

November 29, 2006

OIL AND GAS DOCKET NO. 08-0249064

APPLICATION OF ANADARKO PETROLEUM CORPORATION TO AMEND THE FIELD RULES FOR HALEY (LWR. WOLFCAMP-PENN CONS.) FIELD, LOVING AND WINKLER COUNTIES, TEXAS

HEARD BY: Thomas H. Richter, P.E.

DATE OF HEARING: November 8, 2006

APPEARANCES:

Ana Maria Marsland-Griffith
James M. Clark
Scott Crump

REPRESENTING:

Anadarko Petroleum Corporation

EXAMINER'S REPORT AND RECOMMENDATION
STATEMENT OF THE CASE

This is the unopposed application of Anadarko Petroleum to amend the field rules for the Haley (Lwr. Wolfcamp-Penn Cons.) Field as adopted by Order No. 08-0240621, effective February 8, 2005, which currently provide for:

1. The entire combined correlative interval from 12,682' to 18,342' as shown on the log of the Forest Avant et al Well No. 1, Section 39, Block 29, Public School Lands Survey, Loving County, Texas, be designated as the Haley (Lwr. Wolfcamp-Penn Cons.) Field.
2. Minimum well spacing of 1,320'/2,640 (lease line/between well);
3. Gas proration units of 640 acres with 10% tolerance and a maximum diagonal of 9,000';
4. An allocation formula based on 95% acreage and 5% per well. The allocation formula is suspended.

Anadarko Petroleum proposes amending the rules to provide for:

1. Rules No. 1, 2, 3, and 4 - No Change.

Adoption of a rule to allow for an alternative method of determining the initial bottomhole pressure determination for the initial G-1 requirements and the initial G-10 filing. In addition, no subsequent shut-in wellhead pressures will be required to be reported on Form G-10. The semi-annual G-10 deliverability test will be reported as the production during the last 24 hours of a 72-hour test period that reflects the stabilized rate of a well under normal operating conditions providing a flowing pressure only and not a shut-in wellhead pressure. The examiner recommends

approval of the application.

DISCUSSION OF THE EVIDENCE

The Haley (Lwr. Wolfcamp-Penn Cons.) Field was created by the consolidation of the Haley (Morrow) and Haley (Strawn) Fields in January 2005. This is a multi-operator field with over 50 wells. The consolidated interval extends from approximately 12,600' to 18,400' subsurface depth. The formations include the Lower Wolfcamp, Strawn, Morrow, and Morrow Shale to the top of the Mississippian Barnett Shale. Cumulative production for the field is 200 BCF of gas.

Elimination of the requirement to shut-in a well for bottomhole pressures (initial or subsequent measurement) determination is necessary for the efficient and effective depletion of the reservoirs. The combination of very low formation permeability and exceedingly high reservoir pressures have created a formation stress problem that is sensitive to abrupt pressure changes. The subject formations are classified as tight gas, i.e. less than .1 millidarcies. The formations are geo-pressured ranging from 11,650 to 15,000 psi (.9 to .95 psi/ft). Liquid loading is a major problem as the wells produce between 2 - 200 BWPD. It is necessary that the wells all produce without a packer to use the benefit of the casing annulus gas volume to lift the wellbore fluids. It is necessary that a foaming surfactant be injected into the casing-tubing annulus to aid in the wellbore fluid unloading.

Multiple production logs with gradientometers to measure bottomhole pressure profiles were run to obtain flowing fluid levels in three wells. The testing shows the fluid levels after shut-ins. If the fluid level rises above any perforations, the adverse effect is the loss of production contribution of those perforations. As the bottomhole pressures deplete over time, the problem will only become worse. The shut-in wellhead pressure will not be indicative of the bottomhole pressure because the fluid level is unknown and because of the low permeability of the formation, a 24-hr shut-in pressure does not allow sufficient time for reservoir pressure build-up.

Shutting-in wells for any reason have adverse effects on the near wellbore formation area. The Gills 13 Well No. 1 was producing from the Strawn and Morrow at \pm 2,000 MCF. A bridge plug was set over these formations and the Wolfcamp was perforated and tested at 2,270 MCFD. The well was shut-in for 24-hrs to obtain pressure and was then returned to production. The choke became clogged with formation material. In an attempt to clean out the well, the drill bit, downhole motor and some coil tubing were lost in the hole. After a month of "fishing operations", it was decided to produce only the Wolfcamp perforations that were un-impaired by the fish and declare the Strawn and Morrow a loss. The portion of the Wolfcamp formation that was open commenced production at 480 MCF and declined to 243 MCFD within a month. The well then loaded-up and has not produced since December 2004. It was discovered when wells are returned to production after a shut-in period, the chokes should not be opened more than 250 psi per day.

The Bowdle 48 Well No. 1 was worked over to remove some bottom plugs using a coil tubing and a mud motor bit. In the process of the workover, the blind pipe ram closed allowing 300' of the coil tubing and motor-bit assembly to drop to the bottom of the hole. This caused an

instantaneous pressure transient in the wellbore and surrounding formation. In fishing attempts it was discovered that formation fills the wellbore to 11,700' and the perforations are from 13,755' to 17,650'. Again, quick pressure changes are detrimental to the formation at near wellbore.

Four of the 40 wells that Anadarko has drilled have been lost because of quick pressure changes.

The allocation formula should remain suspended as there remains a market for 100% of the gas produced from the field. It is requested that any overproduction from a well in the field be cancelled.

EXAMINER'S OPINION

Anadarko seeks exception to Statewide Rule 28 Potential and Deliverability of Gas Wells to be Ascertained and Reported) for wells producing in the subject field. Section (a) concerns the G-1 Testing and states in part "... *The test shall be performed in accordance with the commission's publication, Back Pressure Test for Natural Gas Wells, State of Texas, or other test procedure approved in advance by the Commission and shall be reported on the Commission's prescribed form. An operator, at his option, may determine absolute open flow potential from a stabilized one-point test. For a one-point test, the well shall be flowed on a single choke setting until a stabilized flow is achieved, but not less than 72 hours. The **shut-in** (emphasis added) and flowing bottom hole pressures shall be calculated in the manner prescribed for a four-point test...*". The rule clearly states that an initial reservoir bottomhole wellbore pressure is required. The method by which it is obtained is not mandated. The industry accepted procedures have been to either through the calculation method as stated in the Commission Back Pressure Test Manual or an actual measured bottomhole pressure using a downhole pressure measuring device. Other devices such as formation testers, drill stem testing, core samples, fluid level determinations may also provide near accurate pressure determinations.

Reservoir pressure determinations in a "tight" formation (a formation where the relative permeability is less than .1 millidarcies) are not essentially reliable for shut-in times of only 24 hours. Indeed, these type of reservoirs may take days, weeks or even months for a true determination of reservoir pressure. As an alternative to the shutting-in a well for the determination of the bottomhole pressure for the G-1 requirement, the method proposed by Anadarko is acceptable. Upon completion of a well (i.e. perforation) and while the well bore is still full of "completion fluid", the completion fluid hydrostatic gradient and level (lowest perforation in the well) shall be determined and summed with the shut-in wellhead pressure.

Section (c) concerns the G-10 Testing and states in part "... (c) *Unless applicable special field rules provide otherwise or the director of the oil and gas division or the director's delegate authorizes an alternate procedure **due to a well's producing characteristics**, (emphasis added) deliverability tests shall be performed as follows. ... All deliverability tests shall be performed by producing the subject well at stabilized rates for a minimum time period of 72 hours. A deliverability test shall be conducted under normal and usual operating conditions using the normal*

and usual operating equipment in place on the well being tested, and the well shall be produced against the normal and usual line pressure prevailing in the line into which the well produces. The average daily producing rate for each 24-hour period, the wellhead pressure before the commencement of the 72-hour test, and the flowing wellhead pressure at the beginning of each 24-hour period shall be recorded. In addition, a 24-hour shut-in wellhead pressure shall be determined either within the six-month period prior to the commencement of the 72-hour deliverability test or immediately after the completion of the deliverability test. The shut-in wellhead pressure that was determined and the date on which the 24-hour test was commenced shall be recorded on Form G-10. Exceptions and extensions to the timing requirements for deliverability tests and shut-in wellhead pressure tests may be granted by the Commission for good cause. (emphasis added) ...”.

Anadarko has demonstrated good cause for elimination of the shut-in wellhead pressure requirement pertaining to the semi-annual G-10 testing requirement pursuant to Statewide Rule 28. The accuracy of a 24-hr shut-in wellhead pressure in a tight formation is misleading at best. The production information indicates that the subject formation is sensitive to drastic pressure changes which causes near wellbore formation damage and adversely affects the efficient and effective recovery of reserves.

FINDINGS OF FACT

1. Notice of this hearing was sent to all operators in the subject fields at least ten (10) days prior to the subject hearing.
2. There was no protest at the call of the hearing.
3. The Haley (Lwr. Wolfcamp-Penn Cons.) Field was created by the consolidation of the Haley (Morrow) and Haley (Strawn) Fields in January 2005.
 - a. This is a multi-operator field with over 50 wells. The consolidated interval extends from approximately 12,600' to 18,400' subsurface depth.
 - b. The formations include the Lower Wolfcamp, Strawn, Morrow, and Morrow Shale to the top of the Mississippian Barnett Shale.
4. Elimination of the requirement to shut-in a well for bottomhole pressures (initial or subsequent measurement) determination is necessary for the efficient and effective depletion of the reservoirs.
 - a. The combination of very low formation permeability and exceedingly high reservoir pressures have created a formation stress problem that is sensitive to abrupt pressure changes.
 - b. The subject formations are classified as tight gas, i.e. less than .1 millidarcies. The

formations are geo-pressured ranging from 11,650 to 15,000 psi (.9 to .95 psi/ft).

- c. Liquid loading is a major problem as the wells produce between 2 - 200 BWPD and it is necessary that wells all produce with out a packer to use the benefit of the casing annulus gas volume to lift the wellbore fluids and a foaming surfactant be injected into the casing-tubing annulus to aid in the wellbore fluid unloading.
 - d. Multiple production logs with gradientometers to measure bottomhole pressure profiles indicate that as the fluid level rises above any perforations, the adverse effect is the loss of production contribution of those perforations.
 - e. Shut-in wellhead pressure will not be indicative of the bottomhole pressure because the fluid level is unknown and because of the low permeability of the formation, a 24-hr shut-in pressure does not allow sufficient time for reservoir pressure build-up.
5. Shutting-in wells for any reason has adverse effects on the near wellbore formation area.
 6. The allocation formula should remain suspended as there remains a market for 100% of the gas produced from the field and any overproduction from a well in the field should be cancelled.

CONCLUSIONS OF LAW

1. Proper notice was given to all parties as set out in the provisions of all applicable codes and regulatory statutes.
2. All things have occurred and been accomplished to give the Commission jurisdiction in this matter.
3. Consideration of field rules, a determination of the effectiveness of the rules and appropriate actions is a matter within the Commission jurisdiction.
4. Adoption of the proposed amended field rule will prevent waste, foster conservation and not harm correlative rights.

EXAMINER'S RECOMMENDATION

Based on the above findings and conclusions of law, the examiner recommends approval of the proposed Rule No. 5 for the Haley (Lwr. Wolfcamp-Penn Cons.) Field.

Respectfully submitted,

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Technical Examiner
Office of General Counsel