



# **EPRI-NRC Meeting NRC Review of BWRVIP-194**

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## Meeting Objective

- Agree on schedule for completion of NRC review and issuance of a Safety Evaluation on BWRVIP-194  
“Methodologies for Demonstrating Steam Dryer Integrity for Power Uprate”

## History of BWRVIP-194

- At the specific request of NRC, BWRVIP prepared a topical report documenting a suite of methods for demonstrating steam dryer integrity for power uprate “BWRVIP-194” in 2008
- Methods were based on Continuum Dynamics Inc (CDI) proprietary technology which has since been acquired by Westinghouse Electric Company (WEC)

# BWRVIP-194 Scope

- Overview of steam dryer evaluation approach
- Methods for screening to assess potential for main steam line (MSL) acoustic excitation
- Methods for obtaining in-plant MSL pressure fluctuations during operation using strain gages (SGs)
- Method for using measured MSL pressure fluctuations to determine pressure loading on the steam dryer surfaces - Acoustic Circuit Model
- Methods for determining frequency dependant “bump up” factors to obtain MSL pressures as input for predictions of dryer pressures at Extended Power Uprate (EPU)
- Methods for evaluating dryer stresses in the frequency domain
- Validation of predictive methods based on comparison to Quad Cities Unit 2 (QC2) instrumented dryer testing and separate effects tests

# Chronology of NRC Review

- BWRVIP-194 submitted to NRC staff October 31, 2008
- NRC issued Review Fee Waiver December 12, 2008
- BWRVIP submitted a letter on May 11, 2009 deleting Section 12 of the report (methods to determine turbine stop valve closure (TSVC) and main steam line break (MSLB) loads on the dryer) from the scope of review
- NRC issued a letter on June 30, 2009 accepting BWRVIP-194 for review pending receipt of responses to several supplemental requests for information (SRFIs)
- BWRVIP met with NRC on September 16, 2009 to discuss planned approaches for responding to the SRFIs in the acceptance letter

# Chronology of NRC Review

- NRC requested additional supplemental information March 25, 2010.
- BWRVIP submitted responses to all SRFIs to NRC on September 8, 2011 under WEC affidavit
- These responses essentially modified the original methodology (ACM 4.0) to be identical to the approach used to support Nine Mile Point unit 2 (NMP-2) steam dryer/EPU application which was approved by NRC in 2012. This work resulted in ACM 4.1.
  - (Note: NMP-2 has a GE-Hitachi curved hood dryer).

## Chronology of NRC Review

- During a conference call conducted in November 2012, NRC indicated that the review of BWRVIP-194 had not progressed and that NRC was not sure that the review should proceed because:
  - WEC was using an enhanced version of ACM 4.1 (designated ACE) for Monticello steam dryer analysis
  - WEC was using ACM 4.1 (as documented in BWRVIP-194) for Peach Bottom steam dryer analysis
  - NRC was not convinced that ACM 4.1 was applicable to analysis of WEC style steam dryers (both Monticello and Peach Bottom plants have or will have WEC style dryers)



# Utility Need for ACM 4.1 Approval to Support EPU Applications

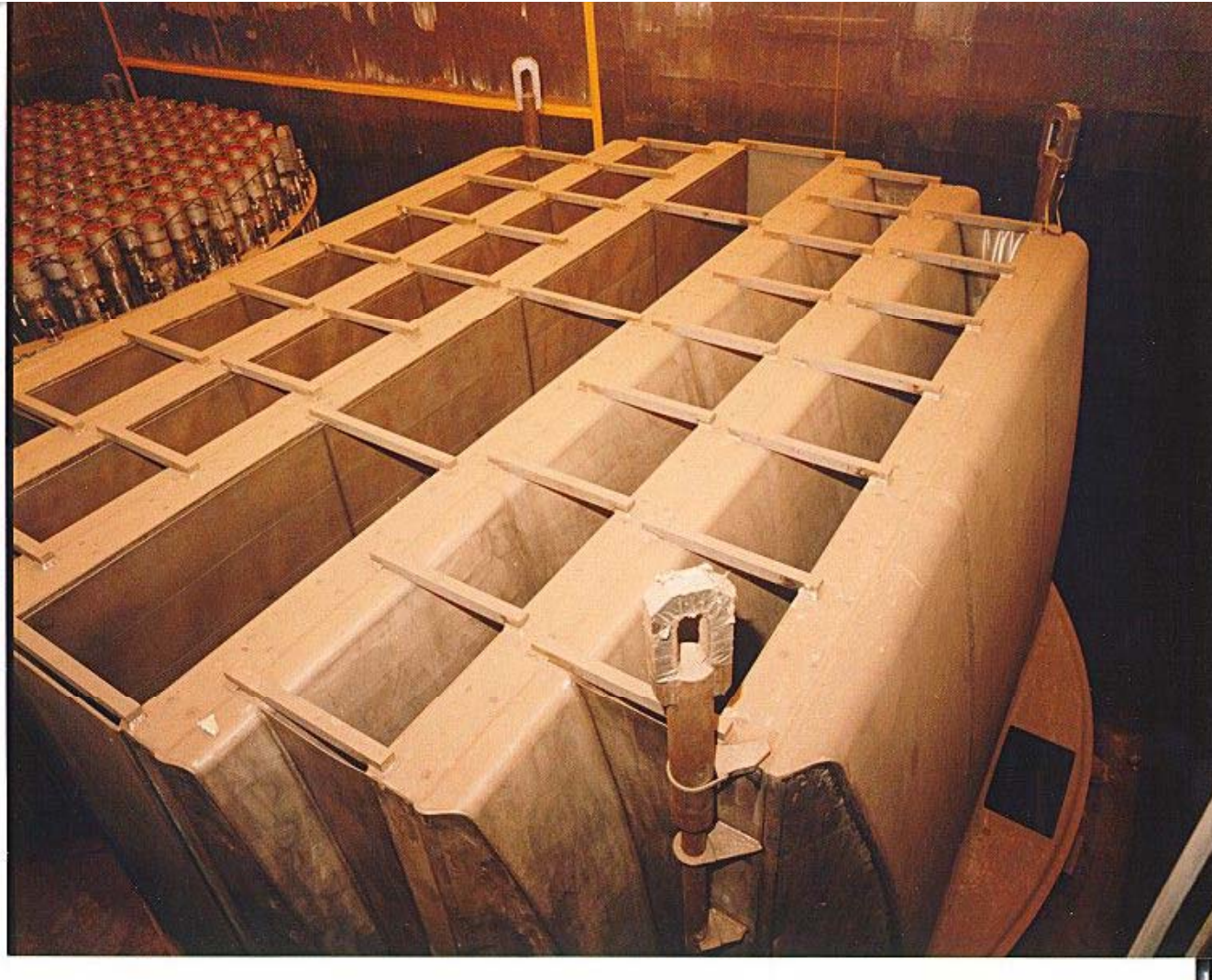
US BWR EPU Status and Potential Need for ACM 4.1 as Documented in BWRVIP-194

Plant/Unit	Utility	EPU status	Dryer type	Potential need for ACM 4.1	Estimated date of EPU LAR Submittal
Cooper	NPPD	Moving forward with EPU at this time	GE Slanted hood	Yes	Fourth quarter 2015-First quarter 2016
Fermi 2	Detroit Ed	Applying for 1.6% MUR now. Plan 120% uprate after License Renewal	GE Curved hood	Yes	No decision to pursue EPU until 2015.
Limerick 1	Exelon	Plan to submit application for EPU	WEC	Yes, plan to use ACM 4.1	Estimate 2019
Limerick 2	Exelon	Plan to submit application for EPU	WEC	Yes, plan to use ACM 4.1	Estimate 2019
Peach Bottom 2	Exelon	EPU application submitted	WEC	Yes, using ACM 4.1	Submitted
Peach Bottom 3	Exelon	EPU application submitted	WEC	Yes, using ACM 4.1	Submitted
LaSalle 1	Exelon	EPU submittal imminent	WEC	Yes, plan to use ACM 4.1	April 2013
LaSalle 2	Exelon	EPU submittal imminent	WEC	Yes, plan to use ACM 4.1	April 2013
River Bend	Entergy	Plan to go to EPU in future	GE Curved Hood	Yes	No decision to pursue EPU until 2015, earliest submittal 2017-2019
Perry	First Energy	Plan 120% uprate after License Renewal	GE Curved hood	Yes	Estimate 2018 submittal

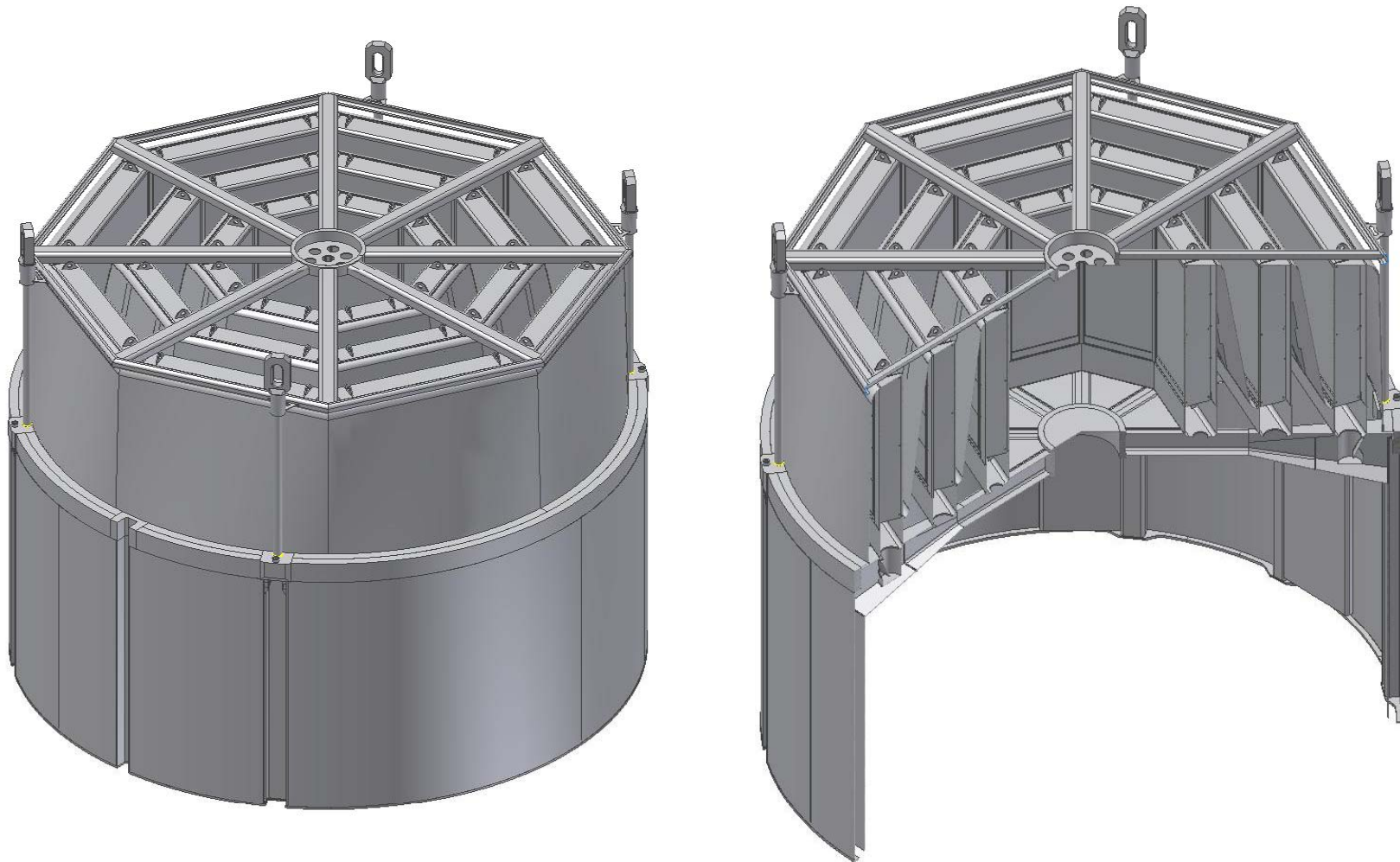
## Applicability of ACM 4.1 to WEC Dryers

- ACM 4.1 methodology is applicable to any steam dryer design as it includes explicit modeling of the specific steam dryer physical geometry and appropriately accounts for geometry effects on the spatial pressure distribution
- ACM 4.1 was benchmarked against data from Quad Cities 2 with a square hood design
- Power ascension testing at NMP-2 confirmed the adequacy of ACM 4.1 predictions for a curved hood design
- Capability of ACM 4.1 to adequately predict pressure loading on WEC dryers will be confirmed based on the results of instrumented steam dryer testing planned at Peach Bottom 2 in the fall of 2014
- Any additional NRC technical issues should be addressed through the RAI process

# GEH Curved Hood Design Dryer



# Westinghouse Steam Dryer Design





# Summary

- BWRVIP-194 developed at the request of NRC to provide a generic validated methodology for steam dryer evaluations
- BWRVIP-194 has been under NRC review for 4 ½ years
- With incorporation of responses to SRFIs, BWRVIP-194 will reflect the approach used to define steam dryer loading and stresses at NMP-2 leading to an EPU license
- Industry needs approval of BWRVIP-194 (PB2 in progress, near term EPU applications at LaSalle, Limerick and Cooper plants)
- Confirmation of applicability to WEC dryer designs will come from instrumented dryer testing at PB2 in fall 2014
- NRC review of BWRVIP-194 should proceed concurrent with PB2 review



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