TEO Plc.
TECHNOLOGY ENHANCED OIL Plc.

Description of selected technologies | **Plasma Pulse**

Removal of near-wellbore damage with Plasma Pulse technology

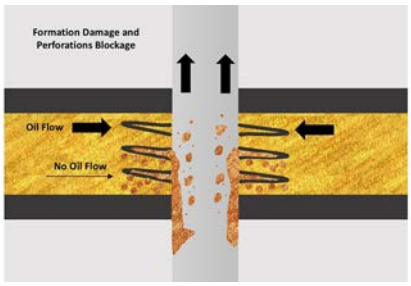
TEO uses Plasma Pulse technology to remove near-wellbore damage and restore production by reconnecting the well to the reservoir. Conventional practices use acids, solvents and explosives to clean out blockages and restore production. PPT is an eco-friendly alternative to fluids, chemicals and explosives and TEO has successfully applied it to increase production and reduce operational costs.

Conventional removal practices for near-wellbore damage

Near-wellbore damage reduces the production potential of a well and is caused by the build-up of different residues that "block" the permeable channels in the reservoir formation and/or the channels that connect the formation to the well. These blockages can be caused by inorganic deposits, such as scales, organic deposits, such as waxes and asphaltenes, and also by the migration and accumulation of clay fines. In most cases near-wellbore damage is caused by different types of deposits acting together.

Conventional practices to treat and remove/dissolve organic and inorganic deposits are hazardous and involve the use of acids and solvents. An incorrect analysis of the damage to a well can make the situation worse and even cause irreversible damage in the formation.

Mechanical solutions are more commonly used than chemical solutions and involve the use of explosives, to clear the channels that connect the reservoir to the well, and hydraulic fracturing to remove and bypass any damage in the near-wellbore area. Even though these practices are effective the use of explosives and high pumping pressure to fracture the formation rock make them extremely hazardous.



Plasma Pulse: A proven technology with worldwide field applications

Plasma Pulse is a proven technology, which has successfully stimulated over 200 wells in North America and thousands around the world, using different applications. On average PPT achieves a 60% increase in production and in a recent study of 150 wells stimulated with PPT the success rate was over 70%. Some observations from the unsuccessful statistics show after-stimulation higher water cuts, indicating the stimulation of undesired zones, or no production increase at all.

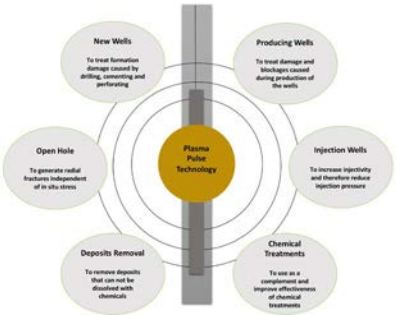
PPT has been used successfully with other technologies to enhance final results. It has been proved that if applied before acid, injectivity of the treatment is increased by the microfractures generated with the Plasma Pulse tool. This creates a higher contact area of the fluids in the near-wellbore zone, which will allow a more extended dissolution reaction and permeability increase.

In wells with high-water saturation zones, stimulation with fluids cannot usually be used to divert into desired zones, which results in increasing oil and water production. PPT has shown successful results when used with logging tools that indicate potential water zones and higher pay areas. This combination of technologies can be used to define specific stimulation intervals, thus performing a more controlled intervention and increasing oil production with a lower water cut.

Plasma Pulse technology

As near-wellbore damage can occur in any type of well and at any stage of the life of a well, PPT can be implemented in a wide range of applications, including new wells, injector wells and mature wells.

Other applications include:



Application of Plasma Pulse in TEO Assets

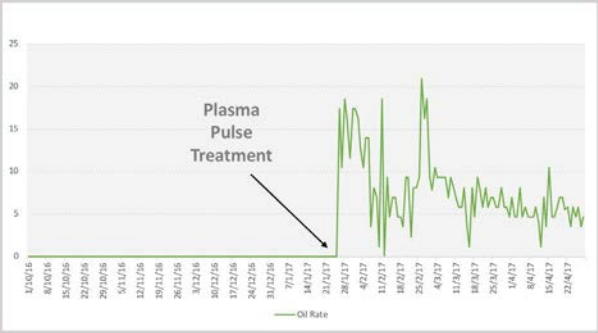
PPT has been successfully applied in the Beauty and Lovely asset, where great results have been achieved with the non-chemical stimulation of four producing wells and an injector well.

Wells selected for the application of PPT were under-producing or shut-in, before the interventions. The causes for under-production were near-wellbore formation damage and partial blockage of the perforations.

After an extended review of available technologies and a complete technical study of the production problems in the wells, we decided to implement this disruptive technology with an eco-friendly approach, as an alternative to conventional practices that include harmful chemicals, acids and solvents.

The application of this technology exceeded our expectations, for example, in Well Cerf 1SE, which was shut-in before the stimulation, stabilized production after three months was increased by over 8 bopd or more than 250%, or well WD Johnson E 04, with a stabilized production increase of 3.5 boepd. The operational procedure used to apply this technology has a big advantage over other practices, as it requires only one vehicle, one technician and the Plasma Pulse tool.

Cerf 1SE



TEO acquires a Plasma Pulse Tool to reduce costs and increase efficiency

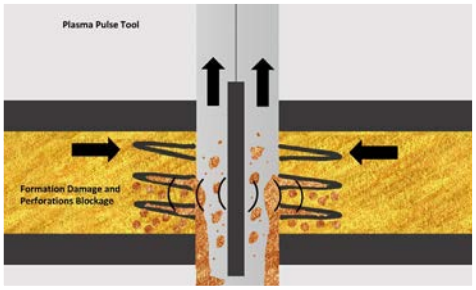
As part of its Q3 2018 plan, TEO has completed the acquisition of a custom - design Plasma Pulse tool which we began testing on our properties in September 2018. The plasma pulse tool (SKIF 100M from IPPT, modified to suit TEO's requirements) was delivered in early September to TEO's facilities. The acquisition will enable a more proactive response to a production decline by having a Plasma

Plasma Pulse: A disruptive technology to replace chemicals, explosives and fracturing

Plasma Pulse is a groundbreaking tool that creates a powerful hydraulic pulse in front of the production interval by applying a small electric charge at the surface.

The hydraulic pulse is a high power shockwave, that travels at >1,500 metres per second and is followed by a 10,000psi high pressure pulse. A small amount of energy (around 1 KJ) creates a power output of 240 megawatts for a few microseconds. One of the advantages of this technology is that these pulses can be repeated hundreds or thousands of times, according to the severity of the problem in the well.

PPT is green, safe and economic and removes the need for fluids, toxins and explosives. PPT can be used independently or with other treatments.



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