



RAILROAD COMMISSION OF TEXAS

OFFICE OF GENERAL COUNSEL

July 24, 2007

OIL AND GAS DOCKET NO. 08-0252227

THE APPLICATION OF OXY USA WTP LP TO CONSIDER PERMANENT GAS WELL CLASSIFICATION FOR THE DORA ROBERTS DEVONIAN UNIT WELLS NO. 806, 1616, 1617, 3405, AND 4506, DORA ROBERTS (DEVONIAN) FIELD, MIDLAND COUNTY, TEXAS

Heard by: Thomas H. Richter, P.E., Technical Examiner

Hearing Date: July 6, 2007

Appearances:

Representing:

Rick Johnston

OXY USA WTP LP

EXAMINER'S REPORT AND RECOMMENDATION

STATEMENT OF THE CASE

OXY USA WTP LP requests that the Dora Roberts Devonian Unit Wells No. 806, 1616, 1617, 3405 and 4506 in the Dora Roberts (Devonian) Field be permanently classified as gas wells. The examiner recommends approval.

DISCUSSION OF EVIDENCE

The Dora Roberts (Devonian) Field was discovered August 1955 at an approximate depth of 11,487 as a gas field. The field is governed by Special Field Rules. The field is classified as an Associated 49-B field. This is a large gas field with multiple wells. The subject reservoir was permitted for gas re-injection for gas cycling and pressure maintenance (Oil & Gas Docket No. 8-44,574 effective July 1960). Gas recycling continued until 1992 and the gas allowable was assigned to an imaginary single participation unit well. The gas recycling has resulted in the recovery of liquid hydrocarbons that otherwise would have gone unrecovered.

The original static reservoir pressure was 5,121 psia reported in 1958. Cities Service, the original operator in the field, performed a reservoir analysis, Constant Volume Depletion (CVD), at that time. The measured dew point pressure was 4,680 psig at 194°F. The analysis shows that the reservoir fluid did exist as a single phase system at initial reservoir conditions. Continued reservoir pressure reduction below the dew point will result in greater 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 are immobile.

Subsequent PVT analysis performed in 1963 on the five wells completed in the reservoir had an average dew point of 4,761 psia. The entire analysis clearly shows that the reservoir fluid was in a gaseous state at original reservoir conditions.

The Dora Roberts Wells No. 806, 1616 and 1617 were completed in 2006. The Commission advised OXY that based in the completion forms (G-1 and G-5) submitted that the wells should be classified as oil wells pending the submission of other test data which may substantiate gas well classification. The Dora Roberts Wells No. 3405 and 4506 are in the final stages of completion. The subject wells are all horizontal drainhole wells.

OXY believes the subject wells/reservoir should be classified as gas because the wells produce from a common reservoir which has been recognized by the Commission as a retrograde gas condensate reservoir. There is a reservoir dew point pressure which is below the original reservoir pressure. Dry gas recycling was necessary for liquid hydrocarbon removal from the hydrocarbon in the pore space of the reservoir because it was not mobile.

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 than 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

To be classified as a gas well pursuant to Rule 79 if the initial producing gas-hydrocarbon liquid ratio is less than 100,000:1, the following requirements must be met:

- * There must be a measured dew point pressure (condensation point or saturation pressure), wherein the hydrocarbon liquid begins to form in the reservoir; and
- * The liquid hydrocarbon that forms in the reservoir (condensate) must be immobile in the reservoir and not produced at the surface.

The subject wells/reservoir at original reservoir conditions was single phase i.e. gas. According to the PVT CCE analysis, as the reservoir pressure continues to decline, a greater volume of liquid will condense from the gas phase into the pore space of the formation and it was necessary for dry gas re-injection to recover the liquid hydrocarbon that condensed in the reservoir for.

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. ¹ 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

¹ 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.

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 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.²

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 wells/reservoir should be classified as a retrograde gas condensate and the liquid hydrocarbon is not mobile.

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 Dora Roberts (Devonian) Field was discovered August 1955 at an approximate depth of 11,487 as a gas field.
 - a. In 1962, the subject reservoir was permitted for gas re-injection for gas cycling and pressure maintenance (Oil & Gas Docket No. 8-44,574 effective July 1960).
 - b. The reservoir has been recognized as a gas condensate reservoir since 1962.
 - c. The gas recycling has resulted in the recovery of liquid hydrocarbons that otherwise would have gone unrecovered.
3. The Dora Roberts Wells No. 806, 1616 and 1617 were completed in 2006. The Dora Roberts Wells No. 3405 and 4506 are in the final stages of completion. The subject wells

² 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.

are all horizontal drainhole wells in the Dora Roberts (Devonian) Field should be permanently classified as a gas well.

- a. The original static reservoir pressure was 5,121 psia reported in 1958.
 - b. Cities Service, the original operator in the field, performed a reservoir analysis, Constant Volume Depletion (CVD), at that time. The measured dew point pressure was 4,680 psig at 194°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. The reservoir is above the critical temperature as demonstrated by gas-condensation through reservoir pressure reduction at constant temperature.
4. The subject wells/reservoir should be classified as gas because the wells produce from a common reservoir which has been recognized by the Commission since 1958 as a retrograde gas condensate reservoir.
- a. There is a reservoir dew point pressure which is below the original reservoir pressure.
 - b. Dry gas recycling was necessary for liquid hydrocarbon removal from the hydrocarbon in the pore space of the reservoir because it was not mobile.
 - c. Subsequent PVT analysis performed in 1963 on wells completed in the reservoir had an average dew point of 4,761 psia. The entire analysis clearly shows that the reservoir fluid was in a gaseous state at original reservoir conditions.

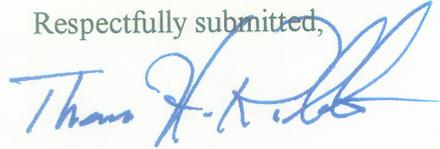
CONCLUSIONS OF LAW

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 OXY, Dora Roberts Devonian Unit Wells No. 806, 1616, 1617, 3405 and 4506 in the Dora Roberts (Devonian) 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 OXY, Dora Roberts Devonian Unit Wells No. 806, 1616, 1617, 3405 and 4506 in the Dora Roberts (Devonian) Field be classified as gas wells.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Thomas H. Richter", with a large, stylized flourish extending from the end of the signature.

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