EGPC

AGIBA

Petroleum Company

Ministry of Petroleum & Mineral Resources

Maximizing Well Productivity Index by Combining Perforating Techniques and Artificial Lift Completion Without Well Killing

Oct-2022

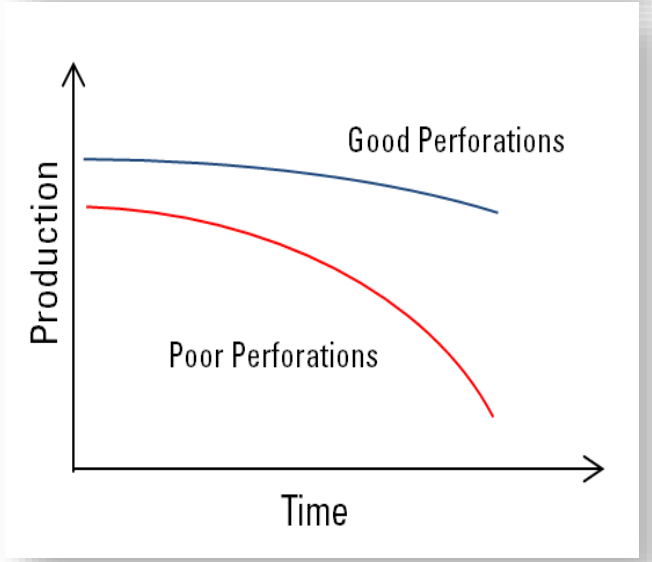
Agenda

- Introduction.
- System Component.
- Operation Concept.
- System Advantage
- Production Performance Evaluation (Case Study)

Introduction

Perforating For Productivity

- ✓ Connects well to reservoir
- ✓ 45 million shaped charges shot per year
- ✓ Perforating sub-optimal in 95% of operations
- ✓ 20% to 50% production lost
- ✓ Modern techniques unlock a reservoir's full potential



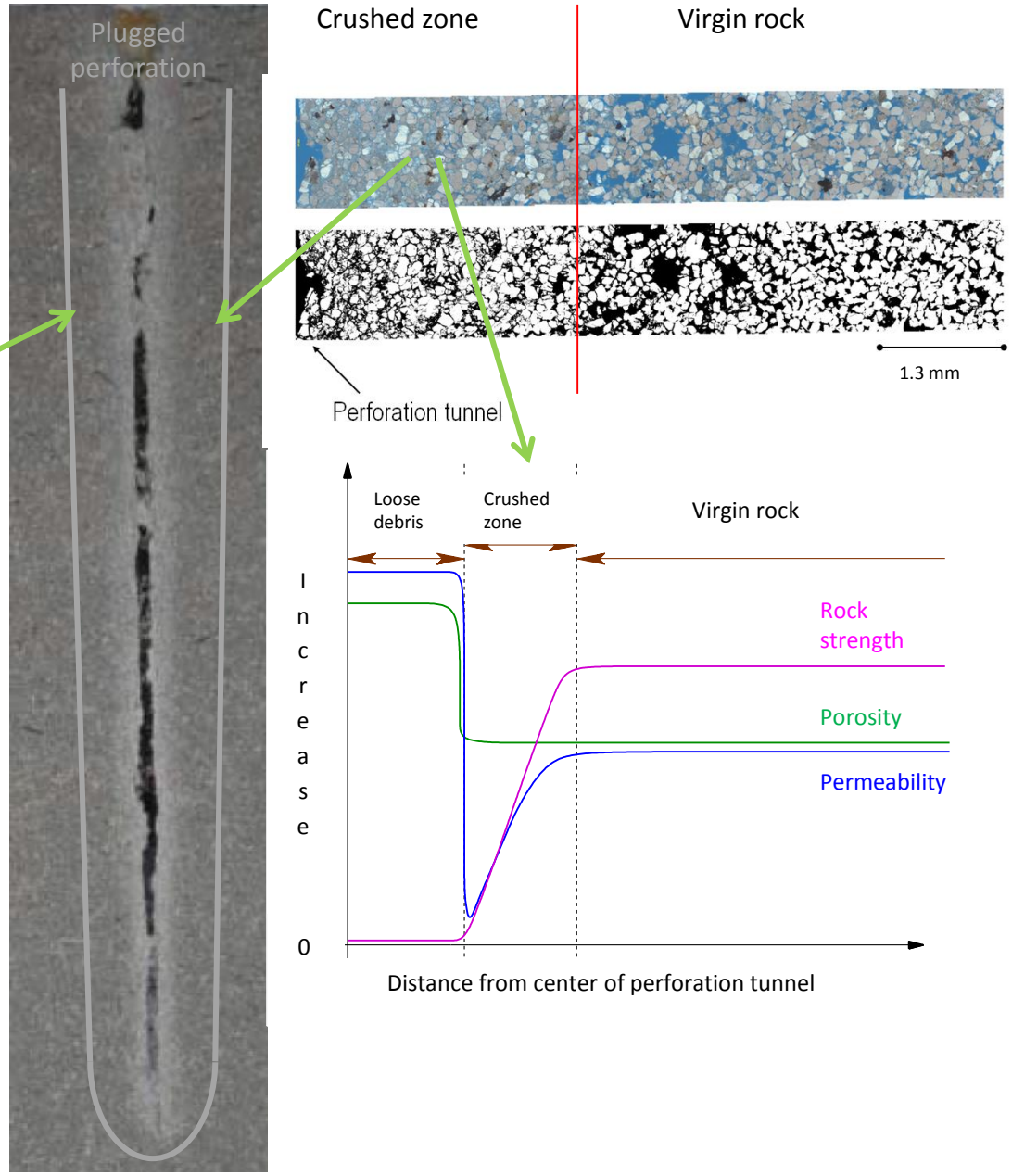
Obtaining Clean Perforations

Typical Perforation

Ideal Perforation

Crushed Zone

- Reduces production or injection
- Weaker than the virgin rock
- Removed by sharp drop in pressure during under balance perforation.

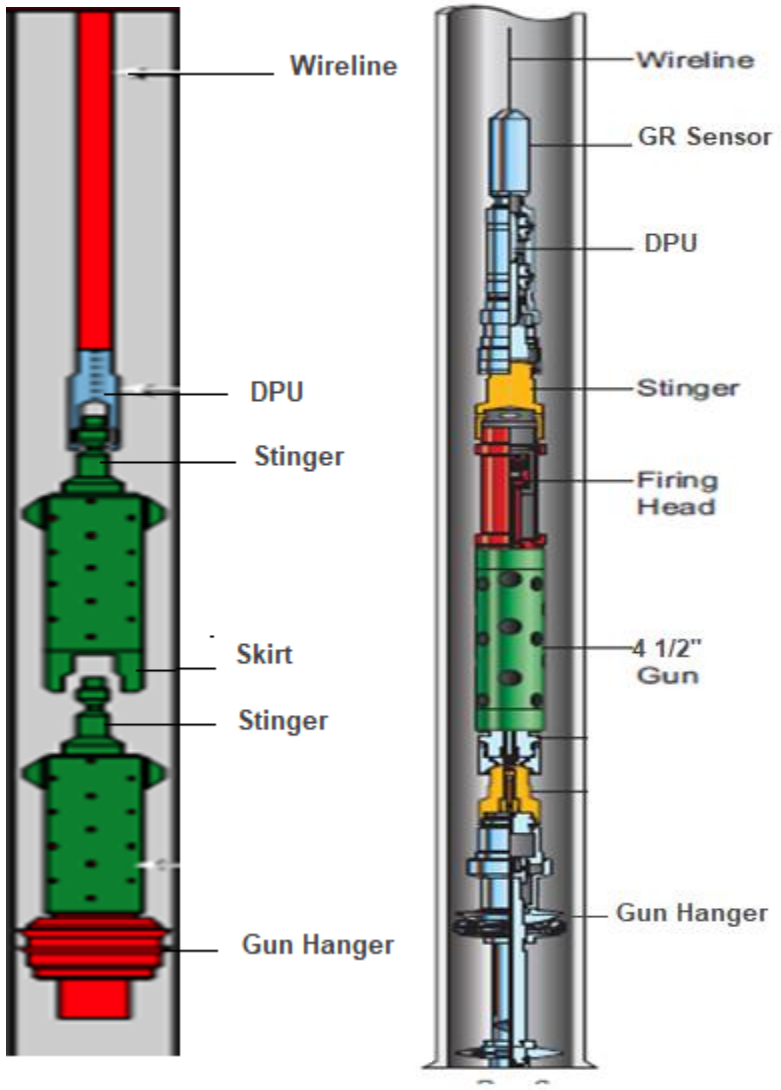


*SPE 122845 “New Fundamental Insights into Perforation Induced Formation Damage” Heiland presented in 2009

System Component

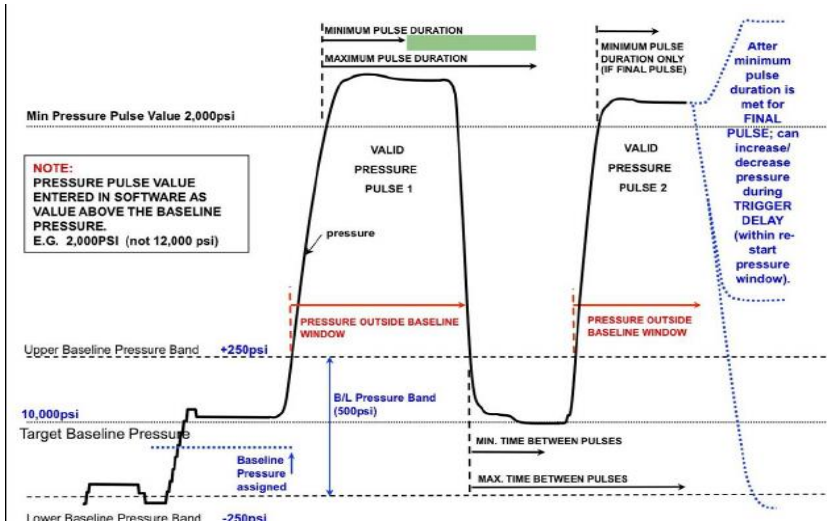
System Component

1. Electronic Firing Head.
2. Stinger & Skirt Assembly.
3. Automatic Release Gun Hanger.



Electronic Firing Head

- ✓ Safe firing mechanism cannot be initiated at surface.(time, pressure & temp. safety interlock … and unique pressure pulses).
- ✓ Lower actuating pressures help prevent damage to ESP Cable & Sensor.
- ✓ Programming flexibility can provide delay times from several minutes to hours or days and can be tailored to the operation time.(up to 36 hrs.).

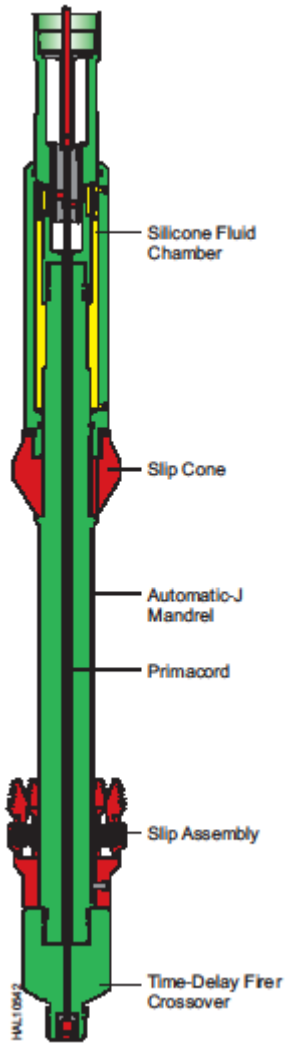


Automatic Release Gun Hanger

Used to hang gun assembly in place and it is designed to drop the assembly automatically after gun activation for any future intervention.

OPERATIONS

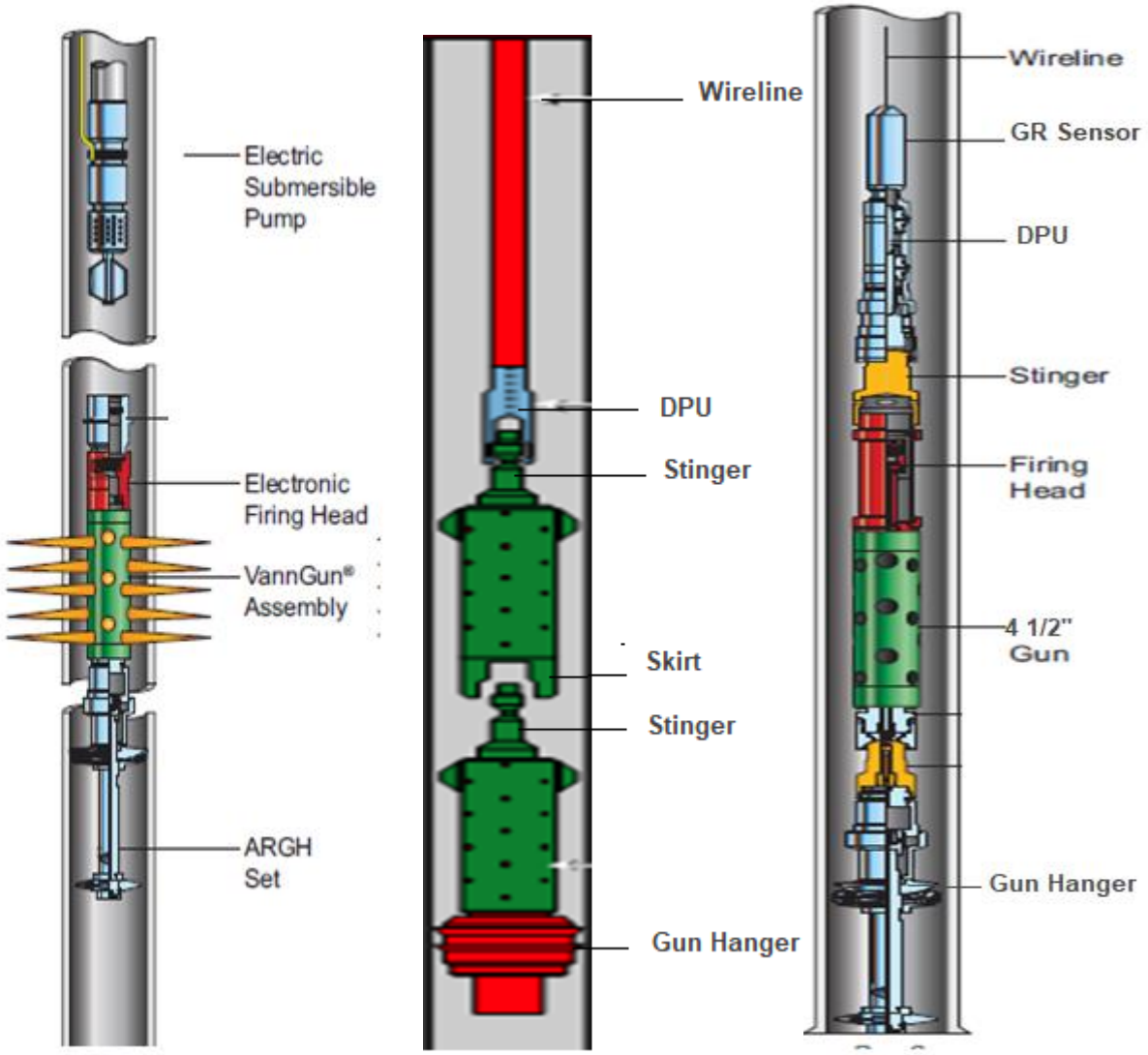
- ✓ Can be Run on Wireline, CT and Slickline.
- ✓ Rotation is Not Required to set the Hanger.
- ✓ Upward & Downward manipulation either sets or Unsets the Hanger.
- ✓ Can be run with conjunction with the Guns. QTY of Guns depend on Cable and Hanger strengths.



Operation Concept

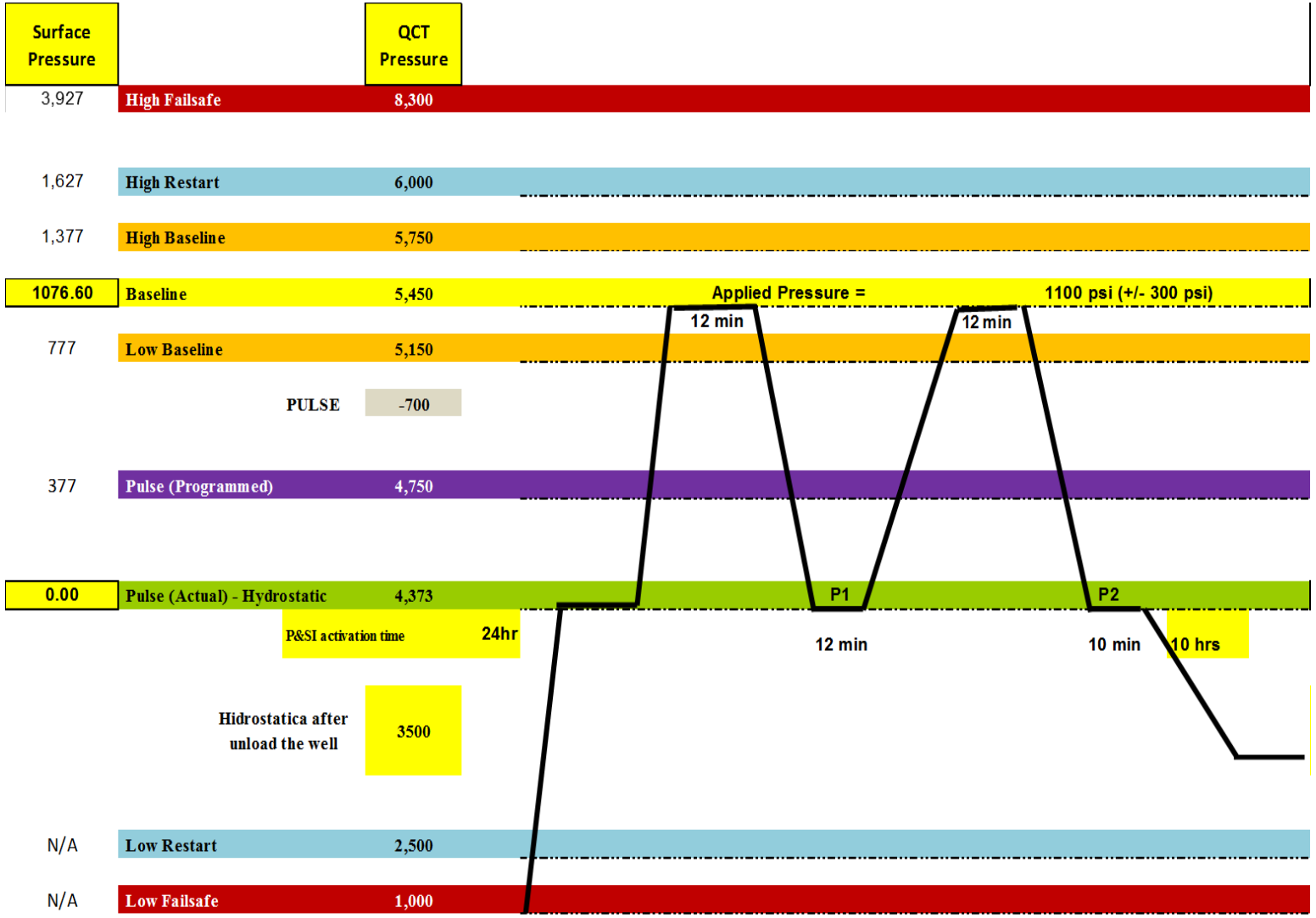
Operation Concept

- The Auto Release Gun hanger with TCP guns are deployed in well using E-Line (First Run).
- Make correlation pass through E-line GR Tool.
- The Auto Release gun hanger with TCP guns are set on depth with an easy mechanical mechanism.
- Release E-Line string from TCP assy. Using DPU then POOH.
- The second set of Guns are deployed in well using E-Line then stacked over the first set in the well.
- Release E-Line string from TCP assy. Using DPU then POOH.
- Run in hole normally with the ESP and complete surface installation.



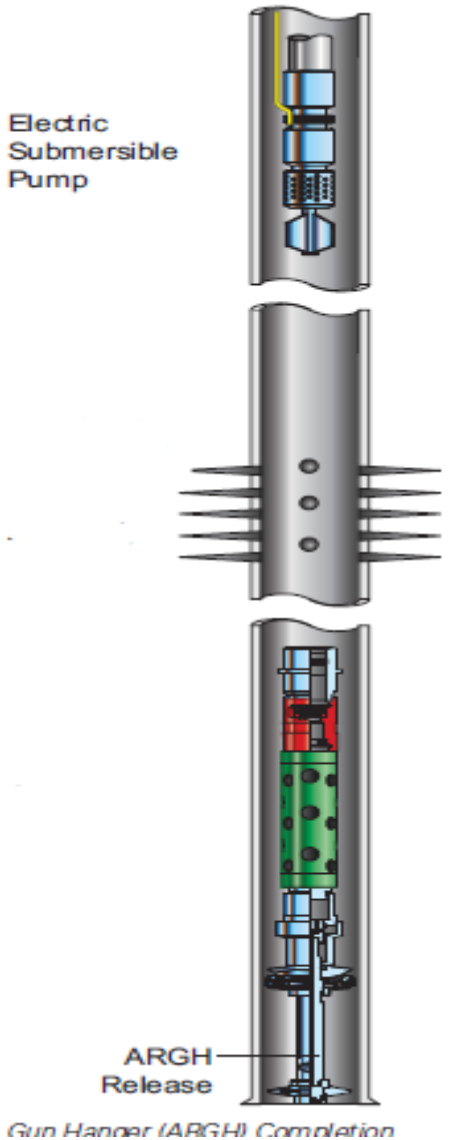
Operation Concept

- Activate the electronic firing head with unique surface pressure pulses.
- Electronic Firing head after activation provides a flexible programmable time delay sufficient to unload the well from completion fluid using the ESP to the desired fluid level required to create the underbalance.



Operation Concept

- After the time delay is elapsed the guns are fired and The assembly is then automatically released to the bottom of the well.
- Start the production after the perforation.



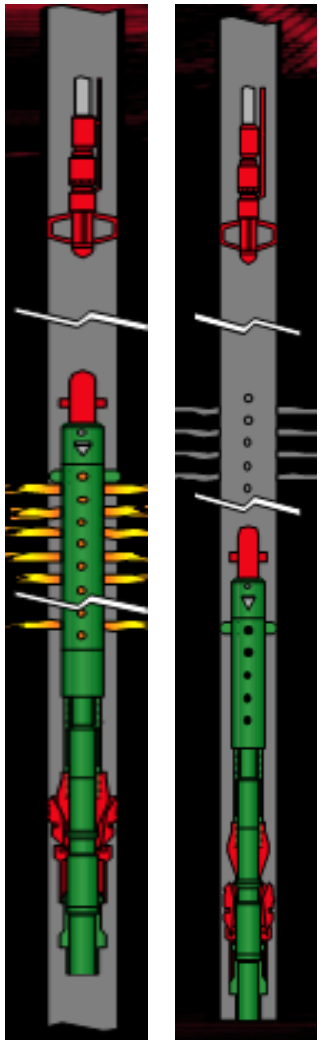
Gun Hanger (ARGH) Completion

System Advantages

Gun Hanger Perforating System

➢ Advantages

- ✓ Allows the well to be perforated underbalance while continuing production thought ESP.
- ✓ No mechanical shock transmitted from the guns to the pump
- ✓ No tubing required between guns and completion.
- ✓ Less rat hole required.
- ✓ No Slick line work required to drop assembly.
- ✓ less makeup space.
- ✓ Additional perforations can be added through the tubing at a later date.
- ✓ No restrictions left in casing below the packer.
- ✓ Eliminate shock on Packer and completion assembly.



Production Performance Evaluation (Case Study)

Production Performance Evaluation

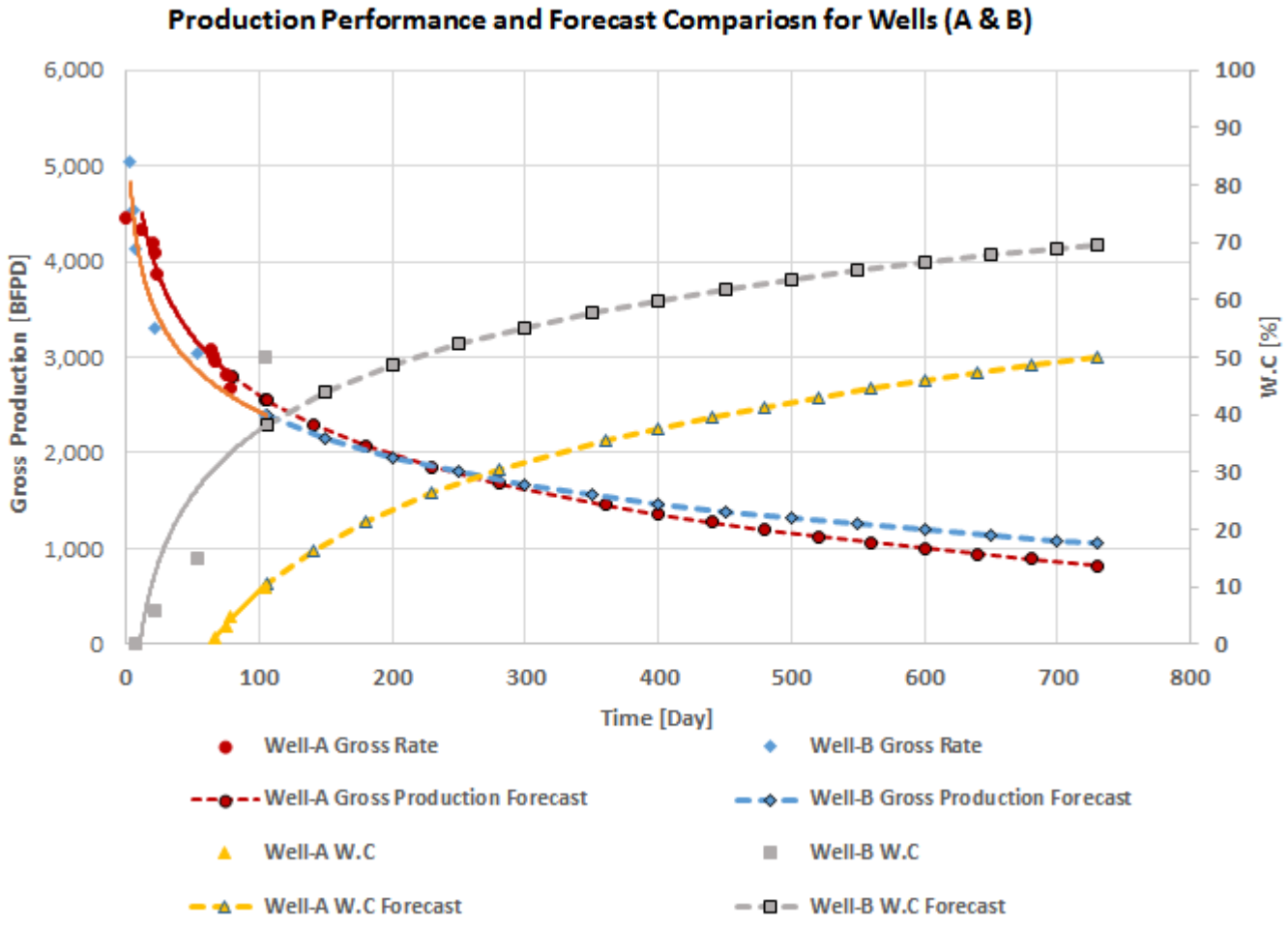
- ✓ A comparison between TCP gun hanger outcomes to the conventional perforation method
- ✓ Productivity index was chosen as a key performance indicator.
- ✓ Well-A Perforated using gun hanger perforating system.
- ✓ Well-B was chosen for comparison since it was perforated using casing gun and it is an excellent candidate for comparison.
- ✓ The results shows that, Well-A has a productivity index of 2.5 compared to 1.5 only for Well-B.
- ✓ The improvement in productivity index equals 66%.

Petrophysical Parameters for Wells (A & B)

Parameter	Well-A	Well-B	Comparison
Reservoir Pressure [psi]	6450 (44.5 MPa)	6750 (46.5 MPa)	
Reservoir Temperature [˚F]	287 (177.2 ˚C)	287 (177.2 ˚C)	
Net Pay [ft]	74 (22.6 m)	104 (31.7 m)	140.5%
Average Mobility [mD/c.P.]	2.25	18.0	800.0%

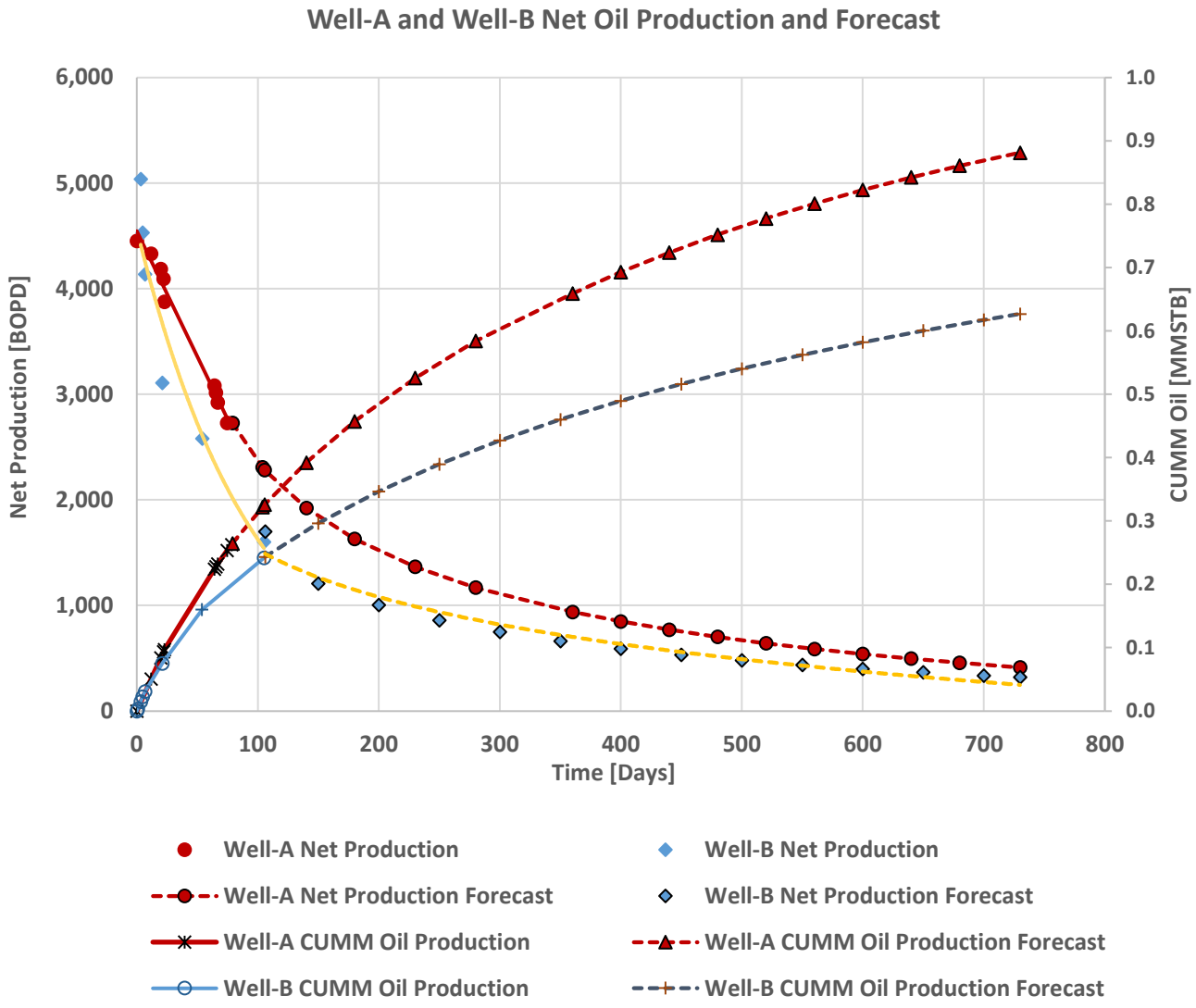
Production Performance Evaluation

- The reduction in drawdown during Well-A production reflected directly on:
- ✓ water cut increasing trend by reduction of water coning effect.
- ✓ Reduce abandoned pressure.



Production Performance Evaluation

- ✓ The reduction of water cut increasing trend in addition to abandoned pressure reduction of Well-A increases cumulative oil production from Well-A by 40% during same production period compare to Well-B.



Thanks
Any Questions?