

**STATE OF NEW MEXICO  
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT  
OIL CONSERVATION COMMISSION**

**IN THE MATTER OF THE HEARING  
CALLED BY THE OIL CONSERVATION  
COMMISSION FOR THE PURPOSE OF  
CONSIDERING:**

**CASE NO. 12587**

**THE AMENDED APPLICATION OF SAPIENT ENERGY CORPORATION FOR  
AN UNORTHODOX WELL LOCATION AND (i) TWO NON-STANDARD 160-  
ACRE SPACING UNITS OR, IN THE ALTERNATIVE, (ii) ONE NON-  
STANDARD 160-ACRE SPACING AND PRORATION UNIT, LEA COUNTY,  
NEW MEXICO,**

**AND**

**CASE NO. 12605**

**THE APPLICATION OF SAPIENT ENERGY CORPORATION FOR SPECIAL  
POOL RULES, LEA COUNTY, NEW MEXICO,**

**ORDER NO. R-11652-B**

**ORDER OF THE NEW MEXICO OIL CONSERVATION COMMISSION**

**BY THE COMMISSION:**

This case came before the Oil Conservation Commission (hereinafter referred to as "the Commission") on December 4, 2001 at Santa Fe, New Mexico, and the Commission, having carefully considered the evidence, the pleadings and other materials submitted by the parties hereto, now, on this 26th day of March, 2002,

**FINDS,**

1. Notice has been given of the application and the hearing on this matter, and the Commission has jurisdiction of the parties and the subject matter herein.

2. In Case No. 12587, Sapient Energy Corporation (hereinafter referred to as "Sapient") seeks approval of an unorthodox gas well location for its Bertha J. Barber Well No. 12 (hereinafter referred to as "the Barber 12 well"), located 330 feet from the North line and 660 feet from the East line of Section 7, Township 20 South, Range 37 East, NMPM. Sapient proposes to dedicate the Barber 12 well to a non-standard 80-acre gas spacing unit consisting solely of its acreage in the E/2 of the NE/4 of Section 7, create another spacing unit in the W/2 of the NE/4, and produce natural gas from the West

Monument-Tubb Gas Pool. Sapiant requests that the Commission's approval of the non-standard unit be retroactive to September 9, 1999, the date of first production.

3. In Case No. 12605, Sapiant seeks special pool rules for the West Monument-Tubb Gas Pool identical to existing rules in the Monument Tubb Oil Pool, including standard 80-acre spacing units and a 330-foot set back requirement for both oil and gas wells.

4. Sapiant's requests are opposed by Chevron U.S.A. Production Company (hereinafter referred to as "Chevron") and Conoco Inc. (hereinafter referred to as "Conoco").

5. The Commission conducted an evidentiary hearing on December 4, 2001 on the applications of Sapiant, heard testimony from witnesses called by Sapiant and jointly by Chevron and Conoco (hereinafter referred to collectively as "Chevron/Conoco") and accepted for the record exhibits presented by both parties during the hearing. The Commission also accepted pre-hearing statements and closing statements.

6. Sapiant argued during the hearing that the evidence establishes that the Barber 12 well is capable of draining 53 to 60 to at most 80 acres. Sapiant argues its contention is supported by its material balance calculations and production decline analysis.

7. Sapiant argued that its geologic evaluation of the Tubb reservoir supports a finding that the West Monument-Tubb Gas Pool, in which the Barber 12 well is located, should be treated similarly for purposes of spacing and well location as the adjoining Monument Tubb Oil Pool. Sapiant claims its geologic evidence demonstrates that the West Monument-Tubb Gas Pool is an extension of the same Tubb gas/oil accumulation, that the Barber 12 well has identical producing attributes as gas wells in the Monument Tubb Oil Pool, and that a continuous geologic correlation exists from the Barber 12 well east across the Monument Tubb Oil Pool.

8. Sapiant argued that establishment of a 160-acre unit would leave 70% of the gas in place in the W/2 NE/4 necessitating an additional well in Section 7.

9. Sapiant further argued that the evidence established that it is both reasonable and practicable to adopt 80-acre spacing units consisting of the E/2 NE/4 and the W/2 NE/4 of Section 7. Sapiant further argues that because its well only drains 60 acres, its location 330 feet from the North line and 660 feet from the East line of Section 7 does not impair correlative rights.

10. Chevron/Conoco argued that the applications of Sapiant should be denied because the evidence presented during the hearing demonstrates that the Barber 12 well actually drains 165 acres, and its conclusion in this regard is supported by material balance calculations and production decline analysis.

11. Chevron/Conoco point out that evidence of drainage is seen in Chevron's G.C. Mathews Well No. 12 (hereinafter referred to as "the Mathews 12 well"), 736 feet north of the Barber 12 well. Chevron/Conoco argue that the Barber 12 well has already drained beyond the Mathews 12 well and the pressure found in the Mathews 12 well when it was re-completed in late 2001 verifies this drainage.

12. The Barber 12 well is within the West Monument-Tubb Gas Pool. The West Monument-Tubb Gas Pool was created on January 12, 2000 in Order No. R-11304 (Case No. 12321). The pool was created for production of natural gas from the Tubb formation and comprises the E/2 of Section 7, Township 20 South, Range 37 East, NMPM, Lea County, New Mexico.

13. The West Monument-Tubb Gas Pool is subject to 19.15.3.104(C)(3) NMAC, which establishes 160-acre gas spacing units comprising a single governmental quarter section, and 19.15.3.104(D)(3) NMAC, which restricts the number of producing wells within a single gas spacing unit within non-prorated pools.

14. Sapient owns 100% of the working interest in the E/2 E/2 of Section 7, Township 20 South, Range 37 East, NMPM, Lea County, New Mexico.

15. The working interest ownership of the W/2 E/2 of Section 7 is divided amongst the following working interest owners:

Conoco, Inc.	37.41862%
Phillips Petroleum Company	25.00000%
Atlantic Richfield Company	
(ARCO), now BP/Amoco	18.70931%
Chevron	18.70931%
James Burr	0.06511%
Larry Nermyr	0.06511%
Ruth Sutton	0.03255%.

16. The Barber 12 well was drilled by Sinclair Oil & Gas Company in December 1953/January 1954 to a total depth of 5,250 feet and was subsequently completed in the Monument-Paddock Pool at a standard oil well location within a standard 40-acre oil spacing and proration unit comprising the NE/4 NE/4 of Section 7. In 1993 ARCO Oil & Gas Company, successor operator to Sinclair Oil & Gas Company, sold the Barber 12 well to Cross Timbers Operating Company (hereinafter referred to as "Cross Timbers"), which in December 1998 deepened the well to 7,530 feet. From January, 1999 to August, 1999 the well produced as an oil well from the Monument-Abo Pool (production interval 6,892 feet to 7,380 feet) at a standard location for a 40-acre oil spacing and proration unit also comprising the NE/4 NE/4 of Section 7.

17. Administrative notice is taken of a copy of the Division's well file pertaining to the Barber 12 well.

18. Cross Timbers filed its intent to re-complete the Barber 12 well on August 18, 1999 to the Tubb formation as an oil well. Cross Timbers also applied, on September 10, 1999, for approval to plug the Barber 12 well back and re-complete it in the Tubb interval as a gas well and dedicated the 160 acres comprising the E/2 E/2 of Section 7 to the well.

19. As a gas well, the Barber 12 well was located at an unorthodox location and the acreage purportedly dedicated to the well by Cross Timbers comprises a non-standard unit.

20. Falcon Creek Resources, Inc. (hereinafter referred to as "Falcon Creek") acquired the Barber 12 well from Cross Timbers on April 1, 2000 and Sapien acquired the well from Falcon Creek on July 14, 2000 through merger.

21. The Barber 12 well produced at a rate of about 500 mcf/day after completion in August of 1999 until January 2000, at which time the well was fractured. After fracturing, the well increased its production to over 1,400 mcf/day, but Cross Timbers kept the well choked. At the time it was shut-in by Order of the Division in October 2001, the well was producing approximately 840 mcf/day. At the time the well was shut-in it had produced 808 mmcf according to Sapien, 818 mmcf according to Chevron/Conoco and 935 mmcf according to Division records.

22. Chevron re-completed the Matthews 12 well, located 330 feet from the South line and 990 feet from the East line (Unit P) of Section 6, Township 20 South, Range 37 East, NMPM, Lea County, New Mexico, into the Tubb formation in late 2001. This well is also located in an unorthodox location, but the location was approved in Division Administrative Order NSL-3752-A, dated August 29, 2001.

23. Administrative notice is taken of a copy of the Division's well file pertaining to the Mathews 12 well.

24. The Mathews 12 well directly offsets the Barber 12 well and is approximately 736 feet north.

25. The key issue for the Commission to resolve in this matter is the drainage of the Barber 12 well. If the Barber 12 well drains less than 80 acres, Sapien's applications may be approved; if the well drains more than 80 acres, the applications should be denied. Resolving the question of the well's true drainage requires application of principles of petroleum engineering.

26. Both parties presented detailed engineering and geological testimony and exhibits in support of their respective positions. But the conclusions drawn by the parties are based on engineering interpretation and judgment, which must be exercised carefully. In general, each party exercised that interpretation and judgment in favor of its respective position. Thus, while Sapien claims the well drains between 53 and 60 acres and no more than 80 acres and Chevron/Conoco claim the well drains 165 acres, the truth is

probably somewhere in between. But, in order for Sapien to be successful in its application, it must convince this body that the well drains 80 acres or less.

27. The drainage of a well like the Barber 12 well is estimated by calculating the initial gas in place. Gas in place can be determined by plotting  $P/Z$  against  $\Sigma q$ , where  $P$  is the downhole pressure,  $Z$  is a constant derived from the temperature and pressure of the formation of interest, and  $\Sigma q$  is accumulated production. The parties refer to this methodology as a "material balance" calculation.

28. No initial pressure readings were made when the Barber 12 well was re-completed as a gas well, and therefore the initial pressure,  $P_i$ , is unknown and must be extrapolated from available data.

29. Sapien calculates  $P_i$  at 2597 psia (Sapien Exhibits 14, 18), and used an initial constant,  $Z_i$ , of 0.7837 to calculate a  $P_i/Z_i$  of 3314 psia. Sapien's initial pressure calculation was based on the average of six drill stem tests from wells producing from the Tubb formation that were within five miles of the Barber 12 well. The tests were performed early in the life of the reservoir, in the 1940s, 1950s and 1960s.

30. Chevron/Conoco calculated the well's initial pressure at 2462 psia (Chevron/Conoco Exhibit 8 revised, Exhibit 14) and used a  $Z_i$  of 0.7687 to calculate a  $P/Z$  of 3202.4 psia. Chevron/Conoco extrapolated an initial pressure from known readings in six nearby wells, excluded the two highest and lowest readings, and normalized the calculated pressure gradients to a common datum, resulting in a pressure gradient of 0.386 psi/ft and yielding an estimate of the initial pressure in the Barber 12 well of 2,468 psi at 6394 feet.

31. The parties differ on the cumulative production of the Barber 12 well. Sapien claims cumulative production is 808 mmcf (Sapien Exhibit 21) but also notes that its October figures were estimated. Chevron/Conoco claims cumulative production is 818 mmcf (Chevron/Conoco, Exhibit 15). Division records indicate that the various operators have reported total production from the Barber 12 well of 935 mmcf. It is thus apparent that total production is closer to 818 mmcf than 808 mmcf and probably in excess of the total production used by the parties during the hearing.

32. Both parties calculated  $P/Z$  of the Barber 12 well as of the date of its shut-in. Sapien calculated  $P/Z$  from an October, 2001 shut-in pressure test, which yielded a shut-in bottom hole pressure as of that date of 1231 or 1235 psia depending on the depth. Sapien calculated the  $Z$  factor of 0.8362, and derived a  $P/Z$  as of October 24, 2001 of 1477 psia. Chevron/Conoco calculated  $P/Z$  by an entirely different means. Chevron/Conoco rejected Sapien's shut-in pressure test as defective because the gauge was not run down to the midpoint perforations and no information was provided concerning liquids in the well, both of which could have resulted in higher pressure. From this analysis, Chevron/Conoco used a bottom hole pressure of 1446 psia as of September 6, 2001, and calculated a  $Z$  factor of 0.8026, from which it calculated  $P/Z$  to be 1801.6 psi.

33. Sapiient thus calculated gas in place at the Barber 12 well as 1.458 bcf. Chevron/Conoco calculated gas in place at the Barber 12 well as 1.828 bcf. Sapiient used an abandonment pressure of 300 psia to calculate an estimated ultimate recovery of 1.326 bcf, and Chevron/Conoco used an abandonment pressure of 250 psia to calculate an estimated ultimate recovery of 1.680 bcf.

34. Armed with its material balance calculations, Sapiient calculated the drainage area by dividing the estimated ultimate recovery by its estimate of the amount of pay (30 feet), divided by its calculation of the gas present per acre foot (0.815 mmcf/acre-foot), which Sapiient arrived at through standard volumetric calculations.<sup>1</sup> This calculation resulted in a drainage area of the Barber 12 well of 53 or 60 acres.

35. Chevron/Conoco calculated the drainage area by dividing the estimated ultimate recovery by the amount of pay (26.5 feet), divided by its calculation of the estimated ultimate recovery in terms of gas per acre foot (0.3813 mmcf/acre-foot). This calculation resulted in a total drainage radius of the Barber 12 well of 1513 feet. Chevron/Conoco also calculated the radius drained by the well to date, 1060 feet. Chevron/Conoco's calculations resulted in a total drainage area for the Barber 12 well of 165 acres.

36. Both parties used decline curve analysis to verify the results of the material balance calculations. Decline curve analysis uses the well's production patterns to assemble data; once production begins and the pressure in the well begins to drop, data points may be accumulated and these points plotted. Once enough data points are accumulated, a judgment concerning the resulting decline rate can be made. The intersection of the resulting line with the x-axis is the cessation of production and may help determine the amount of gas in place.

37. Applying decline curve analysis to the Barber 12 well is difficult because of the lack of consistent production over time and the production problems detailed by the parties. For example, the parties testified that the Barber 12 well experienced pipeline curtailment and damage. The well began production as a gas well in December of 1999 and produced for a period of time. The well was choked back during the months of June and July 2001 due to pipeline constraints and subsequently developed a scaling problem. The parties disagree whether the various production trends experienced by the well are significant.

38. However, as very small differences in calculation of the slope in a decline study result in large differences in the determination of the amount of gas in place, decline curve analysis is dependent on the exercise of judgment. A certain amount of subjectivity is also present in decline analysis because it relies on selecting or rejecting relevant data points and using engineering judgment concerning the most likely decline based on the circumstances. Each party has made an interpretation of the data that benefits that party.

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<sup>1</sup> For example, see Katz & Lee, Natural Gas Engineering: Production and Storage, at 434-435 (1990).

39. Based on its decline curve analysis, Sapient claims a rate of decline of 43% and Chevron/Conoco claims the rate of decline is actually 30%. The resulting calculations of gas in place are 1.759 bcf (Chevron/Conoco) and 1.3 bcf (Sapient) respectively. Thus, Chevron/Conoco calculates that remaining reserves are in the neighborhood of 852 mmcf, and Sapient calculates remaining reserves to be 507 mmcf.

40. It appears from the evidence presented that the Barber 12 well drains far in excess of 80 acres and the approach used by Sapient to evaluate the drainage of the Barber 12 well is defective.

41. In its analysis, Sapient used the most liberal assumptions possible in estimating the drainage area and arrived at the result that benefits its position. However, Sapient's approach is not reasonable because it is inconsistent with the physical phenomena documented by the parties.

42. For example, the initial pressure found during re-completion of the Mathews 12 well was 1,440 psia. Since the initial reservoir pressure was in the neighborhood of 2,500 psia, it is obvious that the Mathews 12 well has suffered significant depletion before production even commenced from that well. The only reasonable source of that depletion is the Barber 12 well. If the Barber 12 well only drains 60 acres as alleged by Sapient, the Mathews well, 736 feet away, should not be so depleted. Indeed, if the well drains only 60 acres, the drainage radius should only be around 670 feet at this time, and downhole pressure at the Mathews 12 well should be closer to 2,500 psia. The depletion of the Mathews 12 well demonstrates that the Barber 12 well will ultimately drain far more than 60 to 80 acres. Sapient's conclusions to the contrary are defective since they fail to account for this observation.

43. Sapient's porosity assumptions may be the single most significant factor reconciling the parties' differing calculations of the drainage area of the Barber 12 well; Sapient's assumption of 12.2% porosity yields a calculation of recoverable gas in place of 741.3 mcf/acre-foot, whereas Chevron/Conoco's assumption of 6.6% yields recoverable gas in place of 381.5 mcf/acre-foot, almost half of Sapient's calculated value. Sapient's assumption has the same affect on the drainage calculations so that Sapient's drainage area was calculated at 60 acres and Chevron/Conoco's calculation was 165 acres.

44. Sapient's conclusion does not agree with the physical properties observed by Chevron in the Mathews 12 well when it re-completed that well. When that well was re-completed, it was logged and porosity logs were developed. Chevron obtained pressure data and sidewall cores. Examining the logs is important, but obtaining the actual reservoir rock provides an important confirmation of their accuracy, and the core data correlate very strongly with porosity values calculated from the neutron density cross plot.

45. The strong correlation between the plots based on the data from the sidewall cores and the neutron density cross plot seems to confirm the accuracy of the log results

and therefore seems to confirm Chevron/Conoco's calculation of many reservoir properties, including its porosity: 6.6%.

46. Sapien's technique of calculating porosity from PE bulk density is not the best method of determining these values, particularly when the actual rock is available to test. Moreover, Chevron/Conoco's core data confirmed the presence of anchorite, dolomite, limestone and pyrite in the formation that most likely would have skewed PE results.

47. While the cores were taken from the Mathews 12 well, not the Barber 12 well, the correlation of the logs from the two wells seems to confirm the similarity of the rocks in the two wells, and helps to establish the validity of data obtained from the Mathews 12 well for analyzing characteristics of the reservoir at the Barber 12 well. Thus Chevron/Conoco's calculation of the net feet of pay for the Barber 12 well of 26.5 feet with an average porosity of 6.6 seems more reasonable than Sapien's calculations in this regard.

48. Sapien's failure to correlate its engineering judgments with observed phenomena apparently affected its engineering conclusions. Sapien's calculation of  $P_i$  is an example. As noted, the initial pressure was not available in the Barber 12 well. Sapien used pressures from completions deeper in the Tubb formation as a basis like Chevron, but made no attempt to normalize those pressures to a common datum and instead used simple averaging. This approach supported Sapien's own analysis, but does not appear to reflect a realistic view of the reservoir. Chevron/Conoco, by contrast, used conservative assumptions whenever possible and calculated the pressure gradient to a common datum, established the pressure gradient expected in the Barber 12 well, and applied the pressure gradient to arrive at  $P_i$ .

49. Another example is Sapien's decline curve analysis. Sapien's analysis verifies its other conclusions but doesn't account for the depletion seen at the Mathews 12 well. Sapien disregarded key facts such as the restriction of the well, the pipeline constraints, and the scaling problem which affected production. Selection and rejection of points during decline analysis introduces an element of subjectivity unless correlated with objective facts, and the physical data, such as the bottomhole pressures, the significant depletion at the Mathews 12 well, and the core samples, do not support Sapien's analysis.

50. All these facts, taken collectively, establish that Sapien's analysis is strained to achieve the result it desires. Chevron/Conoco has also strained its data to some degree to reach a desired (and opposite) result, but its approach is not only more principled and scientific but also correlates with the observed conditions.

51. Thus, the engineering and geological evidence, taken as a whole, establishes that the Barber 12 well drains considerably more than 60-80 acres. The evidence supports a conclusion that the standard 160-acre spacing unit consisting of a governmental quarter section is the appropriate unit for the well.



52. The engineering and geological evidence supports a conclusion that the Barber 12 well is capable of draining in excess of 80 acres and Sapiient's proposed special rules adopting 80-acre spacing will result in the drilling of unnecessary wells thereby causing waste.

53. The engineering and geological evidence supports a conclusion that establishing 80-acre spacing in the West Monument-Tubb Gas Pool would violate correlative rights of other interest owners in Section 7, as evidence indicates that wells in Section 7 will drain in excess of 80 acres.

54. Adoption of special pool rules for the West Monument-Tubb Gas Pool providing for 80-acre spacing, or creation of a non-standard spacing unit for the Bertha J. Barber Well No. 12 comprising the E/2 E/2 of Section 7, will result in reserves being drained from offsetting tracts which could only be recovered by the owners of those reserves by the drilling of unnecessary wells.

55. To the extent that Sapiient still claims that it relied upon Division approval of certain forms in connection with the re-completion of the Barber 12 well, any such reliance was misplaced. Division rules 19.15.3.104(B)(2) NMAC, and 19.15.3.104(D)(2) NMAC, require an operator to file an application for administrative approval of a non-standard well location and receive approval of that location before production from the well begins, and apply for and receive administrative approval of a non-standard unit before production begins. In the absence of such approval, a 160-acre unit should have been dedicated to the Barber 12 well. 19.15.3.104(C)(3) NMAC. The purported dedication of a 160-acre unit to the Barber 12 well on an application for a permit to drill is thus ineffective. Division approval of the forms submitted by Cross Timbers cannot substitute for the administrative approval process, particularly since that process involves notice to affected parties.

56. The 160-acre standard unit comprising the NE/4 of Section 7 in the West Monument-Tubb Gas Pool in place by operation of 19.5.3.104(C)(3) should remain unchanged.

57. The requested unorthodox location of the Bertha J. Barber Well No. 12 was not an issue in this matter. The unorthodox location of the Barber 12 well should therefore be approved.

58. The application of Sapiient in Case No. 12587 for approval of two non-standard 160-acre gas spacing units in the E/2 of Section 7 should be denied. Further, the application of Sapiient in Case No. 12605 for the adoption of special pool rules for the West Monument-Tubb Gas Pool should also be denied.

59. Should voluntary agreement not be reached with parties in the standard 160-acre unit with respect to pooling of the various interests pursuant to NMSA 1978, § 70-2-17(A) and concerning allocation or reallocation of production since September 9, 1999,

the date of first production, the parties should seek compulsory pooling from the Division pursuant to NMSA 1978, § 70-2-16(C).

60. With entry of this order, the Division's order requiring shut-in of the Barber 12 well should be rescinded and production permitted to resume.

**IT IS THEREFORE ORDERED THAT:**

1. The application of Sapient Energy Corporation in Case No. 12587 for an unorthodox well location for its Bertha J. Barber Well No. 12 is granted.
2. The application of Sapient Energy Corporation in Case No. 12587 for a non-standard 80-acre gas spacing unit consisting solely of its acreage in the E/2 of the NE/4 of Section 7 is denied.
3. The application of Sapient Energy Corporation in Case No. 12587 for a non-standard 80-acre gas spacing unit consisting of the W/2 of the N/E/4 of Section 7 is denied.
4. The application of Sapient Energy Corporation in Case No. 12587 for retroactive approval is denied as moot given the above orders.
5. The application of Sapient Energy Corporation in Case No. 12605 for special pool rules for the West Monument-Tubb Gas Pool identical to existing rules in the Monument Tubb Oil Pool, including standard 80-acre spacing units and a 330-foot setback requirement for both oil and gas wells is denied.
6. The order of the Division shutting-in the Bertha J. Barber Well No. 12 is hereby rescinded.
7. Jurisdiction of this case is retained for the entry of such further orders as the Commission may deem necessary.

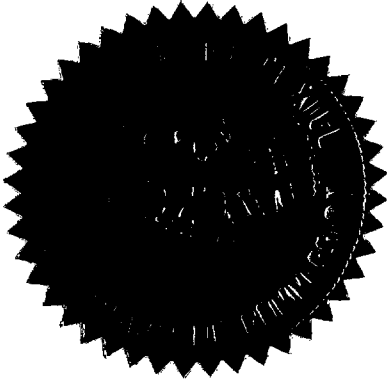
**DONE** at Santa Fe, New Mexico, on the day and year hereinabove designated.

**STATE OF NEW MEXICO  
OIL CONSERVATION COMMISSION**

  
**LORI WROTENBERY, CHAIR**

  
**JAMI BAILEY, MEMBER**

  
**ROBERT LEE, MEMBER**



**SEAL**