



RAILROAD COMMISSION OF TEXAS

HEARINGS DIVISION

OIL AND GAS DOCKET NOS. 7C-0291169 AND 7C-0291171

**THE APPLICATION OF PIONEER NATURAL RESOURCES USA, INC. TO AMEND
FIELD RULES FOR THE SPRABERRY (TREND AREA) FIELD IN VARIOUS
COUNTIES, TEXAS**

HEARD BY: Paul Dubois – Technical Examiner
Laura Miles-Valdez– Hearings Examiner

HEARING DATES: September 25, 2014 and November 3, 2014

APPEARANCES:

REPRESENTING:

APPLICANT:

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Purvis Operating Co.
COG
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EXAMINER'S REPORT AND RECOMMENDATION**STATEMENT OF THE CASE**

Pioneer Natural Resources, USA, Inc. ("Pioneer") requests the Commission amend the field rules for the Spraberry (Trend Area) Field (the "Field", and includes the four commission Field ID Nos. 85279200, 85279201, 85279300, and 85279301.) Pioneer is requesting a series of changes to the existing rules to prevent waste and to promote the orderly development of the Field. Specifically, Pioneer is requesting 11 amendments, which the Examiners have broadly categorized as follows:

Well Spacing

- Change the lease line spacing from 467 feet to 330 feet.
- Clarify that Statewide Rule 37 (16 Tex. Admin. Code §3.37) exception notice for a dual lease line spaced horizontal well is 330 feet perpendicular to the horizontal wellbore and with a 100-foot radius of the first and last take points.

Acreage Assignment

- Add a new provision that Statewide Rule 40 (16 Tex. Admin. Code §3.40) does not apply to the assignment of drilling and proration acreage as between horizontal and vertical wells; such that a 640 acre section in the Field may receive regular drilling permits for 8 vertical wells and 8 horizontal wells.
- Add a new provision requiring the use of the P-16 Data Sheet, or subsequently adopted Commission Form, in conjunction with permit applications and completion filings for all horizontal wells in the Field and for all wells on a lease or pooled unit where both vertical wells and horizontal wells are assigned to the same field number on the same acreage.
- Amend the notice provision for an exception to Statewide Rule 38 (16 Tex. Admin. Code §3.38) from 1867 feet to 660 feet.
- Add a provision to Field Rule 6 that Statewide Rule 86(d)(4) [16 Tex. Admin. Code §3.86(d)(4)] does not apply to Stacked Laterals.

Allowable Production Rate

- Change the maximum efficient rate (MER) allowable from 515 barrels of oil per day (BOPD) on 80 acres to 1,030 BOPD on 80 acres.

- Add a provision permitting oil wells and/or leases to balance overproduction over a period of one year.

Administrative Well Completion

- Add a provision to provide for an exception to Statewide Rule 16(b) [16 Tex. Admin. Code §3.16(b)] to allow additional time to conduct initial potential tests for horizontal wells, up to the earlier of 90 days after completion or 150 days after drilling operations are completed.
- Add a provision to provide for a 90 day exception to Statewide Rule 51(a) [16 Tex. Admin. Code §3.51(a)] for the filing of potential tests.
- Change the distance limitation for defining stacked laterals as set forth in Field Rule 6(1)(c) from 300 feet to 660 feet.

The Commission has received a number of letters of support from operators and mineral interest owners in the Field. Pioneer's application is not protested. The Examiners recommend the field rules be amended as requested by Pioneer.

MATTERS OFFICIALLY NOTICED

The Examiners take official notice of the proposal for decision and final order approved by the Commission in Oil & Gas Docket No. 7C-0283443, dated December 18, 2013: *The Application of Pioneer Natural Res. USA, Inc. to Amend Field Rules for the Spraberry (Trend Area) Field, Various Counties, Texas.*

DISCUSSION OF EVIDENCE

Pioneer's expert testimony was provided by Cary McGregor, P.E.; Margaret Allen, geologist; and Omkar Jaripatke, completion engineer. One hundred thirty-one exhibits were offered and admitted into evidence.

The Field

The Spraberry (Trend Area) Field occupies more than 4 million acres across 15 counties in the Midland Basin of West Texas.¹ The Field was established on December 22, 1952, by the consolidation of several fields that were discovered in the 1940s, into the Spraberry (Trend Area) Field (Oil & Gas Docket Nos. 125 and 126, 7 & 8-25,841). Over time other fields have been consolidated into the Field, expanding its reach horizontally

¹ Exh. No. 1.

across the Midland Basin, as well as vertically. The Field's 3,740-foot correlative interval now extends from the top of the Clearfork Formation to the top of the Strawn Formation, and includes all of the Clearfork, Spraberry, Dean, and Wolfcamp Formations.²

Currently there are 22,254 wells in the Field. The Field has produced 1.38 billion barrels of oil and 3.88 trillion cubic feet of gas. The Field currently produces 335,715 barrels of oil and more than 1 billion cubic feet of gas per day. With 6,577 wells, Pioneer is the largest operator in the Field.³

Development of the Field progressed from the 1950s through the early 2000s with vertical wells completed first in the Spraberry Formation, and then deepening into the Dean and Wolfcamp Formations. From the 1980s onward, significant efforts were focused primarily by infill drilling on small-acreage (less than 80 acre) units, thereby increasing production efficiency. Efficiencies were also realized by commingling production from the Field and deeper fields in the Strawn Formation and below. Since 2011, operators have drilled and completed horizontal wells in various Wolfcamp and Spraberry Formation intervals, some with lateral drainhole lengths of up to 10,000 feet.⁴ Of the nearly 2,400 drilling permits issued for the Field thus far in 2014, nearly half have been for horizontal wells.⁵

The recent development of shale resources in the Field reveals an astounding productive potential. Pioneer estimates a recoverable resource potential of 75 billion barrels of oil equivalent (BOE) in the Field's primary Spraberry and Wolfcamp shale intervals. These estimates represent an increase from the 50 billion BOE that Pioneer estimated in 2013.⁶ Additional resource potential may exist from downspacing and development of other shale intervals in the Clearfork and Middle Spraberry Formations.⁷ In terms of estimated recoverable resources, the Spraberry (Trend Area) Field is—by far—the largest oil field in the United States.

² Exh. No. 3.

³ Exh. No. 6.

⁴ Exh. No. 5.

⁵ Exh. No. 10.

⁶ See Oil & Gas Docket No. 7C-0283443, Final Order issued December 18, 2013.

⁷ Exh. No. 12.

Geologic Setting

The Spraberry (Trend Area) Field occupies the Midland Basin, which is the eastern portion of the Permian Basin in West Texas. The Midland Basin is bounded to the east by the Eastern Shelf, to the west by the Central Basin Shelf, and to the north by the Horseshoe Reef.⁸ The Val Verde Basin is south of the Midland Basin, and beyond that is the Marathon-Ouachita Fold Belt.⁹ Generally, during the time period that the Wolfcamp and Spraberry Formations were deposited (Pennsylvanian and Permian, respectively), the shelf areas were shallow-water environments dominated by platform carbonates. Carbonate debris flows line the shelf edges into the basin. The Marathon-Ouachita Fold Belt was the source of clastic sediments into the basins from the south. The basin margins, therefore, contain higher amounts of coarse sediments from shelf-edge debris flows, while the interior of the Midland Basin generally contains finer textured shales, with some coarser material from turbidite flows. The calm deep-water basin interior areas created anaerobic conditions, which provided for the accumulation of organic matter without oxidation and decomposition.¹⁰ The organic matter accumulated in the very fine textured carbonate and clastic sediments in the deep basin interior and were preserved through burial, becoming the source material for today's hydrocarbon resources. The depositional system was complex and occurred during times of high and low water levels; lithologic facies are observed to change quickly over short distances from primarily silt to carbonate sediments, with textural variability as well.¹¹

This broad-scale depositional system resulted in two general statements that can be made about hydrocarbon occurrence and recovery throughout the basin. First, vertical wells tend to be more productive along the basin margins where coarser-grained sediments are more likely to occur as a result of debris flows adjacent and interior to the basin shelf. While vertical wells have been productive throughout the basin, a study of 9,640 mostly vertical Spraberry and Wolfcamp Formation wells completed from 1998 and 2011, indicate most of the high-producing wells in the Midland Basin are clustered adjacent to the Central Basin Shelf.¹² Second, horizontal wells in the deeper interior basin areas where thick shale sequences are located have demonstrated excellent initial production from the very fine-

⁸ Exh. No. 18.

⁹ Exh. No. 20.

¹⁰ Exh. No. 22.

¹¹ Exh. No. 23.

¹² Exh. No. 25.

grained sediments that are not effectively or efficiently produced from vertical wells.¹³ The vertical target zones in the Spraberry Formation exhibit permeabilities from about 0.24 to 0.49 millidarcies (md); the horizontal target zones in Spraberry and Wolfcamp Formation shale intervals is much tighter at 10^{-5} to 10^{-9} md.¹⁴

Horizontal well performance is highly dependent on several key shale rock attributes. The mineralogy of the rock determines its brittleness. A brittle rock can be mechanically fractured and remain propped open, whereas a less brittle rock (with a higher clay mineral content) may not fracture or remain propped open. The porosity of the shale rock is important too, and shales can have good porosities. But shales typically have very low permeabilities, and so there are no pathways to connect the hydrocarbon-filled pore spaces. Therefore these formations require fracture stimulation to open the rock and connect the pore spaces to each other and to the wellbore. The organic richness is important as it determines the amount of organic material in the original sediments that may be transformed into producible hydrocarbons. As was seen above, the deep anaerobic conditions of the Midland Basin were conducive to large accumulations of organic matter that were not subject to oxidation. Over time, these organic sediments were chemically converted into producible hydrocarbons by burial at depth with the consequent conditions of high temperature and pressure. In the Midland Basin Wolfcamp Formation shales, these conditions were optimal for significant oil formation.¹⁵

A series of geologic cross sections illustrated the continuity of the primary shale targets across the Midland Basin, in both east-west and north-south orientations. As currently identified, the primary targets for horizontal development by Pioneer are the Middle Spraberry Shale, Jo Mill, Lower Spraberry Shale, and the Wolfcamp A, B and D zones. The Wolfcamp C is a lesser target, and other targets may be identified for future development.¹⁶ The cross-sections generally indicate a thickening of the Wolfcamp from west to east. Structurally, the current top of the Wolfcamp Formation is shallower to the east, but the sequence thickness is greatest in the east. The Wolfcamp thins to the north, as the depositional basin is bounded by the Horseshoe Reef to the north, limiting Wolfcamp-age deposition in this area.¹⁷ Although there is some variation in thickness and structure, all of the primary formations and target intervals—the “lithofacies packages”—in

¹³ Tr. p. 75, Ins. 15-20.

¹⁴ Exh. No. 26.

¹⁵ Tr. pg. 79, Ins. 4-6. Exh. No. 27.

¹⁶ Exh. No. 14.

¹⁷ Exh. Nos. 30-31, and 34-36.

the Field are continuous and identifiable throughout and across the Midland Basin.¹⁸

Pioneer also presented several smaller cross sections illustrating subsurface conditions in areas where the Spraberry (Trend Area) Field abuts some other regulatory fields [e.g., Lin (Wolfcamp)] that are producing from the same geologic interval. In these cases, Pioneer's position is that there is no reason for wells completed in the two fields to have different lease-line spacing provisions.¹⁹ Currently, the Spraberry (Trend Area) Field has 467-foot lease line spacing, whereas the Lin (Wolfcamp) and other correlative fields have 330-foot lease line spacing. Pioneer believes this disparity puts wells in the Spraberry (Trend Area) Field at a competitive disadvantage to adjacent wells assigned to other regulatory fields. Additionally, these basin shales, although continuous on a large scale, demonstrate variability over short distances. This lenticular nature of the rock is better developed with closer spacing.²⁰

Well Spacing Study

Pioneer has undertaken a study to optimize the spacing of horizontal wells completed in the shale intervals of the Spraberry (Trend Area) Field. This study follows a similar effort Pioneer undertook in the Eagleford Shale of South Texas.²¹ Through the Eagleford study, Pioneer has come to recognize that "Each shale play is unique with respect to geology, lithology, and production mechanism."²² The Spraberry (Trend Area) Field, unlike the Eagleford, is approximately 3,740 feet thick and contains multiple shale intervals targeted for horizontal well development. Pioneer has developed a tool kit to investigate the optimal spacing (and other design characteristics) of horizontal wells in shale formations.

In the present study, Pioneer selected four discrete areas within its field acreage for evaluation: D. L. Hutt; E. T. O'Daniel; Scharbauer Ranch; and Sale Ranch.²³ The objective was to characterize the fracture geometry for optimal well placement, and to do so in a manner such that one test does not interfere with the results of another test.²⁴ Key

¹⁸ Tr. pg. 94, Ins. 6-9. Exh. No. 37.

¹⁹ Tr. pg. 90, Ins. 3-6. Exh. Nos. 32-33.

²⁰ Tr. pg. 99, Ins 11-23.

²¹ Exh. Nos. 39-40.

²² Tr. pg. 113, Ins. 9-10.

²³ Exh. No. 44.

²⁴ Tr. pg. 113, Ins 21-24.

tools employed by Pioneer in the study as evidenced in the hearing include the following:

- **Chemical tracers:** Unique and identifiable chemical tracers are mixed with the fracture fluid. Detection of these tracers in an adjacent well can be evidence of hydraulic communication between the wells as a result of the fracture stimulation treatment, and thus an indication of hydraulic fracture half-length.²⁵
- **Radioactive tracers:** Radioactive isotopes are bound to the proppant material used during a fracture stimulation treatment. Detection of these isotopes by a spectral gamma ray log in an adjacent well can be evidence of propped communication, and thus an indication of the actual propped fracture length.²⁶ Propped communication was based on an observed minimum proppant distribution of 0.2 pounds of proppant per square foot of fracture surface.
- **Pressure monitoring:** Interval pressures are measured during the fracture stimulation treatment and during subsequent production to evaluate the degrees of hydraulic conductivity and propped conductivity, respectively. Pressure monitoring during production can also indicate the decay of between-well conductivity over time.²⁷
- **Microseismic analysis:** Geophones located at positions offset to a well being fracture stimulated can detect noise and microseismic events from the treatment. This data can be used to estimate fracture half-length and stimulated reservoir volume.²⁸
- **Fracture models:** Calculated fracture stimulation model pressures were calibrated with actual real-time pressures, rates and proppant data to predict fracture geometry and net pressures on adjacent wells.²⁹

Exhibit A to this Examiners' Report illustrates Pioneer's configuration of these

²⁵ Tr. pg. 107, ln. 19, to pg. 108, ln. 4.

²⁶ Tr. pg. 108, ln. 5, to pg. 109, ln. 6.

²⁷ Tr. pg. 109, ln. 22, to pg. 111, ln. 23.

²⁸ Tr. pg. 111, ln. 24, to pg. 112, ln. 15.

²⁹ Tr. pg. 130, ln. 17, to pg. 131, ln. 3.

various tools for use in evaluating the Wolfcamp A, B and D zones in the D. L. Hutt area.³⁰ The diagram identifies 13 horizontal wellbores drilled on five pads. The various wellbores targeted individual Wolfcamp Formation intervals. Horizontal distances between the wellbores are indicated. Vertical wellbores and horizontal pilot holes were also tested to obtain petrophysical properties of the target intervals and to conduct initial model calibration. The tests were run to enable correlation and calibration of spatial relationships (horizontally between wells completed in the same zone and vertically between wells completed in adjacent zones) with the modeled and observed outcomes of the key tool indicators. For example, in the D. L. Hutt Wolfcamp A interval, Pioneer concluded the modeled propped height (200 feet to 247 feet) was in close agreement with the observed propped height using radioactive tracers (about 210 feet).³¹

These methodologies and evaluation processes were applied to all four of the areas evaluated. Pioneer continues to develop its comprehensive study of the Field. However, as of the date of the hearing Pioneer is able to conclude the following with regard to fracture geometry:³²

- D. L. Hutt Area:
 - The Wolfcamp A fracture half-length is 250 feet, fracture height is 439 feet, propped half length is 173 feet, and propped height is 304 feet.
 - The Wolfcamp B fracture half-length is 443 feet, fracture height is 258 feet, propped half length is 316 feet, and propped height is 185 feet.
- E. T. O'Daniel Area:
 - The Wolfcamp A fracture half-length is 340 feet, fracture height is 315 feet, propped half length is 252 feet, and propped height is 228 feet.
 - The Wolfcamp B fracture half-length is 387 to 432 feet, fracture height is 273 to 307 feet, propped half length is 310 to 320 feet, and propped height is 202 to 245 feet.
- Scharbauer Ranch Area:
 - The Lower Spraberry Shale fracture half-length is 235 feet, fracture height is 425 feet, propped half length is 200 feet, and propped height is 320 feet.
 - The Wolfcamp B fracture half-length is 346 feet, fracture height is 270 feet, propped half length is 256 feet, and propped height is 220 feet.

³⁰ Exh. No. 12.

³¹ Exh. Nos. 56-57.

³² Exh. Nos. 59, 63, 85-87, 94-95, 101, 104, 106, and 108.

- Sale Ranch Area:
 - ▶ The Wolfcamp A fracture half-length is 215 feet, fracture height is 450 feet, propped half length is 150 feet, and propped height is 320 feet.
 - ▶ The Wolfcamp B fracture half-length is 220 feet, fracture height is 440 feet, propped half length is 165 feet, and propped height is 320 feet.
 - ▶ The Wolfcamp D fracture half-length is 180 feet, fracture height is 350 feet, propped half length is 125 feet, and propped height is 260 feet.

In summary, the propped fracture half-lengths, which indicate the initial drainage distance from the horizontal wellbore, for each of the shale zones tested are as follows:

- The Lower Spraberry Shale exhibits a propped fracture half-length of 200 feet.
- The Wolfcamp A exhibits a propped fracture half-length from 150 feet to 252 feet.
- The Wolfcamp B exhibits a propped fracture half-length from 165 feet to 320 feet.
- The Wolfcamp D exhibits a propped fracture half-length from 125 feet to 336 feet.

Pioneer asserts the evidence it presented at the hearing demonstrates that the longest fracture half-length it would expect to observe in the Field would be 336 feet. Based on this study, Pioneer stated its belief that 660 feet is an appropriate between-well spacing parameter horizontal wells in Spraberry (Trend Area) Field shale intervals. Consequently, Pioneer believes the lease line spacing should be reduced from the current 467 feet to 330 feet.³³

Proposed Field Rules

Pioneer is requesting field rules be amended for the Spraberry (Trend Area) Field. What follows are a summary and rationale for each of the amendments requested by Pioneer.

³³ Tr. pg. 196, ln. 15, to pg. 197, ln. 6.

Well Spacing**1. Reduce the lease line spacing from 467' to 330'.**

Pioneer's well-spacing study described above established 330 feet to be an appropriate lease line spacing distance for the Field. Amending the lease line spacing requirement from 467 feet to 330 feet will permit the additional recovery of approximately 1.17 billion BOE from a single zone and 8.2 billion BOE from the seven target zones throughout the Field. The lease line spacing is also supported by other evidence. The current field rules provide for a streamlined exception to Statewide Rule 38 (well density) from the standard unit size in the Field of 80 acres to 20 acres. Statewide Rule 38 also states that the statewide lease line spacing rule for a 20 acre unit is 330 feet. Pioneer's analysis of microseismic data during fracture stimulation in the Field indicates that 84 percent of observed events occur within 330 feet of the stimulated wellbore.³⁴ Pioneer also cited data from BHP Billiton that indicated "Wolfcamp drainage beyond 250 (feet) from the lateral is not indicated."³⁵ In addition, there are several nearby fields, such as the Lin (Wolfcamp) Field, that are defined over a similar correlative interval and have already been granted 330-foot lease line spacing.³⁶

2. Conform the lease line spacing exception distances to match the dual lease line take point spacing provisions.

Citing microseismic data from Laredo Petroleum, Pioneer indicated that most microseismic events occurred within 200 feet of the horizontal lateral, and nearly no events occurred more than 100 feet beyond the heel or toe of the lateral.³⁷ Based on this information, Pioneer believes that when a spacing exception is sought under Statewide Rule 37, the lease line spacing requirement should be expressly based on the established dual lease line spacing provisions of the field rules. Pioneer's amendment seeks to clarify this provision.

Acreage Assignment**3. Provide that Statewide Rule 40 applies separately to horizontal and vertical wells on a lease.**

³⁴ Exh. No. 111.

³⁵ Exh. No. 112 (taken from Oil & Gas Docket No. 08-0290788.)

³⁶ Exh. No. 117.

³⁷ Exh. No. 110.

Pioneer seeks to allow acreage in the Field to be assigned independently to vertical and horizontal wells, such that a 640 acre section may receive regular (80-acre) drilling permits for 8 vertical wells and 8 horizontal wells. Much of the Field is currently developed to density, and new vertical and horizontal wells usually require exceptions to Statewide Rule 38.³⁸ Pioneer demonstrated on its Hutt 'C' Lease that vertical and horizontal wells do not interfere with one another.³⁹ Horizontal wells in the extensive shale intervals produce much larger quantities of hydrocarbons, while vertical wells tend to exploit localized coarse-grained zones of limited aerial extent.⁴⁰ Thus vertical and horizontal wells are both necessary on the same acreage to maximize ultimate recovery in the Field.⁴¹

4. Require the use of the P-16 Data Sheet (Attached)

For the assignment of acreage in the Field, Pioneer requests that operators be required to file Form P-16 data sheet with Form W-1 for all horizontal wells and for vertical wells on a tract where both vertical wells and horizontal wells are assigned to the same field number on the same acreage.⁴²

5. Amend the special Statewide Rule 38 exception notice provision from 1,867' to 660'.

Currently, an operator in the Field may obtain an exception to Statewide Rule 38 after providing notice to affected parties within 1,867 feet of the proposed wellbore. Consistent with Pioneer's demonstration of the propped fracture half-length distances in the Field as being 330 feet or less, it believes reducing the notice provision from 1,867 feet to 660 feet is appropriate.

Since 2008, the number of drilling permits issued in the Field with exceptions to Statewide Rule 38 has increased dramatically. In 2008 fewer than 300 Rule 38 permits were issued. In 2014 (through September 11), nearly 1,600 Rule 38 permits were issued. The number of Rule 38 permits has exceeded 1,000 in each

³⁸ Tr. pg. 41, Ins. 9-18.

³⁹ Exh. Nos. 113-114. Tr. pg. 210, Ins. 17-19.

⁴⁰ Exh. No. 25.

⁴¹ Tr. pg. 76, ln. 2, to pg. 77, ln. 7.

⁴² Exh. No. 128. Tr. pgs. 246-250.

of the last four years.⁴³

6. Provide that Statewide Rule 86(d)(4) does not apply to Stacked Laterals.

Current field rules do not require operators to file a proration unit plat identifying the unit boundaries for each well. Therefore, Pioneer believes the requirement in Statewide Rule 86(d)(4) that all points on the drainholes of a stacked lateral be within the boundaries of the proration unit is unnecessary and should be removed.

Allowable Production Rate

7. Increase the field-wide MER allowable from 515 BOPD on 80 acres to 1,030 BOPD on 80 acres.

Pioneer estimates that its Hutt "C" Lease 15H and 16H horizontal wells will produce together about 1 million barrels of oil. In the same area there are currently 10 producing wells, which together are anticipated to produce a total of 413,000 barrels of oil. In this example the recovery ratio for horizontal wells is approximately 108 times that of a vertical well. That is, the same acreage drained by one of the horizontal wells would require 108 vertical wells to achieve the same estimated ultimate recovery from the Wolfcamp B zone, or one vertical well for each 1.05 acres.⁴⁴

In addition, lateral wellbores that are assigned as one stacked lateral well must share an allowable based on the acreage assigned to the well. That is, one vertical or horizontal well is assigned the same allowable (515 BOPD) as a stacked lateral well containing two or more horizontal wellbores. In one example, Laredo Petroleum's JE Cox-Blanco 29B Lease, Well No. 2, is one stacked lateral well with three horizontal wellbores completed in the Upper, Middle and Lower Wolfcamp Formations. On initial potential testing in June and July 2014, this one stacked lateral well produced 2,436 BOPD.⁴⁵ Pioneer also asserts that an increased allowable production rate will not harm the reservoir, as the gas production rate is not sensitive to or affected by the rate of oil production.⁴⁶

⁴³ Exh. No. 119.

⁴⁴ Exh. No. 114

⁴⁵ Exh. Nos. 115-116.

⁴⁶ Exh. No. 121.

8. Add a provision permitting oil wells and/or leases to balance overproduction over a period of one year.

In addition to increased MER allowables for the Field, Pioneer requests that additional time—specifically, one year—be available for an operator to balance overproduction. Under the current field rules a well in the Field may produce 515 BOPD. But, as Pioneer has shown, many wells produce two to three times this much at initial production, and more if the subject well has stacked laterals. Currently an operator may not produce more than 110 percent of a monthly allowable in any given month, and overproduction must be balanced with underproduction from subsequent months. Pioneer believes the production characteristics of horizontal wells in the Field—high initial production rates, steep decline curves, and rate-insensitive production—indicate that allowing overproduction to be balanced over a one-year period will not cause waste or harm the reservoirs in the Field. Combining the 1,030 MER with a one-year balancing period will provide for more efficient administrative management of the Field without harm to the Field.⁴⁷

Administrative Well Completion

9. Provide for an exception to Statewide Rule 16(b)

Pioneer seeks an administrative exception to Statewide Rule 16(b) to file completion reports for horizontal wells completed in the Field. Currently, Rule 16(b) states, "*the operator of a well shall file with the commission the appropriate completion report within 30 days after completion of the well or within 90 days after the date on which the drilling operation is completed, whichever is earlier.*" Pioneer requests that 30 and 90 day time periods in the current rule be extended to 90 and 150 days, respectively. Pioneer provided evidence indicating that filing completion reports within the compliance time frame is very difficult to achieve given the current pace of well completion in the Field. The proposed time extensions are necessary to prevent operators from having to obtain individual exceptions to Rule 16(b).⁴⁸

10. Provide for an exception to Statewide Rule 51(a)

Pioneer seeks an administrative exception to Statewide Rule 51(a) to conduct initial potential tests for horizontal wells completed in the Field. Currently, Rule 51(a) states, "*A potential test form with all information requested thereon filled in shall be filed in the district office not later than 10 days after the test is completed.*" Pioneer

⁴⁷ Exh. No. 120.

⁴⁸ Exh. No. 124.

requests that the 10 day time period in the current rule be extended to 30 days. Pioneer provided evidence indicating that filing initial potential tests within the compliance time frame is very difficult to achieve given the current pace of well completion in the Field, and the time necessary for Pioneer's staff to evaluate the well test data prior to filing. The proposed time extensions are necessary to prevent operators from having to obtain individual exceptions to Rule 51(a).⁴⁹

11. Change and clarify the distance limitation for defining stacked laterals from 300 feet to 660 feet.

Current field rules require that all take points on drainholes for a stacked lateral well must be within 300 feet of the record well. Pioneer contends there is some ambiguity in the current wording, and proposes instead to define a 660-foot wide rectangle as the maximum horizontal spread for all wellbores assigned to a single stacked lateral well.⁵⁰ While doubling the current 300-foot requirement would yield a 600-foot wide rectangular area, Pioneer believes 660-feet is more appropriate as a regulatory value as it corresponds to twice the requested lease line spacing and the requested notice radius for an exception to Rule 38.

EXAMINERS' OPINION

The Spraberry (Trend Area) Field is an important resource for the State of Texas. As has been described in detail elsewhere (see Oil & Gas Docket No. 7C-0283443, Final Order issued December 18, 2013), the Spraberry (Trend Area) Field is challenged by a regulatory framework built for a conventional model of reservoir mechanics and development—a model with a number of limitations in its application to the development of unconventional fields. The existing regulatory framework applies two-dimensional acreage requirements on what is clearly a three-dimensional resource—in terms of both the depositional environments and efficient economic development.

In Oil & Gas Docket No. 7C-0283443, the Commission recognized the limitations of the existing regulatory scheme and acted in its regulatory authority to prevent waste, protect correlative rights, and prevent confiscation, by molding the field rules to accommodate relief from certain limiting aspects of acreage-based regulation. The Examiners find that the proposed field rules—especially the proposed exception to Statewide Rule 40—are consistent with Commission's intent and interests in the earlier docket and are a precedent for the current application.

The Examiners are of the opinion that acreage issues will continue to challenge

⁴⁹ *Ibid.*

⁵⁰ Exh. No. 121.

operators in the Field, but the proposed field rules will provide adequate relief on this issue for the time being. Consequently, however, the Examiners conclude operators will continue to be limited by the allowable production rate of wells in the field, as the allowable production rate is a function of acreage, and not another representative measure, such as the aggregate length of horizontal wellbore in a stacked lateral well. Pioneer sought allowable production rate relief by demonstrating that a 1,030 BOPD MER was appropriate. Indeed, Pioneer's data and testimony suggest an even higher MER may be supportable.

In consideration of allowable production rates, steep decline curves, and the potential for the on-going completion of stacked lateral wells, Pioneer also requested the ability to "balance" overproduction for wells or leases over a period of one year. The Examiners are of the opinion that such a request is a reasonable accommodation, but it cannot be implemented, at least in the short term, given limitations of the existing production accounting and compliance system. In particular, oil production is reported to the Commission on a lease basis, not a well basis. The Commission has no way to administratively manipulate the oil production account for a specific well; it must be done by lease. Further the Commission's production and compliance system has not been programmed to balance oil accounts, by well or by lease, over any period of time.

However, overproduction is routinely cancelled by the Commission as a provision of Final Orders granting MER allowables, and therefore the Examiners proposed instead that interim relief be provided as follows:

Upon an operator's written request, the Commission shall cancel overproduction for any lease in this field for any twelve one-month periods.

It is the Examiners' understanding that Pioneer and Commission staff find this language to be workable, at least as an interim solution, for which it is intended. As constructed, it is self-limited to twelve one-month periods; a permanent solution is needed. This relief will require operators to respond in writing to monthly overproduction notices for each lease; it will require Commission staff to manually cancel the overproduction for each month and lease for which relief is requested. The degree of the administrative burden on operators and staff is unclear at this point, but the Examiners do not see—and the evidentiary record does not provide—another viable interim solution.

The Examiners recommend that Pioneer's application be approved and that the field rules be amended as set out in the attached proposed Final Order.

FINDINGS OF FACT

1. Notice of this hearing was sent to all persons entitled to notice.
2. This application to amend the field rules for the Spraberry (Trend Area) Field is not protested.

3. The Spraberry (Trend Area) Field was discovered in the 1940's and currently extends over approximately four million acres.
4. Field rules for the Spraberry (Trend Area) Field were originally adopted in Final Order No. 7C & 8-25,174 on December 22, 1952. Since that time, the field rules have been amended and the Field has grown vertically and horizontally.
5. The Spraberry (Trend Area) Field is designated as the interval from 6,865 feet to 10,605 feet as shown on the log of the Pioneer Natural Res. USA, Inc. Houpt Lease, Well No. 1.
6. The Spraberry (Trend Area) Field is located in the Midland Basin of the Permian Basin. The Midland Basin was a deepwater basin at the time of deposition. Debris flows off the shelf edge, turbidite flows out into the basin, and windblown silt and sand grains, in combination with the rise and fall of the sea level, resulted in a complex layering of reservoir rock that varies from coarse-grained carbonates to fine-grained sands and silts.
7. Daily production for the Field for June, 2014 is 335,715 BOPD and 1,051,665 MCFPD from 22,254 wells.
8. The cumulative production through June, 2014 is more than 1.3 billion BO and 3.8 trillion CFG.
9. Drilling permit applications for horizontal wells in the Field have increased between 2010, when fewer than 100 were requested, and 2014 when almost 2,400 horizontal well applications have been filed. Over the same time period, the number of vertical drilling permit applications has decreased.
10. The Spraberry (Trend Area) Field is the largest oil field in the United States with an estimated resource potential from the shale intervals of 75 billion barrels of oil equivalent.
11. Total field production from the Spraberry (Trend Area) Field had peaked in 1997 at 65,000 BOPD. Subsequently, production has increased by 2014 to more than 300,000 BOPD as a result of the horizontal development of the unconventional shale portions of the Spraberry (Trend Area) Field.
12. Horizontal development covers the entire field area.
13. The vertical variability or lenticularity that is present in the shales and unconventional resource zones in the Spraberry (Trend Area) Field within

lithofacies packages indicates the need for close well spacing to encounter these lenses and recover the hydrocarbons.

14. Close well spacing is necessary because of the very low permeability encountered by wells in the shales and unconventional zones in the Spraberry (Trend Area) Field.
15. Lease line spacing of 330 feet is necessary to allow recovery of the hydrocarbons because wells in the shale and unconventional resource zones in this field are capable of draining no more than 330 feet.
 - a. Fracture stimulation modeling conducted in four separate study areas in the Field indicates that fracture half lengths vary from 125 feet in the Wolfcamp D in the Sale Ranch Study Area to 336 feet in the Wolfcamp D in the D.L. Hutt Study Area. These numbers represent the outside limit of the effective propped length of fractures, demonstrating the need for 330 foot lease line spacing.
 - b. The fracture stimulation model results demonstrating the need for 330 foot lease line spacing are confirmed by radioactive tracer response, chemical tracer results, microseismic monitoring and well production performance.
 - c. Modeling in the D.L. Hutt Study Area for the Wolfcamp A shows a fracture half-length range between 138 and 173 feet.
 - d. Modeling shows that the largest effective propped fracture height in the D.L. Hutt Study Area for the Wolfcamp B interval is 178 feet. Fracture height revealed by radioactive tracers observed on a spectral gamma ray log demonstrated a prop height of 180 feet, thus confirming the modeling.
 - e. Fracture modeling for the Wolfcamp B in the D.L. Hutt Study Area indicates effective propped fracture half-lengths between 241 and 316 feet and effective propped fracture heights between 142 feet and 185 feet. Radioactive tracer studies and interference studies between wells 600 feet apart confirms these modeling results.
 - f. Interference studies with radioactive tracers indicate that there is no propped or conductive communication and thus no interference between two wells 600 feet apart, confirming that wells affect areas of less than 330 feet.
 - g. Wells may be in hydraulic communication over distances of 450 feet

during fracture stimulation treatment, but once the treatment is stopped the effective propped fracture is all that produces.

- h. Fracture modeling studies, confirmed by radioactive tracer surveys, in the E.T. O'Daniel Study Area indicate for the Wolfcamp A effective propped fracture half-lengths from 210 to 252 feet and effective fracture heights between 184 and 228 feet.
- i. Fracture modeling studies, confirmed by radioactive tracer surveys, on wells in the E.T. O'Daniel Study Area indicate for the Wolfcamp B effective fracture half-lengths from 200 feet to 320 feet and effective fracture heights from 150 feet to 245 feet.
- j. Modeling and microseismic studies for the Scharbauer Ranch Study Area indicate effective fracture half-lengths in the Wolfcamp B of 210 feet to 256 feet and effective fracture heights in the Wolfcamp B of 190 feet to 220 feet. Real time pressure monitoring in a well 630 feet away show no effect on the Wolfcamp B pressure, validating the model and showing that at 630 feet there is no communication during production.
- k. Effective propped fracture half-lengths in the Lower Spraberry Shale range from 140 feet to 200 feet and effective fracture heights range from 250 to 320 feet.
- l. Effective propped fracture half-lengths in the Wolfcamp D in the Sale Ranch Study Area range from 115 to 125 feet and effective fracture heights range from 225 to 260 feet.
- m. Effective propped fracture half-lengths in the Wolfcamp B in the Sale Ranch Study Area range from 135 to 165 feet and effective fracture heights range from 270 to 320 feet.
- n. Effective propped fracture half-lengths in the Wolfcamp A in the Sale Ranch Study Area range from 130 to 150 feet and effective fracture heights range from 270 to 320 feet.
- o. Real time pressure monitoring indicates that unpropped fractures move fluid during stimulation, but these fractures close during production so that there is no sustained communication.
- p. The primary fracture propagation mechanism is multiple fractures.
- q. The ease of correlation of lithofacies packages across the Field area

demonstrates that the results of these detailed drainage area studies are relevant and applicable across the Field.

16. Spacing of 467 feet to lease line will cause the ultimate loss of hydrocarbons because the absence of communication beyond 330 feet from a well indicates that reserves are being left in the reservoir with 467 feet spacing.
17. Analysis of 43 horizontal wells with microseismic data across six counties in this field shows that 84% of the microseismic events fall within 330 feet of the wellbores. These microseismic events are shear events, not propped fracture events.
18. The standard spacing for wells on 20 acres is 330 feet to lease line.
19. Amending the lease line spacing requirement from 467 feet to 330 feet will permit the recovery of approximately 1.17 billion BOE from a single zone and 8.2 billion BOE from the seven target zones.
20. Because wells in the Field do not affect more than 330 feet, notice of administrative Rule 38 exception applications to offset owners within 660 feet of the wells is adequate to provide notice to those affected.
21. The majority of the leases in the Spraberry (Trend Area) Field are drilled with vertical wells to the maximum density permitted by the field rules. Drilling horizontal wells under the current field rules will often require a Rule 38 exception, which imposes an administrative burden on the Commission and operators.
 - a. Under the current rules, the ninth well on any 640-acre tract the well penetrates and all additional wells on that tract would require an exception to Statewide Rule 38. Thus, any horizontal well drilled on a 640-acre tract with 8 vertical wells requires a Rule 38 exception. As a result, most horizontal wells in the Spraberry (Trend Area) Field require exceptions to Rule 38.
 - b. Under the proposed rule, 8 vertical wells and 8 horizontal wells could be permitted as regular locations on a 640-acre tract. The ninth vertical well or the ninth horizontal well that penetrates a 640-acre tract will require a Rule 38 exception as will additional wells of the same type.
22. An exception to Statewide Rule 40 to provide that proration units for horizontal and vertical wells are independent and may overlap is necessary to recover the hydrocarbons in this field because there is no destructive

interference between vertical and horizontal wells.

- a. Comparison of vertical and horizontal well development density on the Hutt 'C' Lease demonstrates that the vertical and horizontal wells do not impact each other.
 - b. The average vertical well in the Wolfcamp B zone on the Hutt 'C' lease will recover 4,719 barrels of oil.
 - c. The average horizontal well in the Wolfcamp B zone on the Hutt 'C' lease will recover 508,250 barrels of oil.
 - d. Horizontal wells recover 108 times a vertical well on the Hutt 'C' Lease in the Wolfcamp B Zone such that a vertical well would be needed on every 1.05 acres to accomplish recoveries similar to the horizontal well.
 - e. The limited, approximately one-acre drainage areas of the vertical wells indicates no destructive interference between the horizontal and vertical wells.
 - f. Decline curves show no destructive interference between vertical and horizontal wells.
23. Horizontal wells are much more capable of recovering large volumes of hydrocarbons, but the vertical wells remain capable of recovering a substantial volume of hydrocarbons over their lives.
24. Both horizontal and vertical wells are necessary on the same acreage to maximize ultimate recovery in the Spraberry (Trend Area) Field because the horizontal wells target and produce from different rock than the vertical wells.
- a. Vertical wells target the better quality conventional reservoir rock which is typically the coarse-grained detrital carbonate facies.
 - b. Traditional vertical targets have average permeabilities in the range of .07 to .49 md.
 - c. Horizontal wells target the fine-grained brittle mudrock that can be successfully fracture stimulated.
 - d. Horizontal wells target unconventional targets with average permeabilities in the range of 10^{-5} to 10^{-9} md.

25. Compliance with these amended field rules can be best assured by requiring the filing of a Form P-16 Data Sheet along with the Form W-1 and completion report for all horizontal wells and for vertical wells on a tract where both vertical wells and horizontal wells are assigned to the same field number on the same acreage in the Spraberry (Trend Area) Field.
26. Producing gas-oil ratio data shows there is no need to restrict the producing oil rate in the Spraberry (Trend Area) Field to improve ultimate recovery.
 - a. Gas-oil ratios in this field are very low.
 - b. Gas-oil ratios in this field are unaffected by producing rates.
 - c. There is no rate sensitivity even with artificial lift.
 - d. The only hydrocarbons that are produced in these horizontal wells is in the matrix that is contacted, fracture stimulated, and propped.
27. An MER of at least 1,030 BOPD is necessary to provide an adequate allowable to horizontal wells and in particular to stacked lateral wells that come on production at the same time.
 - a. Improved completion techniques, such as pad drilling and zipper fracs, result in more efficient recovery but also result in higher volumes that require higher allowables.
 - b. Horizontal drainhole lengths have increased from 3,000 feet initially to the current 9,000 feet, which results in increased reserves and increased production rates.
 - c. Stacked laterals have demonstrated the capability to produce 2,436 BOPD in this field, and the current 515 BOPD MER allowable will result in curtailments or shut in of the well to make up overproduction.
 - d. The proposed 1,030 BOPD allowable may not be sufficient and may need to be revised up in the future.
28. In consideration of the production characteristics and steep decline curves for horizontal wells in the Field, and the potential for the on-going completion of stacked lateral wells on a lease, additional relief is necessary to prevent overproduction.
 - a. Overproduction is routinely cancelled by the Commission as a provision of Final Orders granting MER allowable production rates.

- b. Administrative cancellation of overproduction is a limited solution providing interim relief until to a long-term solution is crafted.
- 29. Notice distances for Rule 37 exception applications should be consistent with the dual lease line spacing rules in the Spraberry (Trend Area) Field of 100 feet from the first and last take point in directions not perpendicular to the well.
 - a. Microseismic data for a Spraberry (Trend Area) well indicate that microseismic events fall within 100 feet of the first and last take point.
- 30. Orderly development will be promoted by amending the stacked lateral rule in this field to provide that stacked laterals are to be located within a 660 foot wide box and to remove the requirements of Rule 86(d)(4) and Field Rule 6, paragraph 2.a. stating that all points on a drainhole must be within the proration and/or drilling unit.
 - a. A 660 foot wide box represents a reasonable size for development of stacked laterals with 330 feet spacing to lease lines and allows for possible drift.
 - b. The 660-foot wide box will provide eight fairways on a standard 640-acre section.
 - c. Because no proration unit plat is required to be filed in this field, it is reasonable to remove any requirement that all points on a drainhole must fall within the proration unit.
- 31. Exceptions to the deadlines for filing completion reports in Statewide Rules 16(b) and 51(a) are appropriate in this field.
 - a. Ten days is insufficient to obtain the data needed to file a completion report for a horizontal well, including as-drilled surveys and accurate stabilized test information.
 - b. It often takes more than 30 days of flow from a well to clean it up.
 - c. The Commission has previously adopted field rules permitting additional time for completion report filing for fields with horizontal wells, including the Gin (Spraberry) Field.

32. The proposed field rules will work in combination to increase ultimate recovery and protect correlative rights in the Spraberry (Trend Area) Field.
 - a. The 1,030 BOPD MER, the Rule 40 exception provision, and limited overproduction cancellation are necessary in combination to address overproduction issues that would otherwise discourage drilling and development of horizontal wells and particularly of stacked lateral wells in multiple intervals.
 - b. The 330-foot spacing rule and the Rule 40 exception provision are necessary in combination to permit recovery of hydrocarbons which would otherwise not be recovered.
 - c. The Rule 37 notice clarification, the Rule 38 notice amendment, the Rule 40 exception provision, the Stacked Lateral Rule amendments, the Rule 16 exception, and the Rule 51 exception, will together reduce unnecessary administrative burdens on operators and the Railroad Commission.

CONCLUSIONS OF LAW

1. Resolution of the subject application is a matter committed to the jurisdiction of the Railroad Commission of Texas. Tex. Nat. Res. Code § 81.051
2. All notice requirements have been satisfied. 16 Tex. Admin. Code § 1.45
3. The proposed field rules will prevent waste, protect correlative rights, and satisfy statutory requirements.

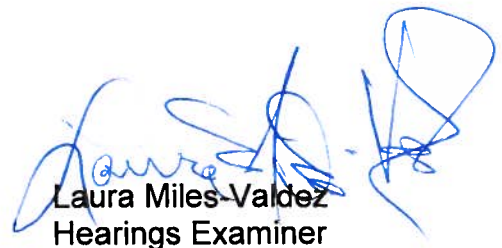
RECOMMENDATION

Based on the above findings of fact and conclusions of law, the Examiners recommend Pioneer's application be approved and that the field rules the Spraberry (Trend Area) Field be amended as requested and as set out in the attached proposed Final Order.

Respectfully submitted,

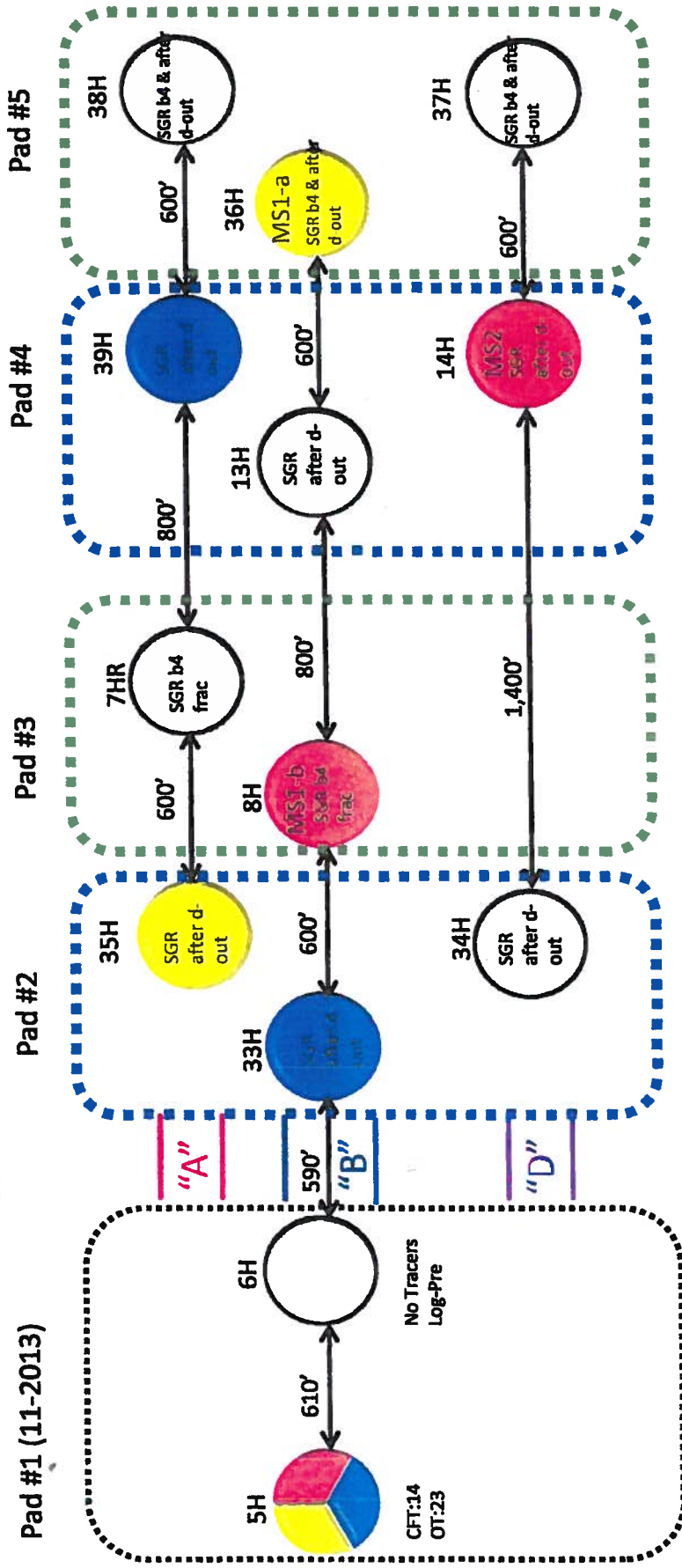


Paul Dubois
Technical Examiner



Laura Miles-Valdez
Hearings Examiner

D.L. Hutt – Science Plan – gun barrel with distances



- Chemical Tracers: On Pad #3-5
- Oil Tracers: On 39H, 13H & 14H
- MS1-a: Monitor Pad #4 zipper-frac from 36H on Pad #5
- MS1-b: Monitor Pad #2 zipper-frac from 8H on Pad #5
- MS2: Monitor heel stages of Pad #5 zipper-frac from heel of 14H on Pad #4
- Bottom-hole psi gauges on all Pad #2-#5 wells
- Run SpectraScan log on all Pad 2-5 wells as specified above for each well
- Catch oil & water samples and analyze on all Pad 1-5 wells
- Monitor psi gauges on all Pad #2-5 wells
- Biomarkers - Matt Laughland

PIONEER NATURAL RES. USA, INC.
Docket No. 7C-0291171 & 7C-0291169
November 3, 2014
Exhibit No. 54