The Right Approach Can Counter The Effects Of Near-Wellbore Damage

Just about every well, at one time or another, is going to suffer the effects of wellbore damage. Near-wellbore damage generally is defined as any restriction to flow capacity. These restrictions often are caused by a reduction in near-wellbore permeability, most often from perforating debris or mud filtrate caused by the drilling process. Not surprisingly, this damage can dramatically impact a well’s overall production. How an operator or service company chooses to address this issue can dictate overall performance over the life of a well.

In a 2009 presentation on formation damage, George King, global technology consultant at Apache Corporation, contends it is important to first ascertain where the damage is located and how it is affecting production. The effect of the damage, the type of damage, severity of plugging, the depth, and the ability to prevent, remove, or even bypass the damage are all key factors in an operator’s strategy to address near-wellbore damage.

King asserts that shallow damage is the most common and that it takes a significant amount of damage to reduce production dramatically. He says the problem is that, generally, the highest permeability zones are the easiest to damage and also are the ones that will cause the greatest reduction in production. How one approaches cleanup can be a most useful tool in addressing the issue of near-wellbore damage.

In their 2013 SPE paper, An Integrated Approach to Simulation of Near-Wellbore and Wellbore Cleanup (SPE 166509), authors Theuveny, Mikhailov, Spesivtsef, Starostin, Osipstov, Sidorova and Shako from Schlumberger explore a modeling approach to help predict and address near-wellbore issues. Their model looks at the issue from a global level in layers while considering such things as an internal mud cake formed by mud solids coming into the reservoir, an external mud cake, a mud filtrate, issues with potential perforations, dynamics with multiphase flow, and flow control devices.

The authors compare field data with core flooding and transient return experiments in the laboratory. These experiments generated multiple recommendations for cleanup, recognizing several constraints, including operational constraints such as limited storage, rig time, and drawdown limits. Other constraints include fluid limitations, geomechanics, and lithology.

The authors assert that thoughtful planning and recognition are key factors in successfully treating wellbore damage. Losses should be monitored during and after drilling. Fluid placement near the wellbore needs to be understood prior to cleanup operations, along with the operational design of the cleanup. Once this is understood, the design, safe disposal, and storage of fluids are key.

The authors suggest that real-time monitoring and diagnostics can help address the issue early and avoid costly treatments down the road. During the process, choke management is essential for successful cleanup. Finally, post-job analysis and integration of lessons learned can be a key factor in successfully implementing a near-wellbore treatment program.

In addition to a technological and monitoring approach to addressing near-wellbore damage, there also are several emerging techniques and technologies being evaluated to assist in addressing this issue. Each is aimed at keeping wells flowing. One such technology developed by SPE legend of fracturing, Claude Cooke Jr. in conjunction with CSI Technologies, is called ReadyFrac.

ReadyFrac uses pellets of biodegradable polymer containing proppant that are placed into a well and allowed to degrade into a highly viscous liquid. This liquid is injected into the formation at a low pump rate, creating a hydraulic fracture that is designed to extend just past reservoir damage. While this process is limited by well geometry, depth and temperature, the technology is thought to be an effective means for addressing near-wellbore damage, since the degraded polymer forms a perfect transport fluid, leaving no residue to damage the formation along with a significantly higher proppant concentration, thus increasing fracture conductivity.

Near-wellbore cleanup can be especially difficult in horizontal wells, where traditional methods can be limited. In a paper titled, Acoustic Stimulation to Mitigate Near-Wellbore Damage (SPE 90356-MS), Fred van der Bas, Eric de Rouffignac, Pedro Zuiderwijk and Diederik van Batenburg introduce a technology aimed at complementing traditional methods of cleanup using acoustic sound waves within the wellbore. This technology uses a wireline fitted with an acoustic stimulation tool to selectively treat required reservoir intervals. The authors say the preferred application is in an underbalanced condition, and that the high-frequency sound waves serve to shake loose the solid particles in the wellbore and mobilize them so they can be removed through production flow.

There are as many potential solutions for addressing near-wellbore damage as there are causes of dramatic reductions in production. There are no silver bullets, but combining the fundamental elements of how wellbore damage can impact operations with emerging technology can be one key to long-term successful operations.

“Combining the fundamental elements of how wellbore damage can impact operations with emerging technology can be key.”

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