INDUSTRIJA NAFTE, d.d.

SD NAFTAPLIN
Sektor istraživanja i
proizvodnje NIP za JIE

Successful work-over activities in function of safety and enhanced productivity at Deep Podravina wells: Stari Gradac-3, Kalinovac-8, Kalinovac-19 and Stari Gradac-6

septembre 2011 / V. Tišljar

SUMMARY

- presentation of succesful workovers on the wells :
  - StG-3 (May - August 2010)
  - Kal-8 (December – January 2010)
  - Kal-19 (November 2009)
  - StG-6 (December 2010)
- significance of the formation protection
- isolation of flooded intervals
- new interval perforating
- production increasing in Deep Podravina district

DEEP PODRAVINA PRODUCTION FIELDS

- MOLVE
- KALINOVAC
- STARI GRADAC
- GOLA DUBOKA

Contents of acid gases:

CO_2 ~ 10% - 56%

H_2S ~ 100 – 1000ppm

Hg, RSH, Cl^-

high P, high T

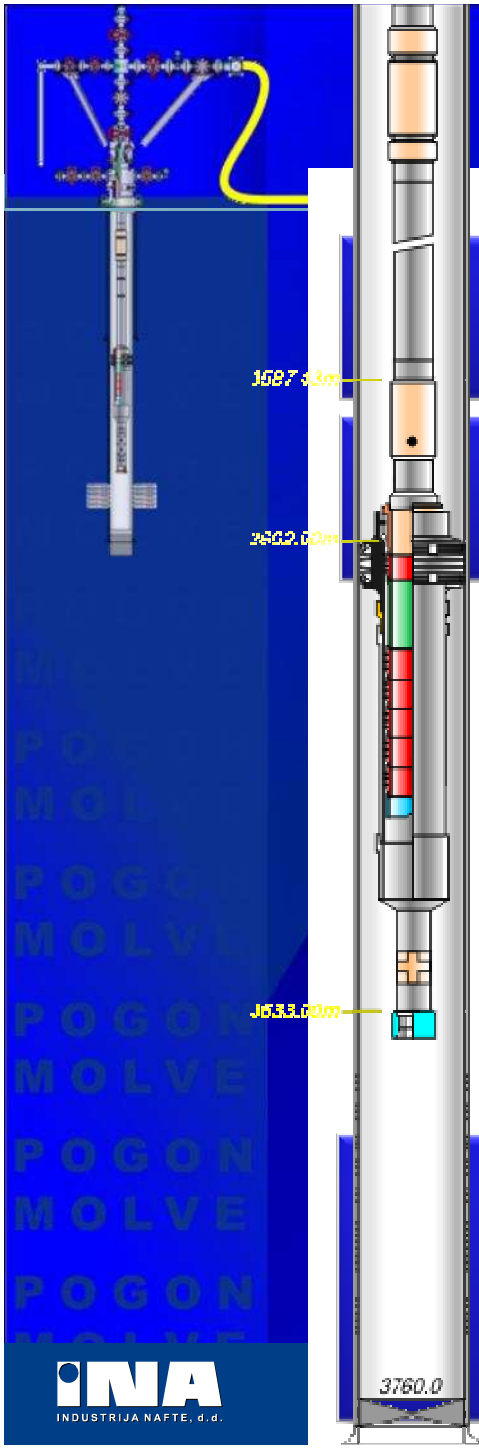
COROSIVE CONDITIONS

PRODUCTION EQUIPMENT:

Tubing 13%Cr – 25%Cr, SSSV, SD, seal units, permanent packer with seal bore extension …

Production casing – packer fluid with pressure control

StG-3 WORKOVER – WELL SAFETY

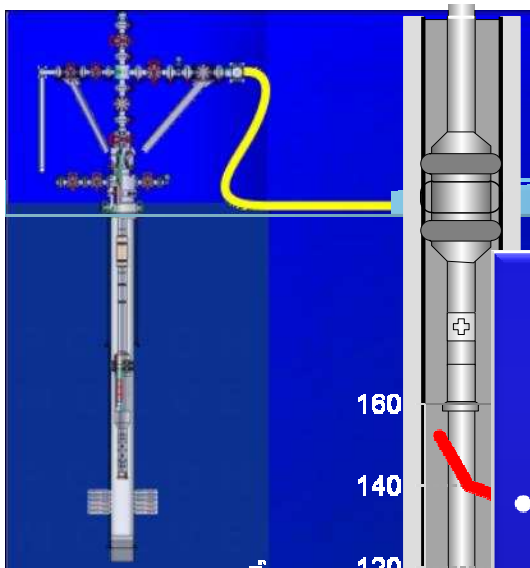


BRINGING WELL INTO PRODUCTION

- well
- wate
- slidi
- N_2 ~
- well
- clea

STSI ~ 2,2 x 10^6 kn
duration 56 days

Kal-8

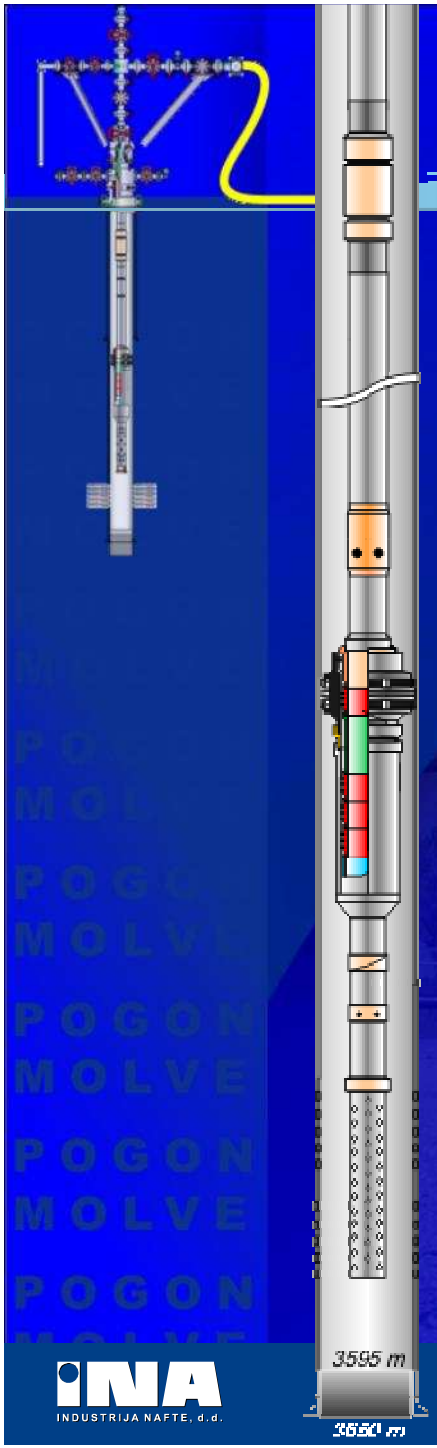


DETAILED WELL ANALYSIS

- Geological survey report: DST
- EPILOG, PL, CBL, EK – diagrams
- HD measurements – interpretation
- Analisys of possibilities and ways of perforating
- System analysis IPR – VLP of future production

Price ~ 5 400 000 kn
Duration 30 days
ROP ~ 35 days

Kal-19 BEFORE CHEMICAL TREATMENT



Before:

Pt = 65 bar

Qg = 41000 m^3/d

Qc = 19 m^3/d

Qv = 2 m^3/d

Sal.= 0,233 g/l

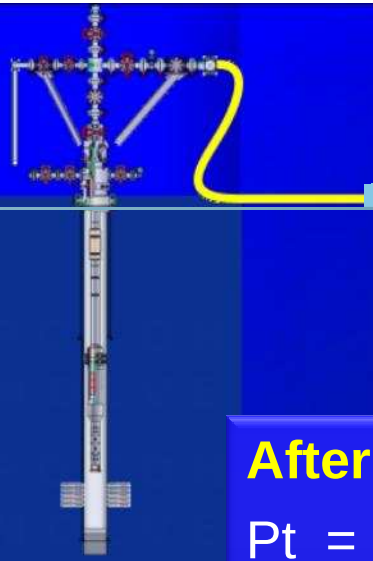
SKIN ~ 63

Δp_{SKIN} ~ 110 bar

Kal-19 BEFORE CHEMICAL TREATMENT

Acid washing tubing – CT
1+1,4 m^3; 7,5% $HCl+N_2$

Acidizing job – bull-head
2+2+2 m^3; 7,5% $HCl+N_2$



Kal-19 AFTER CHEMICAL TREATMENT

After:

Pt = 140 bar

Qg = 98700 m^3/d

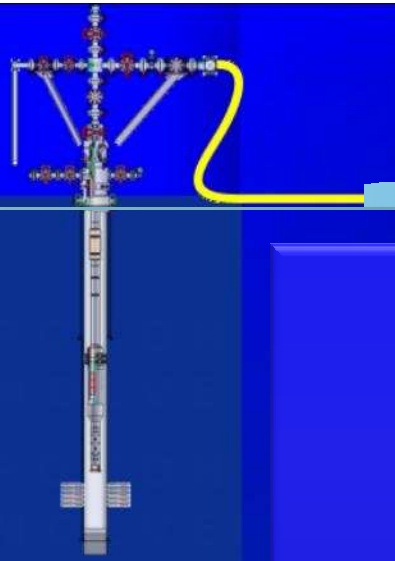
Qc = 33,6 m^3/d

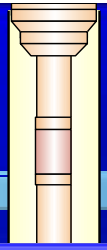
Qv = 6,4 m^3/d

Sal.= 1,75 g/l

- **CAPEX: 910 345 HRK**
- **NPV: 115,8 MHRK**
- **Profitability: 96,68 HRK/HRK**

ROI ~ 8 days



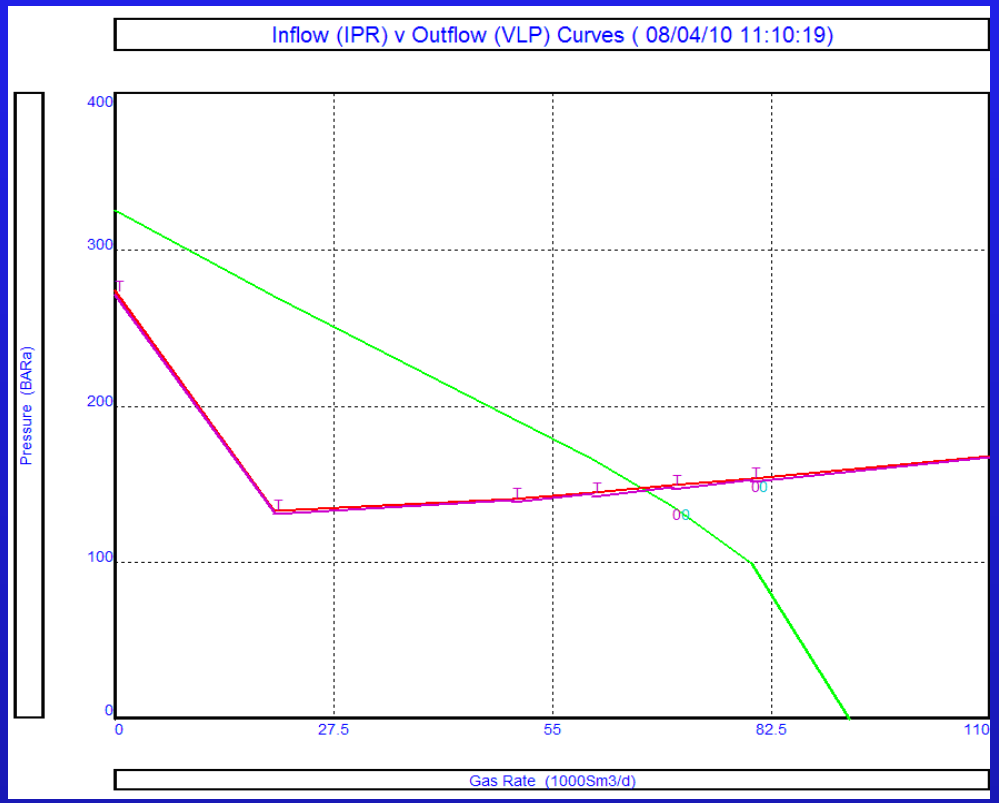


StG-6

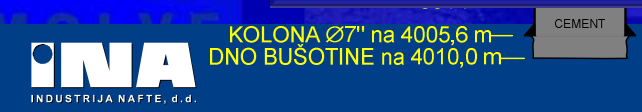
EXPECTED PRODUCTION

Skin = 12.2 (skin removed 75 %)

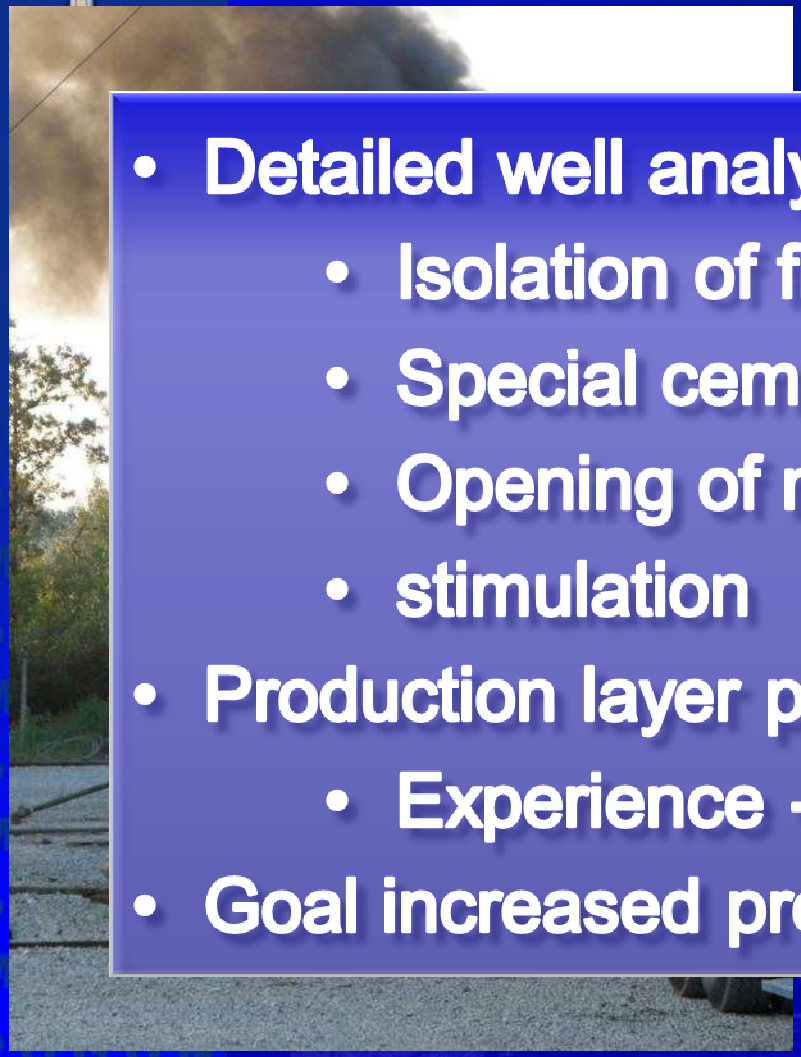
p_t= 68 bar, Q_g = 66 066 m^3/d



SCALE DETECTI



CONCLUSION



- Detailed well analysis
  - Isolation of flooded interval
  - Special cementing procedure
  - Opening of new production interval
  - stimulation
- Production layer protection
  - Experience - $CaCO_3$
- Goal increased production

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