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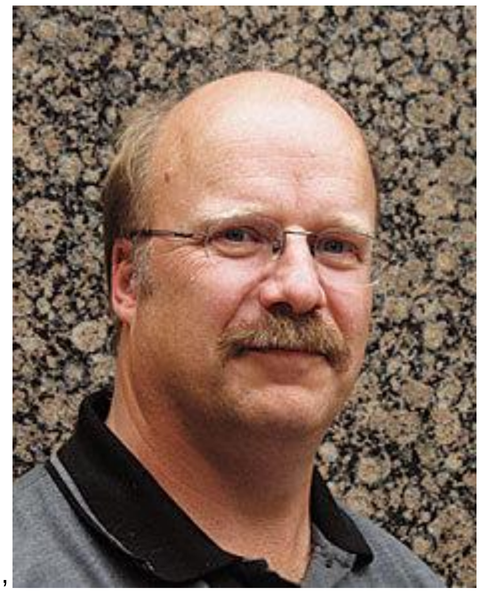
Super Sized Fracs

Eric Schmelzl: Field Operations Grow To An Unprecedented Scale

By Mike Byfield



Three years ago, a big hydraulic fracture of a tight gas well in northeastern British Columbia consumed 100 tonnes of proppant. Today, that figure has mushroomed tenfold to about 1,000 tonnes. And that's just the sand. To stimulate a horizontal wellbore in the Montney and Horn River Basin, a producer will now burn through $1 million within a couple of days. "Well completions of this type require planning-otherwise you'll probably have expensive crews and equipment standing idle," says Eric Schmelzl, technical manager of production enhancement for Halliburton Canada.

Outside of the High Arctic, Canada's onshore conventional oil and gas operators have rarely, if ever, faced a logistical challenge of this magnitude. Adding to the potential risk is the remote location of the prospects, particularly Horn River's Muskwa shale formation near the Northwest Territories. "Horn River will be treated like no other play in Canada has ever been treated," Schmelzl predicts.

The larger scale is changing life in the field. For example, a stimulation team that used to have one eight- or 12-hour shift per day will now work 24/7 until a massive horizontal frac is completed, then move immediately to the next well. "You can't dillydally when that much manpower and equipment is on a site. Speed of execution coupled to risk avoidance becomes essential to profitability," the Halliburton executive comments.

Transportation is just one aspect of the sophisticated new technology that's being deployed in tight rock and shale gas reservoirs across North America. "Our clients used to start drilling and then phone us for a completion a few days before the crew was needed. But with shale gas development, the approach of ,'you call, we haul' simply won't work," Schmelzl explains. "Well design, execution, and completion should be prepared months in advance, then tightly coordinated from start to finish."

Shale superfracs are the sort of cutting edge action that drew Schmelzl to the oil patch in the first place. "I thought the work looked exciting," he says. "Unfortunately, when I graduated from the University of Calgary in 1982, the NEP [National Energy Program] was hammering the industry. No producer would hire an inexperienced mechanical engineer at that time, so I started by driving a truck for Halliburton in Red Deer."

Schmelzl, working his way up through Halliburton's ranks, held operational and marketing positions in Grande Prairie, Alberta; Estevan, Saskatchewan; and Calgary. Professionally fascinated by unconventional gas, he joined Calver Resources and later Evergreen Resources, among this country's early players in coalbed methane. Halliburton drew him back because "the company was creating precisely the suite of tools that I knew from experience were needed for developing gas resource plays." Today he leads the company's unconventional gas team in Canada.

The Halliburton engineer says coal represents one end of the gas reservoir spectrum, binding methane through processes known as absorption and adsorption. At the other end of the spectrum sit very tight sands, where gas is stored by compression. "Shale reservoirs, which represent many rock types, can fall anywhere between coal and tight sands. You can assume nothing," Schmelzl explains. "Shale gas is stored by sorption and by compression, and differentiating these two components is one of the primary goals of an analysis program." That evaluation in turn helps dictate what technical strategies will be used to produce the gas.

Shale is the world's most common sedimentary rock, formed originally from clay and mud under geological pressure. Shale, although often gas-laden, is so impermeable that the pore throats between the grains can be as tight as a single molecule of methane. Even so, shale deposits are arguably the most exciting natural gas plays in North America. The Barnett, Marcellus, Horn River Basin, and other shale prospects present the possibility of mammoth reserves at a time when North America's more conventional onshore gas reservoirs are in decline.

Unlocking a shale reservoir depends on three factors that must all be matched: reservoir characterization, wellbore architecture, and well completion strategy. "Every shale formation is different, and there are often considerable variations within the same shale reservoir," Schmelzl says. Completion strategy-which governs wellbore architecture, in Halliburton's view-must take into account the number of targets, anticipated production rates, and frac design. Wellbore architecture may be vertical or horizontal, cased or uncased, cemented or open hole.

The goal of a well completion is to maximize exposure to the producing formation at the most affordable cost. "An operator with significant Montney interests, using Halliburton crews, made a breakthrough in B.C.'s Montney formation in 2005 through multiple fracs in a horizontal well. Ideally, a horizontal wellbore that's fraced five times will achieve as much production as five vertical wells in the same formation, and that horizontal well would cost much less to drill and complete than five vertical wells," Schmelzl says.

Frac technology has progressed rapidly in the past three years. "A traditional vertical frac exposed hundreds, maybe thousands of square feet to the wellbore," Schmelzl says. "In the Barnett Shale of Texas, we're seeing cumulative exposure of more than 20 million sq. ft through complex fracturing along a single horizontal wellbore. Now the industry is striving to duplicate that success in other shales."

Halliburton offers several options for multiple fracs in horizontal wells. If the well is cased, the operator can use mechanical plugs and perforating guns. For a non-cemented completion, Halliburton developed a suite of packer-sleeve completion methods. To frac through cemented casing, the company created CobraMax® H service. Perforation is achieved with a sand laden water-jet deployed via coiled tubing. Fracturing is performed by pumping down the well casing, with sand plugs used to isolate subsequent frac stages. The process reduces the risks associated with mechanical plugs and their associated removal, while optimizing the speed of the well completion.

Halliburton also has other innovations in its unconventional gas kit. In the U.S. Rocky Mountains, Halliburton pioneered the concept of frac farming, a process by which multiple wells are stimulated from a central pad. Other technologies include an advanced MRI (magnetic resonance imaging) system, reservoir modeling software, and a micro-seismic system that evaluates hydraulic fracture geometry. "We span the technical spectrum," Schmelzl says. "Our clients can count on us to deliver what's needed as a single reliably coordinated package-it's what we refer to as the 'One Halliburton' advantage."