Staff Evaluation

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Sincerely,

ORIGINAL SIGNED BY:

David L. Wigginton, Senior Project Manager
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Office of Nuclear Reactor Regulation

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STAFF EVALUATION OF
RIVER BEND STATION, UNIT NO. 1
INDIVIDUAL PLANT EXAMINATION

I. INTRODUCTION

On January 15, 1993, Gulf States Utilities Co. (now part of the Entergy Operations, Inc.), submitted the River Bend Station Unit 1 Individual Plant Examination (IPE) in response to Generic Letter (GL) 88-20 and associated supplements. On July 26, 1995, the staff requested from the licensee additional information. The licensee responded in a letter dated September 22, 1995.

A "Step 1" review of the River Bend IPE submittal was performed and involved the efforts of Science & Engineering Associates, Inc., Scientech, Inc./Energy Research, Inc., and Concord Associates in the front-end, back-end, and human reliability analysis (HRA), respectively. The Step 1 review focused on whether the licensee's method was capable of identifying vulnerabilities. Therefore, the review considered (1) the completeness of the information and (2) the reasonableness of the results given the River Bend design, operation, and history. A more detailed review, a "Step 2" review, was not performed for this IPE submittal. Details of the contractors' findings are in the attached technical evaluation reports (Appendices A, B, and C) of this draft Staff Evaluation Report (SER).

In accordance with GL 88-20, Entergy proposed to resolve unresolved safety issue (USI) A-45, "Shutdown Decay Heat Removal Requirements." In addition, the generic safety issue (GSI) 23 "Reactor Coolant Pump Seal Failures", GSI-105 "Interfacing System LOCA at LWRs", and USI A-17 "Systems Interactions in Nuclear Power Plants," were proposed to be resolved as part of the River Bend IPE.

II. EVALUATION

River Bend is a BWR 6 with a Mark III containment. The licensee reported in the submittal a core damage frequency (CDF) of 1.6E-5/reactor-year from internally initiated events, including a contribution of about 2E-8/reactor-year from internal floods. The River Bend CDF compares reasonably well with that of other BWR 6 plants. Station blackout contributes 86%, transients 8%, loss of offsite power 4%, and transient induced loss-of-coolant accident 2%. The most important contributors to the estimated CDF that appear in the top sequences include loss of offsite power, and failures of the diesel generators, the reactor core isolation cooling system, and the standby service water system. The licensee, in their response to staff's request for additional information reported that they implemented the modifications identified during the IPE for reducing the station blackout frequency. These changes were credited in the River Bend's living PRA and had an effect of reducing the CDF from 1.6E-5 to 3.6E-6/reactor-year and the station blackout contribution from 86% to 4%. The licensee did not report what sequences comprise the revised CDF.

The licensee performed an HRA to document and quantify potential failures in human-system interactions and to quantify human-initiated recovery of failure events. The licensee identified the following operator actions as important in the estimate of the CDF: manual depressurization, recovery of offsite power, recovery of switchgear room ventilation by means of natural

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circulation, restoration of manual valves V134 and V133 after test and maintenance, restoration of standby service water (SSW) manual valves after test and maintenance, and recovery of the power conversion (i.e., of the steam flow path to the main condenser), feedwater, and fire protection water (FPW) systems.

The licensee evaluated and quantified the results of the severe accident progression through the use of a containment event tree and considered uncertainties in containment response through the use of sensitivity analyses.

The licensee's back-end analysis appeared to have considered important severe accident phenomena. Among the River Bend conditional containment failure probabilities; early containment failure is 27%, late containment failures is 11%, and bypass is 0%. The containment remains intact 62% of the time. Both early radiological releases and late releases are dominated by station blackout sequences. The licensee's response to Containment Performance Improvement Program recommendations is consistent with the intent of 88-20 and associated Supplement 3.

Based on the licensee's IPE process used to search for decay heat removal (DHR) vulnerabilities, and review of River Bend plant-specific features, the staff finds the licensee's DHR evaluation consistent with the intent of the USI A-45, Decay Heat Removal Reliability, resolution. Furthermore, the licensee did not identify any vulnerabilities with respect to GSIs 23 and 105. According to GL 88-20 if a licensee "concludes that no vulnerability exists at its plant that is topically associated with any USI or GSI, the staff will consider the USI or GSI resolved for a plant upon review and acceptance of the results of the IPE." Therefore, the staff concludes that River Bend resolved USIs A-45 and A-17 and GSI-105. Regarding GSI-23 the Commission has decided not to take additional rulemaking action at this time and plans to issue a generic letter on this issue; therefore, the staff cannot conclude that GSI-23 has been resolved.

Some insights and unique plant safety features identified by the licensee at River Bend are:

1. Ability to crosstie SSW and diesel driven FPW to low pressure coolant injection loop B for injection to the vessel,

2. difficulty in using FPW crosstie for injection during station blackout,

3. containment heat removal achieved by containment fan coolers; River bend does not have containment or drywell sprays typically found in Mark III plants,

4. room cooling required for standby electrical switchgear, and

5. four-hour battery lifetime.

The licensee defined a vulnerability as any functional sequence with a CDF exceeding 1E-4/reactor year. Based on this definition, the licensee did not

identify any vulnerabilities. Plant improvements, however, were identified. These improvements[1], listed below, have been implemented:

1. A portable diesel generator (DG) and means of connecting the DG to either Division I or II direct current (DC) buses to carry loads for station blackout were added.

2. the internals of three check valves in the FPW/SSW cross-tie were removed and manual gate valves were added to enhance injection with FPW system,

3. the station blackout procedure was revised to better assure injection with FPW system,

4. a Division 1 SSW return air operated valve was installed to better deal with station blackout events,

5. the guidance for mitigating loss of control room ventilation was improved,

6. two checks per shift to check the fuel to running diesel-powered instrument air compressors were instituted, and

7. SSW pump lockout during testing of normal water was eliminated.

III. CONCLUSION

Based on the above findings, the staff notes that: (1) the licensee's IPE is complete with regard to the information requested by GL 88-20 (and associated guidance in NUREG-1335), and (2) the IPE results are reasonable given the River Bend design, operation, and history. As a result, the staff concludes that the licensee's IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities and, therefore, the River Bend IPE has met the intent of GL 88-20.

It should be noted, that the staff's review primarily focused on the licensee's ability to examine River Bend for severe accident vulnerabilities. Although certain aspects of the IPE were explored in more detail than others, the review is not intended to validate the accuracy of the licensee's detailed findings (or quantification estimates) that stemmed from the examination. Therefore, this draft SER does not constitute NRC approval or endorsement of any IPE material for purposes other than those associated with meeting the intent of GL 88-20.

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[1] The adequacy of the improvements were not part of the staff review.