

## **Enclosure 2**

**MFN 12-058, Revision 1**

**GEH Final Response to RAI 3.9-287**

### **Public Version**

This is a non-proprietary version of Enclosure 1, from which the proprietary information has been removed. Portions of the document that have been removed are identified by white space within double brackets, as shown here [[ ]].

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**NRC RAI 3.9-287**

*GEH is requested to describe the structural finite element model for the SSES steam dryer for use in benchmarking the ESBWR steam dryer analysis in support of the ESBWR design certification application. GEH should address concerns identified during review of the Grand Gulf EPU license amendment request and issues raised during the March audit. For example, GEH should discuss (a) resolution of unconnected nodes, (b) partial penetration welds, (3) dummy elements, and (d) load transfer concerns. Additionally, GEH is requested to update the dryer stresses to address the recently found errors (e.g., disconnected nodes, partial penetration welds, use of overlay) in the finite element model of SSES.*

**GEH Response**

Summary:

The NRC staff's concerns outlined in this RAI have been addressed for the Grand Gulf Nuclear Station (GGNS) analysis, which is now to be used as the end-to-end benchmark for validation of steam dryer strain and acceleration predictions in response to RAI 3.9-269 for the ESBWR steam dryer methodology. The identified issues do not impact the benchmark results for the steam dryer "global model" for either Susquehanna Steam Electric Station (SSES) or GGNS.

Detailed response:

On March 21-23, 2012, the U.S. Nuclear Regulatory Commission (NRC) conducted an audit at the GE Hitachi (GEH) facility in Wilmington, NC, to review the GEH documents pertaining to the ESBWR Licensing Topical Reports (LTRs) that support the steam dryer evaluation methodology. In early discussions concerning the requests for information issued after the audit, GEH indicated that PBLE evaluations of the SSES replacement steam dryer could be provided as an alternate validation demonstration in order to resolve concerns associated with Quad Cities Unit 2 benchmarks. As work progressed to support the Grand Gulf Nuclear Station (GGNS) power uprate during the summer of 2012, it became apparent that plant data obtained from the GGNS would provide a current benchmark for the PBLE methodology. Rather than reanalyzing the data from SSES, it made sense to use the GGNS data and supporting analysis as the most current benchmark available to address all NRC staff concerns. Given that the GGNS data are comprehensive, address NRC questions and concerns, and therefore provide a more useful benchmark for the ESBWR steam dryer, GEH does not intend to revise the SSES analysis and benchmarking contained in NEDC-33408 Supplement 1P-A, and is, in fact, withdrawing this document from the ESBWR Design Control Document references.

The issues listed in the staff's request for information are being addressed in actions related to RAI 3.9-269 and are summarized below. The revised end-to-end benchmark based on the final analysis of the GGNS replacement steam dryer incorporates lessons learned from earlier GGNS structural finite element models related to unconnected nodes and load transfer concerns and no fictitious dummy elements are used in the solution for benchmark. Because the revised benchmark is based on GGNS, any impact on the benchmarking for these issues is, therefore, covered in response to RAI 3.9-269. No changes are necessary for this response.

### Unconnected Nodes

The disconnected nodes identified in the GGNS structural Finite Element (FE) model have been addressed for using the GGNS replacement steam dryer analysis and data as the revised benchmark for ESBWR methodology, as is provided in response to RAI 3.9-269. To address the concerns, GEH re-verified the structural model for GGNS due to concerns associated with disconnected nodes, mesh quality and element shapes, as well as presented the results of mesh density convergence studies. The results of this re-verification show that the predicted steam dryer frequency response is not significantly affected by the disconnected nodes. Given that the initial GGNS model was based on the SSES model, GEH expects that any reanalysis of the SSES model would provide similar results. At any rate, the GGNS benchmark has been adjusted to address these concerns, as needed, and is provided in response to RAI 3.9-269 as the ESBWR benchmark for the steam dryer methodology.

### Partial Penetration Welds

The response to RAI 3.9-279 discusses partial penetration welds in relation to FE model benchmarks and fatigue margin evaluations. In general, steam dryer welds are considered in the analysis process for the steam dryer fatigue assessment, but the presence of partial penetration welds in a steam dryer does not impact the global FE model benchmark comparisons. The steam dryer global model does not contain explicit modeling of detailed features such as welds, so the RAI 3.9-279 response discussion is general and applicable to either GGNS or SSES.

### “Dummy Elements”

The response to RAI 3.9-284 discusses the “dummy elements” in SSES FE model. [[

]] Thus, “dummy elements” are not used in the structural solution and do not have any impact on the stresses determined for either SSES or GGNS.

### Load Transfer Concerns

As part of the GGNS replacement steam dryer review, GEH addressed load mapping concerns and concluded that there are no unresolved concerns related to the load mapping (transfer) process used in PBLE evaluations.

### Licensing Basis Impact

Because the revised benchmark is based on GGNS, any impact on the benchmarking for these issues is covered. The revised benchmark is addressed in RAI 3.9-269. Partial penetration welds are addressed in response to RAI 3.9-279. Refer to RAI 3.9-269 and RAI

3.9-292 for changes to the ESBWR licensing basis for the GGNS replacement steam dryer benchmark.