Gas Well Dewatering
Efforts in OMV-Petrom Fields, Romania

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BACKGROUND

OMV-PETROM GAS WELL DEWATERING

- OMV-Petrom is the largest Producer of Oil and Gas in South Eastern Europe having approximately 7800 Oil Wells and 650 Gas Wells

- In 2007 OMV-Petrom started with its first Gas Dewatering installations

- Over the last 5 years, the Gas Well Dewatering (G.W.D.) Activity has evolved into an accepted process in OMV Petrom including many Dewatering Methods
WELL EVALUATION - OBJECTIVES

► The main purpose of the evaluation is to determine the optimum lift type and uplift potential

► The recommended system is selected based on:
  ► IPR curve
  ► Turner Unloading Velocity
  ► Choke Size Evaluation
  ► Re-sizing Tubing String
The IPR curve is plotted to determine the well flow potential.
WellFlo/Prosper nodal analysis program is run to determine/confirm the liquid loading situation in well Turner Unloading Velocity.
The choke size is evaluated to determine if by increasing it, the well will be able to unload by itself.
**WELL EVALUATION**

**- TUBING SIZE/VELOCITY STRING EVALUATION**

Tubing size is evaluated to see if by decreasing the flow area the well will flow above critical point.

**Gas Velocity for Qg=25,000Sm3/day on 3-1/2"; 2-7/8" and 2-3/8" tubing sizes**

**Critical Velocity on 3-1/2"; 2-7/8" and 2-3/8" tubing sizes**

▶ Tubing size is evaluated to see if by decreasing the flow area the well will flow above critical point.
Pressure losses due to friction are also considered in selecting the best dewatering system.
For 2007 to 2010, over 136 gas wells were installed:

- Foam injection in the annulus
- Capillary injection inside or outside the tubing
- Soap Stick Treatment
- Plunger Lift

Gas production increased with approximately 450,000–455,000 Sm3/day (an average of 3,000–3,500 Sm3/day/well equipped)
ACTIVITY OVERVIEW 2011-2012
(CLASSICAL & NEW METHODS)

► From 2011 to 2012, additional 66 gas wells were included in the Dewatering project
► New methods were applied for Gas Well Dewatering:
  ► A. Gas lift optimization with Plunger Lift
  ► B. Condensate Foamers
  ► C. Wellhead Compressor
► By using Dewatering technologies an increased gas production of approximately 195,000-200,000 Sm3/day has been achieved
(an average of 3,000-3,300 Sm3/day/well installed)
PRODUCTION INCREASE OBTAINED FROM THE WELLS INSTALLED IN 2011-2012

Overall results for the wells installed in 2011-2012

- Period of design
- Period of equipping

Gas Production [kSm³/day]


Gas Production Before — Gas Production After

PETROM
Member of GMV Group
A. GAS LIFT WELL OPTIMIZED WITH PLUNGER LIFT

- Design evaluation for Candidate Selection:
  - By using Foss and Gaul method, were determined:
    - Casing required pressure
    - Necessary minimum FBHP
    - Max no. of plunger cycles/day
    - Used gas/excess gas
    - Liquid slug/cycle

- Results after plunger installation:
  - No mechanical de-waxing
  - Increase in production by 25%
  - Injection of gas only at pressure build up
B. CONDENSATE FOAMER

- The foam quality and foaming efficiency is influenced by the condensate cut

- Over 30 wells with different condensate cuts were equipped with condensate foamers

- The increase in production achieved was approximately 95,000-100,000 Sm3/day (an average of 3,000-3,300 Sm3/day/well equipped)
C. WELLHEAD COMPRESSION

Principles of Wellhead Compression:

- Increase the flow of oil and gas from the reservoir into the well-bore by decreasing wellhead (and bottom-hole) pressure
- Reduce liquid loading and increase gas rate

Criteria for selecting candidate gas wells:

- Discharge pressure: max. 31 bar
- Suction pressure: max. 4,2 bar
- Gas rate: max. 20.000 Scm/day
- Gas consumption: 200 Scm/day
- Dimensions: length - 5,31 m, width - 2,18 m
- European certificates: ATEX, PED, CE
WELLHEAD COMPRESSOR - PILOT PHASE

Results of Gas Well Dewatering test

- Number of wells tested: 7
- Additional cumulative production/12 months:
  - Gas production: approximately 5.100 th. Scm
  - Condensate: 370 to
- Payback time: approximately six months

![Graph showing additional production from well head compressors]

- Condensate prod. cumulative, tone
- Rental cost/ th. Euro/ mth/ two units
- Gas prod. cumulative, th. Scm

Extension wellhead applications
WELL EVALUATION EXAMPLE
- INFLOW PERFORMANCE

Results of test:
- Gas rate before test: 6,000 Scm/day
- Gas rate after test: 22,000 Scm/day
WELLHEAD COMPRESSOR

- EXTENSION OF APPLICATIONS

- Unloading liquid using “Backside auto injection system”
- Decrease the pressure in gas park
- Aspiration of fluid from tubing and discharge over flowline pressure
- Recover the gas from annulus of a group of oil well
- Recover the flare gas
WELLHEAD COMPRESSOR
- RESULTS OF NEW APPLICATIONS

► Application 1 :
  ► Decrease the pressure in gas park

► Application 2 :
  ► Gas recovery from annulus of a group of oil wells

► Application 3 :
  ► Aspiration of fluid from tubing and discharge over flowline pressure

► Application 4 :
  ► Flare gas recovery
WELLHEAD COMPRESSOR
- EVALUATION OF BACKSIDE AUTO INJECTION

 ► Inflow performance

**IPR plot MultiRate C and n (17/08/2012 - 13:47:37)**

- **AOF:** 16.109 (1000m³/d)
- **C:** 17.7007 (BHP/day/bbl)
- **N:** 0.50816

Inflow Type: Single Interval
Completion: Cored Hole
Sand Control: None
Gas Comping: None
Reservoir Model: MultiRate C and n
Compaction/Kinematic Reduction Model: No
Absolute Open Flow (AOF): 16.109 (1000m³/d)
Reservoir Pressure: 36.50 (BHP)
Reservoir Temperature: 60.00 (°F/C)
Water-Cut Rate: 0.0000 (m³/m³)
Condensate Gas Ratio: 0 (m³/m³)
Rate: 1.500 (1000m³/d)
Pressure: 34.50 (BHP)

Discharge: N/C
Inlet: N/C
Between 2007-2012, more than 202 wells have been equipped with dewatering methods:

- 38 capillary technology
- 97 foam injection in the annulus
- 29 soap stick treatment
- 6 plunger lift
- 13 wellhead compression
- 19 choke re-sizing

Total increase of production was between 645,000-655,000 Sm³/day with an average of 3,000-3,500 Sm³/day/well installed.
**CONCLUSIONS**

- Application of dewatering methods results in gas well production increase of up to 21%.

- The success is based on careful well selection and good cooperation between Petrom and Service Companies.

- Based on the good results obtained, we will endeavor to increase the number of proven applications and continue testing new dewatering methods:
  - Extension of Wellhead Compression
  - Gaslift assisted with Plunger Lift
  - Different types of condensate foamers
  - Hydraulic pump for GWD
Thank you!