



**Structural Integrity**  
*Associates, Inc.*

# BWR INTERNALS RECIRCULATION

LINE BREAK ACOUSTIC AND BLOW DOWN LOADS

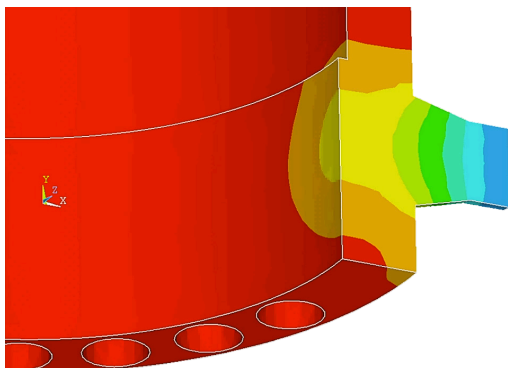
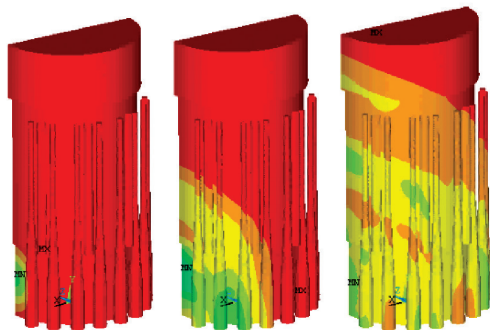


Figure 1: SI's simulation results illustrating propagation of decompression wave around BWR annulus and reflections caused by jet pumps.

## SITUATION

In response to GE-H safety communications (SCs) 09-03, 11-07, 12-20, 13-08, 14-01, 14-02, and 14-03, there has been much activity in the Boiling Water Reactor (BWR) industry regarding acoustic loading of internal components. As a result of these safety communications, many utilities must obtain revised and corrected recirculation line break (RLB) acoustic loads for multiple internal components in order to revise existing flaw evaluations of cracked internal components, perform flaw evaluations if cracking is identified in future inspections, or to determine appropriate re-inspection intervals. The plant original equipment manufacturer has taken the position that all affected plants must develop plant specific loading. Because there are currently no generic fleet loads available, each utility must evaluate the need to obtain plant specific loads.

Since 2009, Structural Integrity Associates (SI) has provided independent, benchmarked methods for calculating RLB acoustic and blowdown loads for all affected BWR internals. We have supported our BWR clients since the first GE-H SC on acoustic loads was published in 2009, and we continue to support our clients on this issue. Subsequent to contracting us for load development, utilities who have utilized our methodology have been unaffected by subsequently published GE-H acoustic load safety communications.

## SOLUTION

We can help obtain your plant specific loads by:

1. Consulting with internals program owners regarding which components might be affected and what actions should be taken.
2. Supporting internals program owners by reviewing existing documentation to identify whether existing acoustic loads are correct.
3. Calculating acoustic and blow down loads for the shroud, jet pumps, shroud support, and access hole covers.
4. Revising existing flaw evaluations, flaw handbooks, and screening criteria.

If your plant does not currently have updated acoustic and blow down loads, then they are needed in order to define shroud re-inspection intervals, evaluate existing indications, or evaluate indications which may be found during a future inspection. Calculating these loads during an outage is not recommended because of the time required to develop the loads and the cost and increased risk associated with calculating these loads in an emergent manner.



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## STRUCTURAL INTEGRITY'S ADVANTAGES

### Features of Structural Integrity RLB Acoustic and Blow Down Load Calculation Methodologies

We have independently developed non-proprietary RLB acoustic and blow down load calculation methodologies which have been extensively documented in the open literature. Some of the key aspects of our methodologies are:

- Non-proprietary - The utility has full access to the design basis and all calculations to facilitate owner review and understanding. We provide non-proprietary literature describing theoretical development and benchmarking for all methods.
- 3-D acoustic methodology - Alternative methods utilize simplifications to the annulus geometry which have been shown to affect the acoustic load amplitude. The SI acoustic finite element methodology has been benchmarked against both experimental data and acoustic load predictions from the NSSS vendor. SI uses a single analytical model for all affected BWR internals: shroud, jet pump, access hole cover, and shroud support. This allows a utility to pay once then be done with the issue.
- 3-D blow down methodology - Innovative heat transfer analogy solves the Laplace equation using commercial FEA. The 3-D flow solution has been benchmarked against 3-D CFD analysis and 2-D potential flow calculations and is published in a peer-reviewed publication.

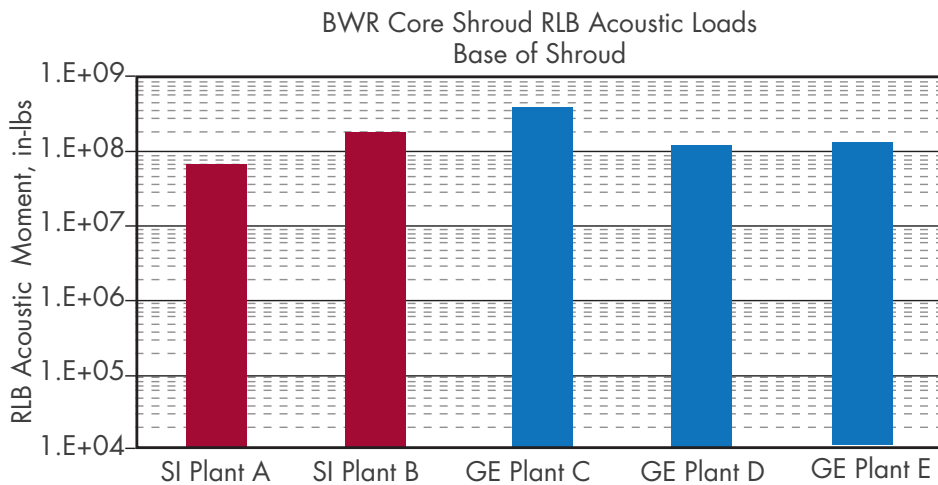


Figure 4: Benchmark results comparing SI RLB acoustic moments with NSSS vendor loads.

## DEPLOYMENT

SI's methodology has already been used to support 16 BWRs for development of loads for the shroud, jet pumps, access hole covers, and shroud support assembly. SI has provided additional consulting support or emergent load calculations during refueling outages for other units.

## CONTACT

To learn more about Structural Integrity's calculation and features, or to discuss how our capability may be useful at your plant, contact us toll-free at **877-4SI-POWER** (877-474-7693) or email [info@structint.com](mailto:info@structint.com).

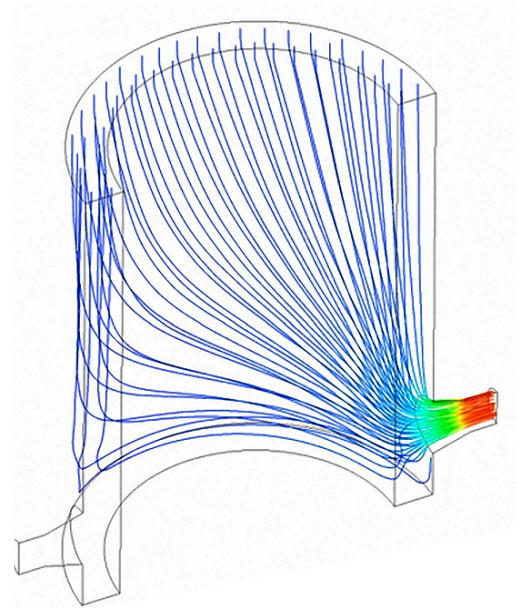


Figure 2: SI's simulation results illustrating blow down loading for a sample plant.

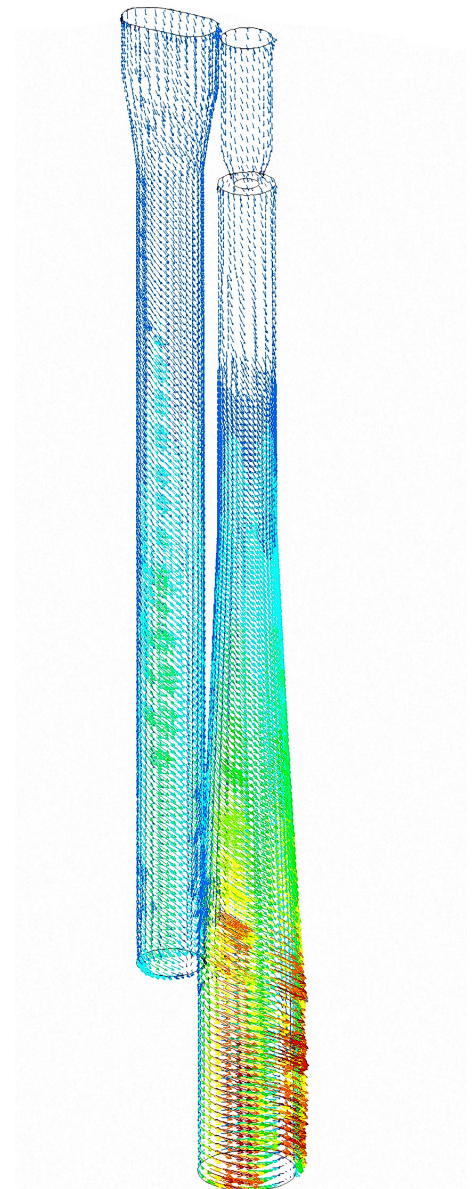


Figure 3: Fluid Flow Around Jet Pump