

College using pump ·
capillary string ·
intermitting



**ASSIGN
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College of

Petroleum Engineering and Geoscience

Petroleum

Engineering Department

Well Completion

- PETE (302)

Enhanced Gas Well Extraction:

Using Combined System of Foam & Gas Lift

Term 171 Project

By

Mohammed Subahi

ID: 201505390

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Instructor/ Dr. RAHUL GAJBHIYE

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Abstract

Liquid droplets that load in gas wells cause several serious issues. To solve these problems, different lifting method were developed. Lifting system

that are used now for horizontal gas well were originally developed for oil wells. Moreover, this research is targeted mainly toward gas well deliquification

(remove liquid from wellbore or dewatering).

Introduction

In natural gas well, the produced gas particles are attached to a load of liquid droplets (oil condensate or water). Moreover, the produced gas can lift liquid droplets to the surface at the early age of the production when the gas pressure is high enough to provide such critical velocity to carry the liquid to surface.

After period of production when the well become mature, an amount of liquid that present inside the tubing along with gas produced result in disperse within gas that drag gas flow downward by gravity. Therefore, gas velocity falls and leads to extra decreases in extracted liquid volume that cause accumulation which rise the burden of the ability to carry up liquid droplets, which lead to gather more liquid and extra builds up accumulation of liquid that cause a reduction or complete stop of the gas production.

Objective

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To discuss the improvement in deliquification.

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To discuss new design method.

Methodology

I collected the data for a research in Well completion course that is about summarizing some latest improvement in the field. Moreover, I collected data using OnePetro website from different journals and SPE papers.

Discussion

Gas well deliquification or gas well dewatering is a method of completion that used to get rid of liquid (oil condensate or water) that occur with gas during production from gas well. To deliquefy liquid in well, there are different possible solutions such as:

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Natural flow.

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Removing hydrostatic barrier using pump

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Capillary string

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Intermitting (cease the production for a time)

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Rocking

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Equalizing

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Venting

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Soaping

·

Velocity string

·

Compression

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Gas lift

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Beam lift

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Plunger lift

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Foam lift

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ESP and HSP

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PCP

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Diaphragm pump

.

Jet pup

In this research we will focus on foamer injection that is used to increase gas production. The foam performance depends on different parameters such as pressure, temperature, hydrocarbon fraction, and foamer agitation velocity. In addition, Foam Assisted Gas Lift may be used and it is considered

to be

an economical choice due to its increased gas production rate and it requires less injected gas. There are three types of tests that applies on foam

to test its performance that are:

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Foam buildup test

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Collapse test

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Liquid carryover test

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In addition to that there are system consideration such as:

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Cost of production and
amount of pay

·

Solution life

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CO₂ and H₂S corrosion

·

Acid resistant

·

Amount of water and the
ability to control it

·

The cause of condensation

·

The depth of condensation

·

Safety valve

·

The power required

.

The costs and risks of
workover

The gas velocity is affected by the design of the well bore (such as sudden expansion/contraction). Moreover, the gas condensate is affected by the
rate of production

Slower velocity => poorer lift => longer transit time => more
heat loss => water condensate.

Some of the methods are depend on recharging the well from near
formation

Recharging from low permeability zones to higher permeable zone

Method such as:

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High permeability streaks

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Natural fracture

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Stimulated fractures

Liquid behavior is affected by the deviation of the well. Where in the vertical well, all the liquid droplets are lifted by flowing gas. However, in a

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deviated well, a separation is possible due gravity where liquid droplets will be accumulating down hole

A. Gas Lift

The method of gas lift is used to improve the production rate and to deliquesce the gas well as an artificial lift technique by decreasing the hydrostatic pressure of the liquid. This method is applied by injecting high pressure gas in the well pipe through valves on the annulus string.

B. Foam Assisted Lift

Foam assisted lift is a new technique that is used to dewater the gas well by decreasing the liquid surface tension and its density. This method depends on injecting soap from surface in the tubing through capillary string.

Moreover, the system components are:

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Capillary

soap

.

Stainless

steel capillary string

.

Foot valve

(soap injection valve)

.

Capillary

hanger

.

Soap pump

.

Soap tank

And

the systematic process is:

C. Foam Assisted Gas Lift

It

hybrid technique that use both Gas lift and Foam assisted lift to improve the effectiveness of the two methods by injecting soap and gas. In other words, the

soap is increasing the liquid column and the injected gas energize the flow.

This method is most effective when:

.

The well

flow is very low, and much liquid was accumulated

.

The liquid

column is lower than gas valve.

D. The study case

This is an example of natural flow gas well that has been completed three times after depletion:

i.

Natural

Flow

The cumulative production after perforation of Sand Y is around 18 MMMCF and around 1 MMSCFD initially that is increasing with time and loads in the tubing. After 8 years of production, the flow rate of gas fall to 1 MMSCF per day and the Water-Gas ratio was 300 STB/MMSCF. Therefore, Sand Z was perforated

to comminglally produce around 7 MMSCFD. Moreover, wellhead gas compression

systems was applied for 10 years to rise flow up to 12 MMSCFD and 30STBMMSCF of

Water-Gas ratio. In 2011, the was depleted due to loss of energy to flow the gas with around 57% recovery rate.

ii.

Gas

Lift

The Gas lift system was introduced in M-1 well in 2012 to deliquefy the gas well by inject 0. 4 MMSCFD of gas the produced around 1. 7 MMSCFD

and 225

STBD of water. Shortly, the gas flow dropped to 1. 2 MMSCFD with larger Water-Gas ratio that show liquid droplets are loading in the tubing. After 6 Months, Gas lift system has produced only 1. 6 BCF that is 2. 4 % recovery.

iii.

Foam

Assisted Lift

After Gas lift system was suspended, a Foam assisted lift was introduced in the gas well. Soap was injected close to the perforation using capillary string. In the beginning of injection, Soap was injected at rate of a half-gallon per day and raised gradually to a rate of 5 gallons per day that result in 1. 5 MMSCFD of gas. However, any further increment of injected soap

leads to drop in the production rate. After three months, a liquid droplets load occurs and requires gas lift to provide sufficient energy to flow the gas well. Therefore, new lifting system were introduced in the well. One of limitation of foam that is affected by temperature.

iv.

Foam

Assisted Gas Lift

After 5 months in 2013, a combined system of Gas lift and Foam assisted lift was applied to dissolve the liquid loading of the gas well. In fact, it was a challenge to determine the optimum rate of soap and gas injection rate at

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that time because there were no standard values for this combined system. Therefore, several trial and error were applied and the best values for M1 well were 2 Gallon per day of soap and 0.3 MMSCFD of injected gas. After 21 days of instable production, the production stabilizes at 1.3 MMSCFD with 300 BBL of water per day.

Conclusion

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It is advantageous to use a combined system of Gas lift and Foam assisted lift that optimize production rate of gas well and overcomes limitation of two methods alone.

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Soap injection has an optimum rate; any variation affects the production negatively.

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High temperature reduce the effectiveness of Foam performance.

References

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