PROCEEDINGS
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Increase gas production at shallow zone reservoir in PSU Area, North Sumatera

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Abstract

PSU Area is known as one of gas producer field in North Sumatera. One of the fields which supports in producing gas in PSU Area is DRO. DRO is an oil and gas field that is included in the North Sumatra Province managed by PT. Pertamina EP Asset 1. The surface location of DRO field is in the form of tidal swamp areas with mangrove plants. Gas production in PSU had decreased about 0.54 mmscfd in September 2016. Since October 2016, DRO Field has already contributed in increasing gas production in PSU area by producing gas in shallow zone reservoir. The reservoir is developed in some of the gas wells, for example, DRO-51, DRO-38, DRO-45, DRO-48, DRO-36. Gas production cumulative of the reservoir until the end of January 2019 is about 620.5 MMSCF. The problem encountered in developing this reservoir consists of liquid loading that restrains gas production of the well. The root causes of this problem are the matter of potential layer selection and bad cement bonding behind the production casing. The matter of layer selection occurred at well DRO-45, DRO-36, DRO-38 and bad cement bonding at well DRO-51, DRO-36, DRO-48, that result in wells-shut in. There are two solutions that given to the problem, the first one by doing remedial cementing to the bad cement bond layer that close to aquifer zone based on Cement Bond Log reading and the second one by perforating the selective potential reservoir based on high resistivity log and appropriate neutron porosity-density log reading. By doing these solutions, gas production is sustainable, and the lifetime of the wells increased.
Keywords: shallow zone, gas production, potential layer selection, bad cement bonding

Introduction

DRO Field, geographically, is located between latitude 445000 – 451000 and longitude 423200 – 433300, and situated within 95 km Northwest of Medan and 12 km Northeast of Pangkalan Brandan.

Up until now, some oil and gas production in DRO were obtained from reservoirs in zone 420 until 660. The reservoirs consist of sandstone layer take turns with shale stone are composed of quartz, clay mineral, mica, glauconite, and plagioclase. They are included in Keutapang Formation aged Late Miocene-Pliocene that are deposited in a deltaic transitional environment.

Keutapang Formation showed facies and deposition environment alteration that in the early depositional time, it showed target zones in the *channel sand bar system* and *distributary mouth bar*. Together with latter rock deposition, the depositional setting has changed to deltaic facies which is *marine dominated*. Keutapang Formation consists of shallow zones that produce gas in DRO.

DRO is an anticline structure that faces Northwest-Southeast and is separated by normal fault, becomes two compartments (center and south). Both compartments have been producing hydrocarbon.

DRO has been produced since 1930, but no data was found that could indicate the number or number of ratios because it was alleged that the data was lost during the Japanese occupation. The data of production, reservoirs, drilling, and production facilities from 1939 to 1978 has not been found. While the data between 1978 and 1995 are very limited, the data after 1995 are easy to access.

DRO Field has already contributed in increasing gas production in PSU area by producing gas in shallow zone reservoir. The reservoir is developed in some of the gas wells, for example, DRO-51, DRO-38, DRO-45, DRO-48, DRO-36. Gas production cumulative of the reservoir until the end of January 2019 is about 620.5 MMSCF. The problem encountered in developing this reservoir consists of liquid loading that restrains gas production of the well. The root causes of this problem are the matter of potential layer selection and bad

cement bonding behind the production casing. The matter of layer selection occurred at well DRO-45, DRO-36, DRO-38 and bad cement bonding at well DRO-51, DRO-36, DRO-48, that result in wells-shut in.

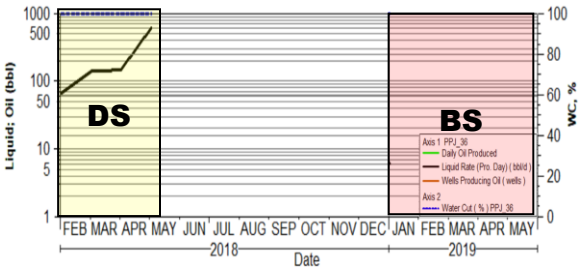
Liquid loading

Liquid loading occurs in one of the wells in DRO which is DRO-36. Based on its production profile, when the water rate rose, the gas production was also reduced. Therefore, the well shut-in because of the water shut-off.

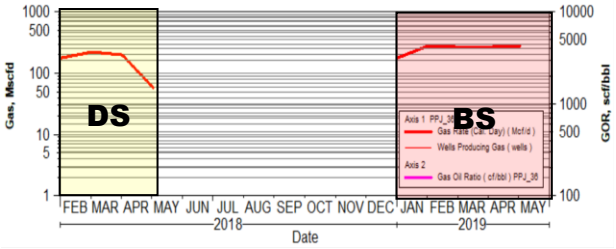
Potential layer selection

DRO-36 is used as an example in selecting the potential layer. In January 2018, gas was produced from layer DS. However, the production time period did not last long. This has caused the production of the layer only last from February to May 2018. The next step includes the application of selectin the potential layer by analyzing the gamma-ray, neutron, and density log. Based on the selection, a potential log was acquired: BS layer. After the production, BS layer produced dry gas (layer with no water production).
Below is the graphic which shows the fluid production from DS layer (before the potential layer selection) and BS layer (after the potential layer selection) from the DRO-36 well.

Liquid:

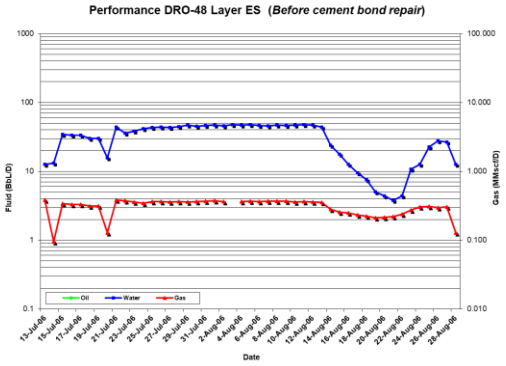


Gas:



Bad cement bonding

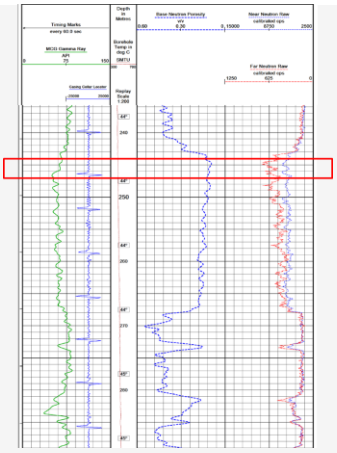
One of the well that which was affected by the bad cement bonding was DRO-48. This well produced gas from the layer ES in 2006. After some times of production period, the water also flows and the rate increased. Here is the production profile from the ES layer of the DRO-48 (before and after the cement repairment).



Result and Discussion

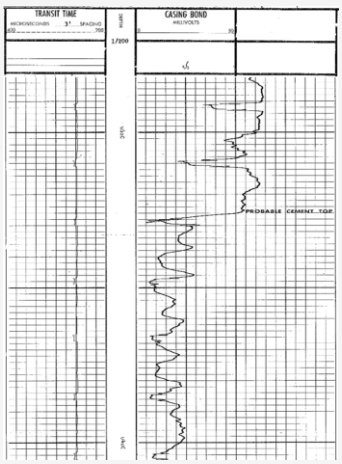
As for the liquid loading and the potential layer selection at the DRO-36 well, some solutions have been applied in the form of reservoir fluid analysis from neutron-density log and cement bonding repair in the depth interval which has a bad CBL (Cement Bond Log) amplitude value.

Here is the image of the neutron-density log which became the base of the potential layer selection.

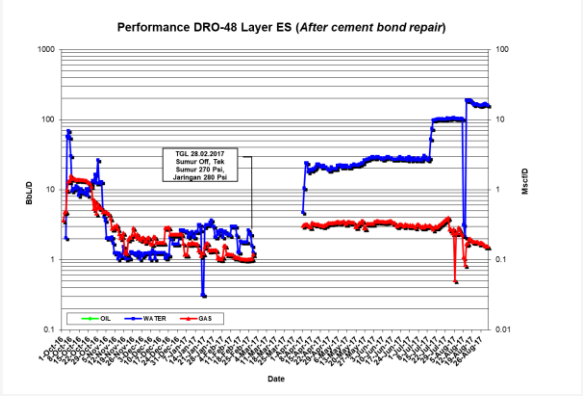


The repair of the cement bonding was also applied at the ES layer of the DRO-48 well when the bad cement bonding occurred. This has resulted in a water shut-off and cause the water flow became obstructed. Eventually, the gas can be reproduced again from this layer.

Here is the image of a bad CBL amplitude at ES layer that has some repair of cement bond.



Based on the image of DRO-48 production profile, it shows that the gas from the ES layer has returned to production after the cement bond repair in 2016. This also affects its lifetime to extend.



Conclusions

- DRO well has the potential in its shallow reservoir.
- The rising problem in the production period of gas are caused by liquid loading, the poor selection of the potential layer, and a bad cement bond.
- By selecting the likely potential layer and the repair of the cement bond can produce a long-lasting gas production at DRO well.