May 23, 2006

OIL AND GAS DOCKET NO. 03-0247199

THE APPLICATION OF SAMSON LONE STAR, L.P. TO CONSIDER PERMANENT GAS WELL CLASSIFICATION FOR THE JOYCE DU JAY LEASE WELL NO. 1, CONSTITUTION (YEGUA) FIELD, HARDIN COUNTY, TEXAS

Heard by: Thomas H. Richter, P.E., Technical Examiner
Hearing Date: May 22, 2006

Appearances:	**Representing:**
Glenn E. Johnson, attorney	Samson Lone Star L.P.
James Bostic	
John Soule	Joyce Du Jay

EXAMINER'S REPORT AND RECOMMENDATION
STATEMENT OF THE CASE

Samson Lone Star L.P. requests that the Joyce Du Jay Lease Well No. 1 in the Constitution (Yegua) Field be classified as a gas well. The examiner recommends approval.

DISCUSSION OF EVIDENCE

The Constitution (Yegua) Field was discovered in 1981at an approximate depth of 12,600' subsurface depth. The field is governed by Statewide Rules. The field is classified as a Non-Associated. Samson is the only operator in the field with three wells. A total of five wells have been completed in the field. It is apparent that the two plugged and abandoned wells (including the "discovery well") are over three miles to the south of the current active portion of the field.

The Samson Lone Star, Joyce Du Jay Lease Well No. 1 was completed through perforations from 13,150' to 13,176' subsurface depth on January 1, 2002 and potentialed at a highest flow rate of 4,997 MCFD. The gas gravity is 0.771 and the condensate gravity is 45.9°API. The initial gas/liquid ratio was 3,621:1. The color of the stock tank liquid is "brown".

The Commission advised Samson Lone Star in February 2002 that the well will be classified as an oil well based on the submitted Form G-5. Samson submitted a PVT analysis in March 2002. Commission letter dated March 4, 2002 stated that the well would be classified as a gas well for a period of 1 year based on the results of a submitted PVT analysis. Subsequently, if this was to be continued as a gas well, a shut-in bottomhole pressure survey must be run annually thereafter. The pressure report and PVT analysis will be reviewed and if the GOR in the reservoir is 100,000:1 or greater the gas well classification would continue for a period of time. If the GOR is less than

100,000:1, the well would be re-classified as an oil well. Since that time the well has continued to be classified as a gas well based on the annual pressure surveys. Commission letter dated April 11, 2006 advised Samson that the gas well classification could not be continued and that Samson should either re-classify the well to oil or request a hearing. Samson believes the subject well should be classified as a gas well because the well produces from a retrograde gas condensate reservoir. The other two wells in the reservoir have been granted gas well classifications (Oil & Gas Dockets No. 03-0242646 and 03-0246026).

Cumulative production is 4.4 BCF of gas and 982,900 BC. The current production level is ±1600 MCFD and ±280 BCPD. The current gas-liquid ratio is approximately 5,600:1.

The original reported static reservoir pressure was 11,410 psia.[1] The initial static reservoir pressure in the Joyce Du Jay was 9,097 psia at 294°F. The mechanical Constant Composition Expansion (CCE) results show a measured dew point pressure of 3,496 psig at 294°F. The analysis shows that the reservoir fluid did exist as a single-phase system at initial reservoir conditions. The latest bottomhole pressure survey measures a pressure of 3,732 psia which is still above the dew point. Reservoir pressure reduction below the dew point will result in retrograde condensate liquid formation in the reservoir. This is anticipated in a retrograde gas condensate reservoir. The hydrocarbon liquids condense from the gas phase in the formation and should be immobile. Compositional analysis indicates the wellstream to be 54.5 mol% methane (ethane at 8.6 mol% and propane at 10.5 mol%) and 12.058 mol% heptanes plus. The high concentrations of ethane and propane indicate a very "rich" retrograde gas which is typical for gas-oil ratios between 3300 and 5500:1. The CCE analysis measured the maximum hydrocarbon liquid volume in the two-phase envelope would occupy 45.81% of the hydrocarbon pore volume (HCPV) at 2,690 psig.[2] Samson Lone Star asserts any liquid hydrocarbon condensation in the subject reservoir is essentially immobile. Typical retrograde gases contain less than 12.5 mole percent of Heptanes Plus and the stock-tank liquid gravities are between 40°and 60°API.

The heptanes plus (C_7+) composition is 12.058 mol%. Subsequent research indicates there is a sharp dividing line between oils and condensates from a compositional basis. Reservoirs containing in excess of 12.5 mol% C_7+ components are almost always in the liquid phase (hence oils). Those with less than12.5 mol% are almost always in the gas phase in the reservoir. Oils have been observed with heptanes and heavier concentrations as low as 10% and condensates as high as 15%, but these cases are very rare and exhibit very high tank liquid gravities.[3]

---

[1] Measured in the Blackstone No. 1 in November 2000. The PVT analysis measured the dew point at 3,544 psig.

[2] This percentage is the maximum space the liquid condensate will occupy of the "hydrocarbon pore volume" and not the "total pore volume".

[3] Engineering Applications of Phase Behavior of Crude Oil and Condensate Systems , by Phillip L. Moses, SPE, Core Laboratories, Inc., copyright 1986 Society of Petroleum Engineers, published in the Journal of Petroleum Technology, July 1986.

Samson Lone Star believes the subject well should be classified as a gas well because the well does have a measured dew point pressure indicating the well to be a gas condensate well and any liquid hydrocarbon that condenses in the reservoir would not be mobile in the reservoir. Pressure surveys of the other two wells in the field that are classified as gas wells through PVT analysis are in communication. The compositions are very similar which is to be expected when producing from a common reservoir.

EXAMINER'S OPINION

The Texas Administrative Code, Title 16, Part 1, Chapter 3, Rule §3.69 Definitions Subsection (11)(C) and Statewide Rule 79 defines a gas well as "....A well which produces hydrocarbon liquids, a part of which is formed by a condensation from a gas phase and a part of which is crude petroleum oil, shall be classified as a gas well unless there is produced one barrel or more of ***crude petroleum oil*** (emphasis added) per 100,000 cubic feet of natural gas; and that the term "crude petroleum oil" shall not be construed to mean any liquid hydrocarbon mixture or portion thereof which is not in the liquid phase in the reservoir, ***removed from the reservoir in such liquid phase*** (emphasis added), and obtained at the surface as such."

The statute requires for a well with a gas-hydrocarbon liquid ratio of less that 100,000:1, a series of tests must be passed to be classified as a gas well. For prima facie gas well classification, the Commission uses the data from Form G-5 (Gas Well Classification Report) for a well and compares it to Commission Guidelines. The key guideline parameters are:

* Gas-liquid hydrocarbon ratio of at least 12,500:1

* API gravity of the liquid hydrocarbon of at least 50 degrees

* On the ASTM Distillation Test of the liquid:

  Initial Boiling Temperature must be less than 120°F

  At 80% recovery, the boiling temperature must not exceed 520°F

  The end point must not exceed 720°F with at least 95% recovery

The subject well's ASTM test failed four of the parameters.

To be classified as a gas well if the initial producing gas-hydrocarbon liquid ratio is less than 100,000:1, the following requirements must all be met:

* There must be a measured dew point (condensation point), wherein the hydrocarbon liquid begins to form in the reservoir;

* The liquid hydrocarbon that forms in the reservoir (condensate) must be immobile in the reservoir and not produced at the surface; and

* No more than one barrel of crude petroleum oil per 100,000 cubic feet of gas is produced.

Technically, anytime there is hydrocarbon liquid dropout in the reservoir, the well is a "retrograde gas condensate well". A true "wet gas" will not condense liquid until it is cooled. Reservoirs remain at constant temperature. If PVT analysis shows condensation with pressure reduction, then the reservoir is above the critical temperature. It is the critical temperature which dictates a gas condensate versus a volatile oil. The hydrocarbon liquid volume and gas composition in this case indicates a rich retrograde condensate. The classification of reservoirs properly depends upon (a) the composition of the hydrocarbon accumulation and (b) the temperature and pressure of the accumulation in the formation. Because compositions can vary in every conceivable proportion and the temperature and pressure gradient vary, the reservoir types may blend in with one another and even overlap. The presence of an oil zone will affect the accuracy of calculations based on a single-phase study. [4] The determination of an accurate dew point (or bubble point) is dependent upon several parameters. The correct recombination ratio of the collected gas and liquid from the separator should be as accurate as possible in the early life of the well. An incorrect dew point pressure may occur because an operator did not properly flow-condition the well before sampling. Ideally, a well should be cleaned up on a higher rate and then the well rate is lowered sequentially in stabilized rate steps to determine the lowest rate that completely unloads all fluids from the wellbore. Few operators take the time and expense to determine the best recombination GOR for laboratory work. The sampling should be performed in the early life of a well before pressure depletion effects the composition of the samples. If this is not performed and the original reservoir pressure is not accurately obtained, the dew point (bubble point) pressure will be in error. If this is accurate, this must be taken into account in the evaluation process.

Retrograde gas-condensate reservoirs are unique and a general understanding of the geological and reservoir/chemical characteristics must be understood to differentiate this reservoir from a volatile oil reservoir. Reservoir temperature is essential in the classification of the type of reservoir i.e. volatile oil or retrograde gas condensate. A fluid composition might be classified as a volatile oil in one reservoir and a gas condensate in a deeper and hotter reservoir. Reservoirs should not be mistakenly classified on the basis of the production characteristics observed at the surface i.e. the yield of hydrocarbon liquid per mmcf of gas. If the reservoir temperature lies between the critical temperature and the cricondentherm of the reservoir fluid, the reservoir is classified as a retrograde gas-condensate reservoir. If the initial reservoir pressure is above the dew point pressure, the hydrocarbon system exists as a single phase (vapor) in the reservoir. As the reservoir pressure declines isothermally (constant temperature) because of production depletion to the dew point pressure or "saturation" pressure, liquids begin to condense out of the gas into the

---

[4] Applied Petroleum Reservoir Engineering, B.C. Craft and M.F. Hawkins, Petroleum Engineering Department, Louisiana State University, Prentice-Hall Inc. Englewood Cliffs, New Jersey, Copyright 1959.

formation. As the pressure is further decreased, instead of expanding (if a gas) or vaporizing (if a liquid) as would be expected, the hydrocarbon mixture tends to condense even more. The retrograde condensation process continues with decreasing pressure until the liquid drop-out reaches its maximum. At this point, some of the liquid which formed in the reservoir may vaporize or near wellbore condensate banking occurs.[5]

A research study on hundreds of wells that were properly conditioned and tested, tracked the C_7+ mol% versus PVT analysis of each well for the determination of dew point or bubble point. The analysis determined that wells with over 12.5 mol% C_7+ had measured bubble points (oil well) and wells with less than 12.5 mol% C_7+ had measured dew points (gas wells). [6]

The liquid hydrocarbons produced at the surface have "flashed" at the surface separation equipment and do not meet the statutory definition of *crude petroleum oil*. The hydrocarbon "liquid" that exists in a retrograde gas condensate reservoir will be the result of *gas condensation*. In a retrograde gas condensate reservoir, the condensed liquids should not be considered in determining the gas-oil ratio because the liquids produced at the surface. The flash condensate at the surface is caused by the pressure/temperature reduction. There is no substantiating data that crude petroleum oil is being produced at the surface.

The examiner recommends the application be approved and the well should be classified as a gas well. The subject well meets the following guide lines:

* There is a measured dew point (saturation) pressure and subsequent pressure reduction result in the condensing of liquid hydrocarbon as shown by a PVT analysis.

* The mol percentage of heptanes plus is ≤12.5%.

* The reservoir is above the critical temperature (this temperature does not necessarily have to be measured if there is a clear demonstration that condensate forms and increases with pressure reductions below the dew point or reservoir pressure, whichever is lower).

FINDINGS OF FACT

1. Notice of this hearing was given to all affected persons at least ten days prior to the date of hearing. No protests were received.

2. The Constitution (Yegua) Field was discovered in 1981at an approximate depth of 12,600' subsurface depth.

---

[5] If the reservoir temperature is near the critical temperature, when the dew point pressure is reached, there will be a rapid liquid build-up (condensation) and subsequently a dramatic increase in the GOR. It should be noted that the composition and mol percent of the hydrocarbons in the reservoir changes significantly with depleting reservoir pressure.

[6] Research by William McCain, Phd, Professor at Texas A&M University.

a. The field is governed by Statewide Rules and is classified as a Non-Associated.

b. Samson is the only operator in the field with three wells.

3. The Samson Lone Star, Joyce Du Jay Lease Well No. 1 was completed through perforations from 13,150' to 13,176' subsurface depth on January 1, 2002 and potentialed at a highest flow rate of 4,997 MCFD.

a. The gas gravity is 0.771 and the condensate gravity is 45.9°API. The initial gas/liquid ratio was 3,621:1. The color of the stock tank liquid is "brown".

b. Cumulative production is 4.4 BCF of gas and 982,900 BC. The current production level is ±1600 MCFD and ±280 BCPD. The current gas-liquid ratio is approximately 5,600:1.

4. The Samson Lone Star, Joyce Du Jay Lease Well No. 1 in the Constitution (Yegua) Field should be classified as a gas well.

a. The original reported static reservoir pressure was 11,410 psia and 282°F.

b. The mechanical Constant Composition Expansion (CCE) results show a measured dew point pressure of 3,496 psig at 294°F.

c. The analysis shows that the reservoir fluid did exist as a single-phase system at initial reservoir conditions.

d. Any hydrocarbon liquids that condense from the gas phase in the formation are immobile.

e. Compositional analysis indicates the wellstream to be 54.5 mol% methane (ethane at 8.6 mol% and propane at 10.5 mol%) and 12.058 mol% heptanes plus. The high concentrations of ethane and propane indicate a very "rich" retrograde gas which is typical for gas-oil ratios between 3300 and 5500:1.

f. The CCE analysis measured the maximum hydrocarbon liquid volume in the two-phase envelope would occupy 45.81% of the hydrocarbon pore volume (HCPV) at 2,690 psig.

g. The reservoir is above the critical temperature as demonstrated by gas-condensation through reservoir pressure reduction at constant temperature.

5. The liquid hydrocarbons produced at the surface have "flashed" at the surface separation equipment and do not meet the statutory definition of crude petroleum oil.

CONCLUSIONS OF LAW

1. Proper notice of this hearing was issued.

2. All things have been accomplished or have occurred to give the Commission jurisdiction in this matter.

3. The Samson Lone Star, L.P., Joyce Du Jay Lease Well No. 1 in the Constitution (Yegua) Field meets the requirements for gas well/field classification pursuant to Rule No. 79(a)(11)(C).

RECOMMENDATION

Based on the above findings and conclusions of law, the examiner recommends that the Samson Lone Star, L.P., Joyce Du Jay Lease Well No. 1 in the Constitution (Yegua) Field be classified as a gas well.

Respectfully submitted,

Thomas H. Richter, P.E.
Technical Examiner
Office of General Counsel