

# ESBWR Steam Dryer Meeting

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# Background

- March 9, 2011, the ESBWR safety review was completed and the FSER was issued
- March 24, 2011, the ESBWR proposed rule was issued for public comment
  - Referenced in the FSER, to support the design methodology for the ESBWR steam dryers, are four approved topical reports (LTRs)
    - NEDE-33312P-A, “ESBWR Steam Dryer Acoustic Load Definition,” Revision 2
    - NEDE-33313P-A, “ESBWR Steam Dryer Structural Evaluation,” Revision 2
    - NEDC-33408P-A, “ESBWR Steam Dryer – Plant Based Load Evaluation Methodology,” Revision 1
    - NEDC-33408 Supplement 1P-A “ESBWR Steam Dryer – Plant Based Load Evaluation Methodology,” Revision 2
- These four LTRs provide the basis for the acceptance criteria in SRP Sections 3.9.2 /3.9.5 and RG 1.20.
  - LTRs describe GEH’s procedure for computing oscillating pressure loads acting on the steam dryers in ESBWR nuclear power plants and provide supporting benchmarking

# Background (cont'd)

- Entergy Operations, Inc. (Entergy) submitted extended power up-rate (EPU) license amendment request (LAR) for Grand Gulf on September 8, 2010.
  - Application references ESBWR LTRs discussed above
  - NRC Staff conducted GGNS audit in September 2011
  - NRC Staff reviewed GEH documentation related to steam dryer design. Errors were noted in:
    - 3<sup>rd</sup> party audit reports
    - Consultant presentation and reports
    - Instrument test reports
    - Root cause analysis report

# Key Errors

- Acoustic finite element model errors discovered:
  - GEH used a mesh size of less elements per wavelength in some critical areas
  - Incorrectly large main steam line (MSL) areas as compared to actual MSL
  - Geometric location of the MSLs with respect to the steam dryer is incorrectly modeled
  - Base modeling errors including number of elements and size of elements
  - Load transfer between the acoustic finite model and structural model was inconsistent
- Acoustic model errors call into question the resulting engineering calculations:
  - Frequency response spectrum
  - Load map transfer
  - Final benchmarks to derive the bias and uncertainty calculations
- GEH conducted an alternate benchmark approach that produced results that were not conservative
- MSL strain gage measurements concerns discovered:
  - the MSL strain gage measurements have additional inaccuracies that were not addressed and impact the bias and uncertainty calculations

# Status

- These key errors have caused the staff to question the basis for their safety evaluation.
- In its SER the staff concluded that the GEH LTRs for the ESBWR complied with the requirements of GDC 1, 2, and 4 in Appendix A to 10 CFR Part 50 and 10 CFR 50.55a and that the ESBWR steam dryer acoustic loading derived from application of the PBLE method should be conservative.

This conclusion was based on the following findings:

- The applicant had submitted sufficient information describing its modeling approaches for specifying acoustic loads acting on the ESBWR dryer.
  - The benchmarking data showed that the PBLE dryer load estimates are generally conservative.
  - Where the dryer loads were not conservative, bias errors and uncertainties were defined for the PBLE method and were found reasonable.
- ESBWR design certification rulemaking on hold until GEH addresses errors in LTRs