Five new techniques improve production/drilling operations

Including a U.S. DOE-supported program zeroing in on the efficiency of sucker rod pumping wells, three downhole systems for: fluid lifting problems, well/reservoir testing, and maintenance/repair, plus a better way to handle drilling mud, the following review of five field-tested technologies gives valuable options for several persistent operating problems.

These new techniques summarize concepts and case histories of: 1) How Oxy USA improved five field wells for a pumping unit "Motor Challenge" project; 2) Using capillary tubing to inject chemicals to alleviate unwanted downhole fluid/solids buildups; 3) A pressure-activated sealant for downhole leaks; 4) Application of a new, programmable downhole valve for well/reservoir testing; and 5) Mud tank mixers that can be adapted to the shape of any vessel. ...

Pressure-activated sealant cures downhole leaks

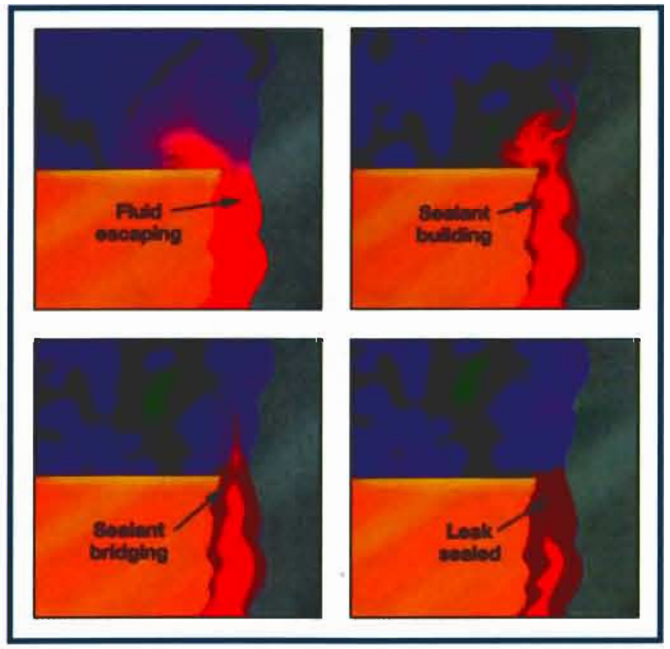
Pressure leaks in a wellhead, downhole tubulars or other equipment can lead to inoperable subsurface safety valves, casing pressure, environmental pollution, loss of production and, in extreme cases, blowouts. It is the policy of most operating companies and governmental regulators that pressure leaks in surface-controlled, subsurface safety valves (SCSSVs), tubulars or other downhole equipment must be cured or alleviated. Regulations generally prescribe that operational capabilities of SCSSVs be tested, sustained casing pressure reported and wells subject to pressure leaks be shut in until the leak is cured or alleviated.

A major component of the repair cost of such leaks is mobilizing expensive equipment and numerous personnel to the well location. There are separate, intangible costs associated with the risks of wellhead and downhole operations. These risks include personnel injury, environmental/wellbore damage and the risk of not being able to re-establish production.

A method of repairing wellhead and downhole leaks in situ is needed, without having to mobilize expensive and risky rig or wireline operations.

Pressure-activated sealant. Seal-Tite International in Mandeville, Louisiana, has developed a new hydraulic fluid additive that is specifically designed to seal leaks in severe-environment hydraulic systems. What distinguishes this sealant is that it is pressure activated. The sealant will remain fluid in any hydraulic system until released through a leak site. Only at that point of differential pressure, through the leak site, will the sealant reaction occur and bridge across the leak, see accompanying figure.

The sealant is analogous to blood coagulating at a cut. The blood only heals the location of the cut. The sealant only "heals" the point of differential pressure, that is, the leak site. The remainder of the sealant stays fluid. It will not clog nor plug the hydraulic system or well components. The sealant can be left in the system or flushed out. Because each sealant formula is custom blended to the particular conditions of the leaking hydraulic system—whether it is tubing, casing, wellhead or SCSSV—the isolated sealing mechanism is possible, regardless of temperature, pressure or delay in reaching the leak site.



Concept of liquid sealant reaction sequence in response to pressure differential at the leak site.

This sealant technology has successfully performed leak-sealant operations in a number of different applications:

- SCSSVs
- Wellhead tubing and casing hanger seals
- Casing/liner PBR seal joints
- Tubing pinholes and joints
- Subsea well-control systems.

The benefit of a pressure-activated sealant process is that, using only a skilled technician and a small, self-contained equipment dolly, custom-blended sealant is injected through the hydraulic system until the leak is corrected. The well may return to production without the expense and risk of using a rig or any downhole operation.

Case histories. The product has been used successfully in the Gulf of Mexico, Alaska, North Sea, Malaysia and Abu Dhabi. The following representative case histories outline the capabilities of the sealant, the procedures used and the results of operations.

SCSSV leaks. In the North Sea, a well had a severe leak of 1,000 ml/min in the SCSSV control line, which caused the well to shut in. Apprised of temperature, pressure and leak rate data, a custom-blended sealant formula was prepared. A technician ran troubleshooting diagnostics at the wellsite. Diagnostics indicated leaks, in both directions, between the V-packing of the wireline-retrievable SCSSV and polished bore nipple. The operating company was unable to retrieve the valve due to ongoing operations on an adjacent well which prevented access to the well with wireline equipment.

Using an SCSSV injection system, the technician pumped sealant into the hydraulic control line of the safety valve until the pressure-activated sealant, after only 10 min of pumping, had repaired the leak. Normal valve-operating pressure of 6,000 psi was maintained. After four hours, the technician performed function tests that verified full capability of the valve, and the well was returned to production.

Casing and tubing leaks. In Alaska, an inner annulus was communicating artificial-lift gas to the outer annulus. The operator was unable to bleed outer annulus pressure below 800 psi. A custom-blended sealant formula was atomized into the artificial-lift gas and injected into the inner annulus, while bleeding the outer annulus to atmosphere. Thus, sealant entrained with artificial-lift gas was carried to the leak site. After sealing the leak, outer annulus pressure dropped to 14 psi. The sealant allowed a successful tubing integrity test to 3,000 psi, and the well was put back on production. A similar procedure has been used in curing tubing leaks.

Wellhead leaks. In the Gulf of Mexico, after venting pressure from the wellhead hanger-cavity port and closing the pressure-release tool, there was a pressure gain to 150 psi—equal to surface FTP—within 30 min. The leak was identified as communication between hanger neck seals and hanger void. In preparation for repair, the operator installed a backpressure valve into the tubing hanger.

The technician filled the wellhead with custom-formulated sealant and installed the tree cap. Using a pump connected to the crown valve, the wellhead was pressured to 5,000 psi and held there until the leak was sealed. The technician cycled pressure between zero and 5,000 psi to force additional sealant into the hanger seals, until the bleed-off rate subsided to zero at 5,000 psi differential pressure. After the seal was verified, the backpressure valve was removed, excess sealant was flushed out and the well was put back online.

Summary. The use of pressure-activated sealant is a safe, low-risk, economical option to repair or replacement of leaking hydraulic systems. In most instances, use of this sealant and process will repair wellhead and downhole leaks in situ, without the need of mobilizing expensive and risky rig or wireline operations, thus reducing risk to personnel, equipment, well and environment. WO

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