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Technique Devised to Measure Pipeline Gas Bubbles

BY ALAN, ON MAY 16TH, 2012


(Alaska.gov)

Researchers at **University of Southampton** in the U.K. have discovered a method to more accurately measure gas bubbles that develop in pipelines. The team led by **Tim Leighton** of Southampton's Institute of Sound and Vibration Research describe their findings **online** in the journal ***Proceedings of the Royal Society A*** (paid **subscription** required).

Pipelines are used to deliver liquid or gas raw materials in many industries, but when bubbles appear in the pipeline they need to be spotted and understood quickly. Bubbles are a particular issue in extracting oil with off-shore oil rigs. When these bubbles are brought up from the seabed, where pressure is very high, to the rig at the surface, the reduction in pressure causes these bubbles to expand and in turn cause a blow out — a sudden release of oil and/or gas from a well. The **failure** of the blow out preventer was a key factor in the extensive damage caused by the BP/Deepwater Horizon oil spill in the Gulf of Mexico in 2010.

Current methods for estimating bubble size distribution involve sending sound waves through the bubble liquid and comparing the measured attenuation or loss of amplitude of the sound wave as it propagates. The calculations are based on a theory that assumes the bubbles exist in an infinite body of liquid, when in this case, they reside in a constricted volume inside the pipe. With theoretical assumptions not matching real-life conditions, erroneous measurements of bubble distribution can happen.

The Southampton team devised a new measurement method, which takes into **account** that bubbles are residing in a pipe. To develop and test the new method, Leighton and colleagues made use of the mercury-filled steel pipelines in the test facility at the **Spallation Neutron Source** (SNS), at the Oak Ridge National Laboratory in Tennessee. SNS is an accelerator that provides intense pulsed neutron beams for scientific research and industrial development.

Oak Ridge Lab is interested in measuring bubble size and distribution because of SNS's use of helium bubbles in the mercury to absorb shock waves from bombardments of proton beams. Without the bubbles to absorb the force of the beams, the steel in the pipelines could erode faster than anticipated.

Leighton's team devised and tested new calculations for measuring bubble size distribution, which they reported in the Royal Society paper. Oak Ridge Lab commissioned the team to build instruments to check that their bubble generators can deliver the correct number and size of bubbles to the location where they will protect the pipelines from erosion.

Leighton notes, however, that just after his team designed the calculation methods, "the 2008 global **financial** crash occurred, and funds were no longer available to build the device into the mercury pipelines of ORNL. A more affordable solution had to be found, which is what we are now working on." Leighton adds, "The original design has been put on hold for when the world is in a healthier financial state."

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