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MFN 09-012

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Subject: Submittal of Licensing Topical Report NEDO-33374, Revision 1, "Safety Analysis Report for Fuel Storage Racks Criticality Analysis for ESBWR Plants," December 2008 – Public Version

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) Licensing Topical Report NEDO-33374, Revision 1, "Safety Analysis Report for Fuel Storage Racks Criticality Analysis for ESBWR Plants," December 2008 - Public Version, (Enclosure 1). The Proprietary Version was submitted by GEH to U.S. Nuclear Regulatory Commission via Reference 1.

Should you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

D068
NRO

Reference:

1. MFN 08-933, *Licensing Topical Report NEDC-33374P, Revision 1, "Safety Analysis Report for Fuel Storage Racks Criticality Analysis for ESBWR Plants," December 2008 - Proprietary Version,* December 03, 2008.

Enclosure:

1. Licensing Topical Report NEDO-33374, Revision 1, "Safety Analysis Report for Fuel Storage Racks Criticality Analysis for ESBWR Plants," December 2008 - Public Version

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GEH (with enclosures)
	RE Brown	GEH (with enclosures)
	eDRF Section	0000-0094-5151

MFN 09-012

Enclosure 1

Licensing Topical Report NEDO-33374, Revision 1, "Safety Analysis Report for Fuel Storage Racks Criticality Analysis for ESBWR Plants", December 2008 – Public Version

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GE Hitachi Nuclear Energy

NEDO-33374
Revision 1
Class I
eDRF Section 0000-0094-5151
December 2008

Licensing Topical Report

SAFETY ANALYSIS REPORT FOR FUEL STORAGE RACKS CRITICALITY ANALYSIS FOR ESBWR PLANTS

David G. Davenport

ELECTRONIC COPY
Electronic approvals filed in
eDRF Section 0000-0094-5151

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Non-Proprietary Notice

This is a non-proprietary version of the document NEDE-33374P, Revision 1, from which the proprietary information has been removed. Portions of the document that have been removed are identified by white space within double square brackets, as shown here [[ ]]. Note that the NRC's Safety Evaluation is enclosed. The portions of the Safety Evaluation that contain GE Hitachi Nuclear Energy proprietary information have been removed, and are identified by white space within single square bold font brackets, as shown here **[ ]**.

Important Notice Regarding the Contents of this Report

Please Read Carefully

The information contained in this document is furnished for the purpose(s) of obtaining NRC approval of the GE Hitachi Nuclear Energy (GEH) ESBWR. The only undertakings of GEH with respect to information in this document are contained in contracts between GEH and participating utilities, and nothing contained in this document shall be construed as changing those contracts. The use of this information by anyone other than those participating entities and for any purposes other than those for which it is intended is not authorized; and with respect to any unauthorized use, GEH makes no representation or warranty, and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

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Acknowledgments

This document is the result of the technical contributions from many individuals and organizations in addition to the authors of this document. At the GEH, significant contributions to the development of this analysis were provided by John Zino (GNF) and Russell Stachowski (GNF). At Equipos Nucleares, S. A., significant contributions was provided by Luis Costas. At ENUSA Industrias Avanzadas, S. A., significant contributions were provided by Carlos Casado, Javier Sabater, Manuel Espino, and Jose Serrano Rodriguez.

Revision Status

Revision Number	Date	Description of Change
0	October 2007	Initial edition
1	December 2008	Criticality analysis of the New Fuel Storage Racks in the buffer pool has been revised. RAI Responses incorporated into LTR.

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1.0 INTRODUCTION

The scope of this document is to verify the criticality safety of the ESBWR fuel storage racks. [[

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The new fuel storage racks in the buffer pool have a K-effective (hereafter, K-eff) less than 0.95 for normal and accident configurations. The normal configuration included a sensitivity study to the presence of the bundle channel and the bundle in transit analysis. The accident configurations considered the drop of a new fuel bundle outside of the storage racks, the inadvertent storage of a spent fuel bundle into the new fuel racks and a seismic event.

The spent fuel storage racks have a K-eff less than 0.95 for both normal and abnormal configurations. The normal configurations included displacement of stored fuel assemblies within the ranges permitted by the rack manufacturing tolerances. The maximum cold uncontrolled K-infinite (hereafter, K-inf) peak considered is 1.35. The abnormal configurations considered the drop or inadvertent storage of a spent fuel bundle outside of the storage racks.

Both the new and spent fuel storage racks satisfy the requirements of K(95/95) < 0.95 for all storage conditions [[ ]]

2.0 REQUIREMENTS

For the new and spent fuel racks, the analyses should determine the most reactive bundle and use this in the various normal and credible accident scenarios. K(95/95) of the system under all conditions should be below 0.95. Reference 1 outlines the standards that must be met for these analyses. For calculation purposes, the peak cold in-core K-inf of the bundle should not exceed 1.35 per Reference 4.

3.0 ASSUMPTIONS

3.1 New fuel rack

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3.2 Spent fuel rack

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3.3 Other Assumptions

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4.0 MODEL

4.1 New Fuel Racks - Buffer Pool

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4.2 Spent Fuel Rack - Buffer Pool

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4.3 Spent Fuel Rack - Spent Fuel Pool

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4.4 Fuel Bundle

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4.5 Fuel Material

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5.0 BIAS AND UNCERTAINTY DETERMINATION

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6.0 CRITICALITY ANALYSIS OF THE NEW FUEL STORAGE RACKS

6.1 New Fuel Handling Process

Upon receipt of new fuel, bundles are uncrated, upended, and loaded into the fuel inspection stand. The inspected new fuel bundles are channeled, as necessary, and moved into the spent fuel pool. From this point on, the assemblies are submerged. The new fuel assemblies are transferred, via the Inclined Fuel Transfer Tube, from the spent fuel pool to the buffer pool in the Reactor Building. The new fuel storage racks are submerged in the buffer pool, where the new fuel assemblies are stored until needed for refueling. ESBWR does not utilize dry storage or a fuel storage vault for new fuel.

6.2 Analysis of Normal Cases

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6.3 Analysis of Credible Accident Cases

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6.4 Normal Cases Results

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6.5 Credible Accident Cases Results

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7.0 CRITICALITY ANALYSIS OF THE SPENT FUEL STORAGE RACKS

7.1 Analysis of Normal Cases

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7.2 Analysis of Credible Accident Cases

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7.3 Normal Cases Results

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7.4 Credible Accident Cases Results

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8.0 CONCLUSIONS

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Thus, the new and spent fuel storage racks design will [[ ]] maintain a subcritical K-eff under both normal and credible accident conditions.

9.0 REFERENCES

1. SRP 9.1.1 "Criticality Safety of Fresh and Spent Fuel Storage and Handling Review Responsibilities", U.S. Nuclear Regulatory Commission, Revision 3, March 2007.
2. [[ ]]
3. [[ ]]
4. [[ ]]
5. NUREG/CR-0200 (ORNL/NUREG/CSD-2) "SCALE: A Modular Code System for Performing Standardised Computer Analyses for Licensing Evaluation", ORNL, Revision 6, September 1998.
6. [[ ]]
7. [[ ]]

Table 1

CSAS/KENO Input for Realistic Axial Geometric Model

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Table 2

Effect of the Modeling of the Axial Structural Material

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Table 3

Effect of the Presence of the Bundle Channel

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Table 4

CSAS/KENO Input for 14Gd2% Fuel at 8 GWD/ST Exposure

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Table 6

New Fuel Storage Racks. Normal Case Results

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Table 7

New Fuel Storage Area. Seismic Event Results

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Table 8

New Fuel Storage Racks. Dropped Bundle Accident

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Table 9

Spent Fuel Storage Racks. Tolerance to the Relative Position of the Bundles

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Table 10

Spent Fuel Storage Racks. Effect of the Temperature of the Water

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Table 11

Spent Fuel Storage Racks. Effect of the Tolerance in Width of the Boxes

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Table 12

Spent Fuel Storage Racks. In-Rack K(95/95) for Normal cases

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Table 13

Spent Fuel Storage Racks. Non-fission Products vs. Fission Products Credit Comparisons

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Table 14

Spent Fuel Storage Racks. Best Fit for the In-Rack K(95/95) for normal cases

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Table 15

Spent Fuel Storage Racks. Dropped Bundle Accident

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Figure 1. Buffer Pool New Fuel Racks Model for Criticality Analysis

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Figure 2. New Fuel Rack Dimensions for Criticality Analysis

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Figure 3. Spent Fuel Rack Model for Criticality Analysis

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Figure 4. Cell Width Tolerance

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Figure 5. Axial Description of the Fuel Bundle Upper Part

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Figure 6. Axial Description of the Fuel Bundle Lower Part

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Figure 7. GE14E Bundle Model for Criticality Analysis

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Figure 8. Axial Fuel Rod Description for Criticality Calculations

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Figure 9. 5% Enriched GE14E In-Core K-inf vs Gadolinium Rods Number

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Figure 10. New Fuel Storage Racks with Bundle in Transit

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Figure 11. In-Rack K(95/95) vs In-Core K-inf

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Figure 12. Dropped Bundle Accident in Spent Fuel Pool