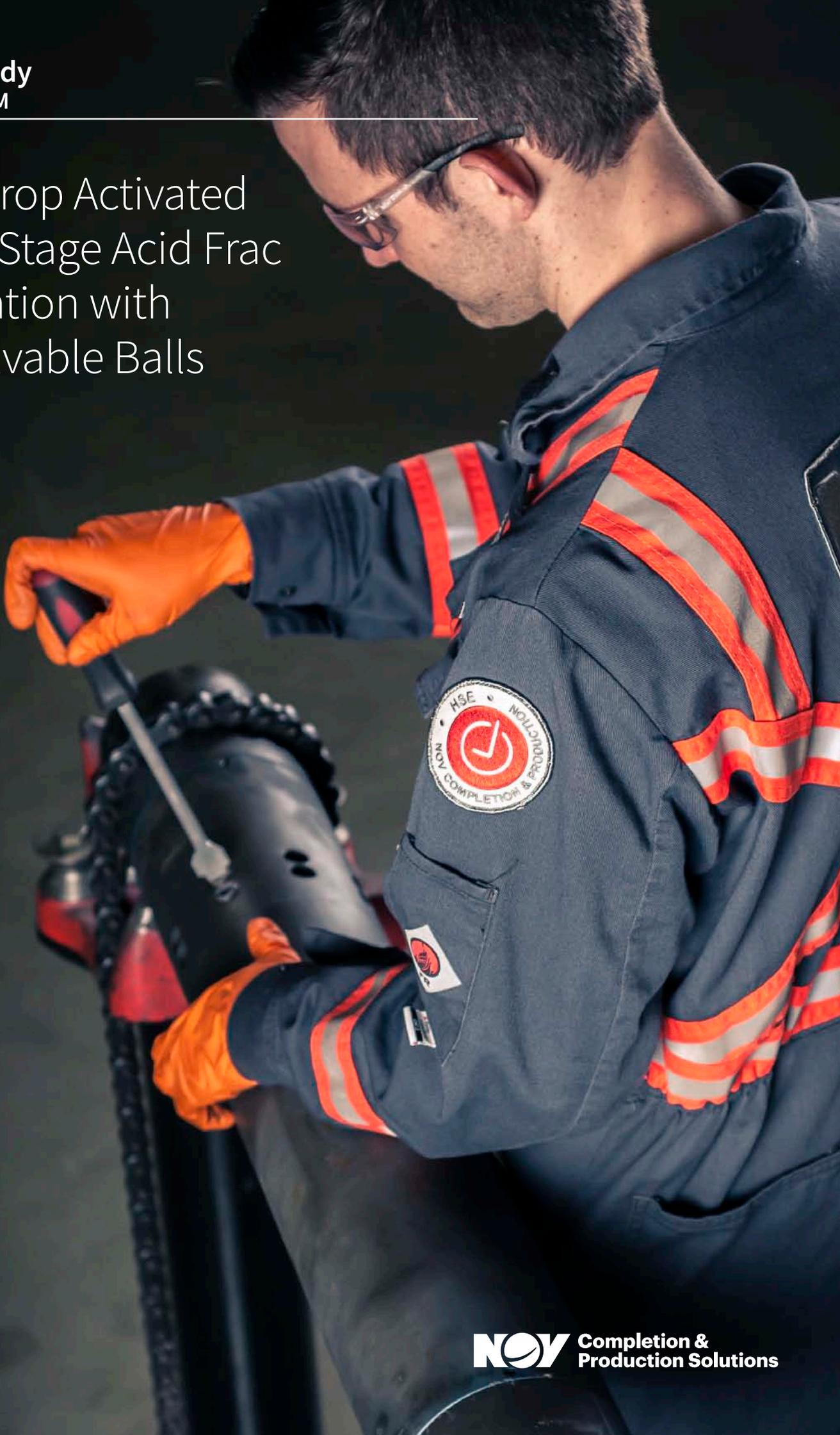


Case Study
i-Frac™ CEM

Ball Drop Activated
Multi-Stage Acid Frac
Operation with
Dissolvable Balls



i-Frac™ CEM

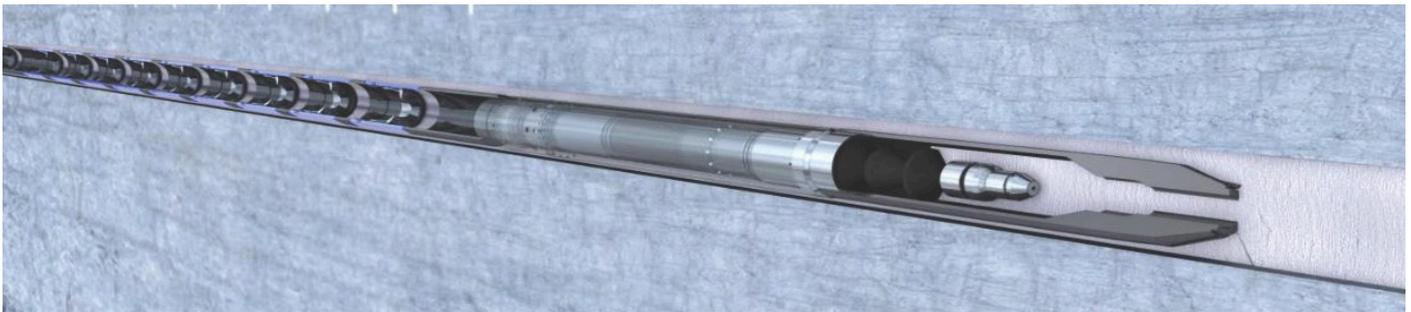
A 2,100 meters multi-stage frac job was planned together with a major operator on the Norwegian Continental Shelf using the i-Frac 400 OC CEM frac sleeves. The OC (open/close) functionality enables the operator to close the sleeves at a later stage with an intervention shifting tool shutting off water and/or crossflow etc. The possibility to adjust the frac port size proved useful for the design engineers when designing the frac for a reservoir with varying layer thickness.

The initial option was to run an open-hole completion with swell packers for zonal isolation, with a contingency to run the reservoir completion as a cemented liner if required due to challenging hole-conditions. Drilling proved to be a challenge and decision was made to cement the liner with a reduction from eight to five frac stages with the following setup:

Stage one: four sleeves per stage - 2.250" OD activation ball
Stage two: five sleeves per stage - 2.375" OD activation ball
Stage three: four sleeves per stage - 2.500" OD activation ball
Stage four: four sleeves per stage - 2.625" OD activation ball
Stage five: four sleeves per stage - 2.750" OD activation ball

The liner was cemented and the wiper dart bumped after having passed all sleeves without any problems. The first i-Frac stage was opened with a ball nose tool, and an impact hammer tool, the i-Stroke, to initiate an injection point for displacement of frac balls for later stages. Due to problems getting the liner to TD, space out was a little off so decision was made not to open stage five as it was too close to previous liner shoe. All stages were fracked successfully using a built-for-purpose frac boat. There were good indications of when the zones were opened and ready to frac, with good zonal isolation from already stimulated stages below. The balls used to open the frac sleeves during this operation was made of a material providing initial strength to open the sleeves and perform the stimulation. The balls are also degradable, meaning that they will dissolve over time eliminating the need for mill-out.

Another success story for the i-Frac system.



Case Study Snapshot

Challenge:

- Complete a staged acid frac job using time efficient methods
- Remove the need for plug and perf
- Remove the need for mill-out after completion

Solution:

- Design the completion using cementable ball drop activated frac sleeves
- Utilize dissolvable frac balls to remove coil tubing mill-out

Result:

- Successfully performed staged acid frac job with good indication of zonal isolation between stages
- No problems breaking through cement to initiate fractures
- Production exceeded operators Expectations

“We just did about a week’s worth of work in 24 hours, so that is definitely a success.”

Stimulation Engineer with Operating Company
