CRYOGENIC PRESSURE ISOLATION OF FLOWING FLUID

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ABSTRACT
Cryogenic freeze techniques can be used for temporary pressure isolation of wellheads, casings, pipelines and other tubulars in land and off-shore applications, but current practice requires zero flow for use of these methods. Biofilm IP LLC (Biofilm) has created a patent pending thermodynamic valve methodology and apparatus and has demonstrated pressure isolation of flowing crude oil.

PERFORMANCE
Feasibility demonstrations include a vertical prototype flowing hot (38ºC) crude oil at 10 feet per second through a one-inch tube oriented vertically. In this one inch prototype, oil flow was controlled in less than 10 seconds from the time of activation of the final cryogen circuit.

As of the deadline for this publication, testing is ongoing using a 3.25 inch horizontally oriented tube. Preliminary test results include activation and flow control of crude oil flowing at 2.5 feet per second. Additional testing is ongoing and results will be reported at the 2011 Southwest Petroleum Short Course. This 3.25 inch design includes monitoring and control elements to allow manipulation of the operational parameters and exploration of the performance envelope. Additionally, variable flow control design elements will be tested.

COMMERCIAL APPLICATIONS
High value commercial applications anticipated by Biofilm include but are not limited to:
-Exploration: as a supplement to mechanical blowout preventer in surface or sub-sea drilling operations; and
-Transportation: as supplement to automated mechanical pipeline valves, the low cost of this design would allow for intermediate placement and could reduce volume of lost product and ecologic damage.

The device can include features and characteristics to allow remote activation in under-water, below ground, or sealed-in concrete applications. It could be incorporated into well casing and cemented in place at relatively low incremental cost.

Activation involves initiating the flow of cryogen and can be accomplished remotely provided a suitable source of cryogen is at hand. In surface applications where very rapid activation may be required during a finite time interval such as during drilling operations, cryogenic liquid is readily supplied from a pressurized Dewar flask or tanker. For sub-sea applications or when prompt operation may be needed over a long period, electrically activated cryogenic refrigeration technology is envisioned. In the case of pipeline networks, Dewars of liquid cryogen could be maintained in reserve and transported to required locations via truck or helicopter should activation of the valve be required.

IMPLEMENTATION COST
The thermodynamic valve uses no moving parts other than commercially available valves to control the flow of cryogen and/or bridging fluid. Precision machining and other high cost manufacturing are not required. In large scale production, the installed cost of this device will be greater than the surrounding sections of tubular, but will be insignificant relative to the cost of additional large diameter ball valves or blow-out preventers.

GOVERNMENT MANDATE
Michael Bromwich, director of the Bureau of Ocean Energy Management, Regulation and Enforcement, has said the oil and gas industry needs to show us and show the public they have developed more effective containment strategies for dealing with oil spills than they have developed to date. (See wsj.com article *Spill Panel to Press Obama Team on Drilling Ban* 7/14/10.) Biofilm's thermodynamic valve offers such a containment strategy.