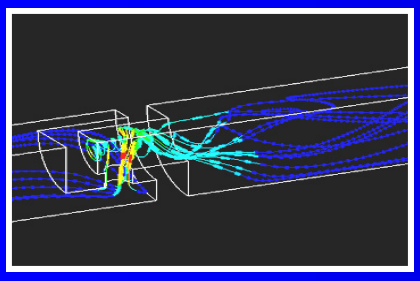
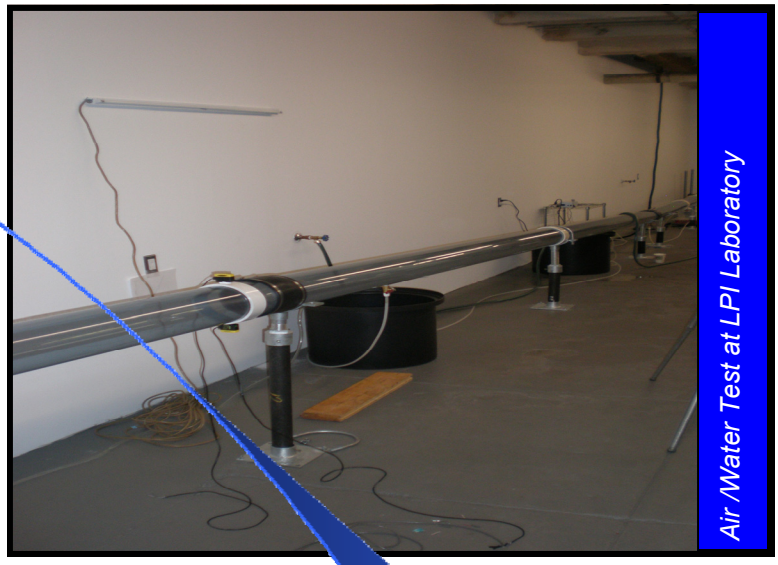


Fluid Mechanics Capabilities

LPI *(Lucius Pitkin, inc..)* capabilities encompass the performance of fluid hydraulics evaluation and fluid dynamics modeling to predict fluid loadings. Our experience and services encompassing power and process plants and steam distribution piping systems. We utilize the latest in fluid dynamics computer codes such as RELAP and CFD tools to determine fluid loading to ensure structural capabilities of components equipment structures and vessels are within acceptable levels, thus minimizing our customers risk in the performance of their function.

Waterhammers and other fluid transients continue to be a frequent occurrence at power and process facilities and within steam distribution systems, resulting in piping and equipment damage and failure. Significant pressure pulses created by a waterhammer event can lead to catastrophic failure of high capital expense components and challenge system operability. The cost of the downtime required to repair a waterhammer failure can easily exceed the capital cost of replacing equipment. Furthermore, because of the transient nature of waterhammer events it is often difficult to localize the cause of the event.



Air /Water Test at LPI Laboratory

Our experience, combined with sophisticated failure analysis and root cause methods have been used to identify causes in numerous plants. Special-purpose analysis programs such as MOC, CFD, RELAP and other numerical methods, combined with our fluid laboratory capability are used to assist our clients in diagnosing the cause of waterhammers. We have also provided extensive instrumentation and testing of systems to monitor fluid transient events, and we have designed modifications to mitigate waterhammer and other events in operating plant systems. Our experience can assist your plant in understanding and determining solutions to transients.

LPI engineer performs pipe slope measurement for GL2008-01 support activities

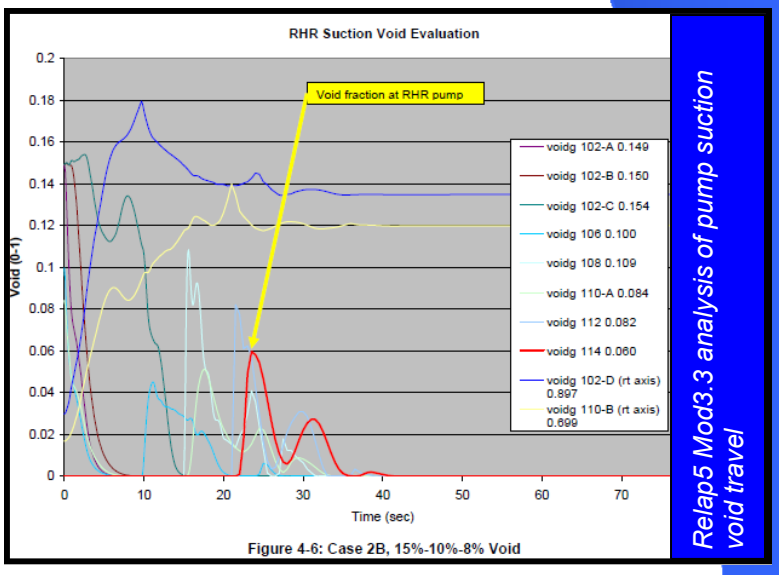


Figure 4-6: Case 2B, 15%-10%-8% Void

Relap5 Mod3.3 analysis of pump suction void travel

Est.1885

LPI Fluid Transient Analysis Experience

Gas intrusion in ECCS system (INPO SOER 97-001/GL2008-01)

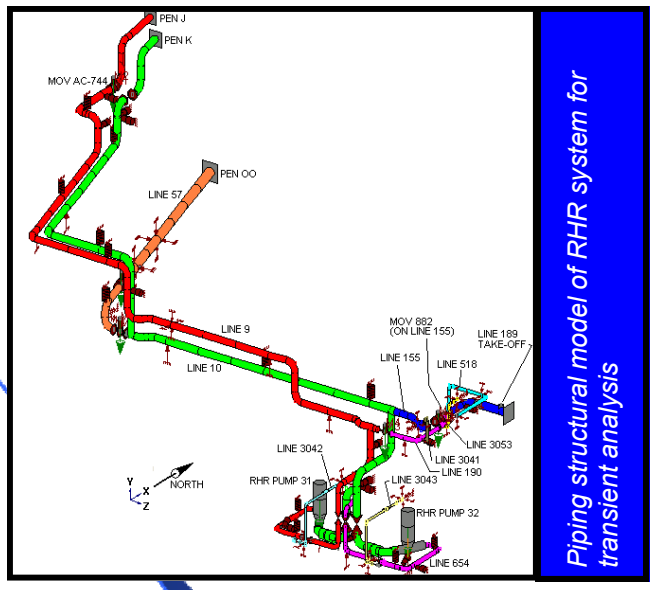
- Compared known intrusion issues to specific plant design
- Plant walkdowns and as-built isometrics for slope and vent
- Determined likely gas accumulation sites
- Recommended added vent lines
- Performed RELAP analysis to determine acceptable void size

Waterhammers due to LOOP/LOCA (GL96-06)

- Industry leader in project to evaluate SW system waterhammers
- Testing to support analysis model
- Developed simplified evaluation methodology

Gas compression transients in Shutdown Cooling system

- Determined probable gas accumulation sites
- Modeled gas compression and rebound
- Determined system pressure pulse and sensitivity to void size
- Recommended solutions



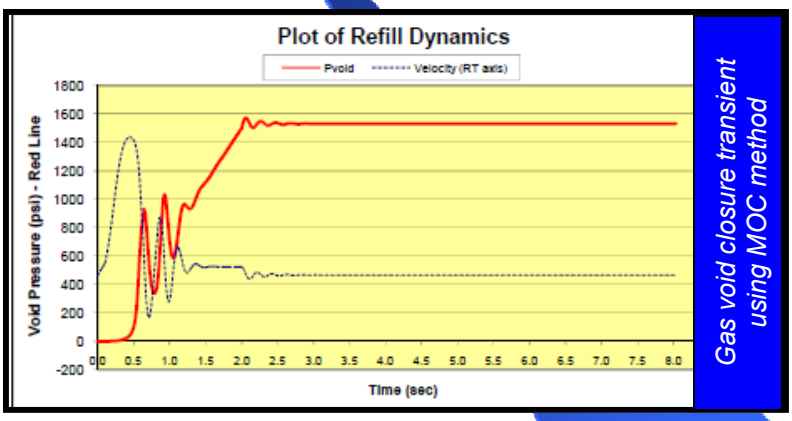
Piping structural model of RHR system for transient analysis

Flow Induced Vibration

- Developed program to monitor pressure and piping dynamics
- Developed acoustic model to predict dynamic pressures
- Performed root cause to isolate vibration source
- Developed structural model to demonstrate piping motion

Main Steam Piping and S/G Design Fluid Loads

- Used RELAP to determine feedwater pipe-break loads for snubber elimination study
- Used RELAP to determine main steam loads for pipe qualification



Gas void closure transient using MOC method

Water slugs in pressurizer relief line

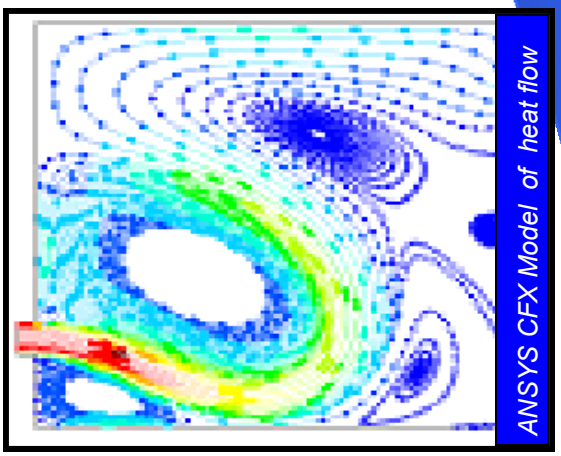
- Showed that water was not likely to accumulate
- Proved that accumulated water would not affect piping
- Provided simple, inexpensive analysis

Waterhammer in fire water system

- Evaluated a large industrial site's buried piping
- Determined cause of pipe breaks
- Recommended solutions to the pipe breaks

Flow modeling/testing in pressurizer spray line

- Created flow models of the spray lines to evaluate flow scoops
- Showed possible imbalance in flow rates
- Showed effect of instrument error on test results



ANSYS CFX Model of heat flow

High Energy Line Break (HELB) analysis

- Investigated potential blowdown region for a line break (ANS 58.2)
- Provided justification of equipment operability under break conditions

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