COILED TUBING SOLUTIONS

STEP-PLEX™ LCM

STEP-PLEX™ LCM Through Coil Improves the Economics of Milling Under-Pressured Wells

STEP-PLEX™ LCM:

- Initially developed for fracturing and refracturing operations
- STEP-PLEX LCM is an effective solution that temporarily blocks leakoff and maintains circulating pressures during coiled tubing milling or cleanout operations
- Products for wells ranging from 30°C to 120°C (86°F to 248°F)
- Can be pumped through mill and motor with no damage to the BHA (based on STEP recommended BHA package)
- All STEP coiled tubing equipment can integrate STEP-PLEX LCM

STEP Operations Example:

- Client's scope of work included milling to 4,200 meters (13,780 feet)
- Using STEP-PLEX LCM, the return-rate increased as more potential leakoff points were exposed
- Reached 5,200 meters (17,060 feet), unlocking 1,000 meters (3,281 feet) of new productive lateral
- Client benefited from an increase in production

In low bottomhole pressure (BHP) wells where maintaining circulation is challenging, STEP-PLEX LCM (Lost Circulation Material) can be pumped through coil and the bottomhole assembly (BHA) to temporarily isolate leakoff in the formation. This solution allows operators to reassess wells requiring a cleanout or millout where the economics and risk were previously unfavorable.

Challenge

To improve the production performance of a new or existing well, operators will perform a cleanout operation; milling with coiled tubing to remove any debris or obstructions thereby increasing production of the well. Fluid is pumped down the coiled tubing and returned up the annulus. In under-pressured formations, leakoff causes reduced or even lost circulation decreasing the success of the operation as debris is unable to return to surface.

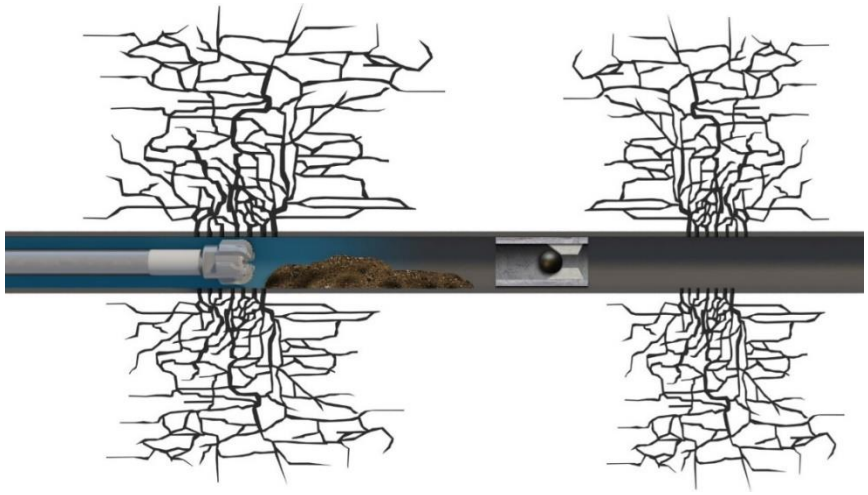

Figure 1: Under-pressured wells decreases success of milling operations.

Operators have used other viable solutions to mitigate under-pressured wells:

- Multi-phase fluid (N_2) to reduce hydrostatic pressure
  - Expensive
  - Returns can still be lost
- Blind milling - push all debris through the sleeves, and to the toe
  - Possible formation damaging
  - Continuous fluid loss
  - Potential for stuck pipe

STEP-PLEX LCM Solution

STEP's lost circulation material is a cost effective and efficient solution. By using STEP-PLEX LCM, operators can quickly, and temporarily, block leakoff to maintain or regain circulation, improving the ability to clean debris from the lateral.

- Reduce N_2 usage
- Reduce friction from debris
- Extend reach of coiled tubing and unlock potential production
- Reduce fluid loss
- Reduce NPT and stuck pipe risks

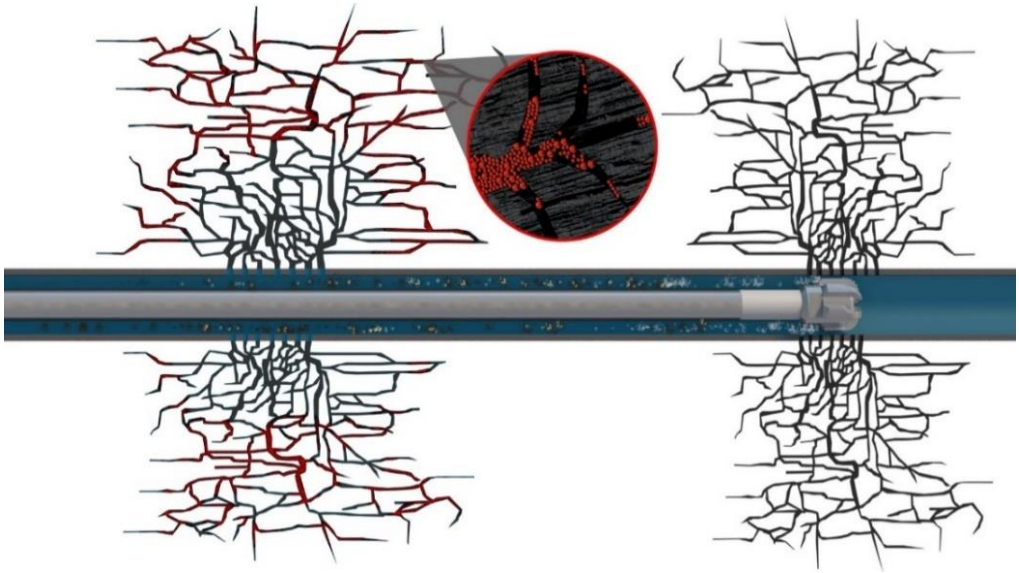

Figure 2: STEP-PLEX LCM through coil temporarily blocks leakoff which increases pressure and circulation during milling operations.

Lab testing supports that STEP-PLEX LCM completely degrades without an accelerator within 24 hours to five days. Using an accelerator, dissolution times can be customized depending on resevoir temperatures.

Temperature	No Accelerator Solubility, %			50% Dissolution Time	100% Dissolution Time
	24 hours	48 hours	96 hours		
50°C | 122°F	14	20	32	1.5 days	5 days
60°C | 140°F	18	24	35	1 day	3 days
70°C | 158°F	32	35	51	1 day	2 days
80°C | 176°F	51	96	98	1 day	2 days
90°C | 194°F	89	96	98	8 hours	24 hours

Table 1: Based on two bags LCM (in water or brine)