UIC - I - __8-1__

EPA FALL-OFF TEST (WDW-2)

DATE:

2011

HOLLYFRONTIER
THE HOLLYFRONTIER COMPANIES

March 2, 2012

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505

RE: 2011 Annual Bottom-Hole Pressure Survey & Pressure Falloff Test for Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3
Navajo Refining Company
Disposal Wells WDW-1, WDW-2, WDW-3

Mr. Chavez,

Enclosed, please find three (3) copies of our 2011 Pressure Falloff (PFO) Test & Bottom-Hole Pressure Survey for Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3.

If you have any questions, please contact me at the above address or by telephone at (575) 746-5382.

Sincerely,

Robert Combs, PhD
Environmental Specialist

Electronic cc (wo/enc): MGM, JEL

Environmental File: 2011 Pressure Falloff Test & Bottom-Hole Pressure Survey
Environmental Library

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, March 15, 2012 11:13 AM
To: robert.combs@hollyfrontier.com
Subject: WDWs Fall-Off Testing & Electronic Data Compilation from Individual FOTs for Software Evaluation

Robert:

Could you please send the supporting electronic data for the FOTs per well to the OCD?

Navajo should have the type of electronic data that the OCD requires in case you have questions.

Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: http://www.emnrd.state.nm.us/ocd/
"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at:
http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental)

SUBSURFACE

2011 PRESSURE FALLOFF TEST AND BOTTOM-HOLE PRESSURE SURVEY ON CHUKKA WELL NO. 2

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO
PROJECT NO. 70A6645

SUBMITTED:
JANUARY 2012

SUBSURFACE TECHNOLOGY, INC.
6925 PORTWEST DR., STE. 110
HOUSTON, TEXAS 77024
pfh@subsurfacegroup.com

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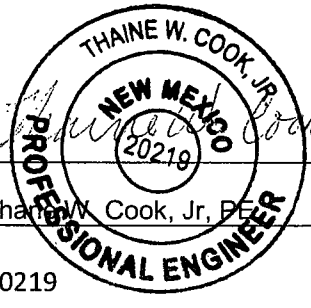
I Thaine W Cook, Jr, PE certify that the following is accurate:

1. I or my agent have visited and examined the facility;
2. This report was prepared in accordance with good engineering practice and accepted and sound industry practices and standards;
3. I either have prepared engineering portions of this report or they were prepared under my supervision and I certify that they are correct.



Signature Thaine W Cook, PE Title: Principal Consultant

Name Thaine W Cook, Jr, PE Date: 1/12/2012

New Mexico PE # 20219

1. FACILITY INFORMATION

a. Name: Navajo Refining Company (subsidiary of the Holly Corporation)
b. Facility Location: Highway 82 East, Artesia, New Mexico 88211
c. Operator's OGRD Number: Section 1, Township 18 South, Range 27 East

2. WELL INFORMATION

a. OCD UIC Permit Number: UIC-CLI-008-2
b. Well Classification: Class I Non-Hazardous
c. Well Name and Number: Chukka Well No. 2
d. API Number: 30-015-20894
e. Well Legal Location: 1980 FNL, 660-FWL

3. CURRENT WELLBORE SCHEMATIC

The Chukka Well No. 2 wellbore schematic is presented in Figure 1. The schematic contains data, as requested by the guidelines and includes the following:

a. Tubing: 3-1/2-inch, 9.2 pound per foot, steel construction, API grade J-55, with smls, NUE 10 rd; (Item 3)

b. Packer: Arrow X-1, 5-1/2-inch by 2-7/8-inch set in tension at 7,528 feet; (Item 7)

c. Tubing Length: 7,528 feet. There are no profile nipples in the tubing or the packer as this was not a requirement of the permit;

d. Size, type, and depth of casing: There are two casing strings in the well and one below the injection interval. The information for these casing strings was obtained from OCD records on file with the state and geophysical logs. The casing strings are:

i. 8-5/8-inch, 32.5 pound per foot, steel construction, API grade J-55, with short thread connections (STC), set at a depth of 1,995 feet. The casing was cemented to the surface with 800 sacks of cement. The casing was set in open hole with a diameter of 11 inches; (Item 2)

ii. 5-1/2-inch, 17 pound per foot, steel construction, API grade L-80, LT&C, set at a depth of 8,869 feet. The casing was cemented to the surface in two stages with 575 sacks of cement in the first stage and 995 sacks of cement in the second stage. The casing was set in open hole with a diameter of 7-7/8-inches. (Item 6)

e. The top of cement: Determined from a CBL run in the 5-1/2-inch casing string on May 28, 1999. The top of cement in the 5-1/2-inch casing was found at the surface. From the CBL run in the 8-5/8-inch on May 9, 1999, the top of cement in the 9-5/8-inch was determined to be at 116 feet.

f. The 5-1/2-inch casing: Perforated on June 1, 1999. The casing was perforated with a 0.5-inch diameter hole, at 2 shots per foot, on a 120° phasing. The perforations are located between 7,570 feet and 7,736 feet and from 7,826 feet to 8,399 feet.

g. The total depth of the well: 10,372 feet, with the plug back depth at 8,770 feet. On October 22, 2011, fill was tagged at 8,335 feet (RKB).

h. The bottom-hole pressure gauges consisted of two memory readout (MRO) pressure gauges. The MRO pressure gauges were placed at 7,569 feet and 7,570 feet (top of the perforations).

4. ELECTRIC LOG ENCOMPASSING THE COMPLETED INTERVAL

The dual induction log is presented as Appendix A and encompasses the completed interval between 7,570 feet and 8,399 feet. The dual induction log was submitted to the OCD with the original permit. The original dual induction log was

completed August 27, 1973 by Amoco Production Company. The log was resubmitted to the OCD when the well was re-permitted as a Class I injection well.

5. RELEVANT PORTIONS OF POROSITY LOG USED TO ESTIMATE FORMATION POROSITY

The neutron density log is presented as Appendix B and encompasses the completed interval between 7,570 feet and 8,399 feet. The neutron density log was submitted to the OCD with the original permit after the well was drilled by Amoco Production Company. The compensated neutron formation density log was completed on August 27, 1973. The log was resubmitted to the OCD when the well was re-permitted as a Class I injection well. The average porosity of the formation, (10%), and the reservoir thickness, (175 feet), were determined from this log. These values were used in the analysis of the pressure falloff data (Section 15). Additional information concerning the geology of the injection reservoir is discussed in Section 11.

6. PVT DATA OF THE FORMATION AND INJECTION FLUID

The Chukka Well No. 2 was recompleted in June 1999, prior to the issuance of the current well testing guidelines (December 3, 2007). At that time, no directives were in place to test formation fluids or derive formation characteristics from cores. However, reservoir fluid samples were obtained and the average density and average total dissolved solids (TDS) were measured at 1.03 g/l and 26,500 mg/l, respectively. The analytical results of the analysis of the formation fluid are summarized in Table I.

The viscosity of the formation fluid, formation water compressibility, and total system compressibility were estimated in reference to bottom-hole temperature using industry accepted correlations. These correlations are found in the Society of Petroleum Engineer's "Advances in Well Test Analysis, Monograph Volume 5" and "Pressure Buildup and Flow Tests in Wells, Monograph Volume 1".

a. Estimation of Formation Fluid and Reservoir Rock Compressibility:

The fluid compressibility of the formation brine was estimated for a sodium chloride solution (26,500 mg/l) at the bottom-hole temperature of 127°F, using Appendix C (Figure D.16 SPE Monograph 5). This value was 2.9 x 10^{-6} psi^{-1}. The formation pore volume compressibility was estimated using Appendix D (Figure G.5 SPE Monograph 1). This value was 5.5 x 10^{-6} psi^{-1}. The total system compressibility is the sum of the fluid compressibility and the pore volume compressibility, 8.4 x 10^{-6} psi^{-1}. The temperature used with the correlations was recorded during the temperature survey conducted in the Chukka Well No. 2 on May 28, 1999 and June 5, 1999, and included in this report as Appendix E.

b. Formation Fluid Viscosity with Reference Temperature:

The formation fluid had an average TDS concentration of 26,500 mg/l. This equates to an approximate equivalent percentage of NaCl of 4.5%. The average viscosity of the formation fluid was estimated using Appendix F (Figure D.35 SPE Monograph 5). This value was 0.57 centipoise (cp) at 127°F.

c. Formation Fluid Specific Gravity/Density with Reference Temperature:

The average formation fluid density was measured at 1.03 g/l at 70°F (Table I).

d. Injection Fluid Specific Gravity, Viscosity and Compressibility with Reference Temperature:

The specific gravity of the refinery waste water was measured during the injection portion of the reservoir testing. The specific gravity was 1.0013 (8.34 pounds per gallon). Using the same methodology described above, the viscosity of the injected fluid was 0.50 cp at 127°F. The compressibility of the injected plant waste was 2.9 x 10^{-6} psi^{-1} at 127°F.

7. DAILY RATE HISTORY DATA (MINIMUM OF ONE MONTH PRECEDING THE FALLOFF TEST)

The daily rate history is summarized in Appendix G.

8. CUMULATIVE INJECTION INTO THE FORMATION FROM TEST WELL AND OFFSET WELLS

The total volume of fluid injected into all three wells as of October 20, 2011, was 2,559,794,549 gallons. The volume of fluid injected into the Mewbourne Well No. 1 was 1,404,428,396 gallons. The volume of fluid injected into the Chukka Well No. 2 was 817,420,486 gallons. The volume of fluid injected into the Gaines Well No. 3 was 337,945,667 gallons. The area of review (AOR) indicates that there are no other wells injecting into the intervals in which the Navajo wells inject. The volumes injected were obtained from plant records.

9. PRESSURE GAUGES

Two (2) downhole memory readout pressure gauges were used for the Chukka Well No. 2 buildup and falloff testing. The downhole MRO gauges were set at 7,569 feet and 7,570 feet. Bottom-hole MRO pressure gauges were also placed in each of the offset wells (Mewbourne Well No. 1 and Gaines Well No. 3). The pressure gauges were set at 7,924 feet in the Mewbourne Well No. 1 and at 7,660 feet in the Gaines Well No. 3.

a. Describe the type of down hole surface pressure readout gauge used including manufacture and type:

In the Chukka Well No. 2, two MRO pressure gauges were used to record the pressure and temperature data during the injection/falloff testing. Both gauges were sapphire crystal gauges. The MRO pressure gauges (Serial Nos. 80785 and 78549) were used. Both gauges were sapphire crystal gauges and were manufactured by Spartek Systems.

In the Mewbourne Well No. 1, two MRO pressure gauges were used to monitor the bottom-hole pressure and temperature during the testing of the Gaines Well No. 2. Both gauges were sapphire crystal gauges with Serial Nos. 75871 and 75900. Both gauges were manufactured by Spartek Systems.

In the Gaines Well No. 3, two MRO pressure gauges were used to monitor the bottom-hole pressure and temperature during the testing of the Chukka Well No. 2. Both gauges were sapphire crystal gauges with Serial Nos. 76170 and 77120. Both gauges were manufactured by Spartek Systems.

b. List the full range, accuracy and resolution of the gauge:

In Chukka Well No. 2, the MRO pressure gauges, Serial Nos. 80785 and 78549, have a full range of 0 psi to 10,000 psi, an accuracy of 0.022% of full scale, and a resolution of 0.0003% of full scale.

In Mewbourne Well No. 1, the MRO pressure gauges, Serial Nos. 75871 and 75900, have a full range of 0 psi to 10,000 psi, an accuracy of 0.022% of full scale, and a resolution of 0.0003% of full scale.

In Gaines Well No. 3, the MRO pressure gauges, Serial Nos. 76170 and 77120, have a full range of 0 psi to 10,000 psi, an accuracy of 0.022% of full scale, and a resolution of 0.0003% of full scale.

c. Provide the manufacture's recommended frequency of calibration and a calibration certificate showing date the gauge was last calibrated:

The certificate of calibration for each of the pressure gauges used during the testing are included as Appendix H. The manufacturers recommended calibration frequency is one year.

10. ONE MILE AREA OF REVIEW (AOR)

Federal Abstract Company was contracted by Subsurface and instructed to undertake a review of well changes made within a one-mile Area of Review (AOR) of the Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3. In 2011, an update of the original AOR, submitted with the Discharge Application Permit 2003, was completed within the one-mile AOR for all three wells. The current update includes all existing wells within the one-mile AOR and any changes that have occurred to these wells since the 2010 update.

No new fresh water wells were reported within the search area since the submittal of the 2010 report. The discharge application lists the water wells located in the Area of Review.

a. Identify wells located within the one mile AOR:

   Table II also contains a listing of all wells within the one-mile AOR of Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3. Figure 6 is a Midland Map Company base map of the area containing the one mile AOR.

b. Ascertain the status of wells within the one mile AOR:

   Table II contains a listing of all wells within the one-mile AOR, with their current status. Tables III through VIII contain a list of all wells within the one-mile AOR that have had modifications to the current permit or have had new drilling and/or completion permits issued since the 2010 annual report submittal.

   Ninety-four (94) wells were found in which the owner had changed. Two (2) new plugged and abandoned oil and gas wells were found. No wells were placed in temporarily abandoned status. One (1) well was found that was returned to production status. One (1) well was found that had been recompleted.

   There were thirty-two (32) new drills and permits to drill, of which none penetrated the Wolfcamp interval. All plugged and abandoned wells were successfully plugged and isolated from the Mewbourne Well No. 1, Chukka Well No. 2, and Gaines Well No. 3 injection intervals according to current OCD records.

c. Provide details on any offset producers and injectors completed in the same interval:

Navajo has two other injection wells in the same interval. Mewbourne Well No. 1 is listed at ID No. 59 in Table II and no changes have occurred to this well. Gaines #3 is listed at ID No. 850 in Table II and no changes have occurred to this well. The wellbore schematics for the Mewbourne Well No. 1 and Gaines #3 is listed at ID No. 944 are presented as Figure 3 and Figure 4, respectively.

11. GEOLOGY

The injection zones are porous carbonates of the lower portion of the Wolfcamp Formation, the Cisco Formation, and the Canyon Formation. These formations occur in the Mewbourne Well No. 1, the Chukka Well No. 2, and the Gaines Well No. 3 at the depths shown in the table below.

Injection Zone Formation	Mewbourne Well No. 1 (KB = 3,693 ft)		Chukka Well No. 2 (KB = 3,623 ft)		Gaines Well No. 3 (KB = 3,625 ft)	
	MD below KB (ft)	SS Depth (ft)	MD below KB (ft)	SS Depth (ft)	MD below KB (ft)	SS Depth (ft)
Lower Wolfcamp	7,450	-3,757	7,270	-3,647	7,303	-3,678
Cisco	7,816	-4,123	7,645	-4,022	7,650	-4,025
Canyon	8,475	-4,782	8,390	-4,767	8,390	-4,765
Base of Injection Zone (base of Canyon)	9,016	-5,323	8,894	-5,271	8,894	-5,269

a. Description of the geological environment of the injection interval:

The lower portion of the Wolfcamp Formation (Lower Wolfcamp) is the shallowest porous unit in the proposed injection interval. The Wolfcamp Formation (Permian-Wolf campaign age) consists of light brown to tan, fine to medium-grained, fossiliferous limestones with variegated shale interbeds (Meyer, 1966,

page 69). The top of the Wolfcamp Formation was correlated for this study to be below the base of the massive, dense dolomites of the overlying Abo Formation. The base of the Wolfcamp coincides with the top of the Cisco Formation. The thickness of log porosity greater than 5% in the entire Wolfcamp Formation ranges from 0 feet to 295 feet in a band three miles wide that trends northeast-southwest across the study area.

The Cisco Formation (Pennsylvanian-Virgilian age) of the Northwest Shelf is described by Meyer (1966, page 59) as consisting of uniform, light colored, chalky, fossiliferous limestones interbedded with variegated shales. Meyer (1966, page 59) also describes the Cisco at the edge of the Permian basin as consisting of biothermal (mound) reefs composed of thick, porous, coarse-grained dolomites. Locally, the Cisco consists of porous dolomite that is 745 feet thick in Chukka Well No. 2, 659 feet thick in Mewbourne Well No. 1, and 720 feet in Gaines Well No. 3. The total thickness of intervals with log porosity greater than 5% is approximately 310 feet in Mewbourne Well No. 1, 580 feet in Chukka Well No. 2, and 572 feet in Gaines Well No. 3. The total thickness with log porosity greater than 10% is approximately 100 feet in Mewbourne Well No. 1, 32 feet in Chukka Well No. 2, and 65 feet in Gaines Well No. 3. The thickness of the porous intervals in the Cisco ranges from 0 feet in the northwestern part of the study area to nearly 700 feet in a band three miles wide that trends northeast-southwest.

The Canyon Formation (Pennsylvanian-Missourian age) consists of white to tan to light brown fine grained, chalky, fossiliferous limestone with gray and red shale interbeds (Meyer, 1966, page 53). Locally, the Canyon occurs between the base of the Cisco dolomites and the top of the Strawn Formation (Pennsylvanian-Desmoinesian age). The total thickness of intervals with log porosity greater than 5% is 34 feet in Mewbourne Well No. 1, 30 feet in Chukka Well No. 2, and 10 feet in Gaines Well No. 3. No intervals appear to have log porosity greater than 10% in any of the three injection wells.

b. Discuss the presence of geological features, i.e., pinchouts, channels, and faults, if applicable:

From the geological study completed and submitted in the Discharge Plan Application and Application for Authorization to Inject, the reservoir appears to be continuous, with the possibility of anisotropic conditions extending to the west-southwest. The injection intervals that were studied are well confined by the Abo and Yeso low porosity carbonate beds, Tubbs shale, and Salado salt. The Cisco and Wolfcamp formations follow the Vacuum arch and have a southeasterly dip. No faults existed in the study area, but the study also shows that faulting occurs via the K-M fault located 6 miles northwest of Artesia and trends northeast-southwest. The distance to this fault line occurs no closer than 16 miles. No faults are known to exist in the confining zone within the AOR.

c. Provide a portion of relevant structure map, if necessary:

The structure map for Strawn is presented as Appendix I. The structure map for the Wolfcamp presented as Appendix J and the structure map for the Cisco Formation is presented as Appendix K.

12. OFFSET WELLS

There are only two offset wells identified in the AOR that inject into the same interval: the Mewbourne Well No. 1 and the Gaines Well No. 3. Both wells were shut-in during the buildup and falloff portions of the testing.

a. Identify the distance between the test well and any offset well completed in the same injection interval:

The Mewbourne Well No. 1 is approximately 10,860 feet from Chukka Well No. 2, the test well. The Gaines Well No. 3 is approximately 3,130 feet from the Chukka Well No. 2.

b. Report the status of the offset wells during both the injection and shut-in portions of the test:

Both the Mewbourne Well No. 1 and Gaines Well No. 3 were shut-in during the buildup and falloff portions of the testing. Bottom-hole pressure gauges were lowered into each well approximately before shutting in the Chukka Well No. 2. The bottom-hole pressure and temperature data are graphically depicted in Figure 2 for the Mewbourne Well No. 1 and Figure 5 for the Gaines Well No. 3.

c. Describe the impact, if any, the offset wells had on the testing:

The offset wells were shut in prior to beginning the 30-hour injection period and remained shut-in during the 30 hour falloff portion of the testing. No impact was observed.

13. CHRONOLOGICAL LISTING OF THE DAILY TESTING ACTIVITIES (OPERATIONS LOG)

Appendix L contains the formal Chronology of Field Activities. This chronology was developed from the field activity reports.

a. Date of the testing:

The bottom hole gauges were placed into the wells on October 17, 2011 and the 48 hour injection monitoring period portion of the testing started on October 17, 2011, at 12:15 p.m., and continued until October 19, 2011, at 2:30 p.m. On October 19, 2011 at 12:08 pm the Mewbourne Well No. 1 and Gaines Well No. 3 were shut-in and the 30 hour buildup portion for Chukka Well No. 2 was started. The buildup portion of the testing ended at 9:08 pm on October 20, 2011 and Chukka Well No. 2 was shut-in with both of the offset wells remaining shut in for the duration of the 30 hour falloff portion of the testing. The Chukka 2 falloff test ended on October 22, 2011, at 7:10 a.m. On October 22, 2011, at 7:10 a.m., five-minute gradient stops were made while pulling out of the wellbore with the pressure gauges. At 2:00 p.m., on October 22, 2011, the well was turned over to Navajo plant operations personnel.

b. Time of the injection period:

The buildup portion of the testing began on October 19, 2011, when the injection rate was set at an average injection rate of 185.60 gallons per minute (gpm). The injection rate was held constant for 30.63 hours. The injection period used in the pressure falloff analysis was 82.75 hours.

c. Type of injection fluid:

The injected fluid was non-hazardous waste water from the plant. The density averaged 8.3 pounds per gallon during the 30-hour injection period (OCD Guideline Section VII.6).

d. Final injection pressure and temperature prior to shutting in the well:

The final flowing pressure (P_{wf}) and temperature (T_{wf}) were 3,783.91 psia and 101.38°F, respectively.

e. Total shut-in time:

The Chukka Well No. 2 was shut-in for a total of 33.98 hours.

f. Final static pressure and temperature at the end of the fall-off portion of the test:

The final static pressure at 7,570 feet was 3,701.16 psia. The final temperature was 107.56 °F.

14. DESCRIBE THE LOCATION OF THE SHUT-IN VALVE USED TO CEASE FLOW TO THE WELL FOR THE SHUT-IN PORTION OF THE TEST

On the pipeline to the Chukka Well No. 2, there is one, 4-inch control valve (CV) installed on the incoming pipeline before the POD filters. Two 4-inch valves are installed between the POD filters and the wellhead and one 4-inch filter bypass

valve is installed at the POD filters. One motorized valve (MV) is installed between the POD filters and the well. All valves were closed during the falloff portion of the testing. A diagram of the wellhead is shown in Figure 7 and a diagram of the valve locations are shown in Figure 8.

At shut-in, the procedure would be to close the motorized valves, isolation valves, control valve, filter bypass valve, and drain the POD filters in that order.

15. PRESSURE FALLOFF ANALYSIS

The following discussion of the analysis of the pressure data recorded during the falloff testing of the Chukka Well No. 2 satisfies Sections 15 through 19 of the OCD's falloff test guidelines. Where appropriate, the specific guideline addressed is annotated. Specific parameters used in the equations and discussed previously in this report are also annotated. The plots included with this report are summarized in Table IX. The inclusion of these plots in this report satisfies OCD Guideline Section IX.18.

The pressure data obtained during the falloff test were analyzed using the commercially available pressure transient analysis software program PanSystem©. Appendix M contains the output from this software program. Figure 9 shows the pressure data recorded by the bottom-hole gauge from the time the tool was in place. Figure 10 shows the pressure and temperature data recorded by the bottom-hole gauge from the time the tool was in place until it was pulled. Figure 11 is a Cartesian plot of the injection rates versus time for the injection period (5.02 days) from the time the bottom hole pressure gauges were placed into the wellbore. The superposition time function was used to account for all rate changes during the since the last stable shut in period. Figure 12 is a plot of the surface pressures and injection rates versus time for the stabilized injection period (30 hours) of the testing. Figure 13 is a plot of the historical injection rates and surface pressures versus calendar time since injection began in 1999.

Figure 14 is a log-log diagnostic plot of the falloff data, showing change in pressure and pressure derivative versus elapsed shut in time. The wellbore storage, radial flow and change in reservoir characteristics flow regimes are indicated on the log-log plot and the superposition Horner plot (OCD Guideline Section IX.18.c and IX.18.d)

Wellbore storage begins at 0.002 hours and continues to an elapsed shut in time of 0.17 hours. Radial flow begins at an elapsed shut in time of 2.92 hours and continues until 7.92 hours (OCD Guideline Section IX.15.b).

The reservoir permeability was determined from the radial flow region of the superposition Horner plot, Figure 15. The radial flow regime begins at a logarithmic Horner time of 534.78 and continues until a Horner time of 1419.13, at which time the pressure data departs the semi-log straight-line. Figure 16 shows an expanded view of the radial flow regime. The slope of the radial flow period, as calculated by the analysis software, was 2.409182 psi/cycle (OCD Guideline Section IX.15.c). The measured injection rate prior to shut in was 6377.14 bbl/day (185.99 gpm).

An estimate of mobility-thickness (transmissibility, OCD Guideline Section IX.15.d), kh/μ, for the reservoir was determined to be 430,405 md-ft/cp from the following equation:

$$\frac{k\ h}{\mu} = 162.6 \frac{q\ B}{m}$$

where,

kh/μ	=	formation mobility-thickness, millidarcy-feet/centipoise
q	=	rate prior to shut in, bpd
B	=	formation volume factor, reservoir volume/surface volume
m	=	slope of radial flow period, psi/cycle

$$\frac{k\ h}{\mu} = 162.6 \frac{(6377.14)(1.0)}{(2.409182)}$$

$$= 430,405$$

The permeability-thickness (flow capacity, OCD Guideline Section IX.15.i), kh, was determined to be 253,939 md-ft by multiplying the mobility-thickness, kh/μ, by the viscosity of the formation fluid (see Section 6), μ, of 0.59 centipoise:

$$kh = \left(\frac{kh}{\mu} \right) \mu$$

$$= 430,405 \times 0.59$$

$$= 253,939 \text{ md-ft}$$

The reservoir permeability (OCD Guideline Section IX.15.e) using the total thickness (see Section 5 and Section 11) of 175 feet was 1451 md:

$$k = \frac{(kh)}{h}$$

$$= \frac{253,939}{175}$$

$$= 1451 md$$

To determine whether the proper viscosity was used in arriving at this permeability, the travel time for a pressure transient to pass beyond the waste front needs to be calculated (OCD Guideline Section VIII.5). The distance to the waste front is determined from the following equation:

$$r_{waste} = \left(\frac{0.13368 \ V}{\pi h \ \varphi} \right)^{1/2}$$

where,

r_{waste}	=	radius to waste front, feet
V	=	total volume injected into the injection interval, gallons
h	=	formation thickness, feet

ϕ = formation porosity, fraction
0.13368 = constant

A cumulative volume of approximately 817,420,486 gallons of waste has been injected into Chukka Well No. 2 (see Section 8). The formation has a porosity of 0.10 (see Section 5 and Section 11).

The distance to the waste front was determined to be 1410 feet:

$$r_{waste} = \left(\frac{(0.13368)(817{,}420{,}486)}{(\pi)(175)(0.10)} \right)^{1/2}$$

$$= 1410 \ feet$$

The time necessary for a pressure transient to traverse this distance is calculated from the following equation:

$$t_{waste} = 948 \frac{\varphi \ \mu_{waste} \ c_t \ r^2_{waste}}{k}$$

where,

t_{waste} = time for pressure transient to reach waste front, hours
ϕ = formation porosity, fraction
μ_{waste} = viscosity of the waste at reservoir conditions, centipoise
r_{waste} = radius to waste front, feet
c_t = total compressibility of the formation and fluid, psi
k = formation permeability, millidarcies
948 = constant

The pore volume compressibility is 8.4 x 10^{-6} psi^{-1} (see Section 6). The time necessary for a pressure transient to traverse the distance from the wellbore to the leading edge of the waste front would be 0.64 hours:

$$t_{waste} = 948 \frac{(0.10)(0.59)(8.4x10^{-6})(1410)^2}{1451}$$

$$= 0.64 \textit{ hours}$$

Since the time required to pass through the waste is less than the 2.92 hours required to reach the beginning of the radial flow period, the assumption that the pressure transient was traveling through formation fluid during the period of the semi-log straight line was correct.

The near wellbore skin damage (OCD Guideline Section IX.15.f) was determined from the following equation:

$$s = 1.151\left[\frac{p_{wf} - p_{1hr}}{m_1} - \log\left(\frac{k}{\varphi \mu c_t r_w^2}\right) + 3.23\right]$$

where,

s	=	formation skin damage, dimensionless
1.151	=	constant
p_{wf}	=	flowing pressure immediately prior to shut in, psi
p_{1hr}	=	pressure determined from extrapolating the first radial flow semi-log line to a Δt of one hour, psi
m_1	=	slope of the first radial flow semi-log line, psi/cycle
k	=	permeability of the formation, md
ϕ	=	porosity of the injection interval, fraction
μ	=	viscosity of the fluid the pressure transient is traveling through, cp
c_t	=	total compressibility of the formation plus fluid, psi^{-1}
r_w	=	radius of the wellbore, feet
3.23	=	constant

The final measured flowing pressure was 3784.91 psia. The pressure determined by extrapolating the radial flow semi-log line to a Δt of one hour, p_{1hr}, was 3705.99 psia (calculated from the analysis software). The wellbore radius, r_w, is 0.3281 feet (completion records). Using these values in addition to the previously discussed parameters results in a skin of :

$$s = 1.151\left[\left[\frac{3784.91-3705.99}{2.409182}\right]-\log\left(\frac{1451}{(0.10)(0.59)\left(8.4x10^{-6}\right)(0.3281)^2}\right)+3.23\right]$$
$$= 29.52$$

The change in pressure, Δp_{skin}, in the wellbore associated with the skin factor (OCD Guideline Section IX.15.g) was calculated using the following equation:

$$\Delta p_{skin} = 0.869(m)(s)$$

where,

0.869	=	constant
m	=	slope from superposition plot of the well test, psi/cycle
s	=	skin factor calculated from the well test

The change in pressure, Δp_{skin}, using the previously calculated and defined values was determined to be 6180 psi:

$$\Delta p_{skin} = 0.869(m)(s)$$
$$= 0.869(2.409182)(29.52)$$
$$= 61.80 psi$$

The flow efficiency (E, OCD Guideline Section IX.15.h) was determined from the following equation:

$$E = \frac{p_{wf} - \Delta p_{skin} - p_{static}}{p_{wf} - p_{static}}$$

where:

E	=	flow efficiency, fraction
p_{wf}	=	flowing pressure prior to shutting in the well for the fall-off test,
p_{static}	=	final pressure from the pressure falloff test
Δpskin	=	pressure change due to skin damage

Using the previously determined parameters, the flow efficiency was calculated to be 0.26

$$E = \frac{3784.91 - 61.80 - 3701.498}{3784.91 - 3701.498}$$
$$= 0.26$$

The radius of investigation (OCD Guideline Section IX.15.a) was calculated using the analysis software and was determined to be 9,154 feet at an elapsed shut in time of 34.03 hours.

$$R_{inv} = 0.029\sqrt{\frac{k\,\Delta t_s}{\theta\,\mu\,C_t}}$$

where,

k	=	formation permeability, millidarcies
Δt_s	=	elapsed shut-in time, hours
θ	=	formation porosity, fraction
μ	=	viscosity of the fluid the pressure transient is traveling through, cp
C_t	=	total compressibility of the formation plus fluid, psi^{-1}

$$0.029 \quad = \quad \text{constant}$$

$$0.029\sqrt{\frac{1451(34.03)}{0.10(0.59)(8.4x10^{-6})}}$$

$$R_{inv} = 9{,}154ft$$

As indicated on Figure 14, the pressure data departs the radial flow region at an elapsed time from shut in of 7.9 hours. Another change in slope is seen at an elapsed time from shut in of 15.0 hours. No pressure or temperature anomalies were noted that would cause this type of pressure response observed on the derivative log-log plot (OCD Section VIII.9). A review of the geology of the injection zones (Section 11) indicates that all three of the formations in which the Chukka Well No. 2 injects into have varying thicknesses and porosities within the mapped area. Changes in formation thickness, porosity, and fluid viscosity can cause the slope changes seen on the derivative log-log plot.

The Hall plot (OCD Guideline Section IX.18.h) is presented as Figure 17. No slope changes are seen in the plotted data.

A comparison of the current analysis results with previous analysis results as well as with the reservoir parameters submitted with the permit application is presented in Table X (OCD Guideline Section IX.19).

On October 22, 2011, a static pressure gradient survey was conducted while pulling the pressure gauges out of the well. Static gradient stops were conducted at 7,570 feet, 7,000 feet, 6,000 feet, 5,000 feet, 4,000 feet, 3,000 feet, 2,000 feet, 1,000 feet, and at the surface. The bottom-hole pressure and temperature, at 7,570 feet, was measured after the well had been shut-in for 2 days and was 3701.34 psia and 107.58 °F, respectively. The gradient survey is summarized in Table XI. The data are depicted graphically in Figure 18.

16. TEMPERATURE SURVEY

A differential temperature survey was performed on October 22, 2011. The temperature log was run from surface to 8335 feet. The fluid level in the wellbore was at approximately 320 feet. The wellbore temperature at 500 feet was 78.1° F. At 2000 feet, the wellbore temperature was approximately 85.2° F. At 5000 feet, the wellbore temperature was approximately 98.1°

From 7200 feet to 7620 feet, the temperature decreases from 111.9° F to 101.5° F. This anomaly is probably caused by cooling due to the difference in pipe size between the 3-1/2" tubing and the 5-1/2" casing at 7528 feet. The final temperature was 107.5 F at 8335 feet. The differential temperature survey can be found in Appendix N.

17. ANNULUS PRESSURE TEST

An annulus pressure test was conducted on October 17, 2011. The annulus pressure was 910 psia at 8:27 AM. At 08:57 AM, the annulus pressure was 900 psig. The total annulus pressure drop was 1.099%. The annulus pressure test was recorded on the chart included in Appendix O. Appendix O also contains the chart recorder certification sheet.

18. NEW MEXICO OIL CONSERVATION DIVISION THREE YEAR RECORDING KEEPING STATEMENT

Navajo will keep the raw test data, generated during the testing, on file for a minimum of three years. The raw test data will be made available to OCD upon request.

TABLES

TABLE I

FORMATION WATER ANALYSIS SUMMARY

Chemical	Mewbourn Well No. 1	Chukka Well No. 2	Gaines Well No. 3	Average
Date	July 31, 1998	June 14, 1999	Nov 8, 2006	
Fluoride (mg/l)	2.6	9.7	Not Detected	6.15
Chloride (mg/L)	19,000	15,000	10,447	14,815.67
NO3-N (mg/L)	<10	<10	--	<10
SO4 (mg/L)	2,200	2000	1,908	2,036
CaCO3 (mg/L)	1000	1210	--	1105
Specific Gravity (g/L)	1.034	1.0249	--	1.0295
TDS (mg/L)	33,000	20,000	--	26,500
Specific Conductance (uMHOs/cm)	52,000	43,000	--	47,500
Potassium (mg/L)	213	235	85.5	177.83
Magnesium (mg/L)	143	128	155	142
Calcium (mg/L)	390	609	393	464
Sodium (mg/L)	12,770	8,074	6,080	8,974.67
pH (s.u.)	8.1	7.2	--	7.65

The data in the above table was referenced from "Discharge Plan Application and Application for Authorization to Inject per Oil Conservation Division Form C-108, into Class I Wells WDW-1 and Proposed WDW-2 and WDW-3" and the "Discharge Permit Approval Conditions", "Reentry and Completion Report Waste Disposal Well No. 2", and "Reentry and Completion Report Waste Disposal Well No. 3".

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID NO	API	Unit No.	Sect	TOWNSHIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
1	30-015-00693	A	36	17S	27E	330N	330E	DELHI #001	GEORGE A CHASE & C SERVICE	O		T/A	8/30/1941
2	30-015-00694	A	36	17S	27E	990N	990E	STATE #013	DELHI OIL CORP.	O	6/24/1948	P&A	6/24/1948
3	30-015-00646	A	36	17S	27E	990N	330E	DELHI #007	GEORGE A CHASE & C SERVICE	O		T/A	4/21/1950
4	30-015-00668	G	36	17S	27E	1650N	2310E	SOUTH RED LAKE GRAYBURG UNIT #010	LEGACY RESERVES OPERATING, LP	O		SHUT IN	12/6/1947
5	30-015-00690	G	36	17S	27E	1830N	2205E	CONKLIN #002	GEORGE A CHASE & C SERVICE	O		ACTIVE	3/6/1949
6	30-015-00667	G	36	17S	27E	2310N	2310E	SOUTH RED LAKE GRAYBURG UNIT #011	FAIRWAY RESOURCES OPERATING INC	I		ACTIVE	3/23/1949
7	30-015-00666	G	36	17S	27E	2310N	2310E	CONKLIN #001	GEORGE A CHASE & C SERVICE	O	N/A	P&A	1/10/1942
8	30-015-00689	H	36	17S	27E	1650N	330E	GATES STATE #001	GEORGE A CHASE JR & C SERVICE	O		ACTIVE	8/4/1950
9	30-015-00647	H	36	17S	27E	1650N	990E	GATES STATE #002	ASPEN OIL INC	O	10/21/2003	ACTIVE	10/21/2003
10	30-015-00669	H	36	17S	27E	2310N	330E	HOMAN #001	GEORGE A CHASE JR & C SERVICE	O	5/6/2008	P&A	5/6/2008
11	30-015-00688	I	36	17S	27E	2310S	330E	RAMAPO #001	KERSEY & CO	O	10/28/1941	P&A	10/28/1941
12	30-015-00670	I	36	17S	27E	2970N	330E	RAMAPO #003	KERSEY & CO	O	1/3/1950	P&A	1/3/1950
13	30-015-00687	I	36	17S	27E	2310S	990E	RAMAPO #002	KERSEY & CO	G	5/7/1948	P&A	5/7/1948
14	30-015-00685	I	36	17S	27E	1650S	330E	EMPIRE ABO UNIT G #020	ARCO OIL & GAS	O	7/10/1989	P&A	7/10/1989
15	30-015-00671	J	36	17S	27E	2310S	2310E	RAMAPO #003	ROJO GRANDE COMPANY LLC	O	1/24/2000	ZONE ABAN	2/13/1942
16	30-015-01221	J	36	17S	27E	2300S	2300E	SOUTH RED LAKE GRAYBURG UNIT #023	MCQUADRANGLE, LC	O	8/13/2002	ZONE ABAN	2/27/1948
17		J	36	17S	27E			DOOLEY STATE #3	MARTIN YATES III				4/22/1961
18	30-015-05934	J	36	17S	27E	1650S	1650E	EMPIRE ABO UNIT #019A	BP AMERICA PRODUCTION COMPANY	O		ACTIVE	2/26/1961
19	30-015-01220	K	36	17S	27E	2310S	2330W	SOUTH RED LAKE GRAYBURG UNIT #022	MCQUADRANGLE, LC	O	7/17/2002	ZONE ABAN	2/3/1949
20	30-015-00674	K	36	17S	27E	2310S	2310W	RAMAPO #002	ROJO GRANDE COMPANY LLC	O		ACTIVE	5/15/1947
21	30-015-01219	K	36	17S	27E	2310S	1650W	SOUTH RED LAKE GRAYBURG UNIT #021	MCQUADRANGLE, LC	I		ACTIVE	1/20/1948
22	30-015-23913	K	36	17S	27E	1650S	1650W	SOUTH RED LAKE GRAYBURG UNIT #043	MCQUADRANGLE, LC	O		ACTIVE	12/11/1981
23		K	36	17S	27E			DOOLEY STATE ABO #3	MARTIN YATES III	O		ACTIVE	4/19/1961
24	30-015-00673	K	36	17S	27E	1650S	2310W	RAMAPO #001	ROJO GRANDE COMPANY LLC	O	1/24/2000	ZONE ABAN	1/24/2000
25	30-015-00682	N	36	17S	27E	990S	1650W	RAMAPO #004	ROJO GRANDE COMPANY LLC	O	1/24/2000	ZONE ABAN	1/24/2000
26	30-015-00683	N	36	17S	27E	965S	1650W	SOUTH RED LAKE GRAYBURG UNIT #028	FAIRWAY RESOURCES OPERATING INC	I		ACTIVE	4/16/1948
27	30-015-01218	N	36	17S	27E	330S	2310W	EMPIRE ABO UNIT #018	BP AMERICA PRODUCTION COMPANY	O	3/11/2009	P&A	3/11/2009
28	30-015-00684	O	36	17S	27E	990S	2310E	STATE B-6961 NO. 1-A	BURNHAM OIL COMPANY	O	5/13/1947	P&A	5/13/1947
29	30-015-01251	O	36	17S	27E	660S	1980E	EMPIRE ABO UNIT #019	BP AMERICA PRODUCTION COMPANY	O	4/27/2009	P&A	9/8/1959
30		I	36	17S	27E							MISPLOT OF 14	
31	30-015-00677	P	36	17S	27E	330S	990E	EMPIRE ABO UNIT #020	BP AMERICA PRODUCTION COMPANY	O	4/10/2009	P&A	4/13/2009
32	30-015-01616	P	30	17S	28E	330S	990E	BLAKE STATE #001	APACHE CORPORATION	O		ACTIVE	3/7/1953
33	30-015-01638	A	31	17S	28E	330N	990E	STATE NO. 1	BEDINGFIELD, MALCO, RESLER	O	7/15/1952	P&A	7/15/1952
34	30-015-21594	B	31	17S	28E	330N	1650E	POWCO STATE #001	FINNEY OIL COMPANY	O		ACTIVE	11/15/1975
35	30-015-01636	C	31	17S	28E	330N	2310E	DELHI-STATE NO. 1	BEDINGFIELD, J E	O	12/23/1952	P&A	12/23/1952
36	30-015-25621	B	31	17S	28E	980N	1620E	POWCO STATE #002	FINNEY OIL COMPANY	O		ACTIVE	7/15/1986
37	30-015-01633	1	31	17S	28E	330N	330W	ASTON & FAIR A #001	GEORGE A CHASE JR DBA G AND C SERVICE	O		ACTIVE	6/23/1942
38	30-015-01634	D	31	17S	28E	350N	345W	STATE 31 NO. 1X	ASTON & FAIR	O		NO COMPL	1/5/1946
39	30-015-01645	F	31	17S	28E	990N	990W	BEDINGFIELD STATE 1 NO. 1	MCLAUGHLIN, C T	O	2/16/1950	P&A	2/16/1950
40	30-015-02666	2	31	17S	28E	2310N	330W	HUDSON SAIKIN STATE #001	APACHE CORPORATION	O		ACTIVE	5/29/1948
41	30-015-24887	2	31	17S	28E	2310N	990W	HUDSON SAIKIN STATE #002	APACHE CORPORATION	O		ACTIVE	7/7/1984
42	30-015-01643	F	31	17S	28E	2310N	2260W	EMPIRE ABO UNIT #022	BP AMERICA PRODUCTION COMPANY	O	7/10/2009	P&A	6/7/1960
43	30-015-01635	F	31	17S	28E	2310N	2310W	ASTON & FAIR #001Y	GEORGE A CHASE JR DBA G AND C SERVICE	O		ACTIVE	5/8/1948
44	30-015-01637	G	31	17S	28E	2310N	2310E	MALCO STATE #001	GEORGE A CHASE JR DBA G AND C SERVICE	O		ACTIVE	10/12/1953
45	30-015-01652	G	31	17S	28E	2288N	1625E	BOLING #001	KERSEY & CO	O		ACTIVE	8/10/1960
46	30-015-10537	H	31	17S	28E	2277N	330E	NORTHWEST ARTESIA UNIT #004	LIME ROCK RESOURCES A, L.P.	O		ACTIVE	9/23/1965
47	30-015-10833	I	31	17S	28E	1980S	660E	NORTHWEST ARTESIA UNIT #010	LIME ROCK RESOURCES A, LP	O		ACTIVE	6/17/1966
48	30-015-01644	I	31	17S	28E	1650S	330E	EMPIRE ABO UNIT #024A	BP AMERICA PRODUCTION COMPANY	O	6/12/2009	P&A	4/29/1960
49	30-015-01642	J	31	17S	28E	1650S	2310E	STATE FW #001	APACHE CORPORATION	O		ACTIVE	12/23/1962
50	30-015-01650	J	31	17S	28E	1650S	1958E	EMPIRE ABO UNIT #023A	BP AMERICA PRODUCTION COMPANY	O	9/17/2003	P&A	9/17/2003

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID NO	API	Unit No.	Sect	TOWNS HIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
51	30-015-01651	K	31	17S	28E	1650S	2387W	EMPIRE ABO UNIT #022B	BP AMERICA PRODUCTION COMPANY	O	10/22/2009	P&A	4/10/1960
52	30-015-01640	3	31	17S	28E	2310S	330W	RAMPO #002	APACHE CORPORATION	O		ACTIVE	7/16/1955
53	30-015-01648	3	31	17S	28E	1651S	1089E	EMPIRE ABO UNIT #021A	BP AMERICA PRODUCTION COMPANY	O	8/24/2002	ZONE ABAN	8/24/2002
54	30-015-01639	4	31	17S	28E	990S	330W	RAMPO #001	APACHE CORPORATION	O		ACTIVE	5/1/1948
55	30-015-01647	4	31	17S	28E	660S	660W	EMPIRE ABO UNIT #021	BP AMERICA PRODUCTION COMPANY	O	7/23/2005	P&A	1/31/1960
56	30-015-01646	N	31	17S	28E	660S	2082W	EMPIRE ABO UNIT #022A	BP AMERICA PRODUCTION COMPANY	O		P&A	1/22/1960
57	30-015-10118	N	31	17S	28E	766S	2188W	STATE FV #001	APACHE CORPORATION	O		ACTIVE	3/1/1963
58	30-015-01653	O	31	17S	28E	990S	1650E	PARKER-STATE NO. 1	OTIS A ROBERTS	O	1/18/1942	P&A	1/18/1942
59	30-015-27592	O	31	17S	28E	660S	2310E	WDW #001	NAVAJO REFINING CO. PIPELINE DIVISION	I		ACTIVE	8/4/1998
60	30-015-01649	O	31	17S	28E	660S	1939E	EMPIRE ABO UNIT #023	BP AMERICA PRODUCTION COMPANY	O	8/14/2009	P&A	2/24/1960
61	30-015-20042	P	31	17S	28E	990S	660E	NORTHWEST ARTESIA UNIT #011	LIME ROCK RESOURCHES A, LP	O		ACTIVE	5/8/1967
62	30-015-01641	P	31	17S	28E	660S	660E	EMPIRE ABO UNIT #024	APACHE CORPORATION	O		ACTIVE	3/12/1960
63	30-015-01654	D	32	17S	28E	330N	330W	ASTON-STATE NO. 1	BEDINGFIELD, J E	O	5/12/1953	P&A	5/12/1953
64	30-015-01671	E	32	17S	28E	2280N	978W	EMPIRE ABO UNIT #025B	BP AMERICA PRODUCTION COMPANY	O	8/14/2008	P&A	9/13/1960
65	30-015-01657	F	32	17S	28E	2280N	1980W	AA STATE NO. 1	APACHE CORPORATION	O		ACTIVE	8/24/1960
66	30-015-10818	K	32	17S	28E	2310S	2105W	NORTHWEST ARTESIA UNIT #008	SDX RESOURCES INC	O	11/6/2006	P&A	11/6/2006
67	30-015-01661	K	32	17S	28E	1650S	2310W	EMPIRE ABO UNIT #026B	APACHE CORPORATION	O		ACTIVE	3/27/1960
68	30-015-10795	L	32	17S	28E	2310S	660W	NORTHWEST ARTESIA UNIT #009	LIME ROCK RESOURCES A, LP	O	5/28/2008	P&A	5/15/1966
69	30-015-01662	L	32	17S	28E	1650S	990W	EMPIRE ABO UNIT #025A	APACHE CORPORATION	O		ACTIVE	4/13/1960
70	30-015-20043	M	32	17S	28E	990S	760W	NORTHWEST ARTESIA UNIT #012	APACHE CORPORATION	O		T/A	5/9/1967
71	30-015-01660	M	32	17S	28E	660S	660W	EMPIRE ABO UNIT #025	BP AMERICA PRODUCTION COMPANY	O	1/14/2009	P&A	3/5/1960
72	30-015-10834	N	32	17S	28E	990S	2030W	NORTHWEST ARTESIA UNIT #013	SDX RESOURCES INC	O	9/15/2006	P&A	9/15/2006
73	30-015-01659	N	32	17S	28E	660S	1980W	EMPIRE ABO UNIT #026A	APACHE CORPORATION	O		ACTIVE	2/14/1960
74	30-015-21539	N	32	17S	28E	150S	1400W	EMPIRE ABO UNIT #261	APACHE CORPORATION	O		ACTIVE	7/25/1975
75	30-015-22009	O	32	17S	28E	330S	2481E	EMPIRE ABO UNIT #272	APACHE CORPORATION	O		ACTIVE	7/18/1977
76	30-015-02606	3	5	18S	28E	330N	1941W	EMPIRE ABO UNIT #026E	APACHE CORPORATION	O		ACTIVE	7/18/1960
77	30-015-22697	3	5	18S	28E	1080N	1914W	EMPIRE ABO UNIT #261A	BP AMERICA PRODUCTION COMPANY	O	6/16/2009	P&A	1/4/1979
78	30-015-02607	4	5	18S	28E	660N	660W	EMPIRE ABO UNIT #025C	APACHE CORPORATION	O		ACTIVE	3/27/1960
79	30-015-22750	4	5	18S	28E	660N	150W	EMPIRE ABO UNIT #251	APACHE CORPORATION	O		SHUT IN	1/12/1979
80	30-015-02608	E	5	18S	28E	1660N	330W	STATE E AI #001	CONOCOPHILLIPS COMPANY	O	1/13/2006	P&A	1/13/2006
81	30-015-24485	E	5	18S	28E	1980N	990W	ILLINOIS CAMP A COM #001	CONOCOPHILLIPS COMPANY	G		ACTIVE	8/10/1983
82	30-015-02602	F	5	18S	28E	1650N	1650W	EMPIRE ABO UNIT #026D	APACHE CORPORATION	O		ACTIVE	12/30/1959
83	30-015-25522	L	5	18S	28E	2240S	400W	WALTER SOLT STATE #001	APACHE CORPORATION	S		ACTIVE	8/12/1983
84	30-015-10244	L	5	18S	28E	2310S	330W	STATE AG #001	MACK ENERGY CORP	O	3/27/2001	ZONE ABAN	3/27/2001
87	30-015-20019	1	6	18S	28E	330N	330E	NORTHWEST ARTESIA UNIT #016	LIME ROCK RESOURCES A, LP	O		ACTIVE	3/14/1967
88	30-015-02615	1	6	18S	28E	660N	660E	EMPIRE ABO UNIT #024B	APACHE CORPORATION	O		ACTIVE	2/29/1960
89	30-015-02625	2	6	18S	28E	470N	2170E	EMPIRE ABO UNIT #023C	APACHE CORPORATION	O		T/A	12/21/1959
90	30-015-21542	2	6	18S	28E	1260N	1580E	EMPIRE ABO UNIT #231	APACHE CORPORATION	O		ACTIVE	11/1/1975
91	30-015-02621	3	6	18S	28E	660N	1980W	EMPIRE ABO UNIT #022E	APACHE CORPORATION	O		ACTIVE	12/29/1959
92	30-015-21626	G	6	18S	28E	1361N	2531E	EMPIRE ABO UNIT #231A	APACHE CORPORATION	O		SHUT IN	10/22/1975
93	30-015-02613	4	6	18S	28E	990N	660W	EMPIRE ABO UNIT #021B	APACHE CORPORATION	O		ACTIVE	12/30/1959
94	30-015-23116	5	6	18S	28E	2050N	100W	EMPIRE ABO UNIT #213	APACHE CORPORATION	O		ACTIVE	6/2/1980
95	30-015-02619	5	6	18S	28E	1990N	660W	EMPIRE ABO UNIT #021C	APACHE CORPORATION	O		ACTIVE	10/30/1959
96	30-015-22637	5	6	18S	28E	2450N	400W	EMPIRE ABO UNIT #212	APACHE CORPORATION	O		ACTIVE	12/28/1978
97	30-015-21395	5	6	18S	28E	2630N	1300W	EMPIRE ABO UNIT #211	APACHE CORPORATION	O		ACTIVE	2/11/1975
98	30-015-22012	F	6	18S	28E	1350N	1572W	EMPIRE ABO UNIT #222	APACHE CORPORATION	O		ACTIVE	3/13/1977
99	30-015-02626	F	6	18S	28E	1650N	1650W	STATE NO. 1	SARKIN, DAVID C & OLIVER, HENRY F	O	2/21/1942	P&A	2/21/1942
100	30-015-10107	F	6	18S	28E	1874N	1874W	STATE FX #001	DORAL ENERGY CORP	O		ACTIVE	8/8/1963
101	30-015-02620	F	6	18S	28E	1990N	2082W	EMPIRE ABO UNIT #022D	APACHE CORPORATION	O		ACTIVE	11/26/1959
102	30-015-22527	F	6	18S	28E	2630N	1930W	EMPIRE ABO UNIT #223	APACHE CORPORATION	O		ACTIVE	5/19/1978

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Tabulation of Wells Within One Mile Area of Review

ID NO	API	Unit No.	Sect	TOWNS HIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
103	30-015-21746	F	6	18S	28E	2610N	2713W	EMPIRE ABO UNIT #221	APACHE CORPORATION	O		ACTIVE	4/23/1976
104	30-015-22913	G	6	18S	28E	1750N	1600E	EMPIRE ABO UNIT #235	APACHE CORPORATION	O		ACTIVE	7/8/1979
105	30-015-22593	G	6	18S	28E	1900N	2441E	EMPIRE ABO UNIT #234	BP AMERICA PRODUCTION COMPANY	O	12/3/2008	P&A	8/27/1978
106	30-015-02614	G	6	18S	28E	1980N	1980E	EMPIRE ABO UNIT #023B	APACHE CORPORATION	O		ACTIVE	1/26/1960
107	30-015-21737	G	6	18S	28E	2253N	1576E	EMPIRE ABO UNIT #232	BP AMERICA PRODUCTION COMPANY	O	5/7/2009	P&A	4/13/1976
108		H	6	18S	28E							MISPLOT OF 107	
109	30-015-22490	G	6	18S	28E	2550N	2050E	EMPIRE ABO UNIT #233	BP AMERICA PRODUCTION COMPANY	O	4/3/2009	P&A	6/5/1978
110	30-015-02616	H	6	18S	28E	1650N	990E	EMPIRE ABO UNIT #024C	APACHE CORPORATION	O		ACTIVE	3/24/1960
111	30-015-23547	H	6	18S	28E	1950N	660E	EMPIRE ABO UNIT #241	BP AMERICA PRODUCTION COMPANY	O	9/19/2008	P&A	4/12/1981
112	30-015-02617	I	6	18S	28E	2310S	990E	EMPIRE ABO UNIT #024K	BP AMERICA PRODUCTION COMPANY	O	12/12/2002	P&A	12/12/2002
113	30-015-22528	J	6	18S	28E	2300S	1570E	EMPIRE ABO UNIT #232A	BP AMERICA PRODUCTION COMPANY	O	4/7/2009	P&A	2/5/1979
114	30-015-02611	J	6	18S	28E	2310S	2310E	STATE NO. 1	BARNEY COCKBURN	O	8/15/1949	P&A	8/15/1949
115	30-015-02628	J	6	18S	28E	2260S	2270E	EMPIRE ABO UNIT #023D	BP AMERICA PRODUCTION COMPANY	O		ACTIVE	5/23/1979
116	30-015-22491	J	6	18S	28E	1700S	2350E	EMPIRE ABO UNIT #231B	BP AMERICA PRODUCTION COMPANY	O	9/2/2009	P&A	8/13/1978
117	30-015-02618	J	6	18S	28E	1647S	2076E	CAPITOL STATE NO. 1	MILLER BROS OIL CO	G	3/21/1955	P&A	3/21/1955
118	30-015-02623	K	6	18S	28E	2248S	2075W	EMPIRE ABO UNIT #022F	APACHE CORPORATION	O		ACTIVE	2/22/1960
119		K	6	18S	28E							MISPLOT	
120		L	6	18S	28E			WDW-2 (ORIGINAL LOCATION)	NAVAJO REFINING COMPANY				
121	30-015-02622	6	6	18S	28E	2219S	660W	EMPIRE ABO UNIT #021D	APACHE CORPORATION	O		ACTIVE	1/23/1960
122	30-015-23548	6	6	18S	28E	1950S	1000W	EMPIRE ABO UNIT #211A	APACHE CORPORATION	O		ACTIVE	7/17/1980
123	30-015-02627	7	6	18S	28E	949S	990W	STATE M-AI #002	RUTH OIL CO, LLC	O		ACTIVE	10/21/1960
124	30-015-26943	7	6	18S	28E	990S	730W	CHALK BLUFF 6 STATE #001	MEWBOURNE OIL CO	G		ACTIVE	4/16/1992
125	30-015-02610	N	6	18S	28E	955S	1750W	EMPIRE ABO UNIT #022C	APACHE CORPORATION	O		ACTIVE	8/5/1960
126	30-015-02624	O	6	18S	28E	968S	2270E	STATE CD NO. 1	PAN AMERICAN PETROLEUM CO	O	5/1/1961	P&A	5/1/1961
127	30-015-25503	P	6	18S	28E	660S	330E	KIMBERLY STATE NO. 1	DICKSON PETROLEUM CO	O	12/30/1985	P&A	12/30/1985
128	30-015-02612	P	6	18S	28E	330S	330E	STATE NO. 1	D & H OIL CO	O	5/13/1952	P&A	5/13/1952
129	30-015-01215	1	1	18S	27E	667N	666E	EMPIRE ABO UNIT #020D	APACHE CORPORATION	O		ACTIVE	11/5/1959
130	30-015-00708	2	1	18S	27E	660N	1980E	EMPIRE ABO UNIT #019B	LIME ROCK RESOURCES II-A, L.P.	O		ACTIVE	7/7/1959
131		C	1	18S	27E			HILL #4	MALCO REFINERIES		5/10/1948	P&A	5/10/1948
132		C	1	18S	27E							MISPLOT	
133	30-015-00710	3	1	18S	27E	660N	1980W	AAO FEDERAL No. 013	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	7/21/2004
134	30-015-26741	F	1	18S	27E	1650N	1350W	CHALK BLUFF FEDERAL COM #002	MEWBOURNE OIL CO	G		ACTIVE	8/24/1991
135	30-015-00706	F	1	18S	27E	2310N	1980W	EMPIRE ABO UNIT #018A	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	5/31/1959
136	30-015-00709	G	1	18S	27E	1980N	1980E	EMPIRE ABO UNIT #019C	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	8/2/1959
137		G	1	18S	27E							MISPLOT	
138	30-015-21552	G	1	18S	27E	2500N	2500E	EMPIRE ABO UNIT #191	CFM OIL, LLC	O		ACTIVE	9/7/1975
139	30-015-00711	H	1	18S	27E	1980N	660E	EMPIRE ABO UNIT #020C	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	10/13/1959
140	30-015-21783	H	1	18S	27E	2490N	1299E	EMPIRE ABO UNIT #202	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	5/13/1976
141	30-015-22656	H	1	18S	27E	2400N	700E	EMPIRE ABO UNIT #203	APACHE CORPORATION	O		ACTIVE	10/10/1978
142		H	1	18S	27E			CRONIN #1	MANHATTAN OIL		7/1/2027	P&A	7/1/1927
143	30-015-21553	H	1	18S	27E	2501N	20E	EMPIRE ABO UNIT #201	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	7/19/1975
144	30-015-27163	I	1	18S	27E	1980S	990E	CHALK BLUFF FEDERAL COM #003	MEWBOURNE OIL CO	G		ACTIVE	1/16/1993
145	30-015-00697	I	1	18S	27E	1980S	660E	EMPIRE ABO UNIT #020K	BP AMERICA PRODUCTION COMPANY	O	1/5/2003	P&A	1/5/2003
146	30-015-22657	J	1	18S	27E	2490S	2200E	EMPIRE ABO UNIT #193	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	10/26/1978
147	30-015-00696	J	1	18S	27E	1980S	1980E	EMPIRE ABO UNIT #019Q	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	8/20/1959
148	30-015-22560	J	1	18S	27E	220S	1390E	EMPIRE ABO UNIT #192	BP AMERICA PRODUCTION COMPANY	O		ACTIVE	6/25/1978
149	30-015-21873	J	1	18S	27E	1526S	1470E	EMPIRE ABO UNIT #191A	ALAMO PERMIAN RESOURCES, LLC	O		ACTIVE	9/23/1976
150	30-015-22658	J	1	18S	27E	1500S	2130E	EMPIRE ABO UNIT #194	APACHE CORPORATION	O		ACTIVE	11/14/1978
151	30-015-22559	K	1	18S	27E	2290S	2445W	EMPIRE ABO UNIT #184	APACHE CORPORATION	O		SHUT IN	7/25/1978
152	30-015-22096	K	1	18S	27E	2370S	1510W	EMPIRE ABO UNIT #183	APACHE CORPORATION	O		ACTIVE	7/24/1977

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID NO	API	Unit No.	Sect	TOWNS HIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
153	30-015-21554	K	1	18S	27E	1367S	1440W	EMPIRE ABO UNIT #181	BP AMERICA PRODUCTION COMPANY	O	4/17/2003	P&A	4/17/2003
154	30-015-00707	K	1	18S	27E	1980S	1980W	EMPIRE ABO UNIT #018B	APACHE CORPORATION	O		ACTIVE	5/22/1959
155	30-015-21792	K	1	18S	27E	1533S	2370W	EMPIRE ABO UNIT #182	LIME ROCK RESOURCES A, L.P.	O		ACTIVE	6/1/1976
156	30-015-00713	N	1	18S	27E	995S	1644W	EMPIRE ABO UNIT #018D	BP AMERICA PRODUCTION COMPANY	O	9/27/2003	P&A	9/27/2003
157	30-015-26575	N	1	18S	27E	790S	2250W	WDW-3	NAVAJO REFINING COMPANY	I		ACTIVE	3/7/1991
158	30-015-20394	O	1	18S	27E	953S	2197E	EMPIRE ABO FEDERAL NO. 5	HUMBLE OIL & REFINING CO	O	4/9/1971	P&A	4/9/1971
159	30-015-00698	O	1	18S	27E	660S	1980E	EMPIRE ABO UNIT #191	BP AMERICA PRODUCTION COMPANY	S		ACTIVE	11/8/1959
160	30-015-00699	P	1	18S	27E	940S	330E	EMPIRE ABO UNIT #020B	APACHE CORPORATION	O		ACTIVE	12/2/1961
161	30-015-26404	A	12	18S	27E	660N	990E	FEDERAL T #001	APACHE CORPORATION	I		ACTIVE	9/13/1990
162	30-015-25099	H	12	18S	27E	1809N	990E	COMSTOCK FEDERAL #006	HARLOW ENTERPRISES LLC	O		ACTIVE	9/11/1985
165	30-015-25997	C	7	18S	28E	940N	1757W	LAUREL STATE #001	EASTLAND OIL CO	O		ACTIVE	2/23/1987
166	30-015-25675	2	7	18S	28E	940N	1757W	LAUREL STATE #002	EASTLAND OIL CO	O		ACTIVE	11/10/1988
167	30-015-25236	F	7	18S	28E	1980N	1980W	STATE BY #001	MOREXCO INC	O		ACTIVE	6/10/1985
168	30-015-22636	J	7	18S	28E	1950N	1300W	PRE-ONGUARD WELL #213	DYAD PE	O		ABAN LOCATION	
169	30-015-22635	J	8	18S	28E	1900N	100W	PRE-ONGUARD WELL #212	DYAD PE	O		ABAN LOCATION	
170	30-015-24372	J	8	18S	28E	1980S	990E	PRE-ONGUARD WELL #001	DYAD PE	O		ABAN LOCATION	
171	30-015-27636	H	7	18S	28E	2310N	810E	CHALK BLUFF 6 STATE #002	PHILLIPS PETROLEUM	O		ABAN LOCATION	
353	30-015-27286	M	36	17S	27E	660S	990W	CHALK BLUFF 36 STATE #001	MEWBOURNE OIL CO	O		ACTIVE	3/30/1993
354	30-015-24612	M	36	17S	27E	790S	990W	STATE M #001	PRONGHORN MANAGEMENT CORP	O	4/21/2009	P&A	10/11/1983
355	30-015-00676	M	36	17S	27E	330N	990W	EMPIRE ABO UNIT #017	LIME ROCK RESOURCES A, L.P.	O		ACTIVE	
356	30-015-10184	M	36	17S	27E	330S	920W	STATE #006	ASPEN OIL INC	O		ACTIVE	
358	30-015-21623	M	36	17S	27E	360S	455W	STATE #007	GEORGE A CHASE JR & C SERVICE	O		ACTIVE	
359	30-015-00662	M	36	17S	27E	330S	330W	STATE NO. 2	ACREY, B L & F D	O	10/15/1942	P&A	10/15/1942
595	30-015-02605	B	5	18S	28E	930N	2271E	EMPIRE ABO UNIT NO. 27 E	BP AMERICA PRODUCTION UNIT	O	6/12/2009	P&A	3/30/1960
748	30-015-00715	4	1	18S	27E	330N	330W	SOUTH RED LAKE GRAYBURG UNIT #037	LEGACY RESERVES OPERATING LP	I		ACTIVE	
748	30-015-00701	D	1	18S	27E	330N	330W	SOUTH RED LAKE GRAYBURG UNIT 37 WIW	FAIRWAY RESOURCES OPERATING LLC	O		ACTIVE	
749	30-015-00712	D	1	18S	27E	647N	667W	EMPIRE ABO UNIT I NO. 17	ARCO OIL & GAS	O	1/24/1987	P&A	1/24/1987
750		E	1	18S	27E	1650N	330W	BRAINARD	JONES	O	5/10/1939	P&A	5/10/1939
751	30-015-00704	E	1	18S	27E	1980N	660W	EMPIRE ABO UNIT J NO. 17	ARCO OIL & GAS	O	3/26/1959	P&A	3/26/1959
752	30-015-00703	L	1	18S	27E	1980S	660W	EMPIRE ABO UNIT #017A	BP AMERICA PRODUCTION COMPANY	O	3/27/2009	P&A	5/22/1995
753	30-015-22815	M	1	18S	27E	670S	330W	EMPIRE ABO UNIT #171	LIME ROCK RESOURCES A, L.P.	O		ACTIVE	5/22/1979
754		M	1	18S	27E							MISPLOT OF 756	
755	30-015-00714	N	1	18S	27E			HILL #1	VALLEY REFINING CO		12/20/1943	P&A	12/20/1943
756	30-015-00705	M	1	18S	27E	990S	660W	EMPIRE ABO UNIT #017B	BP AMERICA PRODUCTION COMPANY	O	7/21/2004	P&A	6/25/1959
757		A	2	18S	27E	330N	610E	STATE 2	BRAINARD & GUY		1/31/1942	NO COMPL	1/31/1942
758	30-015-00721	1	2	18S	27E	330N	990E	SOUTH RED LAKE GRAYBURG UNIT #036	FAIRWAY RESOURCES OPERATING LLC	O		PROD	11/6/1947
765	30-015-00724	1	2	18S	27E	990N	330E	EMPIRE ABO UNIT #016B	LIME ROCK RESOURCES A, L.P.	O		ACTIVE	
766	30-015-00737	B	2	18S	27E	905N	1601E	SOUTH RED LAKE GRAYBURG UNIT #038	FAIRWAY RESOURCES OPERATING LLC	O		ACTIVE	5/23/1948
772	30-015-00745	H	2	18S	27E	1980N	660E	STATE H #001	MACK ENERGY CORPORATION	O	3/7/2008	P&A	3/7/2008
773	30-015-00742	H	2	18S	27E	1650N	990E	SOUTH RED LAKE GRAYBURG UNIT 39 WIW	S&J OPERATING COMPANY	O	2/8/1991	P&A	2/8/1991
774	30-015-00740	G	2	18S	27E	1650N	2197E	SOUTH RED LAKE GRAYBURG UNIT #040	MCQUADRANGLE, LC	I	7/10/2002	P&A	7/10/2002
778		G	2	18S	27E	2310N	1650E	HUDSON #2	RUTTER & WILBANKS	O			1/1/1957
779	30-015-00741	G	2	18S	27E	2310N	1980E	EMPIRE ABO UNIT #015B	APACHE CORPORATION	O		ACTIVE	6/6/1959
781		J	2	18S	27E	2310S	2310E	STATE B-2	MALCO REFINING CO	O	1/1/1947	P&A	1/1/1947
785	30-015-00717	I	2	18S	27E	1980S	660E	EMPIRE ABO UNIT #016	APACHE CORPORATION	O		ACTIVE	2/6/1995
786	30-015-00716	J	2	18S	27E	1980S	1830E	EMPIRE ABO UNIT #015	APACHE CORPORATION	O		ACTIVE	3/23/1959
789	30-015-22896	K	2	18S	27E	1820S	2550W	EMPIRE ABO UNIT #143A	WALTER SOLT, LLC	O		ACTIVE	5/13/1979
791	30-015-22914	I	2	18S	27E	1310S	590E	EMPIRE ABO UNIT #161	COG OPERATING, LLC	O		ACTIVE	9/13/1979
792		O	2	18S	27E							MISPLOT OF 814	
793	30-015-22609	N	2	18S	27E	1200S	1900W	EMPIRE ABO UNIT #143	APACHE CORPORATION	O		ACTIVE	12/20/1978

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ID NO	API	Unit No.	Sect	TOWNSHIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
795		P	2	18S	27E							MISPLOT OF 765	
796	30-015-21544	O	2	18S	27E	1110S	1322E	EMPIRE ABO UNIT #151	APACHE CORPORATION	O		T/A	11/4/1975
797	30-015-22885	O	2	18S	27E	1040S	2025E	EMPIRE ABO UNIT #155	APACHE CORPORATION	O		T/A	5/1/1979
799	30-015-00722	P	2	18S	27E	660S	660E	EMPIRE ABO UNIT #016A	APACHE CORPORATION	O	2/24/2009	P&A	1/20/1959
800	30-015-22808	O	2	18S	27E	600S	1330E	EMPIRE ABO UNIT #156	BP AMERICA PRODUCTION COMPANY	O	2/5/2009	P&A	4/12/1979
801	30-015-00731	O	2	18S	27E	660S	1980E	EMPIRE ABO UNIT #015A	BP AMERICA PRODUCTION COMPANY	O	2/11/2009	P&A	11/19/1958
802	30-015-22669	O	2	18S	27E	800S	2500E	EMPIRE ABO UNIT #154	BP AMERICA PRODUCTION COMPANY	O	1/27/2009	P&A	12/4/1978
805	30-015-22013	O	2	18S	27E	90S	1456E	EMPIRE ABO UNIT #153	BP AMERICA PRODUCTION COMPANY	O	10/30/2008	P&A	4/20/1977
806	30-015-21825	O	2	18S	27E	320S	2602E	EMPIRE ABO UNIT #152	APACHE CORPORATION	O		T/A P&A	6/17/1976
807	30-015-22608	N	2	18S	27E	100S	1950W	EMPIRE ABO UNIT #142	BP AMERICA PRODUCTION COMPANY	O		(No Info on dates)	
808	30-015-21807	M	2	18S	27E	275S	1243W	EMPIRE ABO UNIT #132	BP AMERICA PRODUCTION COMPANY	O		ACTIVE	7/1/1976
812	30-015-00730	N	2	18S	27E	660S	1980W	EMPIRE ABO UNIT #014	APACHE CORPORATION	O		ACTIVE	10/21/1958
813	30-015-00720	A	2	18S	27E	990N	1650E	RIVERWOLF UNIT #004	BP AMERICA PRODUCTION COMPANY	O	12/12/2008	P&A	10/21/1959
814	30-015-22051	K	2	18S	27E	1370S	2445W	EMPIRE ABO UNIT #141A	APACHE CORPORATION	O		ACTIVE	5/17/1977
836	30-015-00869	A	11	18S	27E	330N	653E	EMPIRE ABO UNIT #016C	BP AMERICA PRODUCTION COMPANY	O	10/25/2004	P&A	10/25/2004
837	30-015-22568	B	11	18S	27E	400N	1450E	EMPIRE ABO UNIT #151B	BP AMERICA PRODUCTION COMPANY	O	8/16/2006	P&A	8/16/2006
838	30-015-22838	B	11	18S	27E	200N	1925E	EMPIRE ABO UNIT #153B	BP AMERICA PRODUCTION COMPANY	O	1/4/2009	P&A	5/6/1979
839	30-015-00868	B	11	18S	27E	660N	1980E	EMPIRE ABO UNIT #015C	BP AMERICA PRODUCTION COMPANY	O	7/16/2004	P&A	7/16/2004
840	30-015-22569	B	11	18S	27E	560N	2588E	EMPIRE ABO UNIT #152B	BP AMERICA PRODUCTION COMPANY	O	9/24/2008	P&A	8/23/1978
841	30-015-22834	C	11	18S	27E	225N	2280W	EMPIRE ABO UNIT #141B	APACHE CORPORATION	O		ACTIVE	5/21/1979
842	30-015-00864	C	11	18S	27E	660N	1980W	EMPIRE ABO UNIT M NO. 14	ARCO OIL & GAS	O	9/5/1957	P&A	9/5/1957
843	30-015-22833	D	11	18S	27E	450N	1175W	EMPIRE ABO UNIT #133B	APACHE CORPORATION	O		ACTIVE	5/23/1979
844	30-015-00867	D	11	18S	27E	660N	660W	EMPIRE ABO UNIT M NO. 13	ARCO OIL & GAS	O	4/26/1958	P&A	4/26/1958
846	30-015-22556	D	11	18S	27E	1100N	1200W	EMPIRE ABO UNIT M NO. 131	ARCO OIL & GAS	O	7/10/1978	P&A	7/10/1978
848	30-015-20510	F	11	18S	27E	1650N	1653W	MALCO S NO. 1	AMOCO PRODUCTION CO	O	10/16/1971	P&A	10/16/1971
849	30-015-00865	F	11	18S	27E	1650N	1980W	EMPIRE ABO UNIT N NO. 14	ARCO OIL & GAS	O	2/3/1961	P&A	2/3/1961
850	30-015-00866	E	11	18S	27E	1980N	660W	EMPIRE ABO UNIT N NO. 131	ARCO OIL & GAS	O	3/27/1958	P&A	3/27/1958
851	30-015-00870	J	11	18S	27E	1980S	1980E	SMITH-MCPHERSON NO. 1	AMOCO PRODUCTION CO	O	9/1/1956	P&A	9/1/1956
852	30-015-01201	N	11	18S	27E			AN ETZ #3	OSCAR HOWARD		4/15/2027	P&A	
853	30-015-01202	O	11	18S	27E			AN ETZ #2	OSCAR HOWARD		2/4/2027	P&A	
854	30.015-00863	N	11	18S	27E			VICKERS #1	B.R. POLK, JR.		10/14/1949	P&A	10/14/1949
855	30-015-24857	M	11	18S	27E	700S	990W	FEDERAL DH GAS COM #001	CHESAPEAKE OPERATING INC	G		ACTIVE	5/18/1984
856	30-015-20535	D	12	18S	27E	330N	455W	FEDERAL EA 2	ROBERT G COX	O	8/7/1973	P&A	8/7/1973
857	30-015-00871	D	12	18S	27E	330N	330W	FEDERAL EA #001	RHONDA OPERATING CO	O	4/12/1994	P&A	4/12/1994
858	30-015-23115	D	12	18S	27E	330N	380W	FEDERAL EA NO. 3	RHONDA OPERATING CO	O	3/16/1980	D&A	3/16/1980
859	30-015-25738	G	12	18S	27E	2310N	2310E	COMSTOCK FEDERAL #009	HARLOW ENTERPRISES LLC	O		ACTIVE	4/25/1987
860	30-015-25270	F	12	18S	27E	2310N	2310W	CHUKKA FEDERAL #001	BILL MILLER	O		ACTIVE	4/23/1985
861	30-015-20894	E	12	18S	27E	1980N	660W	WDW #002	NAVAJO REFINING COMPANY	I		ACTIVE	7/18/1973
862	30-015-00874	J	12	18S	27E	2310S	2355E	COMSTOCK FEDERAL #007	HARLOW ENTERPRISES LLC	O		ACTIVE	6/29/1948
863	30-015-00872	L	12	18S	27E	310S	990W	MAGRUDER NO. 1	MCKEE-JONES	O	2/18/1943	D&A	
864	30-015-25201	K	12	18S	27E	1650S	1770W	COMSTOCK FEDERAL #002	HARLOW ENTERPRISES LLC	O		ACTIVE	3/16/1985
865	30-015-25649	L	12	18S	27E	1650S	990W	COMSTOCK FEDERAL NO. 8	FRED POOL DRILLING CO	O	10/10/1986	D&A	
866	30-015-25545	M	12	18S	27E	990S	990W	COMSTOCK FEDERAL #003	HARLOW ENTERPRISES LLC	O		ACTIVE	5/19/1986
867	30.015-00873	M	12	18S	27E			MAGRUDER #2	R.E. McKEE ET AL		2/27/1945	P&A	2/27/1945
868	30-015-26017	N	12	18S	27E	990S	1650W	COMSTOCK FEDERAL #010	EASTLAND OIL CO	O	1/23/2003	P&A	1/23/2003
869	30-015-25100	N	12	18S	27E	330S	1650W	COMSTOCK FEDERAL #001	HARLOW ENTERPRISES LLC	O		ACTIVE	12/10/1984
870	30-015-25202	O	12	18S	27E	330S	2310E	COMSTOCK FEDERAL #005	HARLOW ENTERPRISES LLC	O		ACTIVE	4/19/1985
871	30-015-06171	I	12	18S	27E	1069S	251E	MICHAEL CRONIN NO. 3	PILCHER OIL & GAS	O	5/20/2026	P&A	
872		P	12	18S	27E			MICHAEL CRONIN #1	PILCHER OIL & GAS		2/15/1932	P&A	2/15/1932

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID NO	API	Unit No.	Sect	TOWNS HIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
873	30-015-00875	P	12	18S	27E	330S	330E	MAGRUDER NO. B-4	CITIES SERVICE OIL CO	O	7/30/1952	P&A	7/30/1952
874	30-015-00876	P	12	18S	27E	100S	500E	MAGRUDER NO. 5	ROBERT E MCKEE	O	2/8/1954	P&A	2/8/1954
875	30-015-06170	P	12	18S	27E	200S	200E	MICHAEL CRONIN NO. 2	PILCHER OIL & GAS	O	2/22/2026	P&A	
876	30-015-01200	A	13	18S	27E	0	0	STATE NO. 1	HASSENFUSH-DONNELLY	O	1/1/2026	P&A	
877	30-015-06137	A	13	18S	27E	250N	990E	STATE NO. 2	EASTLAND OIL CO	O	1/1/2026	D&A	
878	30-015-25394	C	13	18S	27E	330N	2310W	ARTESIA STATE #002	BILL MILLER	O		ACTIVE	9/28/1985
879	30-015-25241	C	13	18S	27E	330N	1650W	ARTESIA STATE #001	BILL MILLER	O		ACTIVE	4/13/1985
880	30-015-00884	C	13	18S	27E	990N	1650W	STATE NO. 3	DALE RESLER	O	1/29/1945	P&A	1/29/1945
881	30-015-25370	D	13	18S	27E	480N	940W	ARTESIA STATE UNIT #002A	APACHE CORPORATION	O		ACTIVE	8/27/1985
882	30-015-00883	D	13	18S	27E	990N	990W	ARTESIA STATE UNIT #001	APACHE CORPORATION	O		ACTIVE	12/11/1944
883	30-015-00880	E	13	18S	27E	1650N	990W	STATE NO. 1	DALE RESLER - JONES	O	1/26/1945	P&A	1/26/1945
884	30-015-24881	F	13	18S	27E	1880N	1830W	ANADARKO 13 FEDERAL #001	DAVID G HAMMOND	O	7/17/2011	P&A	6/18/1984
885	30-015-00888	F	13	18S	27E	1980N	1650W	PAGE NO. 1	RALPH NIX & JERRY CURTIS	O	11/28/1954	P&A	11/28/1954
886	30-015-00879	F	13	18S	27E	2310N	1650W	JONES-GOVT NO. 1	DALE RESLER	O	3/14/1945	D&A	3/14/1945
888	30-015-25078	G	13	18S	27E	1724N	2279E	ANADARKO 13 FEDERAL NO. 1	DICKSON PETROLEUM, INC	O	12/30/1984	D&A	12/30/1984
895	30-015-00891	A	14	18S	27E	990N	330E	ARTESIA STATE UNIT TRACT 4 NO. 1	ANADARKO PETROLEUM CORP	O	6/30/1944	P&A	6/30/1944
896	30-015-00893	G	14	18S	27E	1650N	1650E	STATE NO. 1	RESLER	O	1/1/1900	D&A	1/1/1900
897	30-015-00895	H	14	18S	27E	1650N	330E	ARTESIA STATE UNIT #001B	APACHE CORPORATION	O		ACTIVE	2/8/1945
901	30-015-00695	L	1	18S	27E	1650S	330W	HILL NO. 1	WILLIAM & EDWARD HUDSON	O	6/18/1948	D&A	6/18/1948
910	30-015-00744	J	2	18S	27E	2310S	1640E	STATE 1	COMPTON-SMITH	O		P&A	
911	30-015-31123	H	36	17S	27E	1980N	760E	NO BLUFF 36 STATE COM #002	LIME ROCK RESOURCES A, LP	G		ACTIVE	
912	30-015-31036	H	36	17S	27E	2310N	990E	GATES STATE #003	GEORGE A CHASE JR & C SERVICE	O		ACTIVE	
916	30-015-31592	N	36	17S	27E	330S	2310E	RAMAPO #007	ROJO GRANDE COMPANY LLC	O	12/21/2001	P&A	12/21/2001
917	30-015-30784	A	31	17S	28E	330N	480E	NW STATE #012	LIME ROCK RESOURCES A, LP	O		ACTIVE	
918	30-015-30893	A	31	17S	28E	973N	959E	NW STATE #028	LIME ROCK RESOURCES A, LP	O		ACTIVE	
919	30-015-32162	1	31	17S	28E	460N	990W	ENRON STATE #004	LIME ROCK RESOURCES A, LP	O		ACTIVE	4/3/2003
920	30-015-30783	H	31	17S	28E	1650N	330E	NW STATE #011	LIME ROCK RESOURCES A, LP	O		ACTIVE	
921	30-015-30849	I	31	17S	28E	2310S	270E	NW STATE #009	LIME ROCK RESOURCES A, LP	O		ACTIVE	
922	30-015-30760	P	31	17S	28E	735S	330E	NW STATE #010	LIME ROCK RESOURCES A, LP	O		ACTIVE	
923	30-015-31920	D	32	17S	28E	990N	990W	ENRON STATE #002	APACHE CORPORATION	O		ACTIVE	
924	30-015-30781	K	32	17S	28E	1900S	2146W	NW STATE #005	LIME ROCK RESOURCES A, LP	I		ACTIVE	
925	30-015-30777	L	32	17S	28E	2310S	990W	NW STATE #006	APACHE CORPORATION	O		ACTIVE	
926	30-015-30685	M	32	17S	28E	990S	990W	NW STATE #007	APACHE CORPORATION	O		ACTIVE	
927	30-015-30815	N	32	17S	28E	1090S	2126W	NW STATE #008	LIME ROCK RESOURCES A, LP	I		ACTIVE	
928	30-015-32310	1	1	18S	27E	990N	990E	AAO FEDERAL #004	APACHE CORPORATION	O		ACTIVE	5/4/2004
929	30-015-32309	2	1	18S	27E	330N	1690E	AAO FEDERAL #003	APACHE CORPORATION	O		ACTIVE	4/10/2003
930	30-015-32308	3	1	18S	27E	430N	2310W	AAO FEDERAL #002	APACHE CORPORATION	O		ACTIVE	9/19/2002
931	30-015-32307	4	1	18S	27E	330N	990W	AAO FEDERAL #001	APACHE CORPORATION	O		ACTIVE	12/10/2002
932	30-015-22816	O	1	18S	27E	1120S	1440E	EMPIRE ABO UNIT L #192	ARCO OIL & GAS	O	6/23/1980	ABAN LOCATION	6/28/1980
933	30-015-20388	N	1	18S	27E	990S	2297E	EMPIRE ABO #5	ARCO OIL & GAS	O	12/31/9999	SAME AS 158	
934	30-015-27719	I	12	18S	27E	1650S	990E	CHALK BLUFF 12 FED #001	MEWBOURNE OIL CO	G		ABAN LOCATION	
935	30-015-27437	B	14	18S	27E	660N	1980E	BEAUREGARD ANP STATE COM #001	YATES PETROLEUM CORPORATION	G		ABAN LOCATION	
936	30-015-31086	E	5	18S	28E	1650N	990W	LP STATE #001	MARBOB ENERGY CORP	O	3/11/2008	P&A	3/11/2008
937	30-015-31109	E	5	18S	28E	2301N	230W	LP STATE #002	APACHE CORPORATION	O		PROPOSED	
938	30-015-30785	1	6	18S	28E	430N	330E	NW STATE #015	APACHE CORPORATION	O		ACTIVE	
939	30-015-00264	J	6	18S	28E	2310S	2310E	CAPITAL STATE NO. 1	BARNEY COCKBURN	O		SAME AS 114	5/23/1979
940	30-015-31087	7	6	18S	28E	990S	330W	LP STATE #003	MARBOB ENERGY CORP	O	3/17/2008	P&A	7/15/2000
941	30-015-31088	7	6	18S	28E	330S	990W	LP STATE #004	MARBOB ENERGY CORP	O		PROPOSED	
942	30-015-06250	O	6	18S	28E	470S	2170E		BP AMERICA PRODUCTION COMPANY	O		SAME AS 89	
943	30-015-31319	3	7	18S	28E	2310N	330W	LAUREL STATE #003	EASTLAND OIL CO	O		ACTIVE	1/31/2001

TABLE II

Tabulation of Wells Within One Mile Area of Review

ID NO	API	Unit No.	Sect	TOWNS HIP	RNG	NS FTG	EW FTG	WELL NAME	OPERATOR	WELL TYPE	PLUG DATE	STATUS	DATE - Comp or Plug
944	30-015-26575	D	6	18S	28E	778N	995W	WDW-3 (ORIGINAL LOC.)	NAVAJO REFINING COMPANY	I		ACTIVE	
945	30-015-32959	E	1	18S	27E	1650N	875W	AAO FEDERAL #005	APACHE CORPORATION	O		ACTIVE	10/12/2004
946	30-015-33473	G	1	18S	27E	1750N	1650S	AAO FEDERAL #007	MARBOB ENERGY CORP	O		ACTIVE	4/4/2005
947	30-015-33784	H	1	18S	27E	1650N	330W	AAO FEDERAL #008	MARBOB ENERGY CORP	O		ACTIVE	2/25/2005
948	30-015-34071	F	1	18S	27E	2169N	1963W	AAO FEDERAL #006	MARBOB ENERGY CORP	O		ACTIVE	8/5/2005
949	30-015-34387	L	1	18S	27E	1980S	630W	AAO FEDERAL #009	MARBOB ENERGY CORP	O		ACTIVE	1/17/2006
950	30-015-34555	M	1	18S	27E	890S	660W	AAO FEDERAL #011	MARBOB ENERGY CORP	O		ACTIVE	3/9/2006
951	30-015-34576	K	1	18S	27E	2060S	2160W	AAO FEDERAL #010	MARBOB ENERGY CORP	O		ACTIVE	10/26/2006
952	30-015-34998	N	1	18S	27E	890S	1650W	AAO FEDERAL #012	MARBOB ENERGY CORP	O		ACTIVE	9/21/2006
953	30-015-34028	G	6	18S	28E	2285N	1366E	SLIDER 6 STATE NO. 001	BP AMERICA PRODUCTION COMPANY	O	12/17/2006	P&A	12/17/2006
954	30-015-35050	D	32	17S	28E	330N	500W	ENRON STATE NO 012	LIME ROCK RESOURCES A, LP	O		ACTIVE	12/21/2006
955	30-015-36939	A	14	18S	27E	660N	990E	VIOLET BIV STATE COM #1	YATES PETROLEUM CORP	O		EXT PERMIT TO DRILL	2/20/2009
956	30-015-33994	A	36	17S	27E	915N	420E	RED LAKE 36 A STATE #2	EDGE PETROLEUM OPERATING COMPANY, INC	O		ACTIVE	4/20/2005
957	30-015-36116	G	36	17S	27E	2305N	1650E	SOUTH RED LAKE UNIT II #57	LEGACY RESERVES OPERATING LP	O		ACTIVE	6/6/2008
958	30-015-32946	J	2	18S	27E	2210S	1650E	SCBP STATE #1	APACHE CORPORATION	O		ACTIVE	4/26/2005
959	30-015-35814	H	2	18S	27E	2063N	441E	STATE H NO 2	MACK ENERGY CORPORATION	O		ACTIVE	1/11/2008
960	30-015-36343	G	31	17S	28E	1650N	2310E	MALCO STATE NO. 002	GEORGE A CHASE JR DBA G AND C SERVICE	O		ACTIVE	7/9/2008
961	30-015-36978	D	31	17S	28E	990N	330W	ENRON STATE NO. 015	LIME ROCK RESOURCES A, LP	O		ACTIVE	7/3/2009
962	30-015-36554	L	32	17S	28E	1770S	550W	NW STATE NO. 029	LIME ROCK RESOURCES A, LP	O		ACTIVE	1/30/2009
963	30-015-36989	K	32	17S	28E	1630S	1710W	NW STATE NO. 030	LIME ROCK RESOURCES A, LP	O		NO COMPL	7/14/2009
964	30-015-37057	N	32	17S	28E	330S	1750W	NW STATE NO. 031	LIME ROCK RESOURCES A, LP	O		NO COMPL	7/28/2009
965	30-015-37058	M	32	17S	28E	330S	330W	NW STATE NO. 032	LIME ROCK RESOURCES A, LP	O		NO COMPL	8/23/2009
966	30-015-37428	G	31	17S	28E	1980N	1980E	MALCO STATE NO. 3	G&C SERVICE	O		ACTIVE	2/10/2010
	30-015-36281	1		18S	27E	2193S	1520W	SUN DEVILS FEDERAL NO. 001	MACK ENERGY CORPORATION	O		PERMIT TO DRILL 4/11/12	
967	30-015-38240	G	36	17S	27E	1425N	1520E	KIOWA STATE NO. 3	COG OPERATING, LLC	O		PERMIT TO DRILL	
968	30-015-39029	G	36	17S	27E	2210N	2310E	CONKLIN STATE NO. 1-Y	G AND C SERVICE	O		ACTIVE	
969	30-015-39321	M	36	17S	27E	990S	890W	BIG BOY STATE NO. 1	COG OPERATING, LLC	O		PERMIT TO DRILL	
970	30-015-39322	M	36	17S	27E	840S	425W	BIG BOY STATE NO. 3	COG OPERATING, LLC	O		PERMIT TO DRILL	
971	30-015-39323	O	36	17S	27E	870S	1560E	BIG BOY STATE NO. 5	COG OPERATING, LLC	O		PERMIT TO DRILL	
972	30-015-39324	O	36	17S	27E	480S	2210E	BIG BOY STATE NO. 6	COG OPERATING, LLC	O		PERMIT TO DRILL	
973	30-015-39325	O	36	17S	27E	990S	2210E	BIG BOY STATE NO. 7	COG OPERATING, LLC	O		PERMIT TO DRILL	
974	30-015-39326	O	36	17S	27E	275S	1560E	BIG BOY STATE NO. 8	COG OPERATING, LLC	O		PERMIT TO DRILL	
975	30-015-39401	P	36	17S	27E	1110S	630E	EMPIRE ABO UNIT NO. 417	APACHE CORPORATION	O		PERMIT TO DRILL	
976	30-015-39009	G	2	18S	27E	1650N	2430E	EMPIRE ABO UNIT NO. 415	APACHE CORPORATION	O		PERMIT TO DRILL	
977	30-015-39066	L	2	18S	27E	2551S	1170W	EMPIRE ABO UNIT NO. 416	APACHE CORPORATION	O		PERMIT TO DRILL	
978	30-015-38234	P	30	17S	28E	430S	800E	ANTHONY NO. 2	LIME ROCK RESOURCES	O		ACTIVE	
979	30-015-39299	M	30	17S	28E	990S	990W	MAPLE STATE NO. 5	COG OPERATING, LLC	O		PERMIT TO DRILL	
980	30-015-39300	M	30	17S	28E	330S	330W	MAPLE STATE NO. 6	COG OPERATING, LLC	O		PERMIT TO DRILL	
981	30-015-38512	D	30	17S	28E	990N	940W	ENRON STATE NO. 16	LIME ROCK RESOURCES	O		ACTIVE	
982	30-015-39004	P	31	17S	28E	150S	1300E	EMPIRE ABO UNIT NO. 401	APACHE CORPORATION	O		PERMIT TO DRILL	
983	30-015-39011	O	31	17S	28E	1190S	1320E	EMPIRE ABO UNIT NO. 419	APACHE CORPORATION	O		PERMIT TO DRILL	
984	30-015-39020	O	31	17S	28E	140S	2560E	EMPIRE ABO UNIT NO. 408	APACHE CORPORATION	O		PERMIT TO DRILL	
985	30-015-38513	J	32	17S	28E	2310S	2032E	JEFFER 32 STATE NO. 3	LIME ROCK RESOURCES	O		ACTIVE	
986	30-015-39006	J	32	17S	28E	2400S	2450E	EMPIRE ABO UNIT NO. 407	APACHE CORPORATION	O		PERMIT TO DRILL	
987	30-015-39007	M	32	17S	28E	70S	100W	EMPIRE ABO UNIT NO. 409	APACHE CORPORATION	O		PERMIT TO DRILL	
988	30-015-39064	O	32	17S	28E	1175S	1310E	EMPIRE ABO UNIT NO. 403	APACHE CORPORATION	O		PERMIT TO DRILL	
989	30-015-39008	D	6	18S	28E	160N	1300W	EMPIRE ABO UNIT NO. 410	APACHE CORPORATION	O		PERMIT TO DRILL	
990	30-015-39021	D	6	18S	28E	40N	145W	EMPIRE ABO UNIT NO. 411	APACHE CORPORATION	O		PERMIT TO DRILL	
992	30-015-00715	D	1	18S	27E	330N	330W	SOUTH RED LAKE II UNIT NO. 37	LEGACY RESERVES OPERATING LP				

TABLE III

Well Changes in the Combined One Mile Area of Review Since the 2010 Annual Report for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
7	30 015 00666	G	36	17S	27E	2310 FNL & 2310 FEL	Conklin State No. 1	G & C Service	Intention to plug from 533' to the surface.
884	30 015 24881	F	13	18S	27E	1880 FNL & 1830 FWL	Anadarko 13 Federal No. 1	David G Hammond	Plugged - set CIBP at 1476 feet, dumped 35 feet of cement on top of plug, perforated at 374 feet and perforated at 424 feet, spotted 25 sacks of cement, perforated at 60 feet, pumped 35 sacks of cement and circulated to the surface
758	30 015 00721	A	02	18S	27E	330 FNL & 990 FEL	outh Red Lake Grayburg Unit No. :	Legacy Reserves Operating, LP	Changed from shut-in to producing/flaring gas, changed owners from McQuadrangle to Legacy Reserves Operating, LP
5	30 015 00690	G	36	17S	27E	1830 FNL & 2205 FEL	Conklin No. 2	G and C Service	Run 4-1/2" liner to 475' and cement to surface. Continue production
967	30 015 38240	G	36	17S	27E	1425 FNL & 1520 FEL	Kiowa State No. 3	Cog Operating LLC	NEW: Currently drilling to 4850' in the Glorietta-Yeso; To be perforated in Yeso Formation; Proposed TD 4850'
968	30 015 39029	G	36	17S	27E	2210 FNL & 2310 FEL	Conklin State No. 1-Y	G and C Service	NEW: Drilled to 540' TD, producing oil
969	30 015 39321	M	36	17S	27E	990 FSL & 890 FWL	Big Boy State No. 1	Cog Operating LLC	NEW: Permit to Drill
970	30 015 39322	M	36	17S	27E	840 FSL & 425 FWL	Big Boy State No. 3	Cog Operating LLC	NEW: Permit to Drill
971	30 015 39323	O	36	17S	27E	870 FSL & 1560 FEL	Big Boy State No. 5	Cog Operating LLC	NEW: Permit to Drill
972	30 015 39324	O	36	17S	27E	480 FSL & 2210 FEL	Big Boy State No. 6	Cog Operating LLC	NEW: Permit to Drill
973	30 015 39325	O	36	17S	27E	990 FSL & 2210 FEL	Big Boy State No. 7	Cog Operating LLC	NEW: Permit to Drill
974	30 015 39326	O	36	17S	27E	275 FSL & 1560 FEL	Big Boy State No. 8	Cog Operating LLC	NEW: Permit to Drill
975	30 015 39401	P	36	17S	27E	1110 FSL & 630 FEL	Empire Abo Unit No. 417	Apache Corp	NEW: Permit to Drill
976	30 015 39009	G	02	18S	27E	1650 FNL & 2430 FEL	Empire Abo Unit No. 415	Apache Corp	NEW: Permit to Drill
977	30 015 39066	L	02	18S	27E	2551 FSL & 1170 FWL	Empire Abo Unit No. 416	Apache Corp	NEW: Permit to Drill
978	30 015 38234	P	30	17S	28E	430 FSL & 800 FEL	Anthony No. 2	Lime Rock Resources	NEW: Drilled to 4823' TD, PBTD: 4762'. Perforations in Upper Yeso: 3644'-3932', Middle Yeso: 3962'-4254', and Lower Yeso: 4355'-4719'
979	30 015 39299	M	30	17S	28E	990 FSL & 990 FWL	Maple State No. 5	Cog Operating LLC	NEW: Permit to Drill
980	30 015 39300	M	30	17S	28E	330 FSL & 330 FWL	Maple State No. 6	Cog Operating LLC	NEW: Permit to Drill
981	30 015 38512	D	30	17S	28E	990 FNL & 940 FWL	Enron State No. 16	Lime Rock Resources	NEW: Well is drilled to total depth of 3658'. Will be completed later this year.
982	30 015 39004	P	31	17S	28E	150 FSL & 1300 FEL	Empire Abo Unit No. 401	Apache Corp	NEW: Permit to Drill
983	30 015 39011	O	31	17S	28E	1190 FSL & 1320 FEL	Empire Abo Unit No. 419	Apache Corp	NEW: Permit to Drill
984	30 015 39020	O	31	17S	28E	140 FSL & 2560 FEL	Empire Abo Unit No. 408	Apache Corp	NEW: Permit to Drill
985	30 015 38513	J	32	17S	28E	2310 FSL & 2032 FEL	Jeffer 32 State No. 3	Lime Rock Resources	NEW: Drilled to 5093' TD, PBTD: 5070'. Perforations in Upper Yeso: 3441'-4727', 3768'-4076', Middle Yeso: 4130'-4476', and Lower Yeso: 4540'-5007'
986	30 015 39006	J	32	17S	28E	2400 FSL & 2450 FEL	Empire Abo Unit No. 407	Apache Corp	NEW: Permit to Drill
987	30 015 39007	M	32	17S	28E	70 FSL & 100 FWL	Empire Abo Unit No. 409	Apache Corp	NEW: Permit to Drill
988	30 015 39064	O	32	17S	28E	1175 FSL & 1310 FEL	Empire Abo Unit No. 403	Apache Corp	NEW: Permit to Drill
989	30 015 39008	D	06	18S	28E	160 FNL & 1300 FWL	Empire Abo Unit No. 410	Apache Corp	NEW: Permit to Drill
990	30 015 39021	D	06	18S	28E	40 FNL & 145 FWL	Empire Abo Unit No. 411	Apache Corp	NEW: Permit to Drill
991	30 015 32946	J	02	18S	27E	2210 FSL & 1650 FEL	SCBP State No. 001	Apache Corp	NEW to AOR. TD = 3880', Changed owner to Apache Corp from Marbob Energy Group

TABLE IV
Wells that have been Plugged and Abandoned since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
7	30 015 00666	G	36	17S	27E	2310 FNL & 2310 FEL	Conklin State No. 1	G & C Service	Intention to plug from 533' to the surface.
884	30 015 24881	F	13	18S	27E	1880 FNL & 1830 FWL	Anadarko 13 Federal No. 1	David G Hammond	Plugged - set CIBP at 1476 feet, dumped 35 feet of cement on top of plug, perforated at 374 feet and perforated at 424 feet, spotted 25 sacks of cement, perforated at 60 feet, pumped 35 sacks of cement and circulated to the surface

TABLE V
Wells that have been Temporally Abandoned since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes

TABLE VI
Wells that have been put back into Production Since the 2010 Annual Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WI

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator
758	30 015 00721	A	02	18S	27E	330 FNL & 990 FEL	South Red Lake Grayburg Unit No. 36	Legacy Reserves Operating, LP

Report
)W-2, and WDW-3

Changes

Changed from shut-in to producing/flaring gas, changed owners from McQuadrangle to Legacy Reserves Operating, LP

TABLE VII
Wells that have been Recompleted in Upper Zones since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
5	30 015 00690	G	36	17S	27E	1830 FNL & 2205 FEL	Conklin No. 2	G and C Service	Run 4-1/2" liner to 475' and cement to surface. Continue production

TABLE VIII
Newly Drilled Wells in the Area of Review since the 2010 Annual Report
Well Changes in the Combined One Mile Area of Review for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes
967	30 015 38240	G	36	17S	27E	1425 FNL & 1520 FEL	Kiowa State No. 3	Cog Operating LLC	NEW: Currently drilling to 4850' in the Glorietta-Yeso; To be perforated in Yeso Formation; Proposed TD 4850'
968	30 015 39029	G	36	17S	27E	2210 FNL & 2310 FEL	Conklin State No. 1-Y	G and C Service	NEW: Drilled to 540' TD, producing oil
969	30 015 39321	M	36	17S	27E	990 FSL & 890 FWL	Big Boy State No. 1	Cog Operating LLC	NEW: Permit to Drill
970	30 015 39322	M	36	17S	27E	840 FSL & 425 FWL	Big Boy State No. 3	Cog Operating LLC	NEW: Permit to Drill
971	30 015 39323	O	36	17S	27E	870 FSL & 1560 FEL	Big Boy State No. 5	Cog Operating LLC	NEW: Permit to Drill
972	30 015 39324	O	36	17S	27E	480 FSL & 2210 FEL	Big Boy State No. 6	Cog Operating LLC	NEW: Permit to Drill

TABLE IX

FIGURES INCLUDED IN THE REPORT

Figure	Description	OCD Reference
1	Chukka Well #2 Schematic	Section VI.1 and IX.3
2	Plot of Bottom Hole Pressure and Temperature Data Mewbourne Well #1	n/a
3	Mewbourne Well #1 Schematic	n/a
4	Gaines Well #3 Schematic	n/a
5	Plot of Bottom Hole Pressure and Temperature Data Gaines Well #3	n/a
6	Midland Map of One Mile Area of Review	n/a
7	Chukka Well #2 Wellhead Schematic	Section IX.14
8	Diagram of Valve Locations for Shut-in on Chukka Well #2	Section IX.14
9	Chukka Well #2 Test Overview	Section IX.18.f
10	Chukka Well #2 Cartesian Plot of Bottom-Hole Pressure and Temperature vs. Time	Section IX.18.a
11	Chukka Well #2 Cartesian Plot of Injection Rate vs. Time	Section IX.18.b
12	Chukka Well #2 Cartesian Plot of Surface Pressure and Injection Rates vs. Time	Section IX.18.e
13	Historical Surface Pressure and Injection Rates vs. Calendar Time	Section IX.18.g

TABLE IX (cont.)

Figure	Description	OCD Reference
14	Chukka Well #2 Derivative Log-Log Plot	Section IX.18.c
15	Chukka Well #2 Superposition Horner (Semi-Log) Plot	Section IX.18.d
16	Chukka Well #2 Expanded Superposition Horner (Semi-Log) Plot	Section IX.18.d
17	Chukka Well #2 Hall Plot	Section IX.18.h
18	Chukka Well #2 Static Pressure Gradient Survey	n/a

TABLE X

Comparison of Permeability, Transmissibility, Skin, False Extrapolated Pressure, and Fill Depth

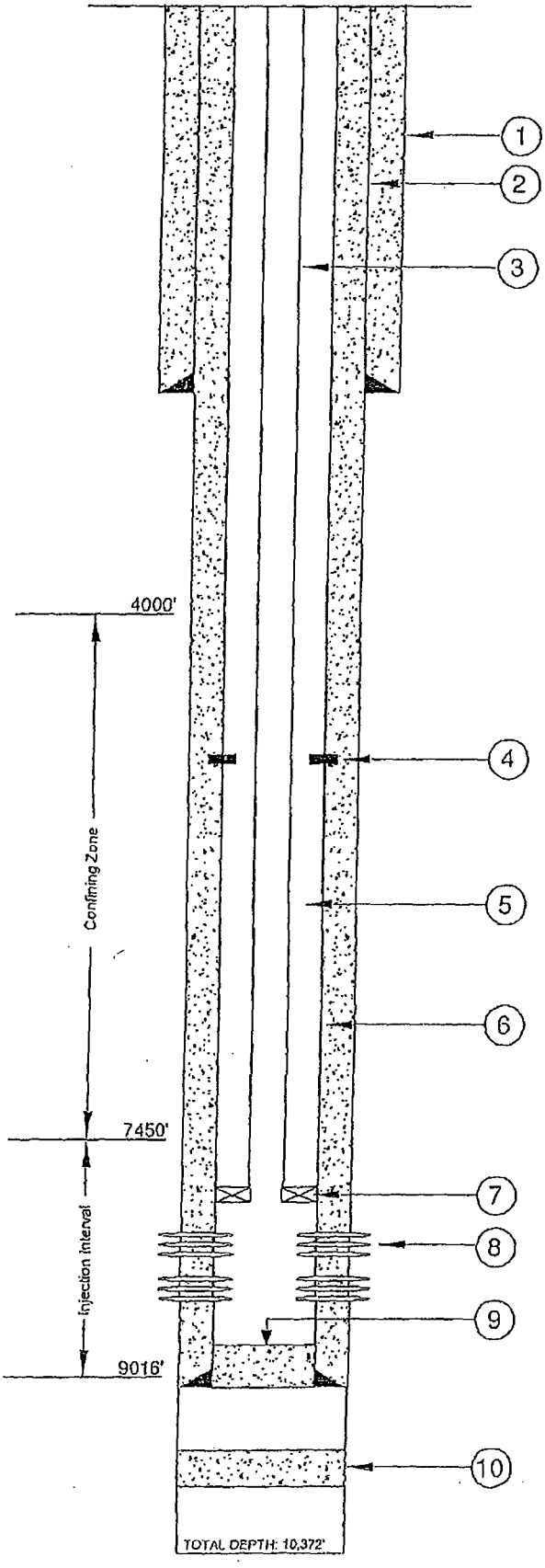
Date of Test	Permeability (k)	Transmissibility (kh/u)	Skin (s)	False Extrapolated Pressure (p*)	Fill Depth
October 17-22, 2011	1451 md	430,405 md-ft/cp	29.41	3697.29 psia	8,335 feet
September 28-October1, 2010	820 md	243,351 md-ft/cp	86.50	3576.58 psia	8,775 feet
October 1-4, 2009	856 md	253,821 md-ft/cp	39.74	3445.89 psia	8,775 feet
April 1-4, 2008	1,091 md	265,300 md-ft/cp	155	3393.47 psia	N/A
April 3-6, 2006	2,183.54 md	707,629 md-ft/cp	81.55	3393.63 psia	N/A
April 2005	2,496.17 md	808,946 md-ft/cp	23.45	3347.95 psia	N/A
April 2001	2,211.07 md	716,551 md-ft/cp	54.07	3236.42 psia	N/A
April 1999	4,712.07 md	1,527,060 md-ft/cp	59.71	2844.45	N/A
Permit Parameters	250 md	40,094 md-ft-cp	N/A	N/A	N/A

TABLE XI

NAVAJO REFINING COMPANY
STATIC PRESSURE GRADIENT SURVEY – CHUKKA WELL #2
OCTOBER 22, 2011

Depth (ft)	Pressure (psia)	Pressure Gradient (psi/ft)	Temperature (°F)
7570	3701.34		107.58
7000	3453.69	0.434	111.09
6000	3020.78	0.433	105.54
5000	2587.29	0.433	99.48
4000	2153.92	0.433	94.93
3000	1720.91	0.433	91.12
2000	1287.96	0.433	88.05
1000	855.49	0.432	82.99
0	423.06	0.432	72.81

FIGURES



BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 13' above ground level. Ground level elevation is 3610' above mean sea level.

1. Base of the USDW at 473'.
2. Surface Casing: 8 5/8", 32 lb/ft, set at 1995' in an 11" hole. Cemented to surface with 800 sacks of cement.
3. Injection Tubing: 3 ½", 9.2 lb/ft, J-55, smls, NUE 10 rd. set at 7528'.
4. DV Tool: at 5,785'.
5. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Technl-Hib 370 corrosion inhibitor.
6. Protection Casing: 5 ½", 17 lb/ft, L-80, LT&C; 8869' to the surface and set in a 7 7/8" hole. Casing cemented in two stages as follows:

   First Stage - 575 sacks of modified Class "H" with 0.4 % CFR-3, 5 lb/sk Gilsonite, 0.5 % Halad-344, and 3 lb/sk salt. Mixed at 13.0 ppg. Opened DV tool at 5785 and circulated 20 sacks to surface.

   Second Stage - Lead Slurry: 300 sacks of Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail slurry: 695 sacks modified Class "H" with 0.4% CFR-3, 5 lb/sk Gilsonite, 0.5 % Halad-344 and 3 lb/sk salt mixed at 13.0 ppg. Circulated 150 sacks to surface. Topped out with 10 yards of Redi-mix.
7. Packer: 5 ½" x 2 7/8" Weatherford Completion Tools (Arrow) Model X-1 retrievable packer set at 7528'. Minimum ID is 2.4375". Wireline re-entry guide is on bottom. To release: turn ¼ turn to the right and pick up.
8. Perforations (2 SPF):

   Zone 1: 7570-7620', 7676-7736'

   Zone 2: 7826-7834', 7858-7880', 7886-7904', 7916-7936', 7944-7964', 7990-8042', 8096-8116', 8191-8201', 8304-8319',8395-8399'.
9. PBTD: 8770'
10. Cement Plug: 45 sacks from 9675' to 9775'.

SUBSURFACE

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

BELOW GROUND DETAILS
WASTE DISPOSAL WELL NO. 2

DATE: 07/13/01	CHECKED BY:	JOB NO: 70D5256
DRAWN BY: WDL	APPROVED BY:	DWG. NO:

FIGURE 1

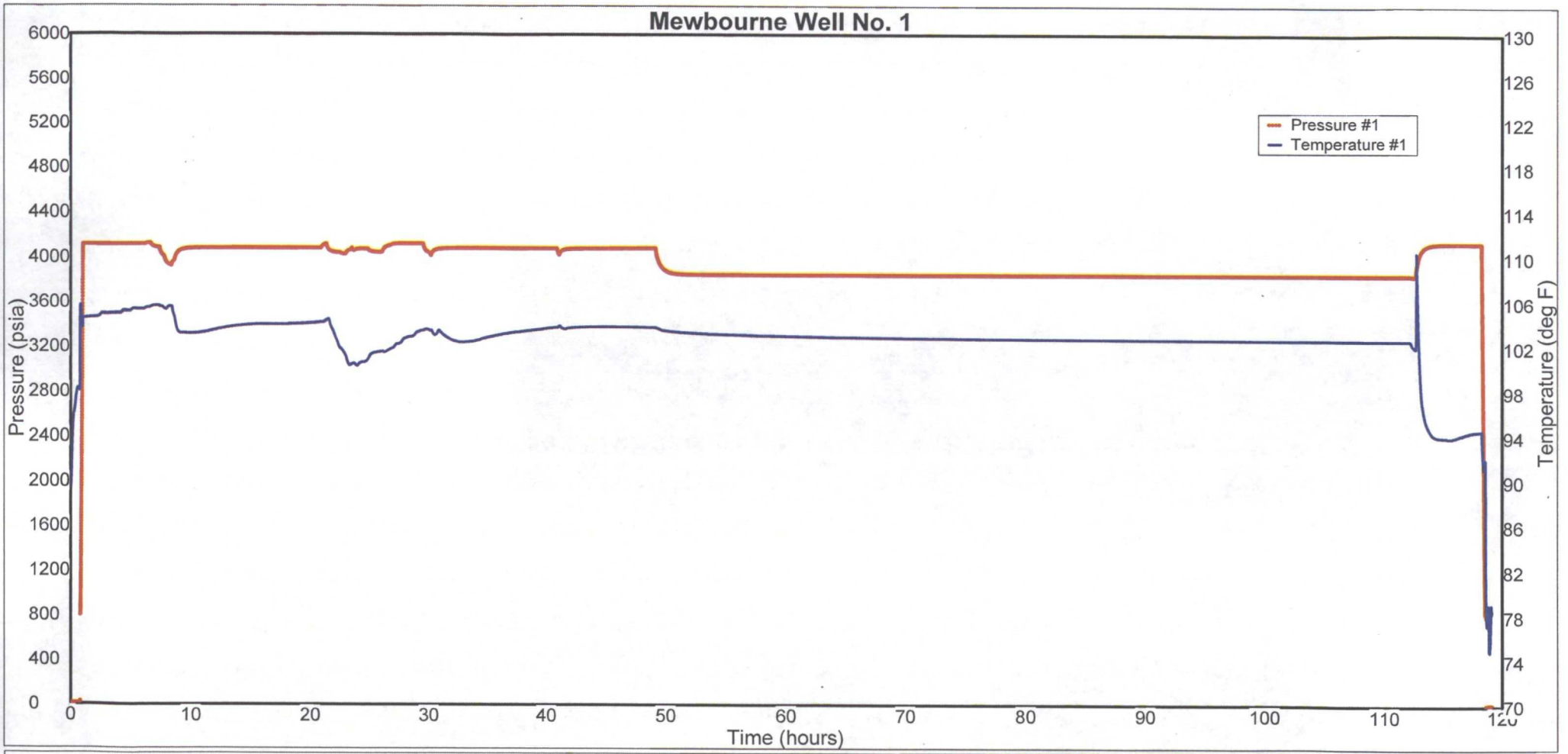
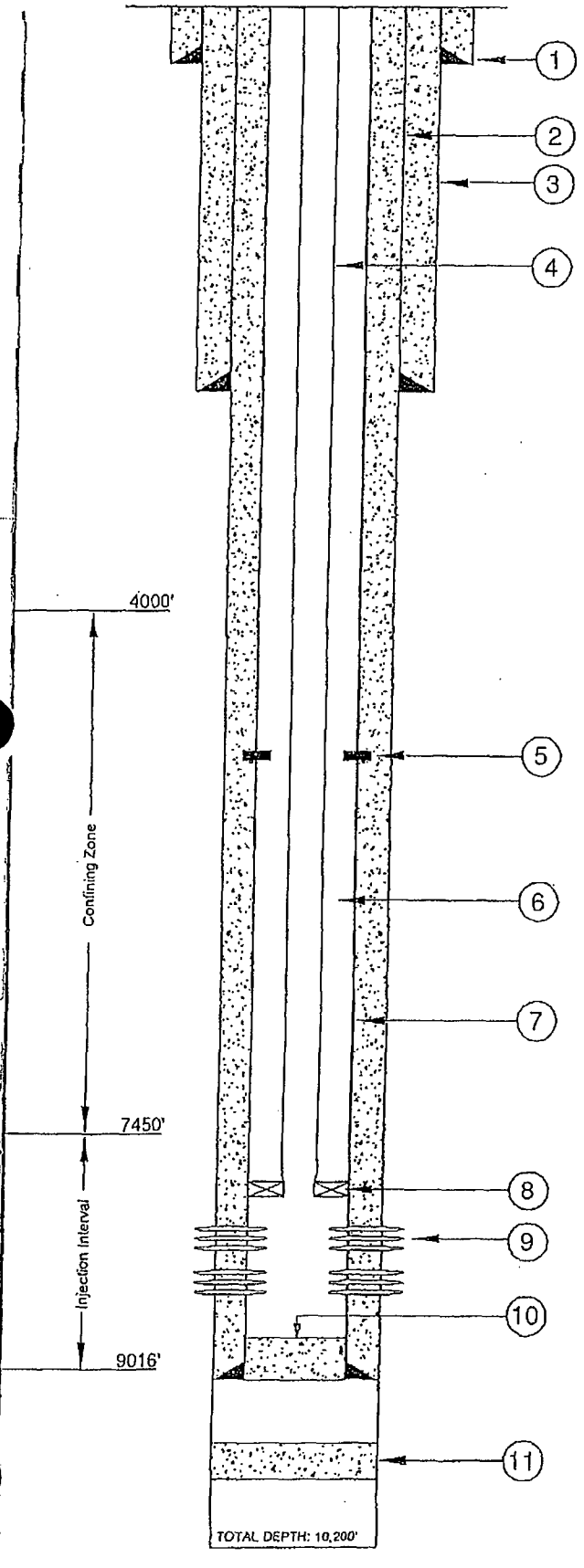

Mewbourne Well No. 1
Pressure #1
Temperature #1
Pressure (psia)
Temperature (deg F)
Time (hours)
6000
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
130
126
122
118
114
110
106
102
98
94
90
86
82
78
74
70
0
10
20
30
40
50
60
70
80
90
100
110
120

FIGURE 2



BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 12.5' above ground level. Ground level elevation is 3,678' above mean sea level.

1. Surface Casing: 13 ⅜", 48 lb/ft, J-55, ST&C set at 390' in a 17 ½" hole. Cemented with 150 sx Class C with 3 % calcium chloride, 375 sx Class C Litewate w/3 % calcium chloride and ½ lb/sx flocele. Circulated 86 sx to surface.

2. Intermediate Casing: 9 ⅝", 36 lb/ft, J-55, ST&C set at 2,555' in a 12 ¼ " hole. Cemented w/800 sx of Class C Lite w/ ½ lb/sx flocele and 2 lb/sx Gilsonite and 12 % salt. Followed by 200 sx of Class C w/2 % calcium chloride. Circulated 133 sx to surface.

3. Base of the USDW at 493'.

4. Injection Tubing: 4 ½", 11.6 lb/ft, N-80, SMLS, R3, LT&C set at 7,879'.

5. DV Tool: at 5,498'.

6. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Techni-Hib 370 corrosion inhibitor.

7. Protection Casing: 7", 29 lb/ft, N-80, LT&C: 9094' to 7031'. 7", 29 lb/ft, P-110, LT&C: 7031' to 5845'. 7", 26 lb/ft, P-110, LT&C; 5845' to surface. Casing cemented in two stages as follows:

   First Stage - 600 sx modified Class H w/0.4 % CFR-3, 5 lb/sx Gilsonite, 0.5% Halad-344, and 1 lb/sx salt mixed at 13.0 ppg. Opened DV tool at 5498' and circulated 142 sx to surface.

   Second Stage - Lead Slurry: 220 sx Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail Slurry: 550 sx modified Class H w/0.4 % CFR-3, 5 lb/sx, Gilsonite, 0.5 % Halad-344, 0.1 % HR-7, and 1 lb/sx mixed at 13.0 ppg. Circulated 75 sx to surface. Top out w/20 sx permium plus 3 % calcium chloride.

8. Packer: 7" x 3.5" EVI Oil Tools (Arrow), Model X-1 retrievable packer set at 7879'. Minimum I.D. is 3.0". Wireline re-entry guide on bottom. To release: turn ¼ turn to the right and pick up.

9. Perforations (2 SPF):

   Upper Zone - 7924-7942', 7974-8030', 8050-8056', 8066-8080', 8118-8127', 8132-8140', 8160-8164', 8170-8188'.

   Lower Zone - 8220-8254', 8260-8270', 8280-8302', 8360-8366', 8370-8378', 8400-8410', 8419-8423', 8430-8446', 8460-8464', 8470-8476'.

10. PBTD: 9004'.

11. Cement Plug: 45 sx Class H from 9624' to 9734'.

SUBSURFACE

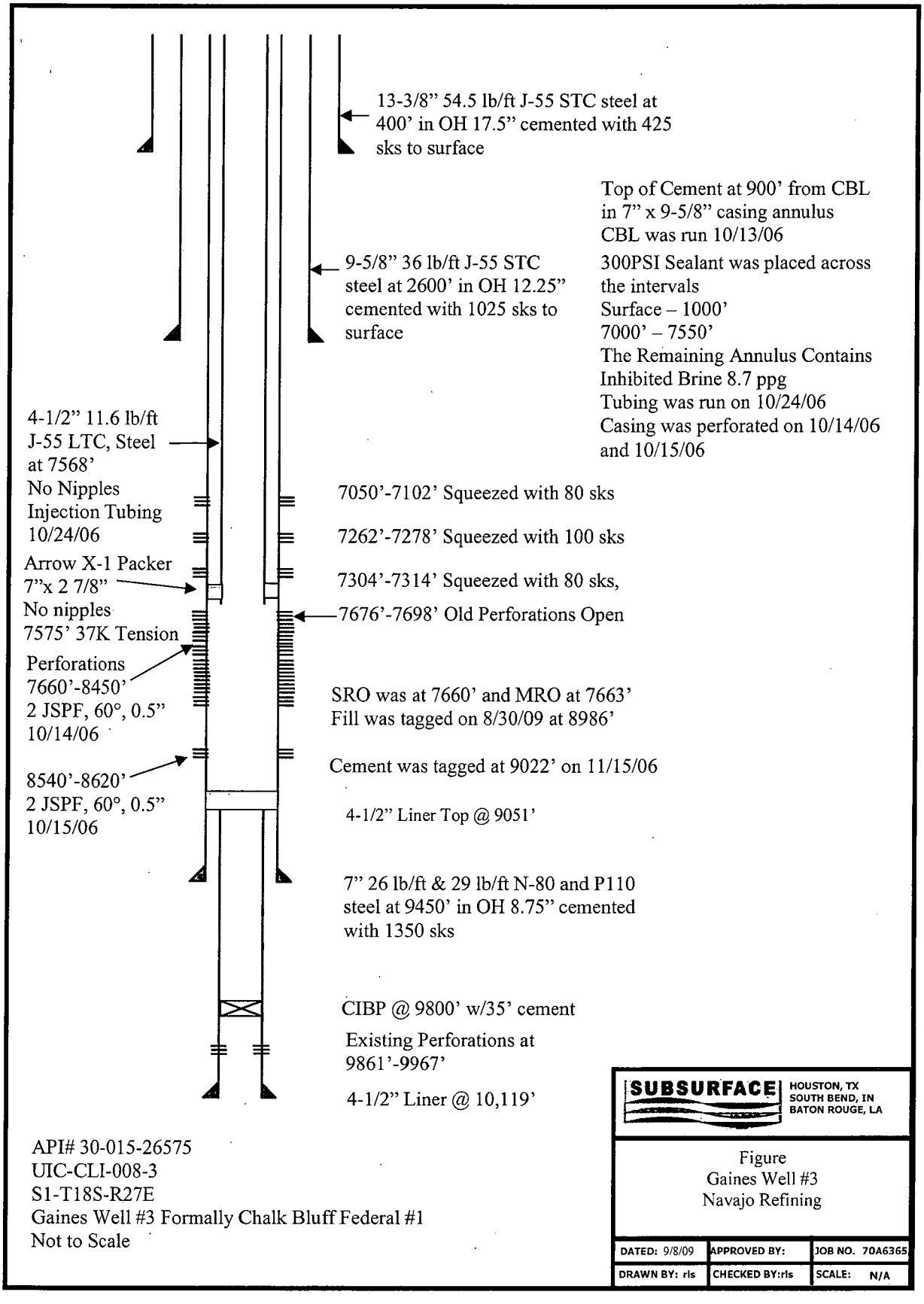
HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

BELOW GROUND DETAILS
WASTE DISPOSAL WELL NO. 1

DATE: 07/13/01	CHECKED BY:	JOB NO: 7005256
DRAWN BY: WDL	APPROVED BY:	DWG. NO:

FIGURE 3



API# 30-015-26575
UIC-CLI-008-3
S1-T18S-R27E
Gaines Well #3 Formally Chalk Bluff Federal #1
Not to Scale

SUBSURFACE HOUSTON, TX SOUTH BEND, IN BATON ROUGE, LA

Figure
Gaines Well #3
Navajo Refining

DATED: 9/8/09	APPROVED BY:	JOB NO. 70A6365
DRAWN BY: rls	CHECKED BY:rls	SCALE: N/A

FIGURE 4

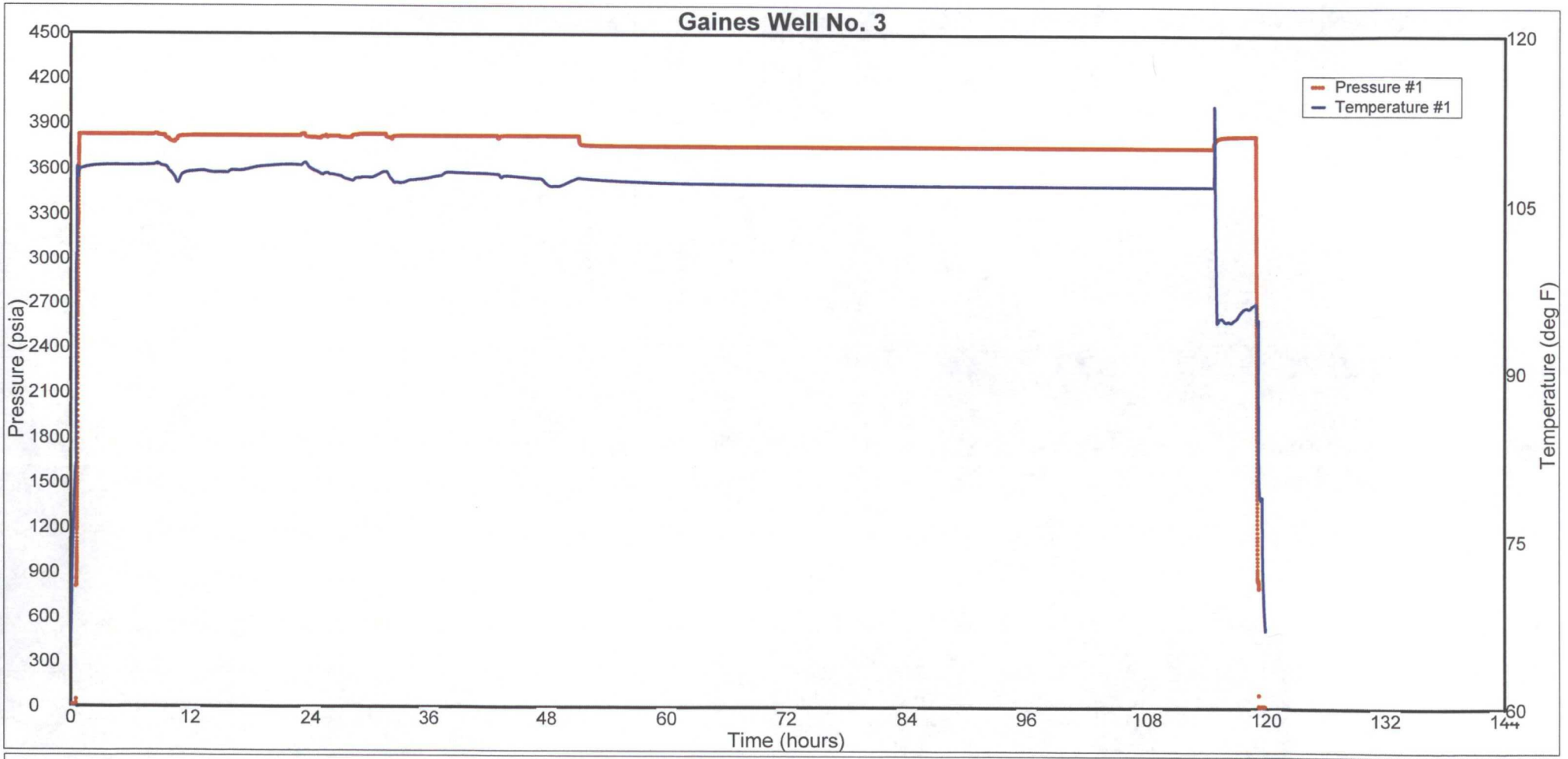

Gaines Well No. 3
Pressure #1
Temperature #1
Pressure (psia)
Temperature (deg F)
Time (hours)
4500
4200
3900
3600
3300
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
120
105
90
75
60
0
12
24
36
48
60
72
84
96
108
120
132
144

FIGURE 5

SUBSURFACE TECHNOLOGY

FIGURE 7

WELL: NAVAJO REFINING WDW #2

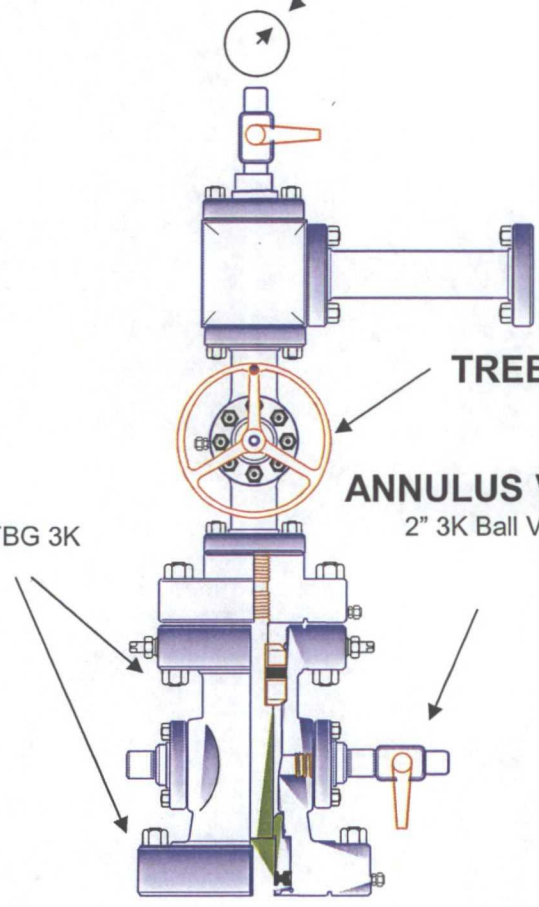
TOP CONNECTION
2-3/8" 8rd x 4-1/16" 3K
2" x 2-3/8" Ball Valve
2-3/8" Bull Plug 1/2" NPT
5000 LB Pressure Guage

UPPER TREE ASSEMBLY
A5PP,4-1/2" 3K X 4-1/16" 3K

TREE GATE VALVE
4-1/16" 3K

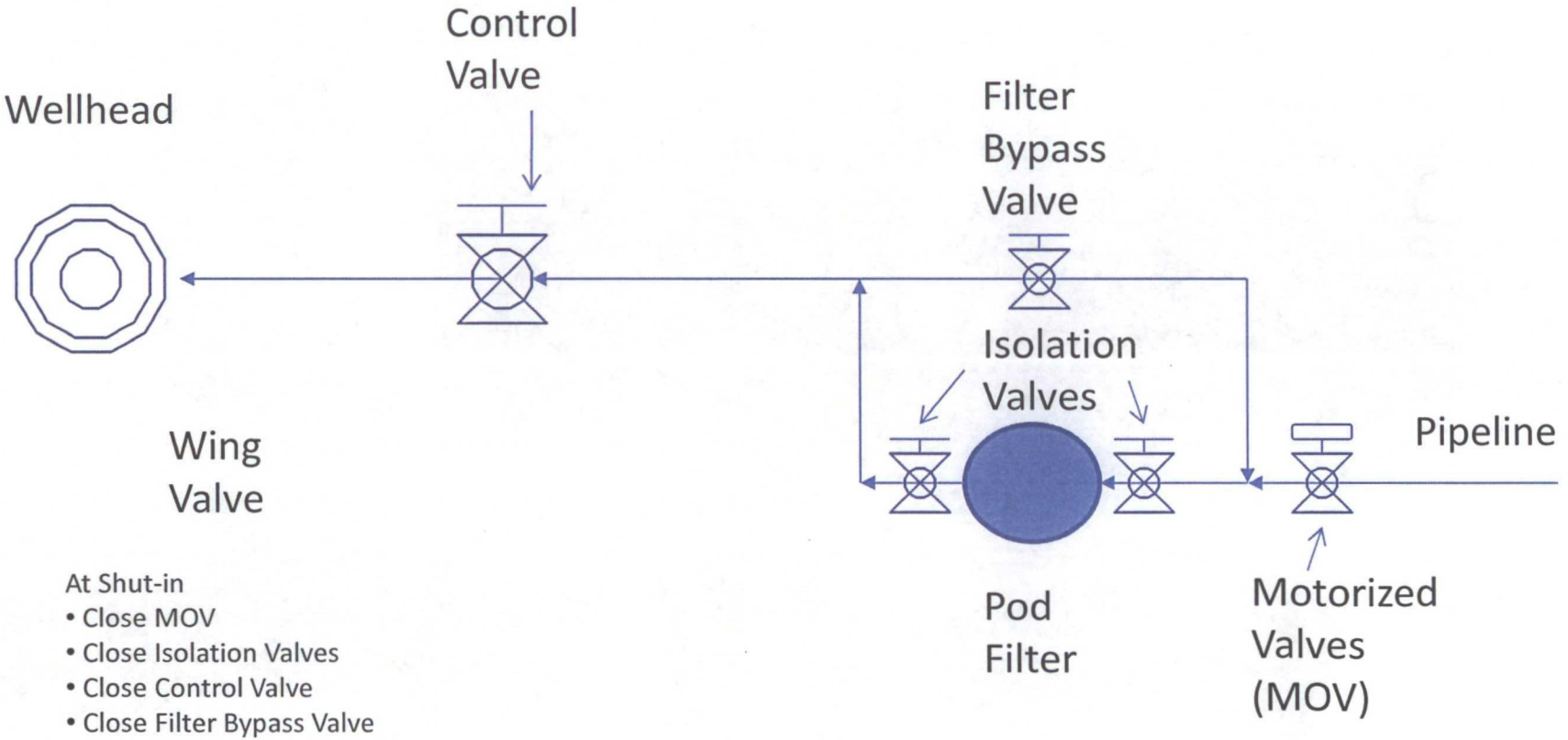
ANNULUS VALVE
2" 3K Ball Valve

FLANGE
7-1/16", 3-1/2" 3K X 4-1/16" UPTBG 3K



SUPERIOR WELLHEAD

FIGURE 8
Chukka Well #2
Diagram of Shut-in Valve Control



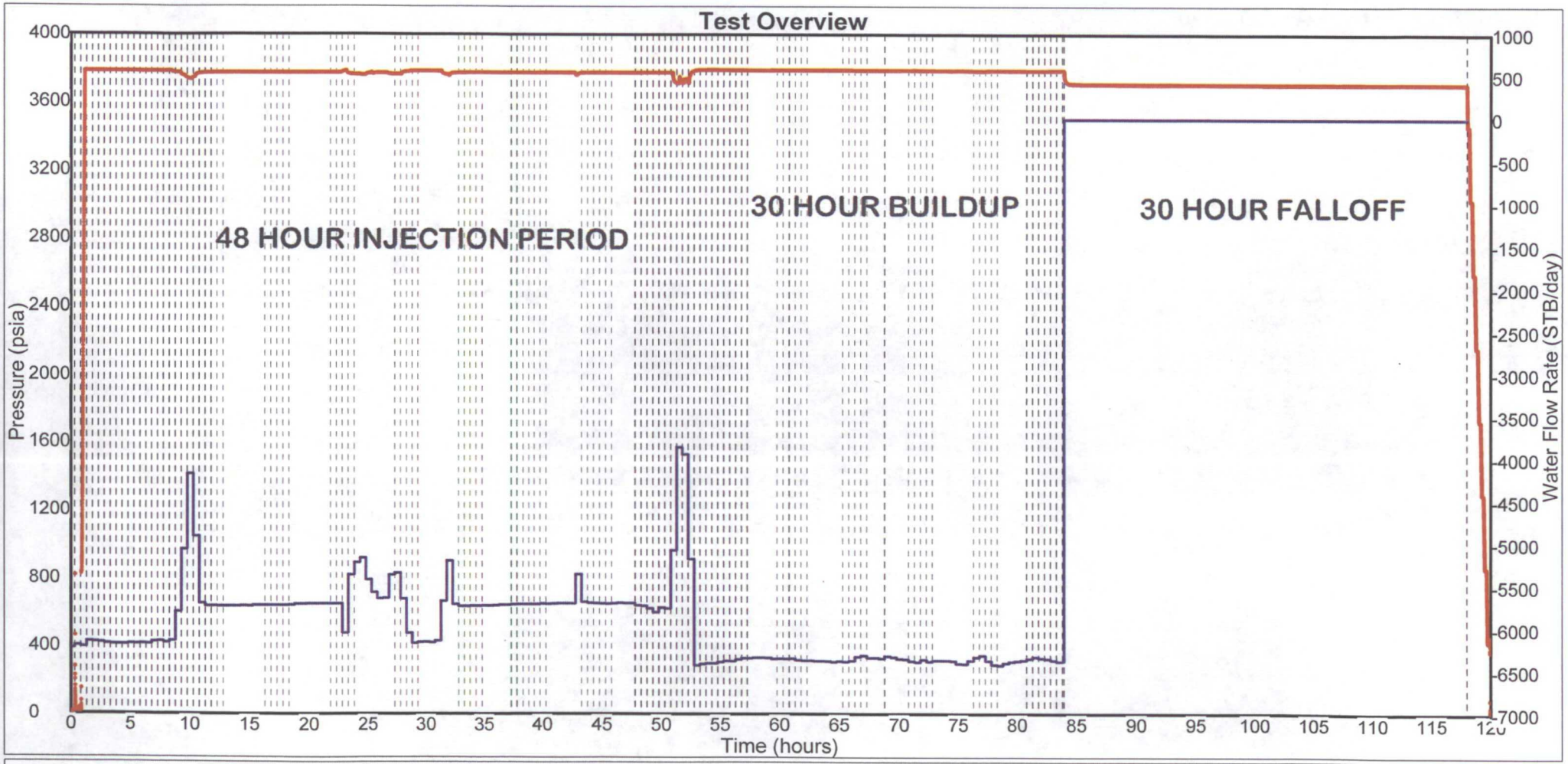

Test Overview
48 HOUR INJECTION PERIOD
30 HOUR BUILDUP
30 HOUR FALLOFF
Pressure (psia)
Water Flow Rate (STB/day)
Time (hours)
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
1000
500
0
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
-4500
-5000
-5500
-6000
-6500
-7000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115

FIGURE 9

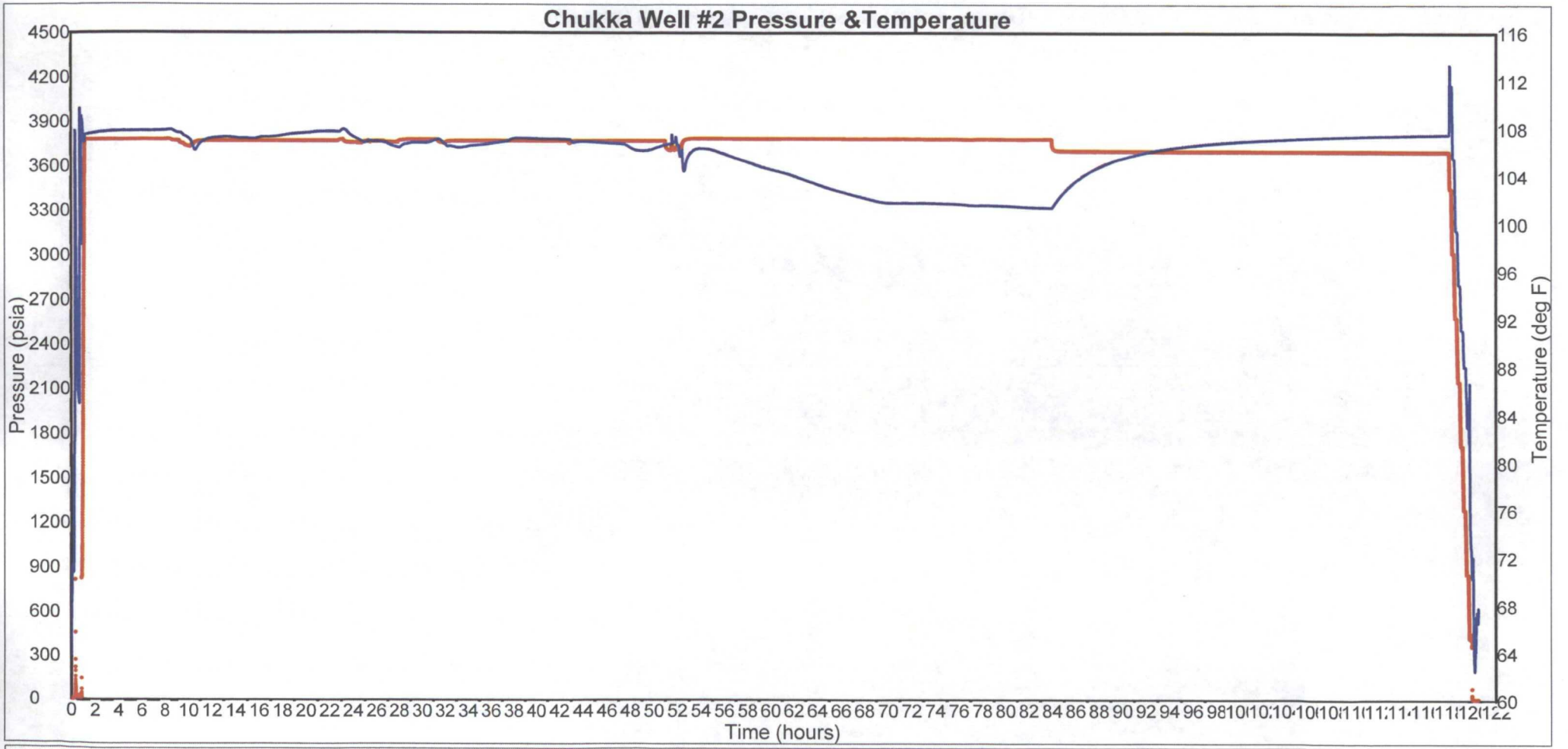

Chukka Well #2 Pressure &Temperature
Pressure (psia)
Temperature (deg F)
Time (hours)
4500
4200
3900
3600
3300
3000
2700
2400
2100
1800
1500
1200
900
600
300
0
116
112
108
104
100
96
92
88
84
80
76
72
68
64
60
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96

FIGURE 10

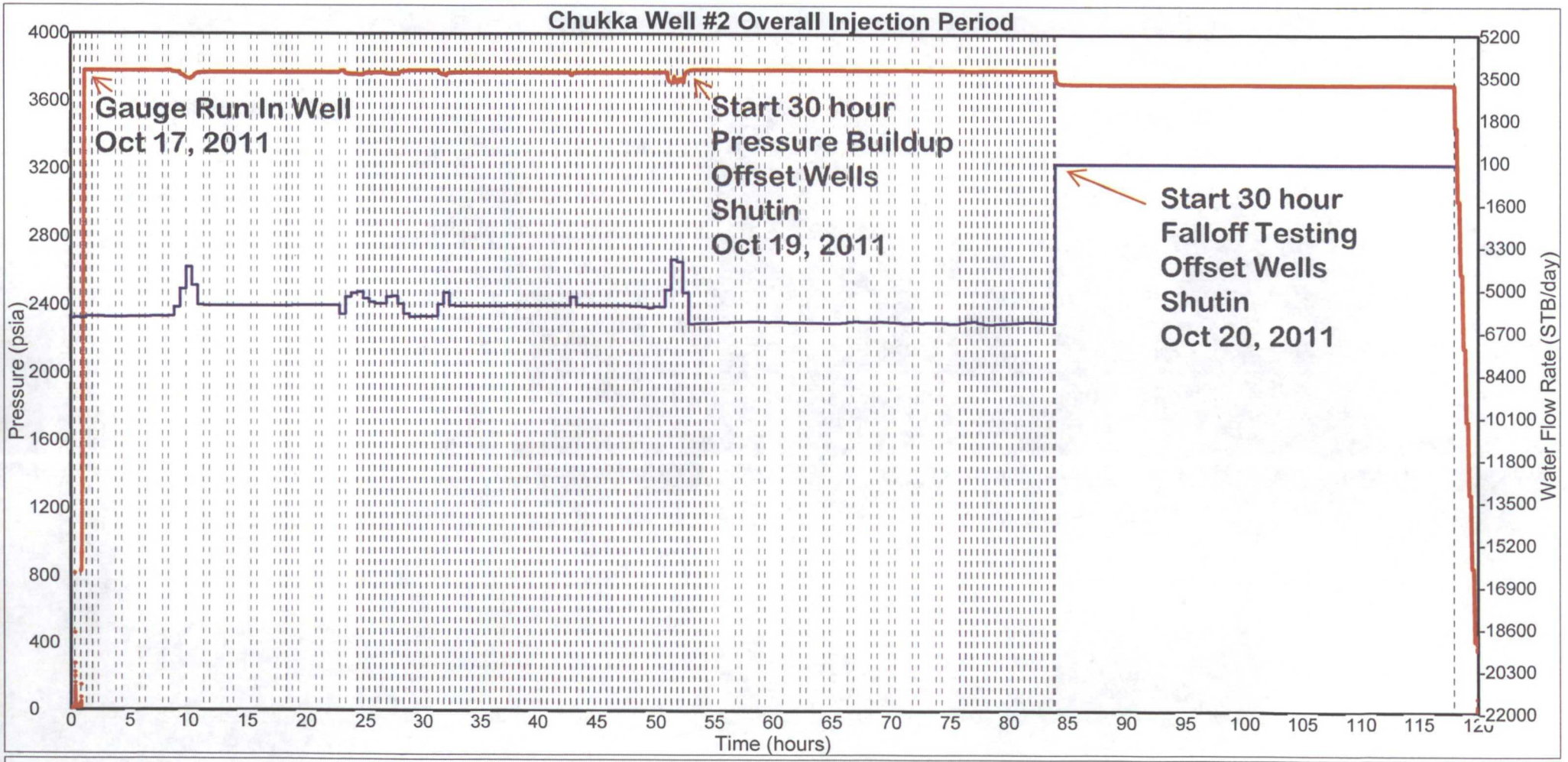

Chukka Well #2 Overall Injection Period
Gauge Run In Well
Oct 17, 2011
Start 30 hour
Pressure Buildup
Offset Wells
Shutin
Oct 19, 2011
Start 30 hour
Falloff Testing
Offset Wells
Shutin
Oct 20, 2011
Pressure (psia)
Water Flow Rate (STB/day)
Time (hours)
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
5200
3500
1800
100
-1600
-3300
-5000
-6700
-8400
-10100
-11800
-13500
-15200
-16900
-18600
-20300
-22000
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115

FIGURE 11

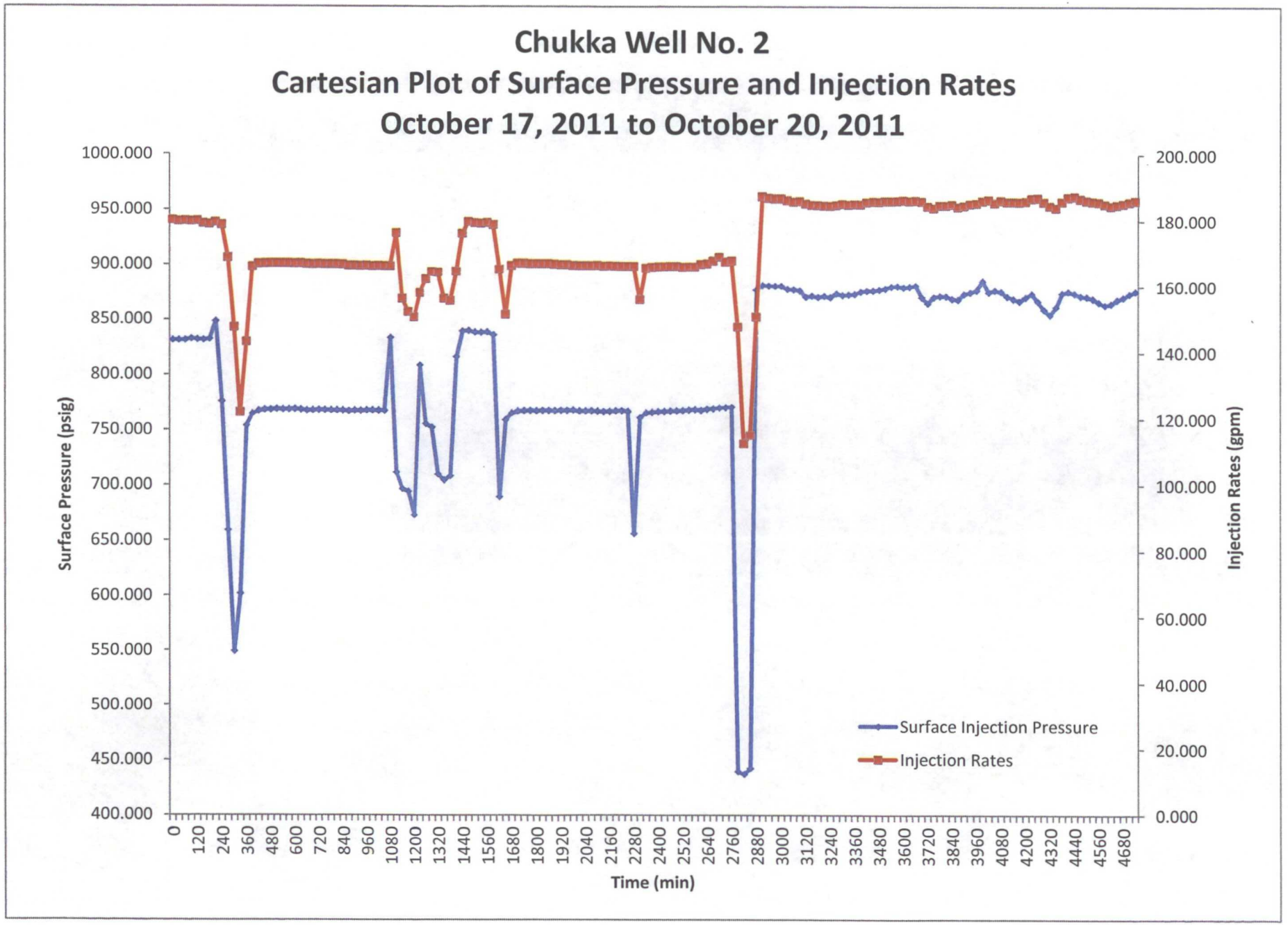

Chukka Well No. 2
Cartesian Plot of Surface Pressure and Injection Rates
October 17, 2011 to October 20, 2011
Surface Pressure (psig)
Injection Rates (gpm)
Time (min)
Surface Injection Pressure
Injection Rates
1000.000
950.000
900.000
850.000
800.000
750.000
700.000
650.000
600.000
550.000
500.000
450.000
400.000
200.000
180.000
160.000
140.000
120.000
100.000
80.000
60.000
40.000
20.000
0.000
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
1560
1680
1800
1920
2040
2160
2280
2400
2520
2640
2760
2880
3000
3120
3240
3360
3480
3600
3720
3840
3960
4080
4200
4320
4440
4560
4680

FIGURE 12

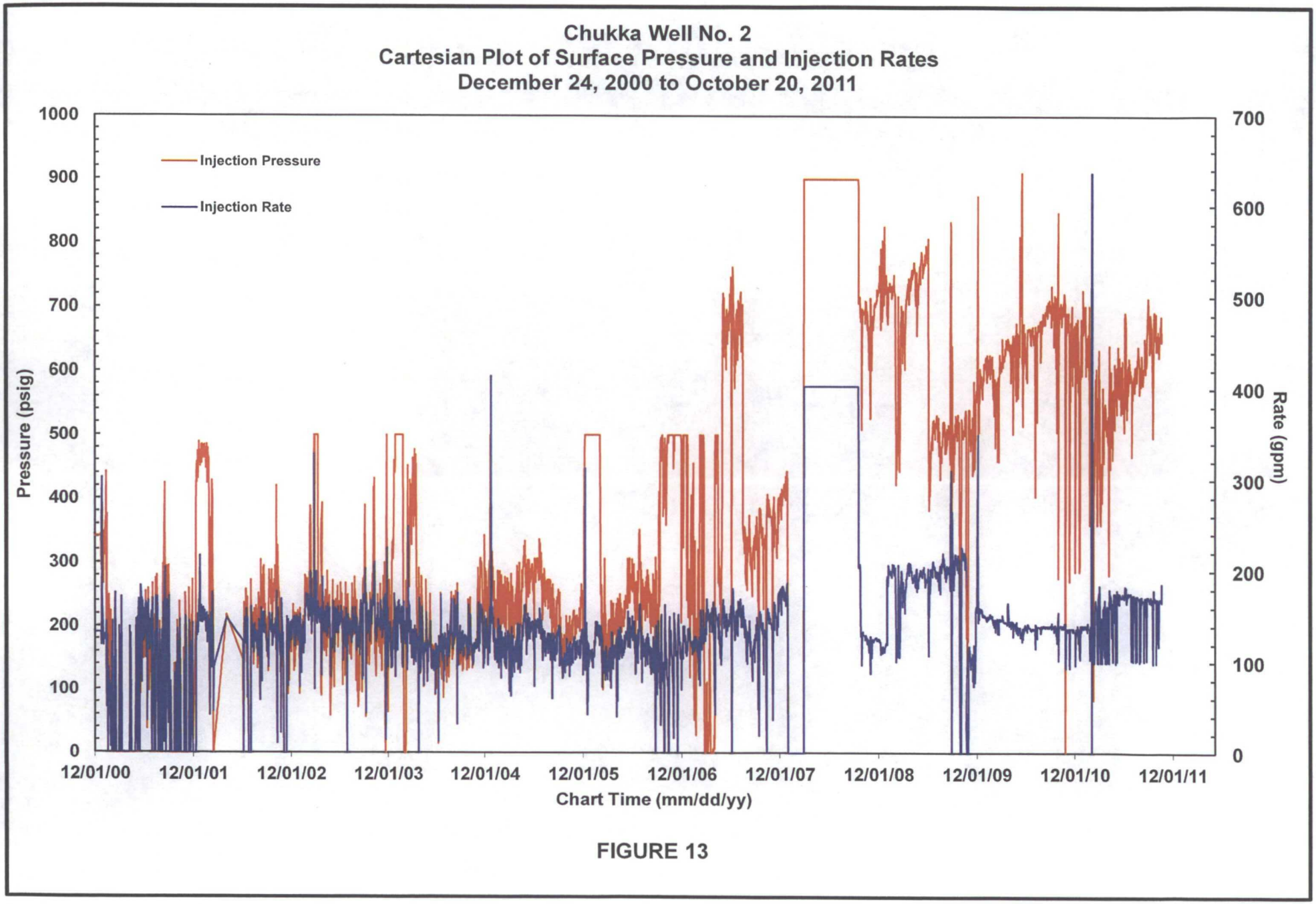

Chukka Well No. 2
Cartesian Plot of Surface Pressure and Injection Rates
December 24, 2000 to October 20, 2011
Injection Pressure
Injection Rate
Pressure (psig)
Rate (gpm)
1000
900
800
700
600
500
400
300
200
100
0
700
600
500
400
300
200
100
0
12/01/00
12/01/01
12/01/02
12/01/03
12/01/04
12/01/05
12/01/06
12/01/07
12/01/08
12/01/09
12/01/10
12/01/11
Chart Time (mm/dd/yy)

FIGURE 13

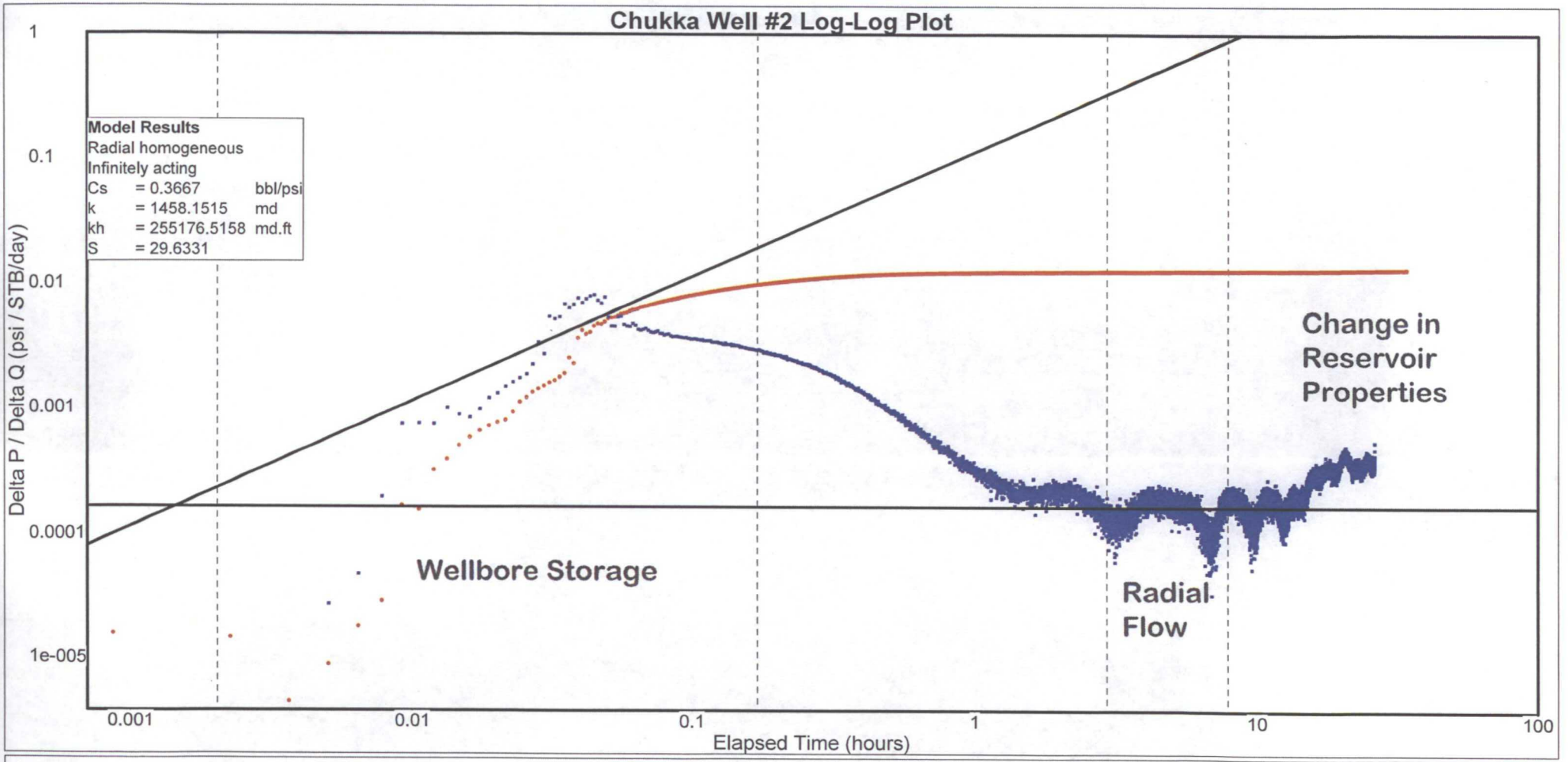

Chukka Well #2 Log-Log Plot
Model Results
Radial homogeneous
Infinitely acting
Cs = 0.3667 bbl/psi
k = 1458.1515 md
kh = 255176.5158 md.ft
S = 29.6331
Change in Reservoir Properties
Wellbore Storage
Radial Flow
Delta P / Delta Q (psi / STB/day)
Elapsed Time (hours)
1
0.1
0.01
0.001
0.0001
1e-005
0.001
0.01
0.1
1
10
100

FIGURE 14

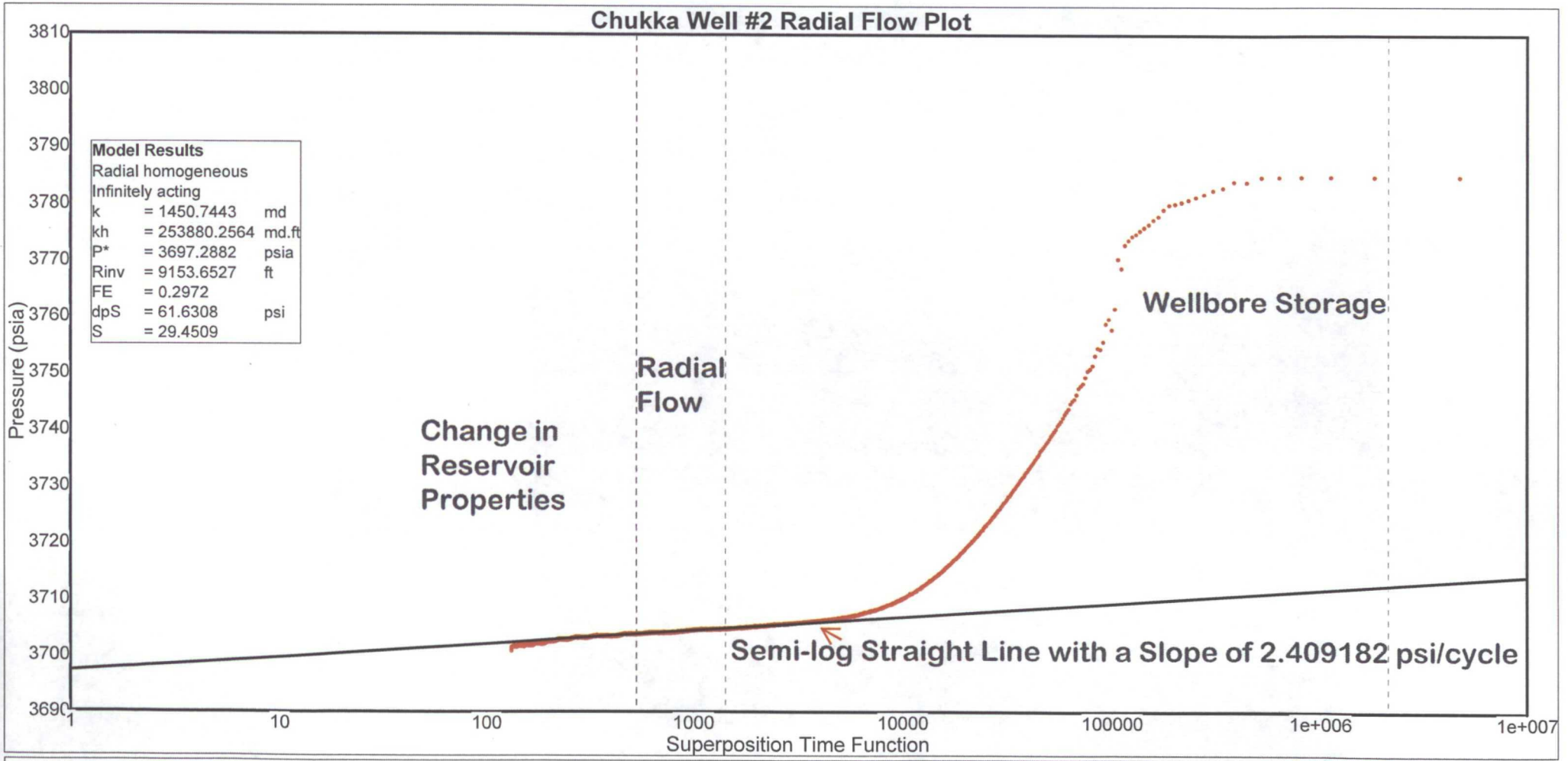

Chukka Well #2 Radial Flow Plot
Model Results
Radial homogeneous
Infinitely acting
k = 1450.7443 md
kh = 253880.2564 md.ft
P* = 3697.2882 psia
Rinv = 9153.6527 ft
FE = 0.2972
dpS = 61.6308 psi
S = 29.4509
Pressure (psia)
3810
3800
3790
3780
3770
3760
3750
3740
3730
3720
3710
3700
3690
Change in Reservoir Properties
Radial Flow
Wellbore Storage
Semi-log Straight Line with a Slope of 2.409182 psi/cycle
1
10
100
1000
10000
100000
1e+006
1e+007
Superposition Time Function

FIGURE 15

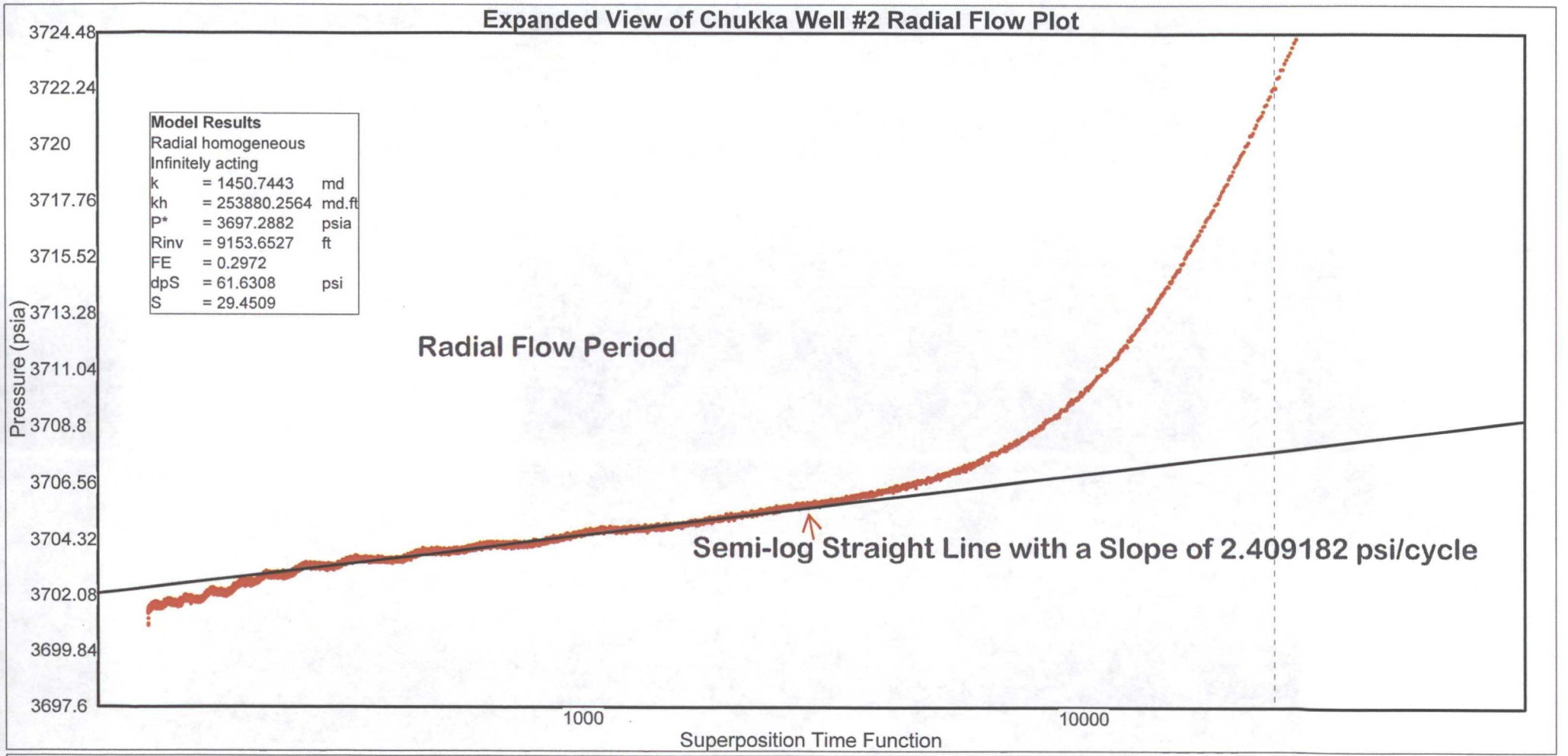

Expanded View of Chukka Well #2 Radial Flow Plot
Model Results
Radial homogeneous
Infinitely acting
k = 1450.7443 md
kh = 253880.2564 md.ft
P* = 3697.2882 psia
Rinv = 9153.6527 ft
FE = 0.2972
dpS = 61.6308 psi
S = 29.4509
Radial Flow Period
Semi-log Straight Line with a Slope of 2.409182 psi/cycle
Pressure (psia)
3724.48
3722.24
3720
3717.76
3715.52
3713.28
3711.04
3708.8
3706.56
3704.32
3702.08
3699.84
3697.6
1000
10000
Superposition Time Function

FIGURE 16

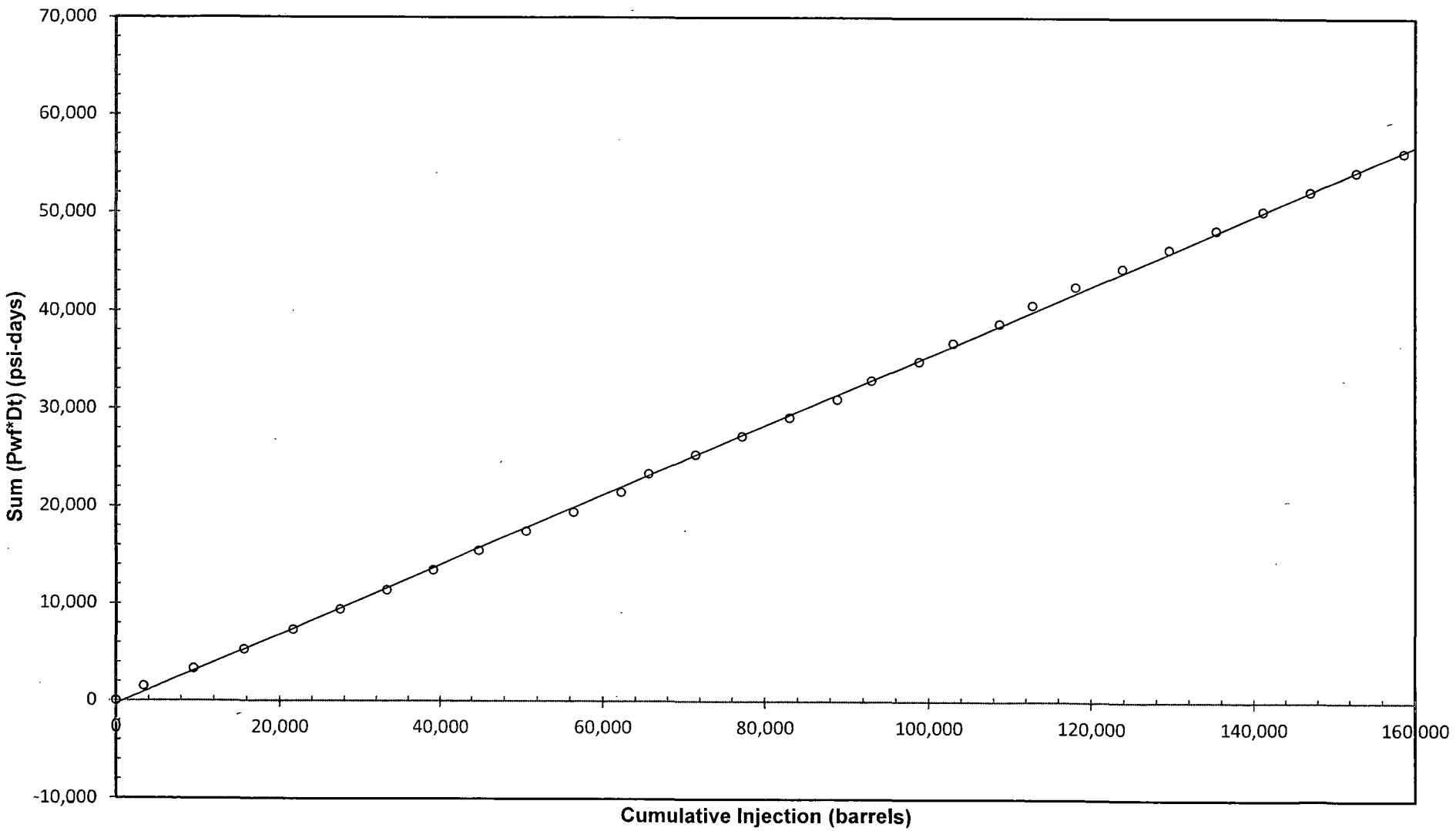

Chukka Well No. 2
Hall Plot
September 17, 2011 to October 19, 2011
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
Sum (Pwf*Dt) (psi-days)
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
Cumulative Injection (barrels)

FIGURE 17

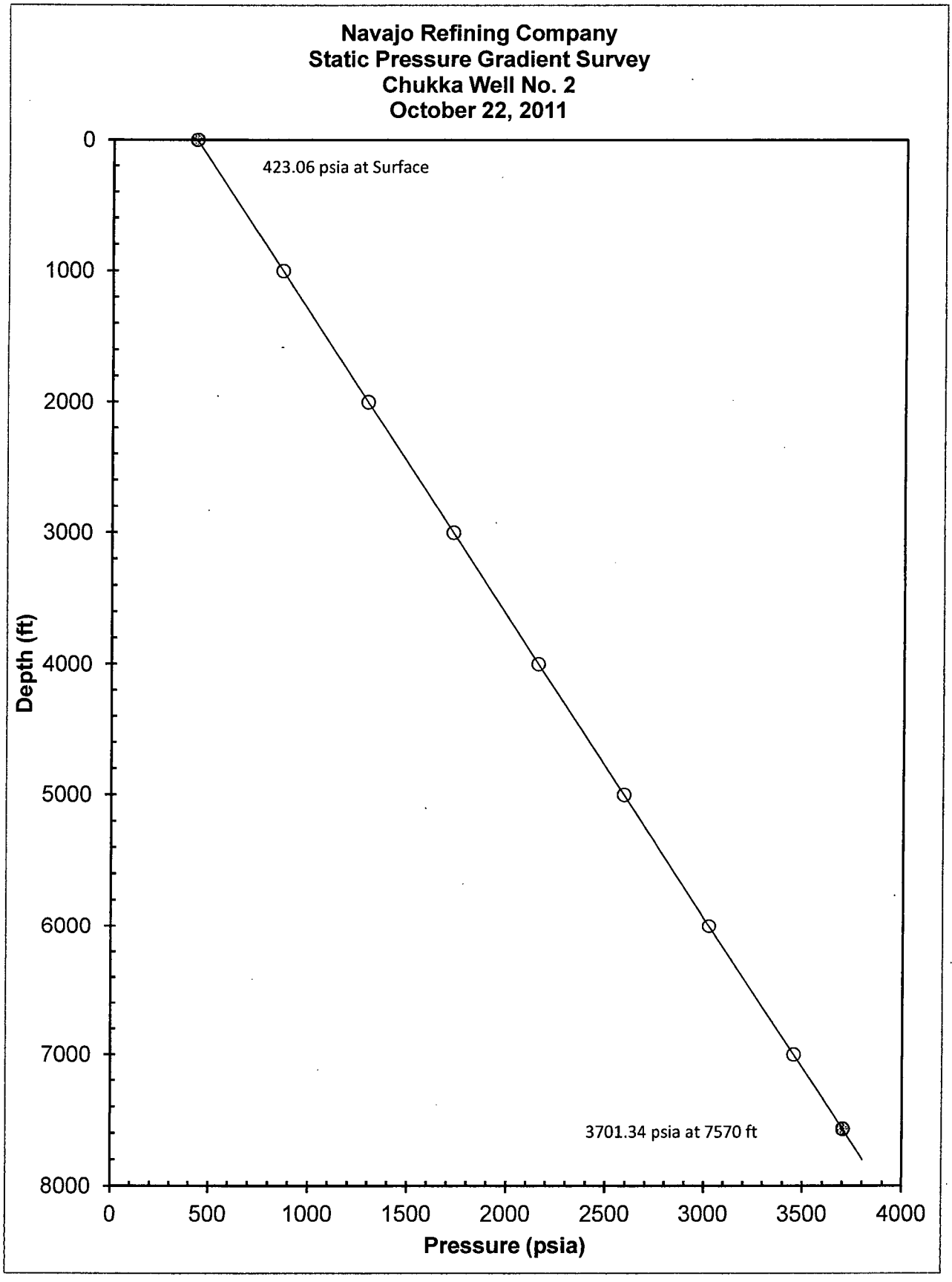

Navajo Refining Company
Static Pressure Gradient Survey
Chukka Well No. 2
October 22, 2011
423.06 psia at Surface
3701.34 psia at 7570 ft
Depth (ft)
0
1000
2000
3000
4000
5000
6000
7000
8000
0
500
1000
1500
2000
2500
3000
3500
4000
Pressure (psia)

FIGURE 18

APPENDICES

APPENDIX A

DUAL INDUCTION LOG SECTIONS FROM 7,660 FEET TO 8,620 FEET

APPENDIX B

NEUTRON DENSITY LOG SECTIONS FROM 7,660 FEET TO 8,620 FEET

SUBSURFACE

APPENDIX C

COMPRESSIBILITY OF FLUID

APPENDIX C

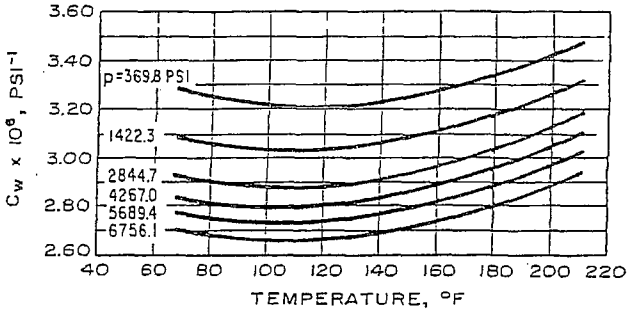


Fig. D.16 Average compressibility of distilled water. After Long and Chierici.[13]

Source: Earlougher, 1977, Advances in Well Test Analysis

COMPRESSIBILITY OF PORE VOLUME AND DISTILLED WATER

APPENDIX D

COMPRESSIBILITY OF PORE VOLUME

APPENDIX D

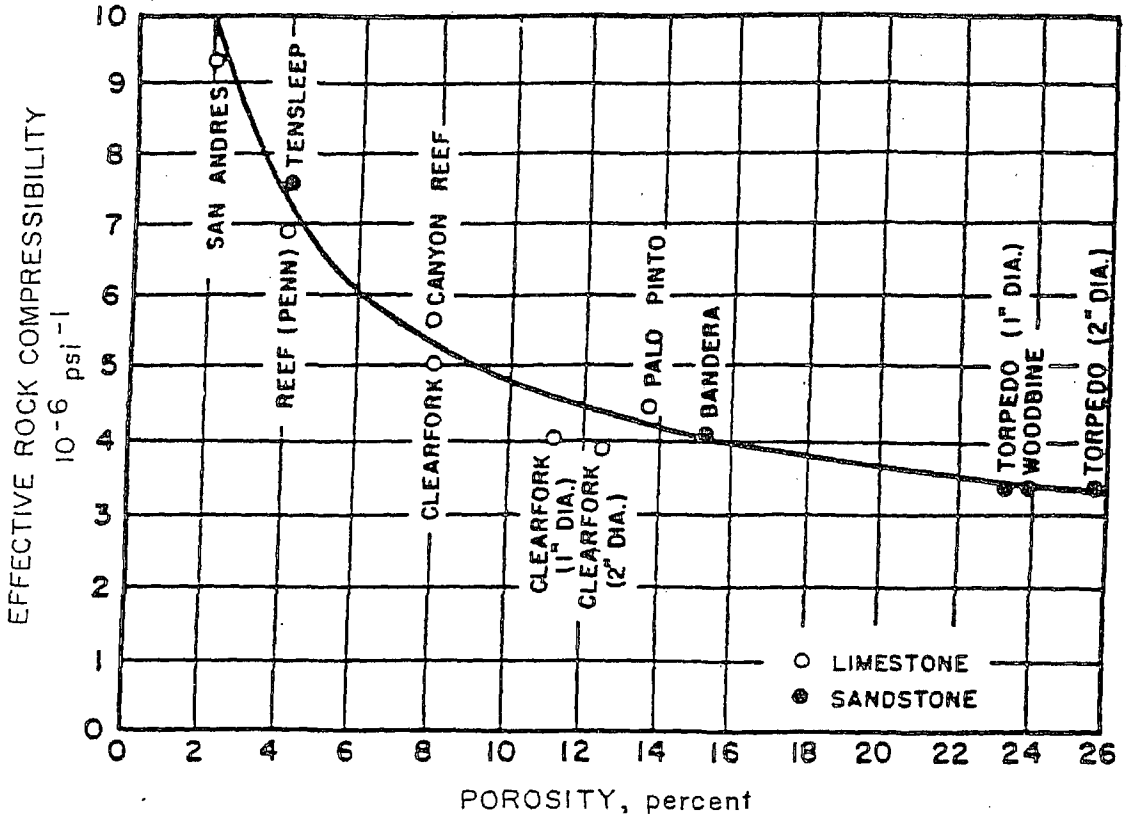


Fig. G.5 Effective formation (rock) compressibility. From Hall, *Trans.*, AIME (1953) 198, 309.

Source: Matthews and Russell, 1967, Pressure Buildup and Flow Tests in Wells

APPENDIX E

CHUKKA WELL NO. 2 MAY 28, 1999 AND JUNE 5, 1999 TEMPERATURE LOG SECTIONS FROM 7,500 FEET TO 8,770 FEET

APPENDIX F

WATER VISCOSITIES AT VARIOUS SALINITIES AND TEMPERATURES

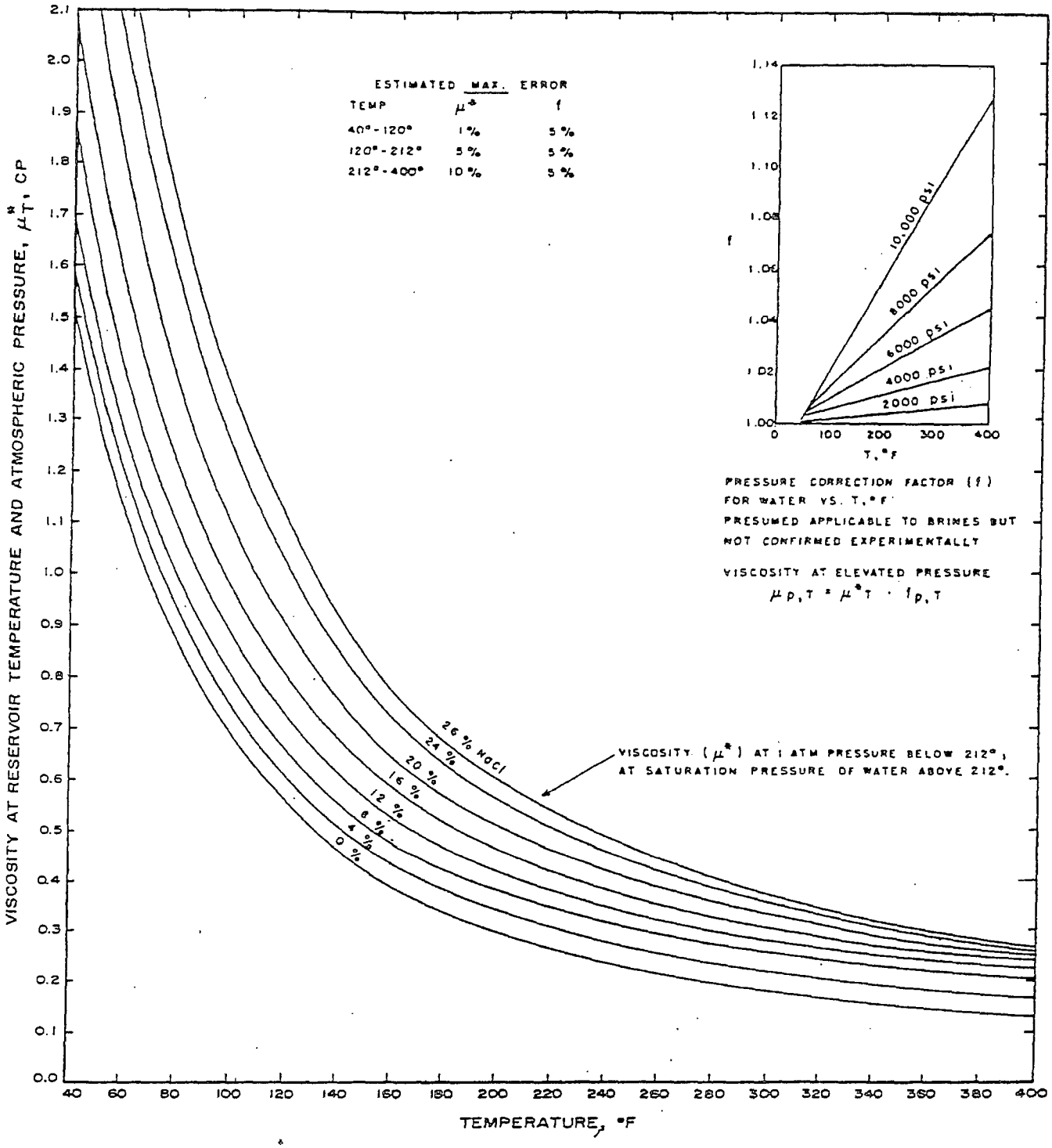


Fig. D.35 Water viscosity at various salinities and temperatures. After Matthews and Russell, data of Chesnut.[18]

FROM: Earlougher, R.C., 1977, "Advances in Well Test Analysis", SPE of AIME, Dallas, Texas

APPENDIX G

DAILY RATE HISTORY DATA

APPENDIX G

NAVAJO REFINING
INJECTION RATES USED IN ANALYSIS

Date	Elapsed Time (hours)	Average Injection Pressure (psig)	Average Injection Rate (bpd)	Average Injection Rate (gpm)	Comments
10/17/2011 12:15	0.00	812.85	6155.31	179.53	BHP Tool placed at 7570 feet
10/19/2011 14:30	50.25	754.32	6424.80	187.39	30 hr constant injection period started
10/20/2011 21:08	80.88	0.00	0.00	0.00	Well shut-in
10/22/2011 7:10	114.92	0.00	0.00	0.00	Final shut-in before pulling BHP Tool out

APPENDIX H

GAUGE CALIBRATION SHEETS

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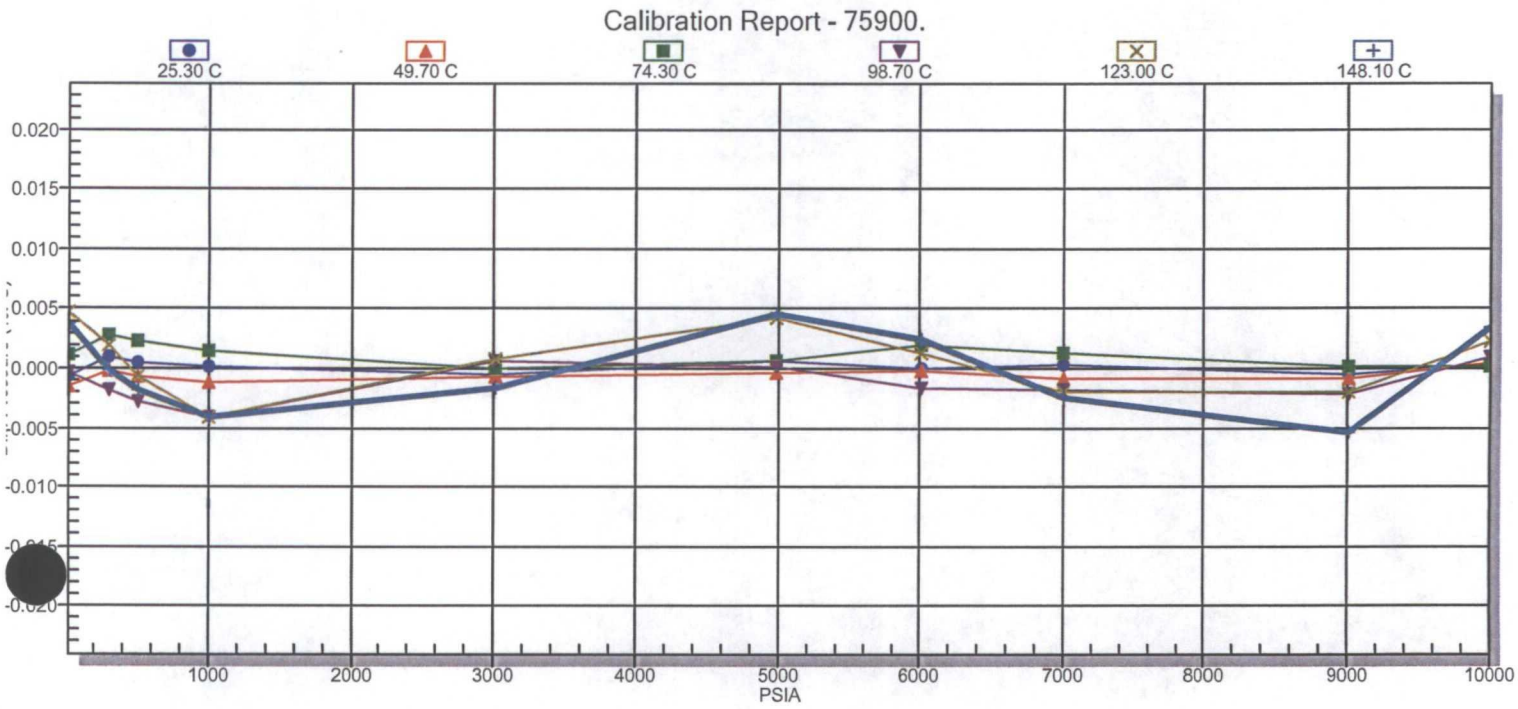
URL www.sparteksystems.com

Pressure Gauge Certificate of Calibration



GAUGE NUMBER: 75900

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp	Pressure Equation:
Fit Order:	3	4	Pressure (PSI) = A + xp(B + xp(C + xp(D)))
Prescale:	xp = m * (fp - fp0)	xt = m * (ft - ft0)	
m:	0.01	0.01	Temperature Compenstation:
	fp0 = 699538	ft0 = 166637	A = A0 + xt(A1 + xt(A2 + xt(A3 + xt(A4))))
			B = B0 + xt(B1 + xt(B2 + xt(B3 + xt(B4))))
			C = C0 + xt(C1 + xt(C2 + xt(C3 + xt(C4))))
			D = D0 + xt(D1 + xt(D2 + xt(D3 + xt(D4))))

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 13.00853743	0.05801425486	0.0001652165752	4.967798855E-07	-5.351374463E-10
B 1.833025732	-0.001405181555	-4.682730297E-07	-2.635051392E-09	-7.63332118E-13
C 1.153936164E-06	1.162571183E-08	1.216794333E-10	4.965639847E-13	2.028300563E-16
D 1.285303115E-10	-3.056931778E-12	-2.013721113E-14	-7.533232117E-17	-4.131924069E-20

Temperature (C) STANDARD FIT COEFFICIENTS

A 24.66625687

B -0.3354976137

C -3.002206867E-05

D -2.119199127E-07

0 points eliminated.
Error File: Gauge # 75900

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.08	25.30	699538.33	166637.00	-0.06
303.04	25.40	715365.33	166651.50	0.09
507.34	25.30	726507.33	166655.50	0.05
1002.92	25.50	753537.67	166674.25	0.01
3008.11	25.50	862746.33	166647.75	-0.06
4993.33	25.40	970370.33	166504.50	0.06
6008.92	25.50	1025095.00	166376.75	0.01
7006.13	25.30	1078602.00	166233.75	0.03
9008.61	25.50	1185100.67	165859.00	-0.06
10001.23	25.40	1237343.67	165629.50	0.03
13.13	49.70	699720.33	159370.50	-0.14
303.09	49.60	714722.67	159383.00	-0.02
507.39	49.70	725285.67	159392.00	-0.07
1002.98	49.70	750912.00	159405.00	-0.12
3008.17	49.70	854489.33	159390.75	-0.07
4993.39	49.70	956602.67	159271.50	-0.03
6008.97	49.70	1008573.00	159170.25	-0.01
7006.18	49.70	1059375.33	159046.75	-0.07
9008.66	49.80	1160602.00	158733.75	-0.09
10001.26	49.70	1210303.67	158540.25	0.05
13.18	74.30	699883.00	152029.75	0.11
303.14	74.30	714132.33	152043.00	0.28
507.44	74.20	724163.67	152052.25	0.22
1003.03	74.20	748500.00	152063.00	0.15
3008.21	74.20	846874.33	152055.00	-0.01
4993.41	74.20	943922.67	151962.25	0.07
6008.99	74.30	993349.33	151881.25	0.20
7006.20	74.30	1041684.00	151782.25	0.13
9008.67	74.30	1138039.00	151518.75	0.01
10001.27	74.30	1185398.33	151358.75	0.01
13.23	98.70	700064.00	144919.25	-0.04
303.19	98.60	713599.33	144932.25	-0.17
507.48	98.60	723136.33	144938.25	-0.28
1003.07	98.70	746280.67	144952.50	-0.41
3008.25	98.70	839916.67	144948.75	0.06
4993.45	98.70	932322.67	144874.50	0.02
6009.03	98.70	979399.67	144808.00	-0.16
7006.24	98.80	1025464.00	144723.50	-0.18
9008.72	98.70	1117367.00	144508.25	-0.21
10001.33	98.70	1162536.67	144363.75	0.09
13.26	123.00	700375.67	138147.75	0.48
303.22	123.10	713245.67	138160.25	0.20
507.51	123.00	722313.67	138165.75	-0.06
1003.10	123.10	744331.00	138175.00	-0.41
3008.29	123.00	833531.67	138180.00	0.09
4993.51	123.00	921675.67	138118.75	0.42
6009.09	123.10	966604.67	138066.75	0.13
7006.30	123.20	1010568.33	137995.00	-0.19
9008.78	123.00	1098342.67	137813.50	-0.19
10001.40	123.10	1141523.00	137697.75	0.23
13.28	148.10	700811.67	131565.00	0.37
303.24	148.10	713033.00	131573.00	-0.01
507.53	148.00	721653.33	131577.25	-0.17
1003.12	148.10	742588.33	131589.75	-0.41
3008.30	148.10	827483.33	131593.75	-0.17
4993.51	148.10	911543.33	131546.00	0.45
6009.09	148.10	954423.67	131501.00	0.24
7006.30	148.10	996402.67	131444.75	-0.25
9008.77	148.10	1080235.67	131292.25	-0.54
10001.37	148.30	1121505.00	131193.25	0.34

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Pressure Gauge Certificate of Conformance

SERIAL NUMBER	75900	CALIBRATION DATE	SEP 03/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.08 - 10001.23 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.30 - 148.10 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within +/- 0.024 %F.S. of the pressure standard used in calibration, which is accurate to within +/- 0.01% of reading. This gives an overall accuracy of +/-(0.024%F.S. + 0.01% of reading)

Accepted By: Jayme Lievre

Date: SEP 06/11

Ramp report: Serial # 75900
Gauge range = 10001.400 PSI. Max. DIFF. = 2.400
Ramp check result: PASS, Max Err = 0.008% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9506.55	9505.82	9507.75	-0.72	0.0072	30.00	32.27
7995.15	7994.36	7996.38	-0.79	0.0079	30.20	31.30
6008.87	6008.40	6010.04	-0.48	0.0048	30.10	30.27
4003.76	4003.41	4004.82	-0.35	0.0035	30.20	29.64
1992.05	1991.80	1993.06	-0.25	0.0025	30.00	29.34
741.47	741.31	742.28	-0.16	0.0016	30.10	29.40
13.08	12.80	13.54	-0.27	0.0027	30.30	29.50
9506.54	9506.95	9507.79	0.41	0.0041	118.00	118.62
7995.15	7995.15	7996.40	0.00	0.0000	117.90	118.17
6008.88	6009.08	6010.09	0.21	0.0021	118.10	117.73
4003.77	4004.16	4004.95	0.39	0.0039	118.10	117.50
1992.06	1991.55	1993.04	-0.51	0.0051	118.10	117.43
741.48	741.39	742.32	-0.09	0.0009	118.10	117.55
13.09	13.62	13.55	0.53	0.0053	118.20	117.66

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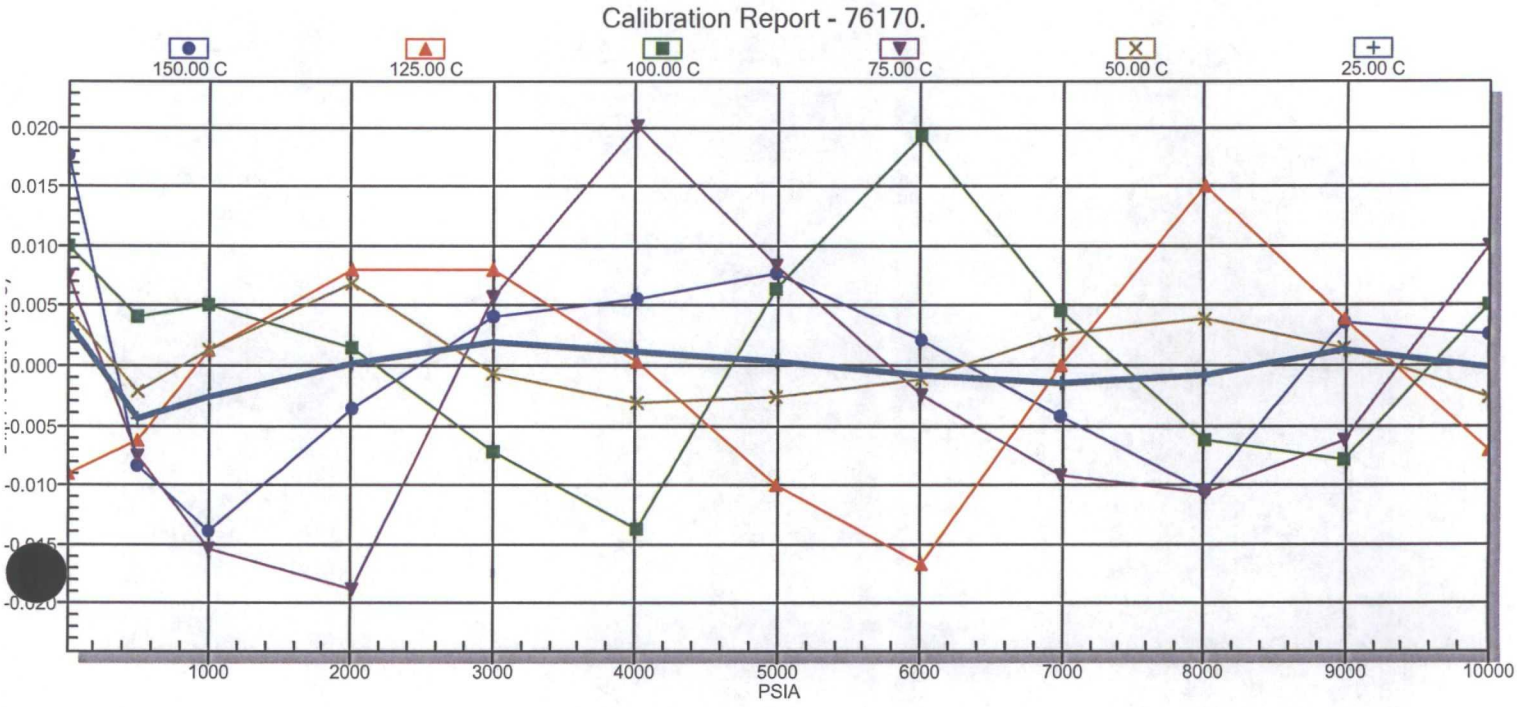

GAUGE NUMBER: 76170

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp	Pressure Equation:
Fit Order:	3	4	Pressure (PSI) = A + xp(B + xp(C + xp(D)))
Prescale:	xp = m * (fp - fp0)	xt = m * (ft - ft0)	
m:	0.01	0.01	Temperature Compenstation:
	fp0 = 681324	ft0 = 119067	A = A0 + xt(A1 + xt(A2 + xt(A3 + xt(A4))))
			B = B0 + xt(B1 + xt(B2 + xt(B3 + xt(B4))))
			C = C0 + xt(C1 + xt(C2 + xt(C3 + xt(C4))))
			D = D0 + xt(D1 + xt(D2 + xt(D3 + xt(D4))))

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 16.46492346	0.01276103041	0.0008198888413	-4.362306202E-06	6.74753504E-09
B 2.50094908	-0.001870680294	-3.664831424E-07	3.705725385E-09	-3.20079622E-12
C -5.972486686E-06	-7.897783757E-08	6.459430044E-10	-5.070109844E-13	-2.108794375E-15
D 4.647457089E-10	1.323420648E-11	-8.43412782E-14	-2.039667561E-17	4.497913976E-19

Temperature (C) STANDARD FIT COEFFICIENTS

A 149.7999391

B -0.4370831656

C 0.0002239486897

D -2.130126817E-07

0 points eliminated.
Error File: Gauge # 76170

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
14.70	150.00	681324.31	119067.25	1.77
507.13	150.00	700909.00	118996.75	-0.83
999.42	150.00	720591.31	119011.50	-1.39
2013.05	150.00	761257.31	119020.75	-0.37
2997.68	150.00	800817.69	119028.50	0.42
4011.27	150.00	841639.31	119086.50	0.55
4995.89	150.00	881259.00	119064.75	0.78
6009.45	150.00	922027.31	119036.50	0.21
6994.05	150.00	961626.31	119001.75	-0.43
8007.57	150.00	1002363.00	118953.75	-1.04
8992.13	150.00	1041990.69	118901.50	0.37
10005.64	150.00	1082678.38	118840.75	0.26
14.70	125.00	681093.69	125027.75	-0.90
507.13	125.00	701734.31	125033.50	-0.62
999.42	125.00	722421.00	125048.00	0.13
2013.05	125.00	765066.31	125063.25	0.81
2997.68	125.00	806550.00	125064.25	0.81
4011.27	125.00	849287.00	125058.00	0.03
4995.89	125.00	890820.00	125038.75	-1.00
6009.45	125.00	933579.69	125000.75	-1.67
6994.05	125.00	975194.31	124957.00	0.00
8007.57	125.00	1017957.31	124898.00	1.50
8992.13	125.00	1059316.63	124834.00	0.39
10005.64	125.00	1101771.00	124753.75	-0.71
14.70	100.00	680972.00	131135.00	1.00
507.13	100.00	702596.69	131117.50	0.41
999.42	100.00	724277.00	131129.00	0.51
2013.05	100.00	768979.00	131145.50	0.15
2997.68	100.00	812462.69	131148.00	-0.72
4011.27	100.00	857288.69	131137.50	-1.38
4995.89	100.00	900959.31	131108.50	0.65
6009.45	100.00	945857.00	131064.50	1.94
6994.05	100.00	989298.31	131009.00	0.46
8007.57	100.00	1033946.69	130938.75	-0.62
8992.13	100.00	1077234.63	130856.00	-0.79
10005.64	100.00	1121713.38	130760.75	0.51
14.70	75.00	680778.00	137763.00	0.76
507.13	75.00	703523.00	137729.50	-0.76
999.42	75.00	726317.69	137743.00	-1.53
2013.05	75.00	773367.69	137757.75	-1.89
2997.68	75.00	819253.31	137755.75	0.58
4011.27	75.00	866465.00	137740.00	2.01
4995.89	75.00	912195.00	137702.75	0.84
6009.45	75.00	959241.31	137649.00	-0.24
6994.05	75.00	1004899.31	137581.25	-0.93
8007.57	75.00	1051827.63	137494.00	-1.06
8992.13	75.00	1097318.00	137392.75	-0.62
10005.64	75.00	1144051.63	137275.25	0.99
14.70	50.00	680637.00	144569.50	0.46
507.13	50.00	704654.69	144583.00	-0.22
999.42	50.00	728729.69	144598.50	0.13
2013.05	50.00	778327.69	144616.00	0.68
2997.68	50.00	826468.69	144608.75	-0.06
4011.27	50.00	876060.31	144582.00	-0.31
4995.89	50.00	924239.31	144537.50	-0.26
6009.45	50.00	973800.69	144468.00	-0.11
6994.05	50.00	1021903.69	144380.50	0.26
8007.57	50.00	1071333.38	144271.25	0.40
8992.13	50.00	1119237.63	144146.50	0.14
10005.64	50.00	1168432.00	144001.25	-0.26
14.70	25.00	680421.31	151448.00	0.36
507.13	25.00	705681.69	151464.50	-0.44
999.42	25.00	731018.00	151481.50	-0.27
2013.05	25.00	783272.00	151497.00	0.02
2997.68	25.00	834109.31	151485.50	0.20
4011.27	25.00	886476.69	151449.00	0.12
4995.89	25.00	937352.00	151388.00	0.04
6009.45	25.00	989692.00	151302.25	-0.09
6994.05	25.00	1040472.69	151195.25	-0.15

8007.57	25.00	1092636.38	151057.50	-0.08
8992.13	25.00	1143202.00	150905.50	0.13
10005.64	25.00	1195079.00	150725.75	-0.01

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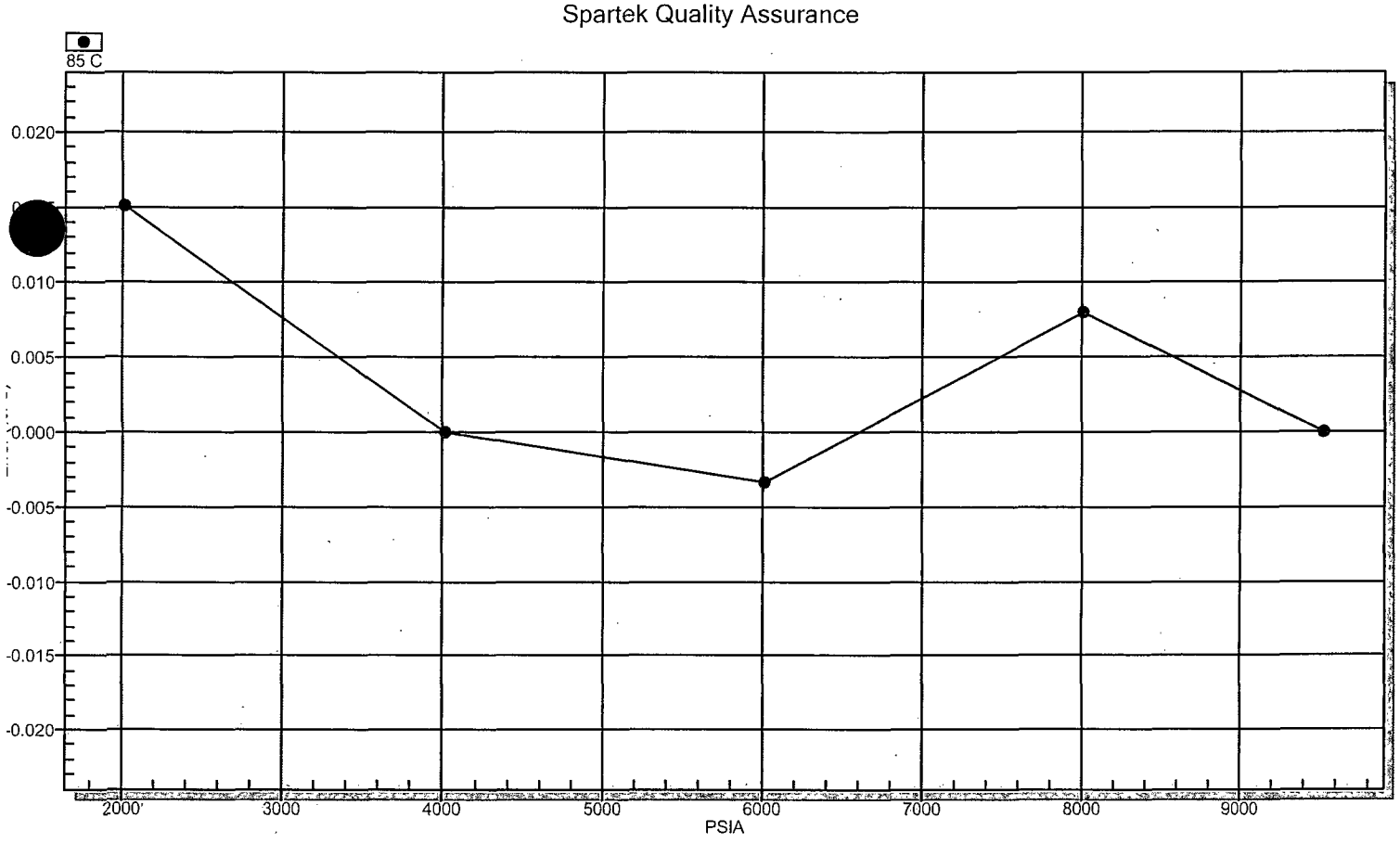
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76170	CALIBRATION DATE	JAN 13/11
MODEL NUMBER	1139 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	14.70 - 10005.64 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.00 - 150.00 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY
As shown in the graph below, this Spartek Gauge conformed to within +/- 0.024 %F.S. of the pressure standard used in calibration, which is accurate to within +/- 0.01% of reading. This gives an overall accuracy of +/-(0.024%F.S. + 0.01% of reading)



Accepted By: Jeff Barnes

Date: JAN 14/11

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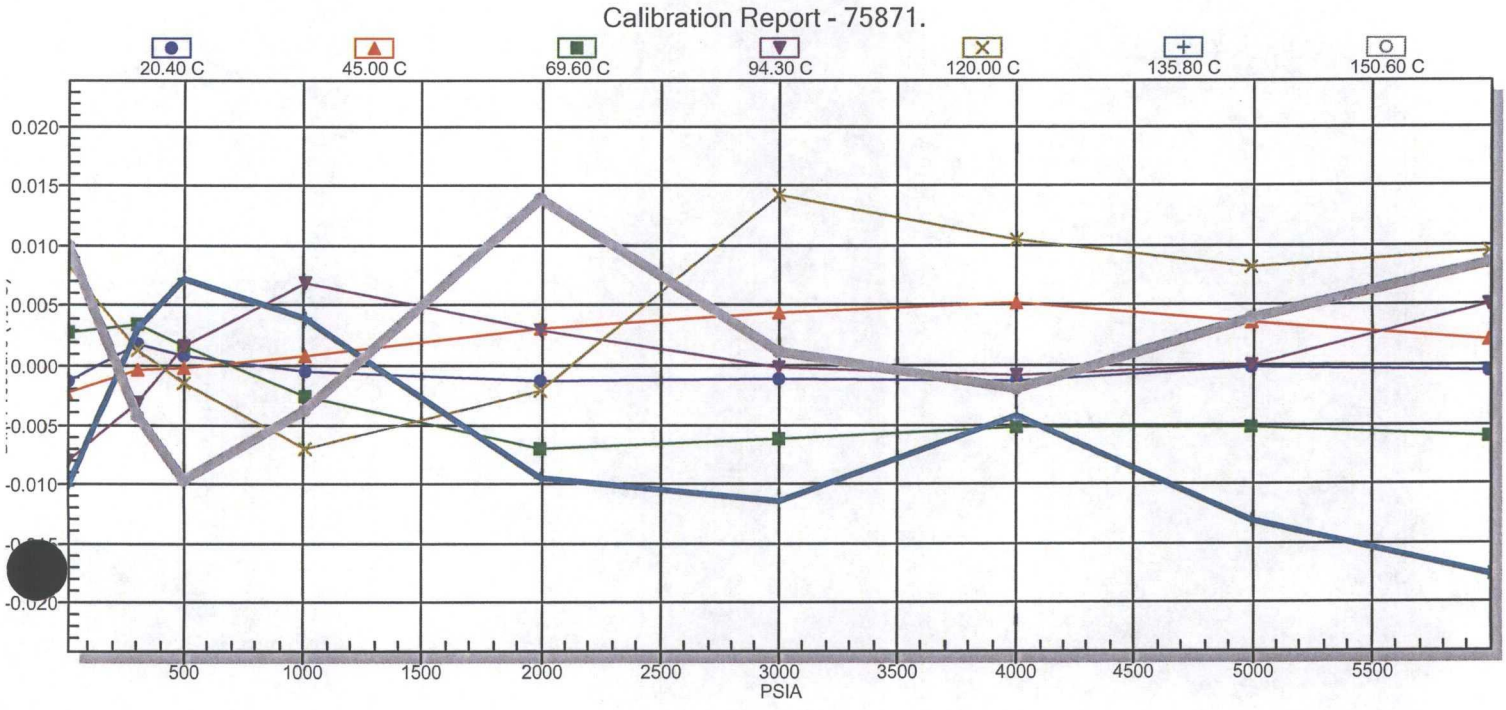
URL www.sparteksystems.com

Pressure Gauge Certificate of Calibration



GAUGE NUMBER: 75871

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp
Fit Order:	3	4
Prescale:	xp = m * (fp - fp0)	xt = m * (ft - ft0)
m:	0.01	0.01
	fp0 = 678735	ft0 = 158408

Pressure Equation:

Pressure (PSI) = A + xp(B + xp(C + xp(D)))

Temperature Compenstation:

A = A0 + xt(A1 + xt(A2 + xt(A3 + xt(A4))))

B = B0 + xt(B1 + xt(B2 + xt(B3 + xt(B4))))

C = C0 + xt(C1 + xt(C2 + xt(C3 + xt(C4))))

D = D0 + xt(D1 + xt(D2 + xt(D3 + xt(D4))))

Pressure (psi) STANDARD FIT COEFFICIENTS:

0	1	2	3	4
A 12.97142642	0.11277823	-0.0001505740173	-1.823019195E-06	-3.301484115E-09
B 1.640874332	-0.001297519254	-3.71224205E-07	-1.385623931E-09	1.181939745E-12
C -4.03108653E-06	9.319688525E-09	1.006689622E-11	-5.12304544E-13	-1.763346489E-15
D 1.30010629E-10	-2.139856247E-12	-1.958534961E-15	7.951008165E-17	2.863833649E-19

Temperature (C) STANDARD FIT COEFFICIENTS

A 20.19981389

B -0.343470116

C -2.629672432E-05

D -2.249422711E-07

0 points eliminated.
Error File: Gauge # 75871

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.06	20.40	678735.67	158408.25	-0.08
303.58	20.30	696461.00	158422.00	0.11
499.73	20.40	708428.33	158434.00	0.05
1002.67	20.20	739155.33	158454.50	-0.03
1998.86	20.30	800150.00	158459.50	-0.08
3000.93	20.20	861624.33	158426.25	-0.07
3999.15	20.30	922915.67	158357.25	-0.08
4998.32	20.20	984256.67	158250.25	-0.01
5997.31	20.30	1045483.00	158099.75	-0.03
13.05	45.00	679208.00	151257.00	-0.14
303.57	44.90	695994.67	151273.75	-0.02
499.73	44.90	707335.00	151286.25	-0.01
1002.66	44.80	736447.67	151306.50	0.05
1998.85	44.80	794234.00	151319.50	0.19
3000.92	44.80	852472.33	151300.50	0.26
3999.14	44.80	910532.33	151243.50	0.31
4998.32	44.90	968636.00	151156.25	0.21
5997.31	44.90	1026665.33	151037.50	0.12
13.06	69.60	679587.67	144051.25	0.17
303.59	69.60	695525.00	144068.50	0.20
499.74	69.70	706286.00	144076.75	0.09
1002.67	69.60	733908.00	144095.75	-0.16
1998.86	69.60	788734.67	144111.00	-0.42
3000.92	69.60	843999.00	144099.00	-0.37
3999.15	69.60	899095.00	144055.75	-0.31
4998.32	69.60	954243.33	143988.25	-0.31
5997.31	69.70	1009316.33	143888.00	-0.37
13.06	94.30	679761.00	137072.75	-0.48
303.59	94.30	694940.67	137085.00	-0.18
499.73	94.30	705200.33	137093.75	0.09
1002.67	94.40	731510.33	137111.00	0.41
1998.86	94.40	783663.33	137127.50	0.18
3000.92	94.40	836203.67	137118.50	-0.01
3999.14	94.30	888588.67	137086.50	-0.05
4998.32	94.30	941030.67	137034.25	0.00
5997.30	94.40	993420.33	136953.00	0.30
13.06	120.00	679944.00	130197.25	0.50
303.59	120.00	694342.00	130207.75	0.08
499.74	119.90	704076.33	130217.50	-0.08
1002.68	120.10	729063.67	130229.25	-0.42
1998.86	120.10	778693.67	130244.25	-0.13
3000.92	120.10	828736.00	130243.50	0.85
3999.14	120.00	878567.00	130223.00	0.62
4998.31	120.00	928441.67	130180.00	0.49
5997.30	120.00	978274.67	130120.75	0.57
13.07	135.80	679988.67	126175.50	-0.61
303.59	135.80	694006.33	126188.00	0.19
499.74	135.80	703465.33	126195.50	0.43
1002.68	135.80	727711.33	126212.75	0.24
1998.86	135.80	775823.33	126229.00	-0.57
3000.92	135.90	824357.00	126229.50	-0.68
3999.13	135.80	872779.67	126211.50	-0.26
4998.30	135.80	921194.33	126173.25	-0.79
5997.29	135.80	969554.33	126117.75	-1.06
13.09	150.60	680190.00	122440.50	0.60
303.62	150.60	693715.00	122453.25	-0.25
499.77	150.60	702870.00	122461.25	-0.58
1002.69	150.50	726441.33	122479.50	-0.22
1998.86	150.60	773291.00	122498.50	0.83
3000.91	150.60	820468.33	122500.75	0.06
3999.12	150.60	867567.00	122490.25	-0.12
4998.28	150.60	914740.00	122463.25	0.24
5997.25	150.60	961847.33	122425.25	0.51

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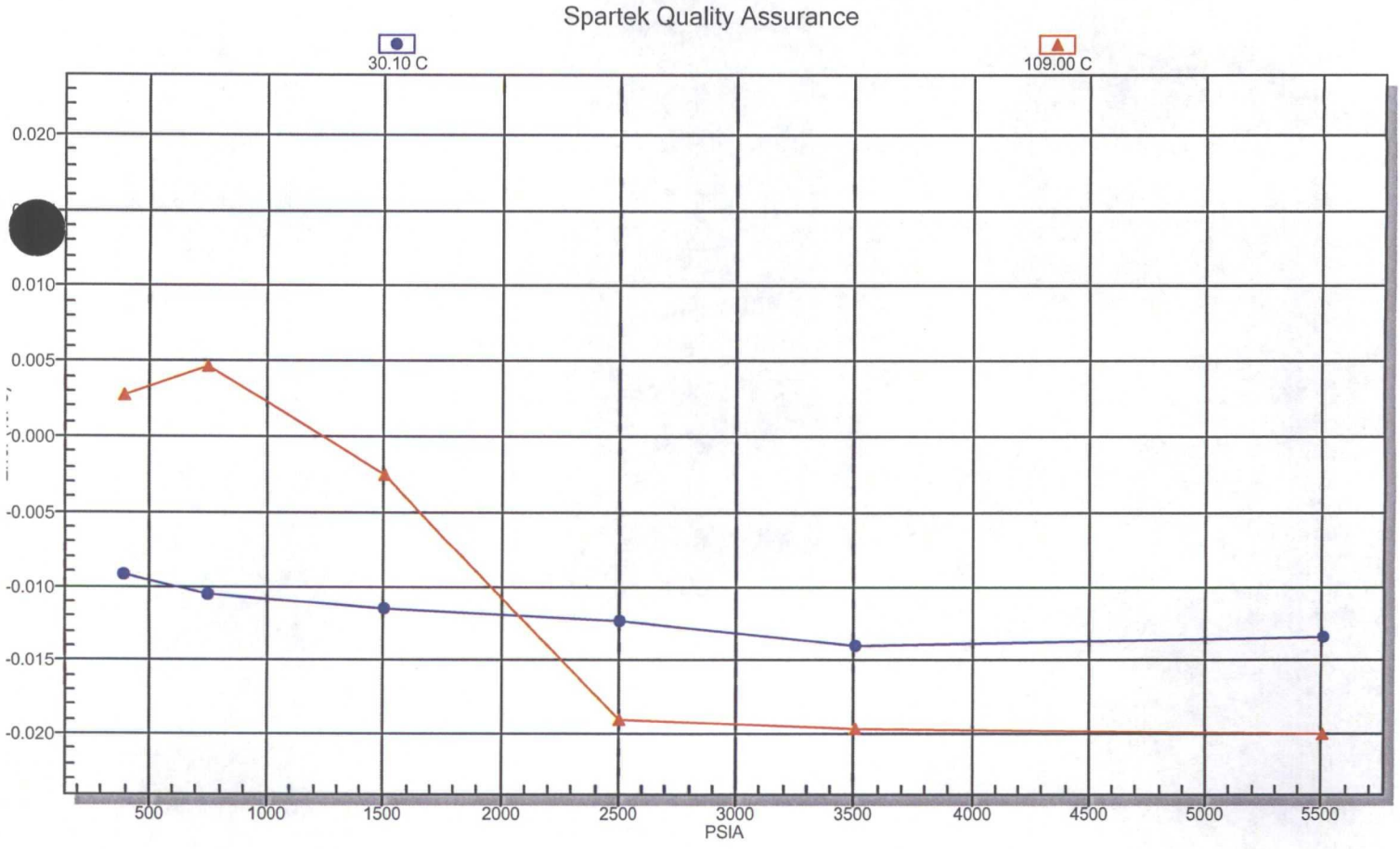
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	75871	CALIBRATION DATE	MAR 25/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.06 - 5997.31 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	20.40 - 150.60 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within +/- 0.024 %F.S. of the pressure standard used in calibration, which is accurate to within +/- 0.01% of reading. This gives an overall accuracy of +/-(0.024%F.S. + 0.01% of reading)



Accepted By: _____

Date: MAR 28/11

Ramp report: Serial # 75871
Gauge range = 5997.314 PSI. Max. DIFF. = 1.439
Ramp check result: PASS, Max Err = 0.020% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
5501.98	5502.78	5500.70	0.80	0.0134	30.10	30.57
3503.40	3504.24	3502.05	0.84	0.0141	30.20	29.92
2501.32	2502.06	2500.02	0.74	0.0124	30.10	29.77
1503.32	1504.01	1501.96	0.69	0.0115	30.20	29.76
753.27	753.90	751.71	0.63	0.0105	30.20	29.82
397.58	398.13	395.90	0.55	0.0092	30.20	29.89
5501.99	5503.19	5500.72	1.20	0.0200	109.00	109.09
3503.42	3504.60	3502.10	1.18	0.0196	109.20	108.84
2501.33	2502.48	2499.94	1.14	0.0191	109.10	108.85
1503.34	1503.49	1501.87	0.15	0.0026	109.20	108.93
753.29	753.01	751.73	-0.28	0.0046	109.10	109.02
397.59	397.43	395.90	-0.17	0.0028	109.20	109.09

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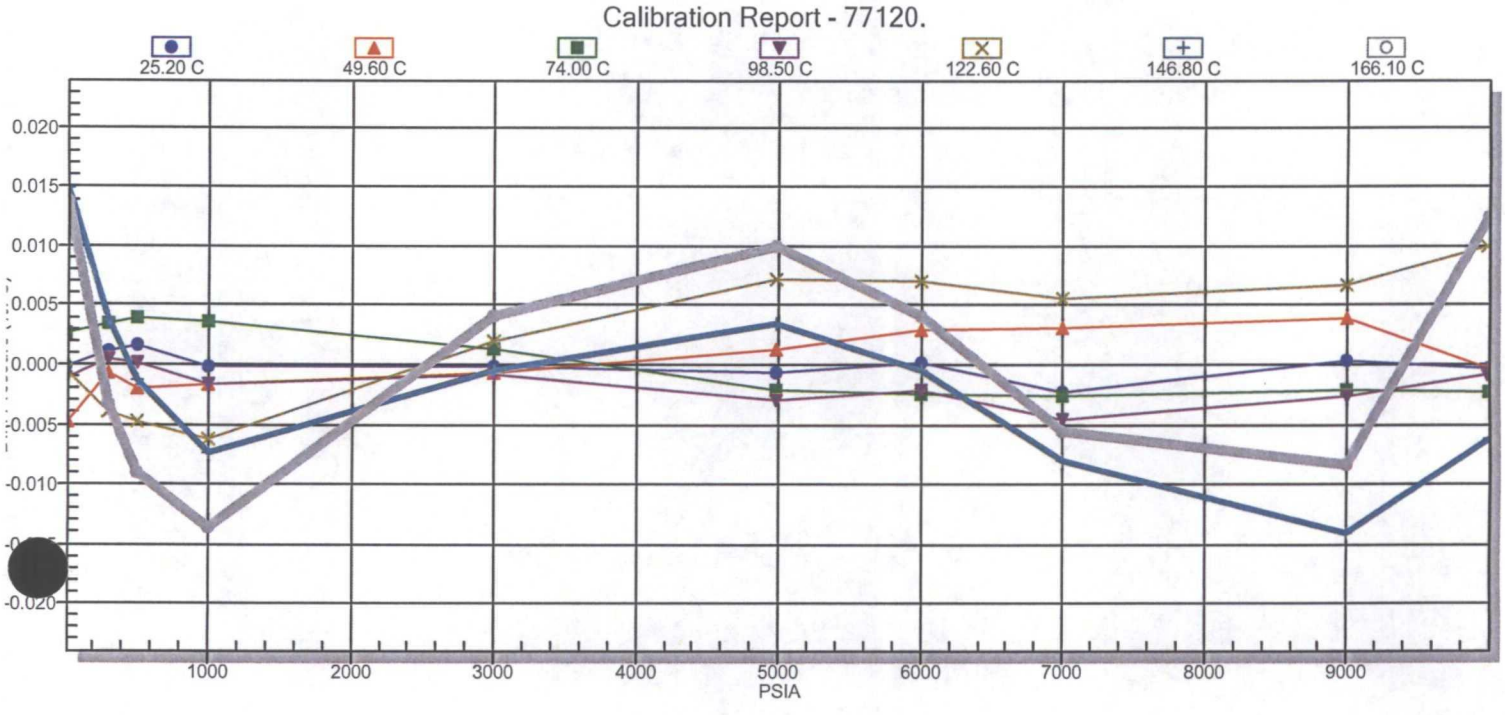
Pressure Gauge Certificate of Calibration



GAUGE NUMBER: 77120

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp
Fit Order:	3	4
Prescale:	xp = m * (fp - fp0)	xt = m * (ft - ft0)
m:	0.01	0.01
	fp0 = 699891	ft0 = 167028

Pressure Equation:

Pressure (PSI) = A + xp(B + xp(C + xp(D)))

Temperature Compenstation:

A = A0 + xt(A1 + xt(A2 + xt(A3 + xt(A4))))

B = B0 + xt(B1 + xt(B2 + xt(B3 + xt(B4))))

C = C0 + xt(C1 + xt(C2 + xt(C3 + xt(C4))))

D = D0 + xt(D1 + xt(D2 + xt(D3 + xt(D4))))

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 13.0432838	0.1499180608	-3.080875207E-05	-1.263127066E-06	-3.057087791E-09
B 4.000558812	-0.003070597307	-5.067364471E-07	-9.711693386E-10	7.200526642E-12
C 2.702005388E-07	-3.059959235E-08	-7.953499894E-10	-5.804401761E-12	-1.267193684E-14
D 4.206977423E-10	1.411644212E-11	3.018115908E-13	1.922674542E-15	3.882800519E-18

Temperature (C) STANDARD FIT COEFFICIENTS

A 25.39179459

B -0.3341482087

C -1.996610629E-05

D -1.908812792E-07

0 points eliminated.
Error File: Gauge # 77120

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.08	25.20	699891.33	167028.75	-0.02
300.10	25.30	707069.33	167038.00	0.11
504.31	25.10	712175.67	167043.75	0.16
1000.87	25.20	724587.67	167063.75	-0.02
3003.67	25.20	774683.33	167113.00	-0.02
4989.63	25.20	824350.00	167129.75	-0.06
6003.59	25.20	849698.67	167131.00	0.01
6996.87	25.10	874506.33	167124.50	-0.22
8995.48	25.10	924358.67	167081.75	0.03
9994.76	25.20	949234.67	167050.25	-0.04
13.09	49.60	700133.67	159748.50	-0.48
300.12	49.60	706942.00	159756.00	-0.06
504.32	49.50	711776.33	159765.00	-0.19
1000.88	49.70	723542.33	159784.75	-0.16
3003.69	49.60	771010.67	159828.75	-0.06
4989.66	49.50	818087.00	159854.00	0.13
6003.62	49.60	842114.00	159855.50	0.29
6996.92	49.50	865638.67	159852.50	0.32
8995.53	49.50	912920.00	159823.25	0.40
9994.82	49.60	936516.00	159798.75	-0.03
13.07	74.00	700346.67	152463.25	0.26
300.09	74.00	706808.33	152470.75	0.34
504.30	74.00	711406.00	152482.00	0.39
1000.86	74.10	722584.00	152497.00	0.35
3003.66	74.10	767679.00	152540.25	0.13
4989.63	74.00	812391.33	152561.00	-0.21
6003.60	74.00	835215.67	152565.50	-0.24
6996.88	74.00	857566.00	152565.50	-0.26
8995.49	74.00	902490.67	152544.25	-0.21
9994.78	74.10	924917.00	152522.25	-0.24
13.05	98.50	700484.00	145396.75	-0.11
300.06	98.40	706638.00	145405.00	0.05
504.27	98.30	711013.67	145413.25	0.02
1000.83	98.30	721653.33	145430.00	-0.16
3003.64	98.40	764589.67	145466.25	-0.08
4989.60	98.40	807156.33	145488.00	-0.30
6003.54	98.50	828883.67	145490.25	-0.21
6996.81	98.40	850155.00	145491.25	-0.45
8995.43	98.40	892930.00	145475.75	-0.26
9994.72	98.40	914281.67	145452.25	-0.08
13.03	122.60	700623.33	138676.00	-0.05
300.08	122.60	706476.33	138682.75	-0.39
504.28	122.60	710644.00	138690.75	-0.48
1000.82	122.60	720781.67	138703.00	-0.63
3003.61	122.60	761726.67	138742.00	0.19
4989.58	122.70	802337.00	138761.50	0.72
6003.54	122.60	823062.67	138766.50	0.70
6996.82	122.60	843354.00	138765.25	0.56
8995.43	122.60	884160.00	138756.25	0.67
9994.72	122.70	904535.67	138740.75	1.00
13.09	146.80	700837.67	132357.75	1.48
300.12	146.80	706393.00	132365.50	0.38
504.33	146.70	710353.00	132372.50	-0.14
1000.88	146.80	720002.33	132386.50	-0.73
3003.68	146.70	759062.67	132420.00	-0.05
4989.66	146.80	797869.33	132439.25	0.35
6003.62	146.70	817682.33	132446.00	-0.05
6996.91	146.70	837080.33	132448.75	-0.80
8995.52	146.80	876083.67	132443.50	-1.41
9994.80	146.90	895561.67	132431.25	-0.63
13.09	166.10	701051.00	127439.00	1.38
300.11	166.10	706365.00	127449.50	-0.32
504.32	166.00	710162.00	127457.50	-0.91
1000.88	166.10	719427.00	127469.50	-1.36
3003.68	166.10	757029.33	127498.75	0.40
4989.65	166.10	794474.00	127521.00	1.00
6003.60	166.10	813606.33	127528.00	0.41
6996.88	166.10	832345.67	127536.00	-0.56
8995.49	166.00	870021.67	127536.50	-0.83

9994.77	166.00	888846.00	127534.25	1.25

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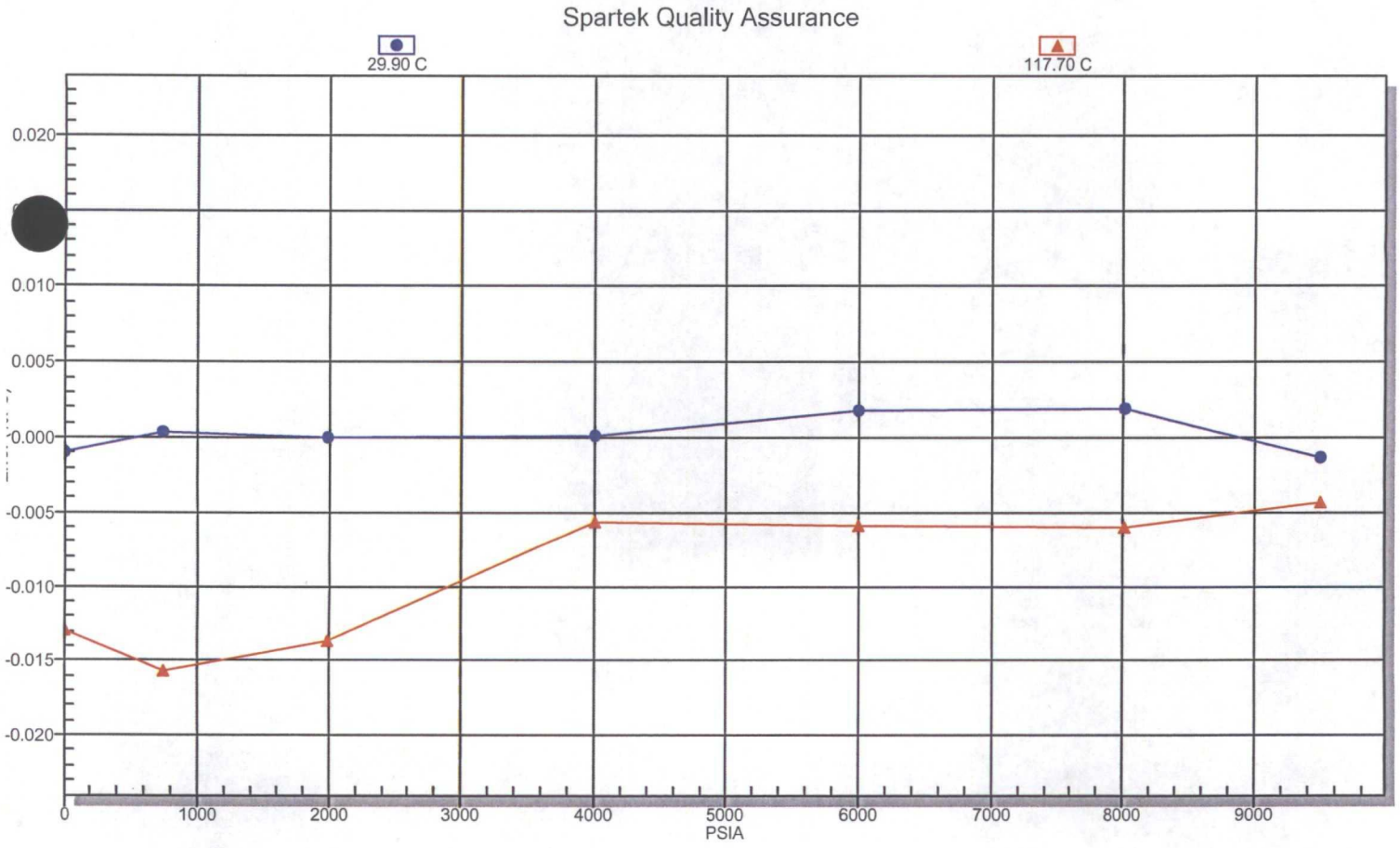
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	77120	CALIBRATION DATE	JUL 19/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.08 - 9994.76 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.20 - 166.10 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within +/- 0.024 %F.S. of the pressure standard used in calibration, which is accurate to within +/- 0.01% of reading. This gives an overall accuracy of +/-(0.024%F.S. + 0.01% of reading)



Accepted By: _____

Date: JUL 21/11

Ramp report: Serial # 77120
Gauge range = 9994.815 PSI. Max. DIFF. = 2.399
Ramp check result: PASS, Max Err = 0.016% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9499.10	9498.97	9499.18	-0.13	0.0013	29.90	29.97
8014.48	8014.67	8014.66	0.19	0.0019	30.00	29.86
6003.61	6003.79	6003.85	0.18	0.0018	30.00	29.81
4000.87	4000.88	4000.93	0.01	0.0001	30.00	29.84
1989.27	1989.27	1989.30	0.00	0.0000	30.00	29.96
738.26	738.29	737.97	0.03	0.0003	30.10	30.10
13.08	12.99	12.45	-0.09	0.0009	30.00	30.20
9499.11	9498.67	9499.17	-0.43	0.0043	117.70	117.27
8014.49	8013.89	8014.59	-0.59	0.0059	117.70	117.33
6003.60	6003.01	6003.80	-0.59	0.0059	117.80	117.40
4000.86	4000.29	4000.94	-0.56	0.0056	117.70	117.53
1989.26	1987.89	1989.17	-1.37	0.0137	117.70	117.70
738.24	736.67	737.94	-1.57	0.0157	117.70	117.82
13.06	11.76	12.41	-1.29	0.0129	117.80	117.94

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Spartek
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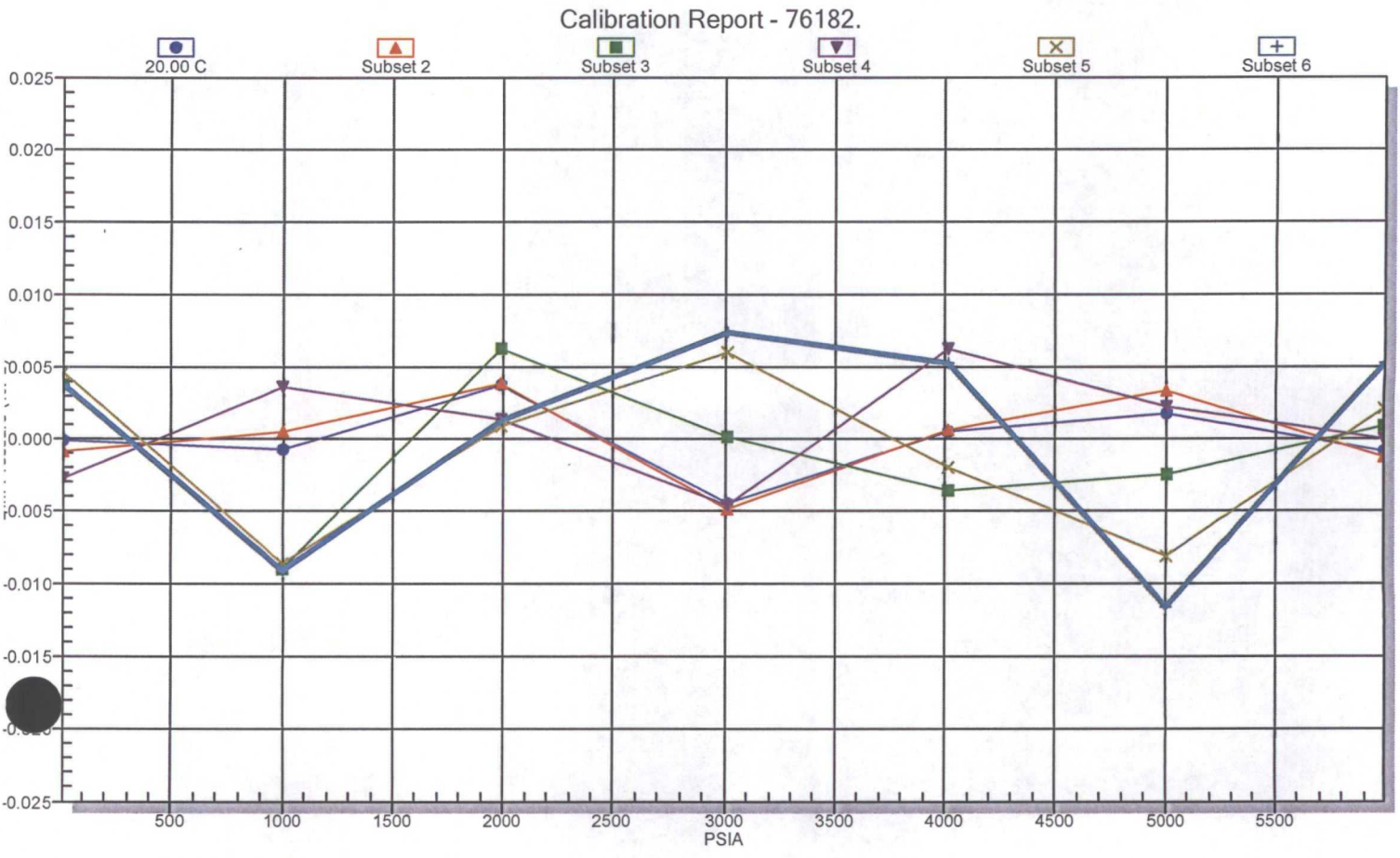
Pressure Gauge
Certificate of Calibration



GAUGE NUMBER: 76182

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp
Fit Order:	3	4
Prescale:	xp = m * (fp - fp0)	xt = m * (ft - ft0)
m:	0.01	0.01
	fp0 = 688862	ft0 = 152426

Pressure Equation:

Pressure (PSI) = A + xp(B + xp(C + xp(D)))

Temperature Compenstation:

A = A0 + xt(A1 + xt(A2 + xt(A3 + xt(A4))))

B = B0 + xt(B1 + xt(B2 + xt(B3 + xt(B4))))

C = C0 + xt(C1 + xt(C2 + xt(C3 + xt(C4))))

D = D0 + xt(D1 + xt(D2 + xt(D3 + xt(D4))))

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 13.47852494	0.2189303292	0.0005428346087	-5.845752466E-07	-4.705748664E-09
B 1.99173863	-0.00165322469	-7.67652636E-07	-2.220527404E-09	4.851584078E-12
C -4.524144325E-06	1.026879913E-08	-4.319609922E-12	-1.009417117E-12	-4.518369862E-15
D 1.235198867E-10	5.134001041E-13	6.499233546E-14	4.86295983E-16	1.270013257E-18

Temperature (C) STANDARD FIT COEFFICIENTS

A 19.94484003

B -0.3611188605

C -4.342615759E-05

D -3.152177425E-07

0 points eliminated.
Error File: Gauge # 76182

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
1003.75	20.00	-0.05	-0.17	-0.17
1993.33	20.00	0.22	-0.22	-0.22
3008.16	20.00	-0.27	-0.18	-0.18
4012.02	20.00	0.03	0.00	0.00
5001.33	20.00	0.11	0.22	0.22
5987.27	20.00	-0.05	0.51	0.51
13.50	50.00	-0.05	-0.05	-0.05
1003.75	50.00	0.03	-0.13	-0.13
1993.33	50.00	0.23	-0.20	-0.20
3008.16	50.00	-0.29	-0.18	-0.18
4012.02	50.00	0.04	-0.09	-0.09
5001.33	50.00	0.20	0.05	0.05
5987.27	50.00	-0.08	0.31	0.31
13.50	85.00	0.22	0.08	0.08
1003.75	85.00	-0.54	0.00	0.00
1993.33	85.00	0.38	-0.08	-0.08
3008.16	85.00	0.01	-0.08	-0.08
4012.02	85.00	-0.21	0.00	0.00
5001.33	85.00	-0.15	0.11	0.11
5987.27	85.00	0.05	0.29	0.29
13.50	110.00	-0.16	0.06	0.06
1003.75	110.00	0.22	-0.03	-0.03
1993.33	110.00	0.08	-0.09	-0.09
3008.16	110.00	-0.27	-0.09	-0.09
4012.02	110.00	0.37	-0.04	-0.04
5001.33	110.00	0.13	0.04	0.04
5987.27	110.00	0.00	0.19	0.19
13.50	135.00	0.27	0.00	0.00
1003.75	135.00	-0.51	-0.06	-0.06
1993.33	135.00	0.06	-0.13	-0.13
3008.16	135.00	0.36	-0.16	-0.16
4012.02	135.00	-0.12	-0.12	-0.12
5001.33	135.00	-0.49	-0.05	-0.05
5987.27	135.00	0.13	0.07	0.07
13.50	150.00	0.22	0.14	0.14
1003.75	150.00	-0.55	0.06	0.06
1993.33	150.00	0.07	-0.03	-0.03
3008.16	150.00	0.44	-0.05	-0.05
4012.02	150.00	0.31	-0.03	-0.03
5001.33	150.00	-0.69	0.03	0.03
5987.27	150.00	0.31	0.14	0.14

```
Spartek
TEMPERATURE
C
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.01
151106
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1
.01
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-3.572157310100253E-0001
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-2.235439455691302E-0007
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0
0
150
0
5987.27
DEC15/11
Sapphire
```

```
Spartek
PRESSURE
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DEC15/11
Sapphire
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Sapphire,Dec 15/11
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5987.27, 150.00, 912722.31, 117222.75
```
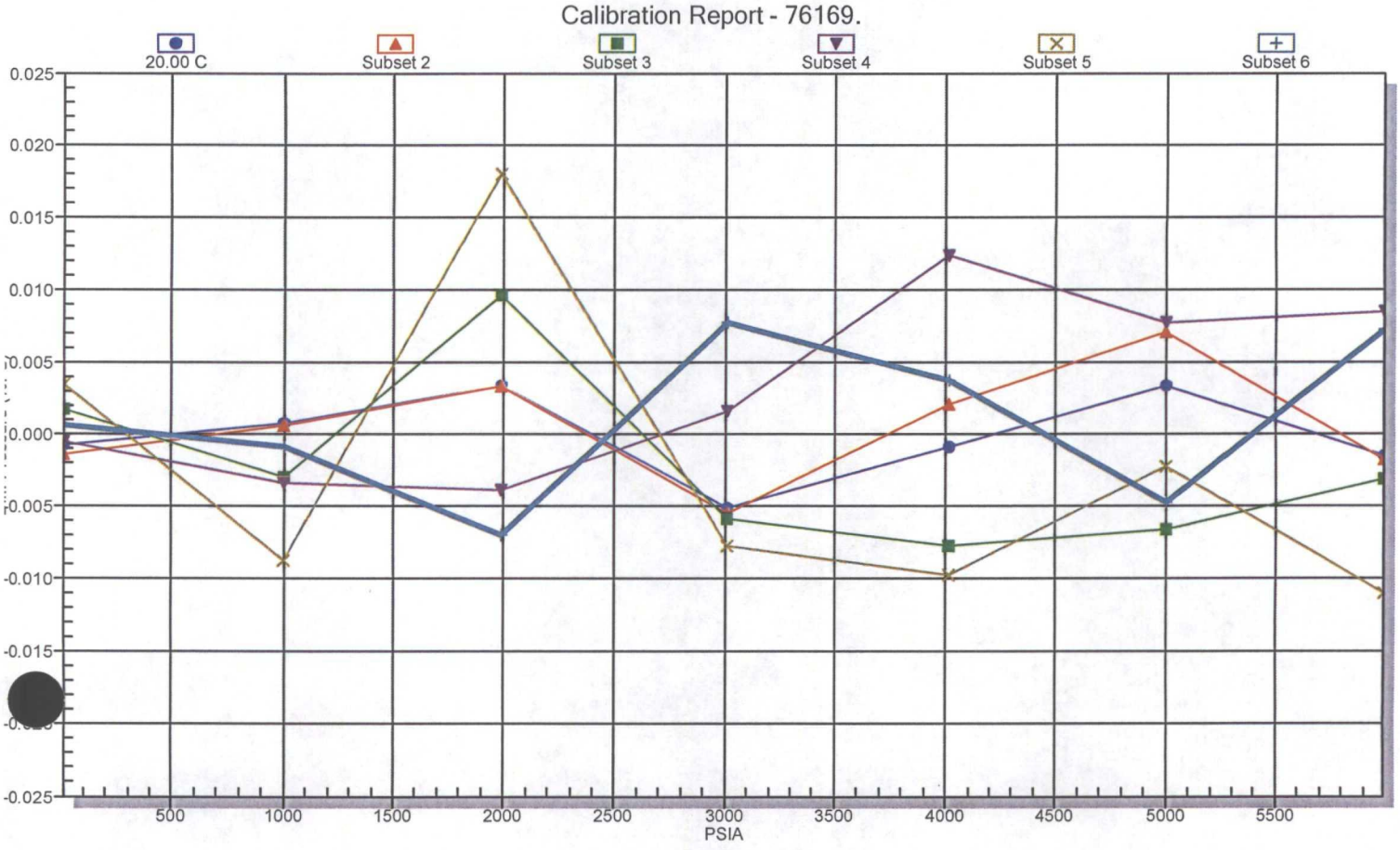

Spartek Systems
#1 Thevenaz Ind. Tr.
Sylvan Lake, AB, Ca, T4S 1P5
Phone (403) 887-2443
Fax (403) 887-4050

Pressure Gauge
Certificate of Calibration



GAUGE NUMBER: 76169

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp
Fit Order:	3	4
Prescale:	xp = m * (fp - fp0)	xt = m * (ft - ft0)
m:	0.01	0.01
	fp0 = 681645	ft0 = 151106

Pressure Equation:

Pressure (PSI) = A + xp(B + xp(C + xp(D)))

Temperature Compenstation:

A = A0 + xt(A1 + xt(A2 + xt(A3 + xt(A4))))

B = B0 + xt(B1 + xt(B2 + xt(B3 + xt(B4))))

C = C0 + xt(C1 + xt(C2 + xt(C3 + xt(C4))))

D = D0 + xt(D1 + xt(D2 + xt(D3 + xt(D4))))

0	1	2	3	4
Pressure (psi) STANDARD FIT COEFFICIENTS:				
A 13.44324838	0.1882850161	0.00101019162	2.870013815E-06	3.120425604E-09
B 2.01472189	-0.001786427729	-3.408955408E-06	-1.762779483E-08	-2.326711214E-11
C -4.883058348E-06	1.031978613E-07	1.962575439E-09	1.037101793E-11	1.587160732E-14
D 2.999047813E-10	-2.003609874E-11	-3.805828823E-13	-2.12811198E-15	-3.419813586E-18

Temperature (C) STANDARD FIT COEFFICIENTS

A 19.9770683

B -0.357215731

C 4.219414208E-06

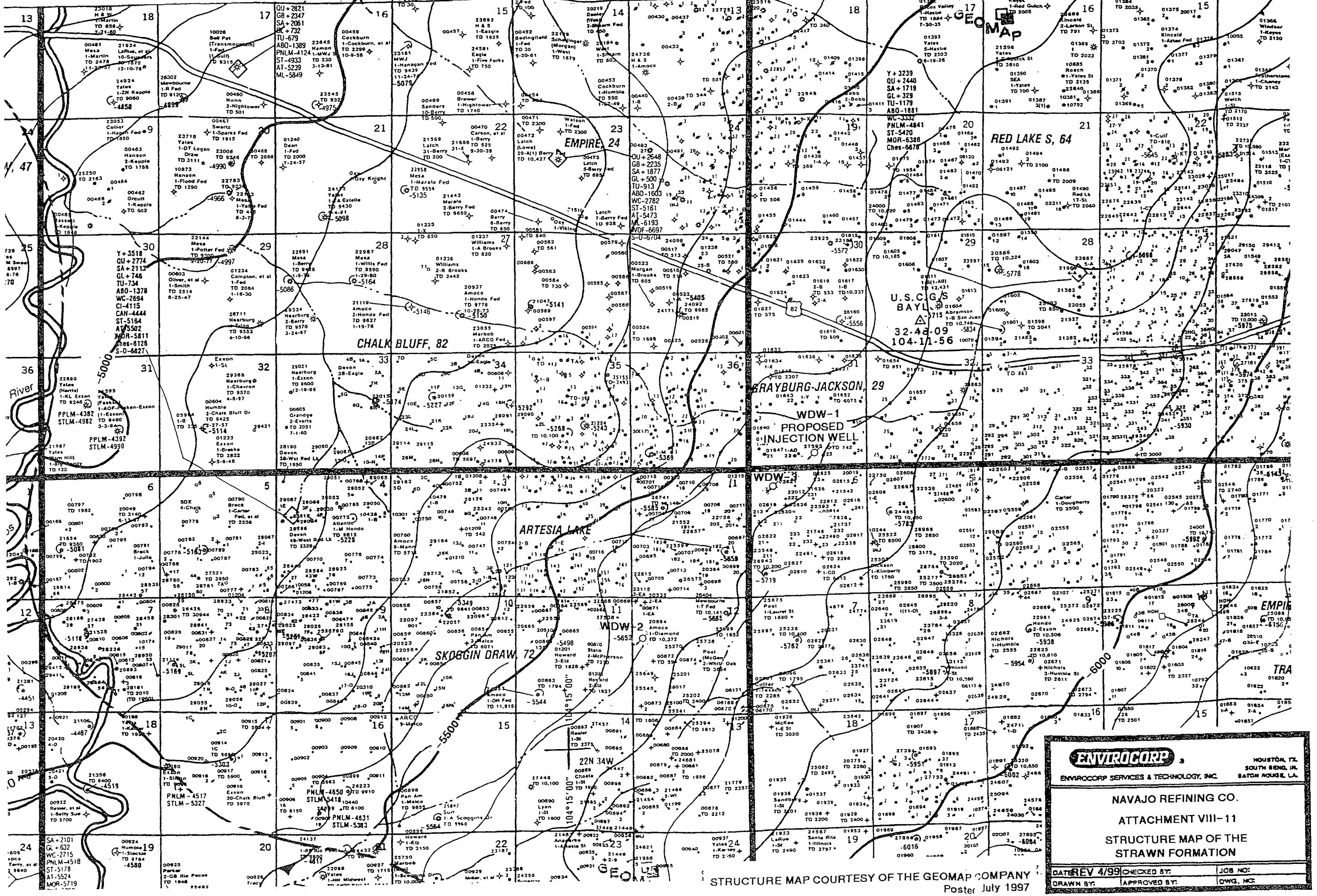
D -2.235439456E-07

0 points eliminated.
Error File: Gauge # 76169

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
1003.75	20.00	0.05	-0.14	-0.14
1993.33	20.00	0.20	-0.19	-0.19
3008.16	20.00	-0.31	-0.16	-0.16
4012.02	20.00	-0.05	0.00	0.00
5001.33	20.00	0.20	0.20	0.20
5987.27	20.00	-0.09	0.47	0.47
13.50	50.00	-0.08	-0.08	-0.08
1003.75	50.00	0.04	-0.16	-0.16
1993.33	50.00	0.20	-0.22	-0.22
3008.16	50.00	-0.33	-0.20	-0.20
4012.02	50.00	0.13	-0.11	-0.11
5001.33	50.00	0.42	0.02	0.02
5987.27	50.00	-0.10	0.28	0.28
13.50	85.00	0.11	0.07	0.07
1003.75	85.00	-0.18	0.01	0.01
1993.33	85.00	0.57	-0.04	-0.04
3008.16	85.00	-0.35	-0.03	-0.03
4012.02	85.00	-0.46	0.02	0.02
5001.33	85.00	-0.39	0.12	0.12
5987.27	85.00	-0.19	0.30	0.30
13.50	110.00	-0.03	0.13	0.13
1003.75	110.00	-0.20	0.01	0.01
1993.33	110.00	-0.23	-0.06	-0.06
3008.16	110.00	0.10	-0.06	-0.06
4012.02	110.00	0.74	-0.01	-0.01
5001.33	110.00	0.46	0.09	0.09
5987.27	110.00	0.51	0.23	0.23
13.50	135.00	0.21	-0.10	-0.10
1003.75	135.00	-0.52	-0.17	-0.17
1993.33	135.00	1.07	-0.21	-0.21
3008.16	135.00	-0.47	-0.23	-0.23
4012.02	135.00	-0.58	-0.21	-0.21
5001.33	135.00	-0.14	-0.13	-0.13
5987.27	135.00	-0.65	-0.01	-0.01
13.50	150.00	0.04	0.17	0.17
1003.75	150.00	-0.05	0.07	0.07
1993.33	150.00	-0.42	0.01	0.01
3008.16	150.00	0.47	0.01	0.01
4012.02	150.00	0.23	0.03	0.03
5001.33	150.00	-0.28	0.08	0.08
5987.27	150.00	0.44	0.19	0.19

APPENDIX I

STRAWN STRUCTURE MAPS



ENVIROCORP

ENVIROCORP SERVICES & TECHNOLOGY, INC.

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING CO.

ATTACHMENT VIII-11

STRUCTURE MAP OF THE STRAWN FORMATION

DATE REV 4/99	CHECKED BY:	JOB NO:
DRAWN BY:	APPROVED BY:	DWG. NO:

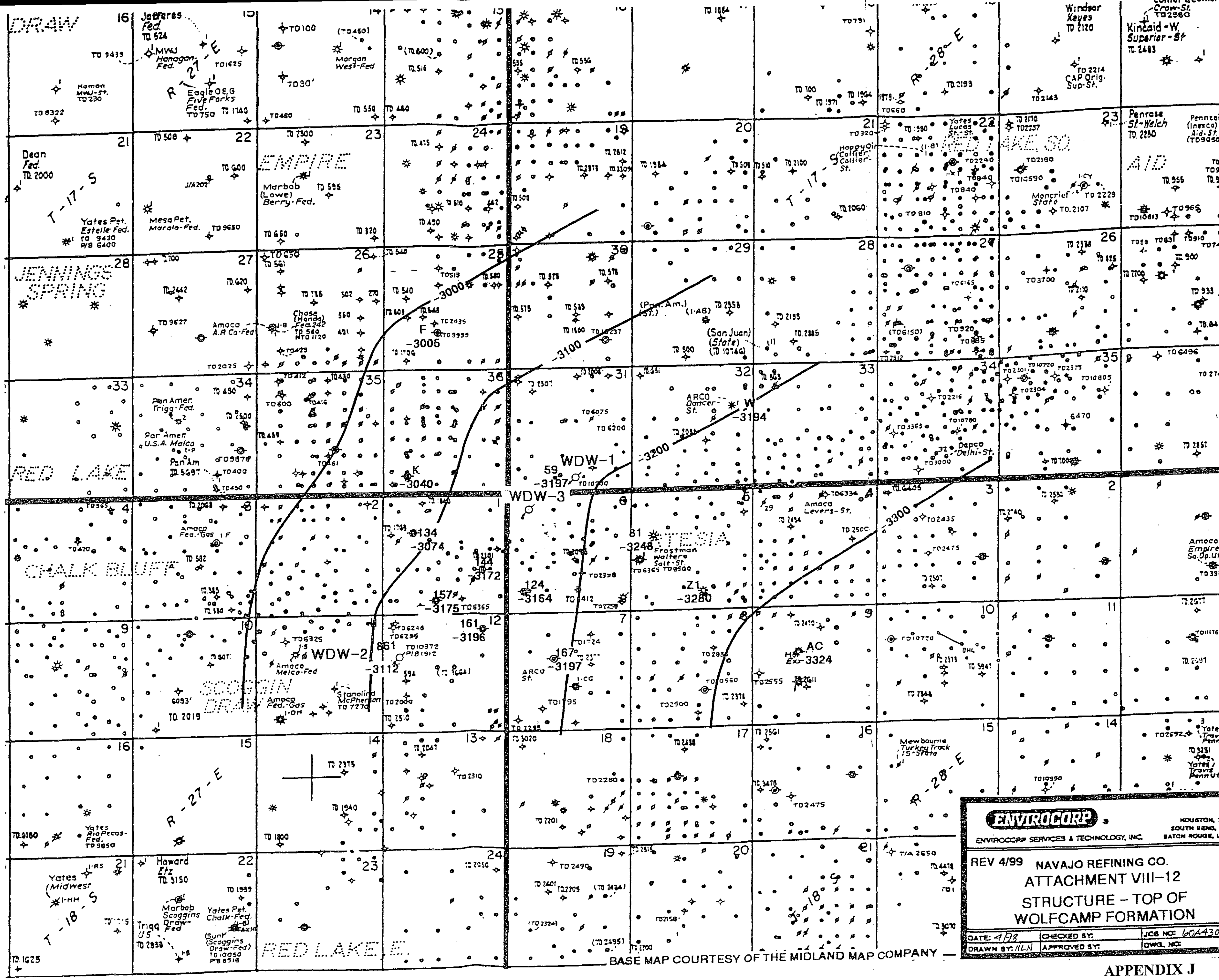
STRUCTURE MAP COURTESY OF THE GEOMAP COMPANY
Poster July 1997

APPENDIX I

APPENDIX J

WOLFCAMP STRUCTURE MAPS

157 -4025 ID NO. SUBSEA DEPTH



ENVIROCORP
ENVIROCORP SERVICES & TECHNOLOGY, INC.
HOUSTON, TX. SOUTH BEND, IN. BATON ROUGE, LA.

REV 4/99 NAVAJO REFINING CO.

ATTACHMENT VIII-12

STRUCTURE – TOP OF WOLFCAMP FORMATION

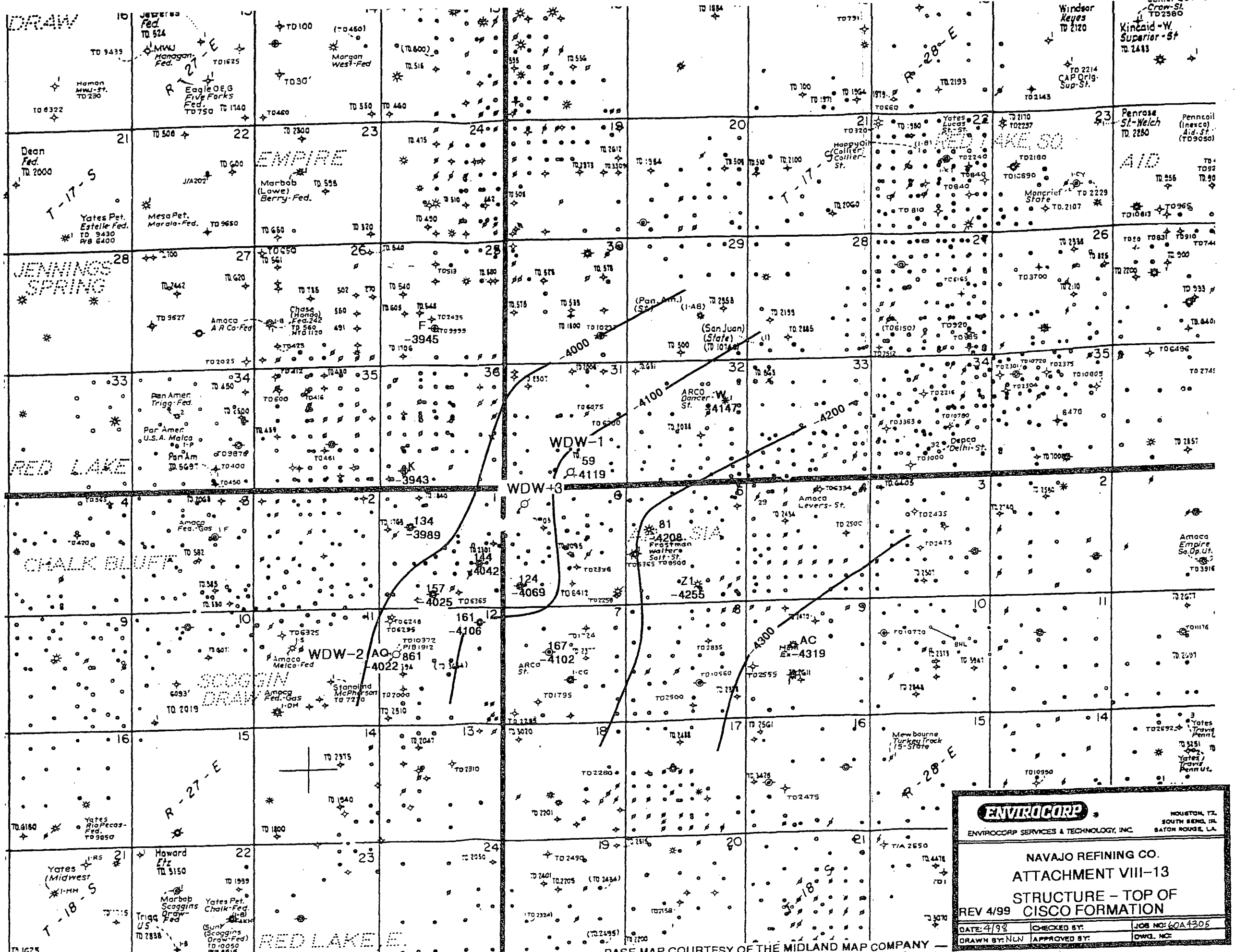
DATE: 4/98	CHECKED BY:	JOB NO: 60A4305
DRAWN BY: HLN	APPROVED BY:	DWG. NO:

APPENDIX J

APPENDIX K

CISCO STRUCTURE MAPS

157 ☼ ID NO.
-4025 SUBSEA DEPTH



BASE MAP COURTESY OF THE MIDLAND MAP COMPANY

ENVIROCORP
ENVIROCORP SERVICES & TECHNOLOGY, INC.
HOUSTON, TX. SOUTH BEND, IN. BATON ROUGE, LA.

NAVAJO REFINING CO.

ATTACHMENT VIII-13

STRUCTURE – TOP OF CISCO FORMATION

REV 4/99

DATE: 4/98	CHECKED BY:	JOB NO: 60A4305
DRAWN BY: NLN	APPROVED BY:	DWG. NO:

APPENDIX K

APPENDIX L

CHRONOLOGY OF FIELD ACTIVITIES

APPENDIX L

CHRONOLOGY OF FIELD ACTIVITIES

OCTOBER 16, 2011

Tim Jones:

Traveled to Artesia, New Mexico, and contacted contractors. Note, all times are in Mountain Standard Time (MST).

OCTOBER 17 2011

Subsurface arrived at the Navajo Plant at 6:30 a.m. MST. Two memory read-out (MRO) gauges were placed into each well as follows:

WDW-1 - 2 MROs spotted on depth at 7,924 feet 12:05 p.m. CST, wire was 092 carbon steel
WDW-2 - 2 MROs spotted on depth at 7,570 feet 10:25 a.m. CST, wire was 092 stainless steel
WDW-3 - 2 MROs spotted on depth at 7,660 feet 09:50 a.m., wire was 092 carbon steel

In addition, an annulus pressure test (APT) was conducted on WDW-2: 0827 hours – 910 psig, 0857 hours – 900 psig. Total annulus pressure loss was 1.1%.

Subsurface personnel traveled from Artesia, New Mexico to Houston, Texas.

OCTOBER 21, 2011

Subsurface personnel traveled from Houston, Texas to Artesia, New Mexico.

OCTOBER 22, 2011

Traveled to Artesia, New Mexico, and contacted contractors. Contractor pulled gauges out of the wells. Gradient stops were made every 1000 feet on WDW-2 as the BHP tool was pulled out of the hole. After removing the BHP tool, a temperature tool was made up and run into WDW-2. A temperature survey was conducted on WDW-2 from the surface to the top of the fill at 8,335 feet.

APPENDIX L

CHRONOLOGY OF FIELD ACTIVITIES (CONTINUED)

Subsurface personnel traveled from Artesia, New Mexico to Midland, Texas.

OCTOBER 23, 2011

Subsurface personnel traveled from Midland, Texas to Houston, Texas.

APPENDIX M

PANSYSTEM© ANALYSIS OUTPUT

Production Optimization Systems		Report File:	2011 chukka wdw-2.pan
PanSystem Version 3.5.1		Analysis Date:	11/16/2011
Well Test Analysis Report			APPENDIX M

Company	Navajo Refining (Holly Corporation)
Location	Artesia, NM
Well	Chukka Well No. 2
Test Date	10/17/2011 to 10/22/2011
Test Type	Buildup/Falloff Test
Gauge Type/ Serial Number	Spartek Systems/76182
Gauge Depth	7570 feet
Injection Interval	7570 feet to 8399 feet
Completion Type	Perforated at 2 SPF on 120 deg Phasing
Top Of Fill	8335 feet
Analyst	TJJ
Subsurface Project No.	70A6645

Remarks:

Reservoir Description

Fluid type : Water
Well orientation : Vertical
Number of wells : 1
Number of layers : 1

Layer Parameters Data

	Layer 1
Formation thickness	175.0000 ft
Average formation porosity	0.1000
Water saturation	0.0000
Gas saturation	0.0000
Formation compressibility	0.000000 psi-1
Total system compressibility	8.4000e-6 psi-1
Layer pressure	0.000000 psia
Temperature	0.000000 deg F

Well Parameters Data

	Well 1
Well radius	0.3281 ft
Distance from observation to active well	0.000000 ft
Wellbore storage coefficient	0.0000 bbl/psi
Storage Amplitude	0.000000 psi
Storage Time Constant	0.000000 hr
Second Wellbore Storage	0.000000 bbl/psi
Time Change for Second Storage	0.000000 hr
Well offset - x direction	0.0000 ft
Well offset - y direction	0.0000 ft

Fluid Parameters Data

	Layer 1
Oil gravity	0.000000 API
Gas gravity	0.000000 sp grav
Gas-oil ratio (produced)	0.000000 scf/STB
Water cut	0.000000
Water salinity	0.000000 ppm
Check Pressure	0.000000 psia
Check Temperature	0.000000 deg F
Gas-oil ratio (solution)	0.000000 scf/STB
Bubble-point pressure	0.000000 psia
Oil density	0.000 lb/ft3
Oil viscosity	0.000 cp
Oil formation volume factor	0.000 RB/STB
Gas density	0.000 lb/ft3
Gas viscosity	0.0 cp
Gas formation volume factor	0.000 ft3/scf
Water density	0.000 lb/ft3
Water viscosity	0.590 cp
Water formation volume factor	1.000 RB/STB
Oil compressibility	0.000000 psi-1
Initial Gas compressibility	0.000000 psi-1
Water compressibility	0.000000 psi-1

Layer 1 Correlations
Not Used

Layer Boundaries Data
Layer 1 Boundary Type : Infinitely acting

	Layer 1
L1	0.000000 ft
L2	0.000000 ft
L3	0.000000 ft
L4	0.000000 ft
Drainage area	0.000000 acres
Dietz shape factor	0.000000

Layer 1 Model Data
Layer 1 Model Type : Radial homogeneous

	Layer 1
Permeability	0.0000 md
Skin factor (Well 1)	0.0000

Rate Change Data

Time Hours	Pressure psia	Rate STB/day
-8793.188944	0.000000	-4820.724923
-8769.188944	0.000000	-4820.724923
-8745.188944	0.000000	-4820.724923
-8721.188944	0.000000	-4820.724923
-8697.188944	0.000000	-4713.016009
-8673.188944	0.000000	-4713.016009
-8649.188944	0.000000	-4820.724923
-8625.188944	0.000000	-4820.724923
-8601.188944	0.000000	-4924.720459
-8577.188944	0.000000	-4820.724923
-8553.188944	0.000000	-4718.401402
-8529.188944	0.000000	-4924.720459
-8505.188944	0.000000	-3427.924282
-8481.188944	0.000000	-3212.504883
-8457.188944	0.000000	-4713.016009
-8433.188944	0.000000	-4713.016009
-8409.188944	0.000000	-4605.305001
-8385.188944	0.000000	-4713.016009
-8361.188944	0.000000	-4713.016009
-8337.188944	0.000000	-4713.016009
-8313.188944	0.000000	-4610.690395
-8289.188944	0.000000	-4605.305001
-8265.188944	0.000000	-4713.016009
-8241.188944	0.000000	-4713.016009
-8217.188944	0.000000	-4713.016009
-8193.188944	0.000000	-4713.016009
-8169.188944	0.000000	-3427.924282
-8145.188944	0.000000	-3212.504883
-8121.188944	0.000000	-3212.504883
-8097.188944	0.000000	-4713.016009
-8073.188944	0.000000	-4713.016009
-8049.188944	0.000000	-4713.016009

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-8025.188944	0.000000	-4713.016009
-8001.188944	0.000000	-4713.016009
-7977.188944	0.000000	-4713.016009
-7953.188944	0.000000	-4713.016009
-7929.188944	0.000000	-4713.016009
-7905.188944	0.000000	-4713.016009
-7881.188944	0.000000	-4605.305001
-7857.188944	0.000000	-4713.016009
-7833.188944	0.000000	-4605.305001
-7809.188944	0.000000	-4605.305001
-7785.188944	0.000000	-4713.016009
-7761.188944	0.000000	-4605.305001
-7737.188944	0.000000	-4605.305001
-7713.188944	0.000000	-4605.305001
-7689.188944	0.000000	-4605.305001
-7665.188944	0.000000	-4605.305001
-7641.188944	0.000000	-4497.596087
-7617.188944	0.000000	-3320.215367
-7593.188944	0.000000	-4605.305001
-7569.188944	0.000000	-4713.016009
-7545.188944	0.000000	-4605.305001
-7521.188944	0.000000	-4497.596087
-7497.188944	0.000000	-4605.305001
-7473.188944	0.000000	-4605.305001
-7449.188944	0.000000	-4497.596087
-7425.188944	0.000000	-4820.724923
-7401.188944	0.000000	-4713.016009
-7377.188944	0.000000	-4605.305001
-7353.188944	0.000000	-4178.180629
-7329.188944	0.000000	-4605.305001
-7305.188944	0.000000	-4605.305001
-7281.188944	0.000000	-4713.016009

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-7257.188944	0.000000	-3639.630824
-7233.188944	0.000000	-3639.630824
-7209.188944	0.000000	-3540.834699
-7185.188944	0.000000	-4713.016009
-7161.188944	0.000000	-4820.724923
-7137.188944	0.000000	-4820.724923
-7113.188944	0.000000	-4820.724923
-7089.188944	0.000000	-4605.305001
-7065.188944	0.000000	-4820.724923
-7041.188944	0.000000	-4820.724923
-7017.188944	0.000000	-4820.724923
-6993.188944	0.000000	-4820.724923
-6969.188944	0.000000	-4820.724923
-6945.188944	0.000000	-4713.016009
-6921.188944	0.000000	-4820.724923
-6897.188944	0.000000	-4820.724923
-6873.188944	0.000000	-4713.016009
-6849.188944	0.000000	-4713.016009
-6825.188944	0.000000	-4820.724923
-6801.188944	0.000000	-4820.724923
-6777.188944	0.000000	-4820.724923
-6753.188944	0.000000	-4820.724923
-6729.188944	0.000000	-4820.724923
-6705.188944	0.000000	-4820.724923
-6681.188944	0.000000	-4713.016009
-6657.188944	0.000000	-4820.724923
-6633.188944	0.000000	-4713.016009
-6609.188944	0.000000	-4713.016009
-6585.188944	0.000000	-4713.016009
-6561.188944	0.000000	-4605.305001
-6537.188944	0.000000	-4820.724923
-6513.188944	0.000000	-4924.720459
-6489.188944	0.000000	-4713.016009
-6465.188944	0.000000	-4713.016009
-6441.188944	0.000000	-4718.401402
-6417.188944	0.000000	-4713.016009
-6393.188944	0.000000	-4713.016009
-6369.188944	0.000000	-4713.016009
-6345.188944	0.000000	-4610.690395
-6321.188944	0.000000	-3535.635027
-6297.188944	0.000000	-4820.724923
-6273.188944	0.000000	-4723.601074
-6249.188944	0.000000	-4820.724923
-6225.188944	0.000000	-4820.724923
-6201.188944	0.000000	-4713.016009
-6177.188944	0.000000	-2.1843e4
-6153.188944	0.000000	0.000000
-6129.188944	0.000000	-2.1843e4
-6105.188944	0.000000	-4713.016009

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-6081.188944	0.000000	-3535.635027
-6057.188944	0.000000	-3427.924282
-6033.188944	0.000000	-4820.724923
-6009.188944	0.000000	-3427.924282
-5985.188944	0.000000	-4497.596087
-5961.188944	0.000000	-3530.249372
-5937.188944	0.000000	-3427.924282
-5913.188944	0.000000	-4713.016009
-5889.188944	0.000000	-5463.270264
-5865.188944	0.000000	-5463.270264
-5841.188944	0.000000	-5567.266323
-5817.188944	0.000000	-5782.685721
-5793.188944	0.000000	-5468.469936
-5769.188944	0.000000	-5674.976807
-5745.188944	0.000000	-5463.270264
-5721.188944	0.000000	-5355.561349
-5697.188944	0.000000	-5355.561349
-5673.188944	0.000000	-3427.924282
-5649.188944	0.000000	-5355.561349
-5625.188944	0.000000	-3427.924282
-5601.188944	0.000000	-5890.396729
-5577.188944	0.000000	-3427.924282
-5553.188944	0.000000	-5998.105643
-5529.188944	0.000000	-6105.816127
-5505.188944	0.000000	-5998.105643
-5481.188944	0.000000	-5890.396729
-5457.188944	0.000000	-6317.521101
-5433.188944	0.000000	-4924.720459
-5409.188944	0.000000	-3427.924282
-5385.188944	0.000000	-3427.924282
-5361.188944	0.000000	-3427.924282
-5337.188944	0.000000	-5140.140381
-5313.188944	0.000000	-5140.140381
-5289.188944	0.000000	-5032.431466
-5265.188944	0.000000	-4605.305001
-5241.188944	0.000000	-3427.924282
-5217.188944	0.000000	-4605.305001
-5193.188944	0.000000	-4924.720459
-5169.188944	0.000000	-5032.431466
-5145.188944	0.000000	-5463.270264
-5121.188944	0.000000	-5355.561349
-5097.188944	0.000000	-5567.266323
-5073.188944	0.000000	-4820.724923
-5049.188944	0.000000	-3639.630824
-5025.188944	0.000000	-5140.140381
-5001.188944	0.000000	-5782.685721
-4977.188944	0.000000	-5140.140381
-4953.188944	0.000000	-3427.924282
-4929.188944	0.000000	-5355.561349

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-4905.188944	0.000000	-5247.850865
-4881.188944	0.000000	-5463.270264
-4857.188944	0.000000	-3427.924282
-4833.188944	0.000000	-5567.266323
-4809.188944	0.000000	-5247.850865
-4785.188944	0.000000	-5463.270264
-4761.188944	0.000000	-5567.266323
-4737.188944	0.000000	-5463.270264
-4713.188944	0.000000	-3433.309937
-4689.188944	0.000000	-5355.561349
-4665.188944	0.000000	-4605.305001
-4641.188944	0.000000	-3427.924282
-4617.188944	0.000000	-5757.143032
-4593.188944	0.000000	-5485.714286
-4569.188944	0.000000	-6171.428571
-4545.188944	0.000000	-5622.857143
-4521.188944	0.000000	-6000.000000
-4497.188944	0.000000	-5828.571429
-4473.188944	0.000000	-5931.428571
-4449.188944	0.000000	-5728.571254
-4425.188944	0.000000	-5554.285714
-4401.188944	0.000000	-4391.428397
-4377.188944	0.000000	-5691.428571
-4353.188944	0.000000	-5625.714111
-4329.188944	0.000000	-3497.142857
-4305.188944	0.000000	-3462.857143
-4281.188944	0.000000	-3462.857143
-4257.188944	0.000000	-5585.714460
-4233.188944	0.000000	-5417.142857
-4209.188944	0.000000	-6034.285714
-4185.188944	0.000000	-4971.428571
-4161.188944	0.000000	-5894.285889
-4137.188944	0.000000	-6000.000000
-4113.188944	0.000000	-5968.571254
-4089.188944	0.000000	-5931.428571
-4065.188944	0.000000	-6034.285714
-4041.188944	0.000000	-3394.285714
-4017.188944	0.000000	-6000.000000
-3993.188944	0.000000	-6000.000000
-3969.188944	0.000000	-5931.428571
-3945.188944	0.000000	-3462.857143
-3921.188944	0.000000	-6137.142857
-3897.188944	0.000000	-5965.714286
-3873.188944	0.000000	-6065.714460
-3849.188944	0.000000	-6034.285714
-3825.188944	0.000000	-5657.142857
-3801.188944	0.000000	-5931.428571
-3777.188944	0.000000	-6034.285714
-3753.188944	0.000000	-5622.857143

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-3729.188944	0.000000	-5862.857143
-3705.188944	0.000000	-6034.285714
-3681.188944	0.000000	-5931.428571
-3657.188944	0.000000	-6000.000000
-3633.188944	0.000000	-5928.571603
-3609.188944	0.000000	-5894.285889
-3585.188944	0.000000	-5862.857143
-3561.188944	0.000000	-5865.714111
-3537.188944	0.000000	-5897.142857
-3513.188944	0.000000	-5897.142857
-3489.188944	0.000000	-5897.142857
-3465.188944	0.000000	-5862.857143
-3441.188944	0.000000	-6015.714111
-3417.188944	0.000000	-6000.000000
-3393.188944	0.000000	-5897.142857
-3369.188944	0.000000	-5897.142857
-3345.188944	0.000000	-5862.857143
-3321.188944	0.000000	-5865.714111
-3297.188944	0.000000	-5865.714111
-3273.188944	0.000000	-5828.571429
-3249.188944	0.000000	-6139.999826
-3225.188944	0.000000	-6102.857143
-3201.188944	0.000000	-6277.142683
-3177.188944	0.000000	-6271.428746
-3153.188944	0.000000	-5965.714286
-3129.188944	0.000000	-6240.000000
-3105.188944	0.000000	-6000.000000
-3081.188944	0.000000	-5654.285889
-3057.188944	0.000000	-5962.857317
-3033.188944	0.000000	-5760.000000
-3009.188944	0.000000	-6034.285714
-2985.188944	0.000000	-6031.428746
-2961.188944	0.000000	-5965.714286
-2937.188944	0.000000	-5916.586042
-2913.188944	0.000000	-6037.142683
-2889.188944	0.000000	-5965.714286
-2865.188944	0.000000	-6000.000000
-2841.188944	0.000000	-5965.714286
-2817.188944	0.000000	-6000.000000
-2793.188944	0.000000	-6024.375000
-2769.188944	0.000000	-6000.000000
-2745.188944	0.000000	-6000.000000
-2721.188944	0.000000	-6031.428746
-2697.188944	0.000000	-6034.285714
-2673.188944	0.000000	-3497.142857
-2649.188944	0.000000	-5965.714286
-2625.188944	0.000000	-3497.142857
-2601.188944	0.000000	-3497.142857
-2577.188944	0.000000	-5965.714286

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-2553.188944	0.000000	-3497.142857
-2529.188944	0.000000	-5965.714286
-2505.188944	0.000000	-5962.857317
-2481.188944	0.000000	-3462.857143
-2457.188944	0.000000	-5451.428571
-2433.188944	0.000000	-5965.714286
-2409.188944	0.000000	-5931.428571
-2385.188944	0.000000	-5897.142857
-2361.188944	0.000000	-5865.714111
-2337.188944	0.000000	-5865.714111
-2313.188944	0.000000	-5828.571429
-2289.188944	0.000000	-5722.857317
-2265.188944	0.000000	-3462.857143
-2241.188944	0.000000	-5928.571603
-2217.188944	0.000000	-5688.571603
-2193.188944	0.000000	-5897.142857
-2169.188944	0.000000	-3497.142857
-2145.188944	0.000000	-5928.571603
-2121.188944	0.000000	-5934.285540
-2097.188944	0.000000	-5934.285540
-2073.188944	0.000000	-5862.857143
-2049.188944	0.000000	-5865.714111
-2025.188944	0.000000	-5862.857143
-2001.188944	0.000000	-5862.857143
-1977.188944	0.000000	-5765.714460
-1953.188944	0.000000	-5860.000174
-1929.188944	0.000000	-5688.571603
-1905.188944	0.000000	-3431.428659
-1881.188944	0.000000	-5794.285714
-1857.188944	0.000000	-5860.000174
-1833.188944	0.000000	-3497.142857
-1809.188944	0.000000	-5897.142857
-1785.188944	0.000000	-5828.571429
-1761.188944	0.000000	-5862.857143
-1737.188944	0.000000	-5894.285889
-1713.188944	0.000000	-5648.571429
-1689.188944	0.000000	-5797.142683
-1665.188944	0.000000	-5794.285714
-1641.188944	0.000000	-5794.285714
-1617.188944	0.000000	-5794.285714
-1593.188944	0.000000	-5757.143032
-1569.188944	0.000000	-5760.000000
-1545.188944	0.000000	-5762.856968
-1521.188944	0.000000	-3462.857143
-1497.188944	0.000000	-5757.143032
-1473.188944	0.000000	-5725.714286
-1449.188944	0.000000	-5860.000174
-1425.188944	0.000000	-5862.857143
-1401.188944	0.000000	-5862.857143

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-1377.188944	0.000000	-5862.857143
-1353.188944	0.000000	-5862.857143
-1329.188944	0.000000	-5860.000174
-1305.188944	0.000000	-3497.142857
-1281.188944	0.000000	-5760.000000
-1257.188944	0.000000	-5897.142857
-1233.188944	0.000000	-5828.571429
-1209.188944	0.000000	-5794.285714
-1185.188944	0.000000	-5831.428397
-1161.188944	0.000000	-5894.285889
-1137.188944	0.000000	-5862.857143
-1113.188944	0.000000	-5797.142683
-1089.188944	0.000000	-5794.285714
-1065.188944	0.000000	-5797.142683
-1041.188944	0.000000	-5760.000000
-1017.188944	0.000000	-5694.285540
-993.188944	0.000000	-5725.714286
-969.188944	0.000000	-5860.000174
-945.188944	0.000000	-5828.571429
-921.188944	0.000000	-5894.285889
-897.188944	0.000000	-5825.714460
-873.188944	0.000000	-5637.143032
-849.188944	0.000000	-5828.571429
-825.188944	0.000000	-5797.142683
-801.188944	0.000000	-5794.285714
-777.188944	0.000000	-5760.000000
-753.188944	0.000000	-5725.714286
-729.188944	0.000000	-3394.285714
-705.188944	0.000000	-3394.285714
-681.188944	0.000000	-6137.142857
-657.188944	0.000000	-6139.999826
-633.188944	0.000000	-5928.571603
-609.188944	0.000000	-5862.857143
-585.188944	0.000000	-5828.571429
-561.188944	0.000000	-5825.714460
-537.188944	0.000000	-5725.714286
-513.188944	0.000000	-5794.285714
-489.188944	0.000000	-5794.285714
-465.188944	0.000000	-5828.571429
-441.188944	0.000000	-3397.142944
-417.188944	0.000000	-5794.285714
-393.188944	0.000000	-5794.285714
-369.188944	0.000000	-5797.142683
-345.188944	0.000000	-5825.714460
-321.188944	0.000000	-4182.857143
-297.188944	0.000000	-5794.285714
-273.188944	0.000000	-4182.857143
-249.188944	0.000000	-5725.714286
-225.188944	0.000000	-4045.714286

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-201.188944	0.000000	-5317.142683
-177.188944	0.000000	-5760.000000
-153.188944	0.000000	-5691.428571
-129.188944	0.000000	-5825.714460
-105.188944	0.000000	-5794.285714
-81.188944	0.000000	-5794.285714
-57.188944	0.000000	-5794.285714
-33.188944	0.000000	-5828.571429
-9.188944	0.000000	-5798.857143
-8.688944	0.000000	-5796.571429
-8.188944	0.000000	-5795.428571
-7.688944	0.000000	-5795.428571
-7.188944	0.000000	-5589.424601
-6.688944	0.000000	-4824.194444
-6.188944	0.000000	-4775.523810
-5.688944	0.000000	-4724.099209
-5.188944	0.000000	-5048.206347
-4.688944	0.000000	-5711.218254
-4.188944	0.000000	-5765.051590
-3.688944	0.000000	-5775.515871
-3.188944	0.000000	-5785.623016
-2.688944	0.000000	-5790.857143
-2.188944	0.000000	-5789.714286
-1.688944	0.000000	-5790.861114
-1.188944	0.000000	-5829.523812
-0.688944	0.000000	-6277.714292
-0.188944	0.000000	-6210.468252
0.311056	0.000000	-6221.051587
0.811056	0.000000	-6193.329362
1.311056	0.000000	-6208.480158
1.811056	0.000000	-6144.190476
2.311056	0.000000	-6150.194447
2.811056	0.000000	-6155.428574
3.311056	0.000000	-6169.138889
3.811056	0.000000	-6174.194450
4.311056	0.000000	-6175.519842
4.811056	0.000000	-6174.857143
5.311056	0.000000	-6164.571429
5.811056	0.000000	-6168.000000
6.311056	0.000000	-6165.234124
6.811056	0.000000	-6169.142854
7.311056	0.000000	-6142.857140
7.811056	0.000000	-6137.146825
8.311056	0.000000	-6154.567458
8.811056	0.000000	-6130.289682
9.311056	0.000000	-5789.242066
9.811056	0.000000	-5062.551585
10.311056	0.000000	-4181.730158
10.811056	0.000000	-4912.666667

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
11.311056	0.000000	-5693.527780
11.811056	0.000000	-5724.567461
12.311056	0.000000	-5725.714286
12.811056	0.000000	-5728.000000
13.311056	0.000000	-5728.000000
13.811056	0.000000	-5728.000000
14.311056	0.000000	-5728.000000
14.811056	0.000000	-5726.194447
15.311056	0.000000	-5728.658728
15.811056	0.000000	-5721.146825
16.311056	0.000000	-5720.000000
16.811056	0.000000	-5721.146828
17.311056	0.000000	-5719.996032
17.811056	0.000000	-5720.003971
18.311056	0.000000	-5719.996032
18.811056	0.000000	-5717.714286
19.311056	0.000000	-5704.662696
19.811056	0.000000	-5706.289682
20.311056	0.000000	-5704.000000
20.811056	0.000000	-5705.138886
21.311056	0.000000	-5701.718254
21.811056	0.000000	-5703.337304
22.311056	0.000000	-5701.714289
22.811056	0.000000	-5701.714289
23.311056	0.000000	-6042.757937
23.811056	0.000000	-5360.865077
24.311056	0.000000	-5221.226188
24.811056	0.000000	-5166.571426
25.311056	0.000000	-5419.242063
25.811056	0.000000	-5565.043648
26.311056	0.000000	-5639.999997
26.811056	0.000000	-5634.765873
27.311056	0.000000	-5361.615077
27.811056	0.000000	-5337.619045
28.311056	0.000000	-5643.813492
28.811056	0.000000	-6040.761905
29.311056	0.000000	-6161.623019
29.811056	0.000000	-6151.515871
30.311056	0.000000	-6146.285711
30.811056	0.000000	-6153.142854
31.311056	0.000000	-6133.238092
31.811056	0.000000	-5667.619045
32.311056	0.000000	-5196.384920
32.811056	0.000000	-5705.619048
33.311056	0.000000	-5729.142857
33.811056	0.000000	-5729.142857
34.311056	0.000000	-5724.571429
34.811056	0.000000	-5724.571429
35.311056	0.000000	-5723.428571

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
35.811056	0.000000	-5724.571429
36.311056	0.000000	-5720.000000
36.811056	0.000000	-5715.432542
37.311056	0.000000	-5714.281746
37.811056	0.000000	-5707.432542
38.311056	0.000000	-5705.801585
38.811056	0.000000	-5705.142854
39.311056	0.000000	-5705.623016
39.811056	0.000000	-5706.952381
40.311056	0.000000	-5700.567458
40.811056	0.000000	-5702.198415
41.311056	0.000000	-5700.567461
41.811056	0.000000	-5697.809524
42.311056	0.000000	-5698.285714
42.811056	0.000000	-5698.285714
43.311056	0.000000	-5351.523810
43.811056	0.000000	-5679.333333
44.311056	0.000000	-5690.285714
44.811056	0.000000	-5694.857143
45.311056	0.000000	-5696.476190
45.811056	0.000000	-5699.432542
46.311056	0.000000	-5697.805556
46.811056	0.000000	-5692.571429
47.311056	0.000000	-5694.861114
47.811056	0.000000	-5694.853175
48.311056	0.000000	-5719.337304
48.811056	0.000000	-5725.226193
49.311056	0.000000	-5755.246032
49.811056	0.000000	-5796.575399
50.311056	0.000000	-5746.281746
50.811056	0.000000	-5755.428571
51.311056	0.000000	-5070.952381
51.811056	0.000000	-3861.694443
52.311056	0.000000	-3948.781746
52.811056	0.000000	-5173.809524
53.311056	0.000000	-6424.666667
53.811056	0.000000	-6410.285714
54.311056	0.000000	-6401.809524
54.811056	0.000000	-6403.904762
55.311056	0.000000	-6384.666667
55.811056	0.000000	-6371.428571
56.311056	0.000000	-6374.857143
56.811056	0.000000	-6351.527780
57.311056	0.000000	-6338.281746
57.811056	0.000000	-6336.000000
58.311056	0.000000	-6331.428571
58.811056	0.000000	-6330.289685
59.311056	0.000000	-6335.515871
59.811056	0.000000	-6346.765873

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
60.311056	0.000000	-6341.714286
60.811056	0.000000	-6344.480161
61.311056	0.000000	-6344.000003
61.811056	0.000000	-6363.428574
62.311056	0.000000	-6369.801585
62.811056	0.000000	-6368.480158
63.311056	0.000000	-6374.857143
63.811056	0.000000	-6376.000000
64.311056	0.000000	-6378.285714
64.811056	0.000000	-6385.142857
65.311056	0.000000	-6378.285714
65.811056	0.000000	-6382.194447
66.311056	0.000000	-6372.757937
66.811056	0.000000	-6324.095238
67.311056	0.000000	-6307.428571
67.811056	0.000000	-6333.047619
68.311056	0.000000	-6334.857143
68.811056	0.000000	-6342.376981
69.311056	0.000000	-6317.718254
69.811056	0.000000	-6328.476190
70.311056	0.000000	-6348.571429
70.811056	0.000000	-6353.619048
71.311056	0.000000	-6378.281743
71.811056	0.000000	-6388.095235
72.311056	0.000000	-6359.337301
72.811056	0.000000	-6381.714286
73.311056	0.000000	-6369.805553
73.811056	0.000000	-6370.769844
74.311056	0.000000	-6367.996032
74.811056	0.000000	-6374.857143
75.311056	0.000000	-6406.190476
75.811056	0.000000	-6409.805553
76.311056	0.000000	-6368.670635
76.811056	0.000000	-6328.666667
77.311056	0.000000	-6308.571429
77.811056	0.000000	-6371.714286
78.311056	0.000000	-6416.480161
78.811056	0.000000	-6424.662699
79.311056	0.000000	-6400.666667
79.811056	0.000000	-6381.714286
80.311056	0.000000	-6373.714286
80.811056	0.000000	-6366.857143
81.311056	0.000000	-6344.666667
81.811056	0.000000	-6326.857143
82.311056	0.000000	-6339.424601
82.811056	0.000000	-6349.718254
83.311056	0.000000	-6366.190476
83.811056	0.000000	-6379.428571
83.949132	3784.981762	-6377.142857
117.984861	3701.527825	0.000000

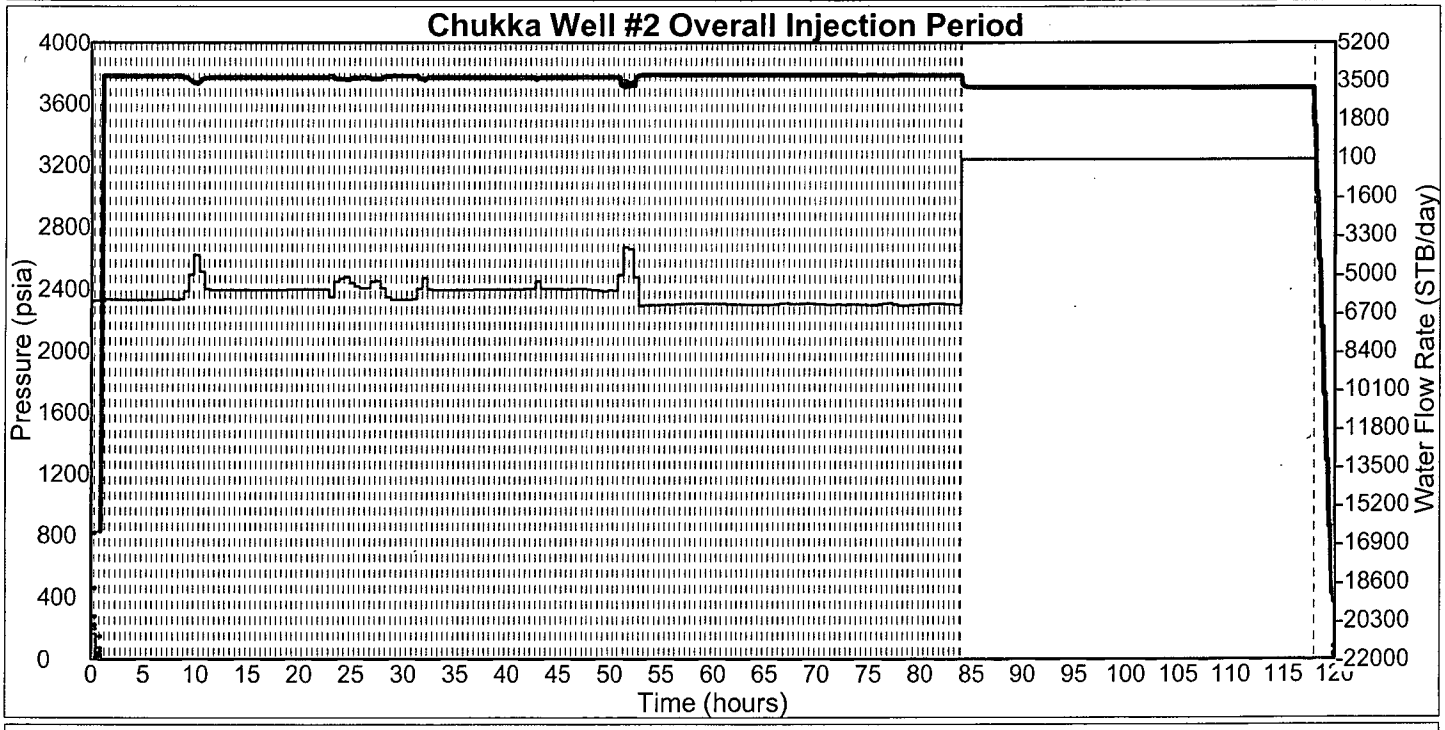
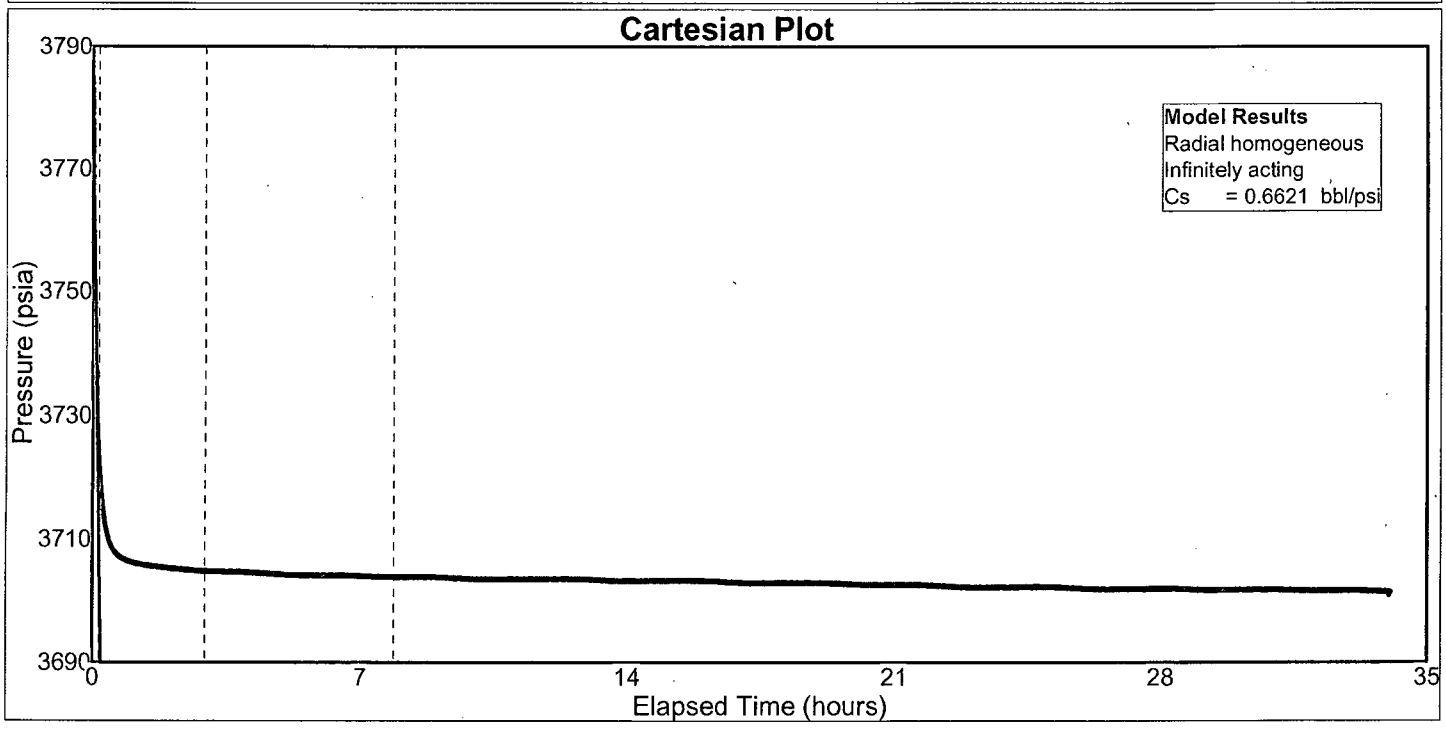

Chukka Well #2 Overall Injection Period
Pressure (psia)
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
Water Flow Rate (STB/day)
5200
3500
1800
100
-1600
-3300
-5000
-6700
-8400
-10100
-11800
-13500
-15200
-16900
-18600
-20300
-22000
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120
Time (hours)

FIGURE 11



Cartesian Plot Model Results
Radial homogeneous - Infinitely acting

Classic Wellbore Storage

	Value
Wellbore storage coefficient	0.662106 bbl/psi

Cartesian Plot Line Details
Line type : Wellbore storage
Slope : -401.317
Intercept : 3779.38
Coefficient of Determination : 0.892479
Number of Intersections = 0

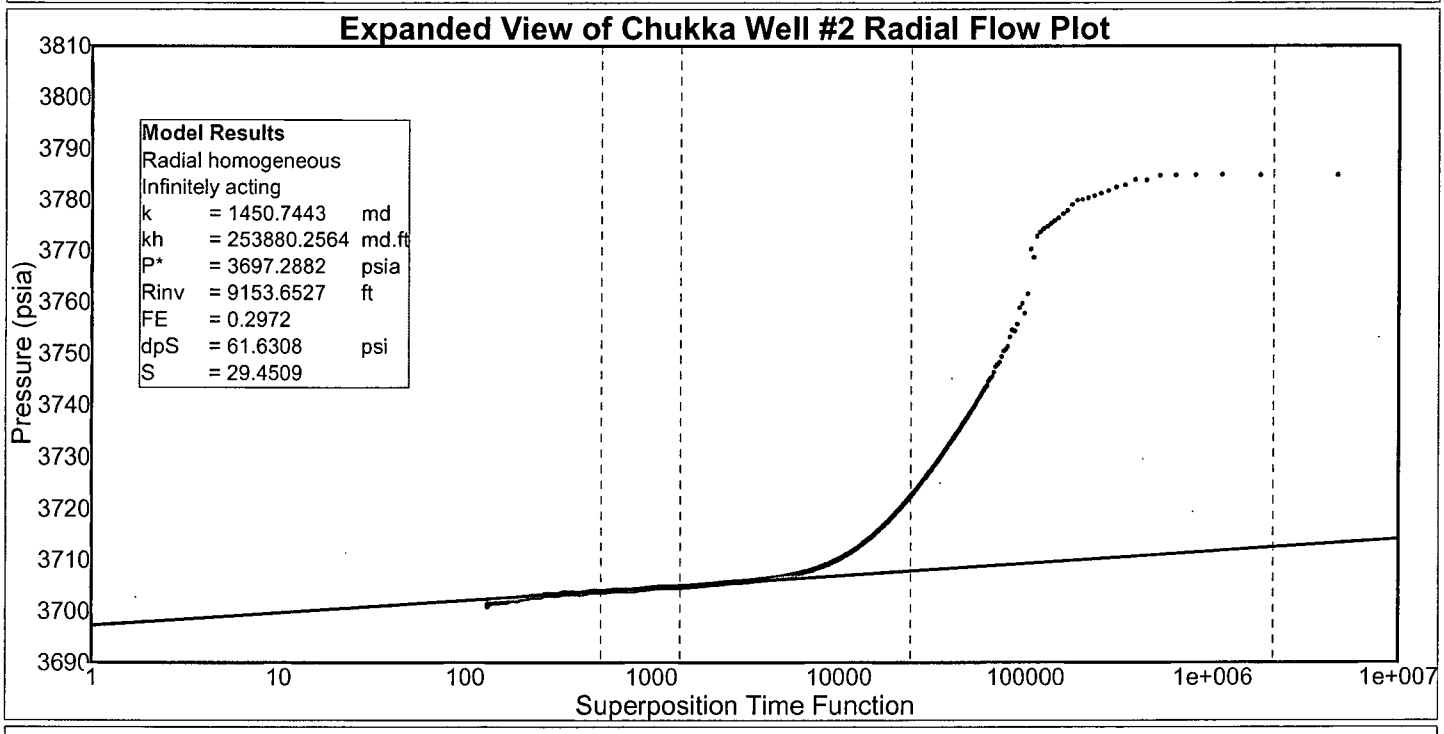


FIGURE 16

Expanded View of Chukka Well #2 Radial Flow Plot Model Results
Radial homogeneous - Infinitely acting

Classic Wellbore Storage

	Value
Permeability	1450.744322 md
Permeability-thickness	2.5388e5 md.ft
Extrapolated pressure	3697.288216 psia
Radius of investigation	9153.652743 ft
Flow efficiency	0.297202
dP skin (constant rate)	61.630829 psi
Skin factor	29.450909

Expanded View of Chukka Well #2 Radial Flow Plot Line Details
Line type : Radial flow
Slope : 2.40918
Intercept : 3697.29
Coefficient of Determination : 0.937454

	Radial flow
Extrapolated pressure	3697.288216 psia
Pressure at dt = 1 hour	3705.990668 psia

Number of Intersections = 0

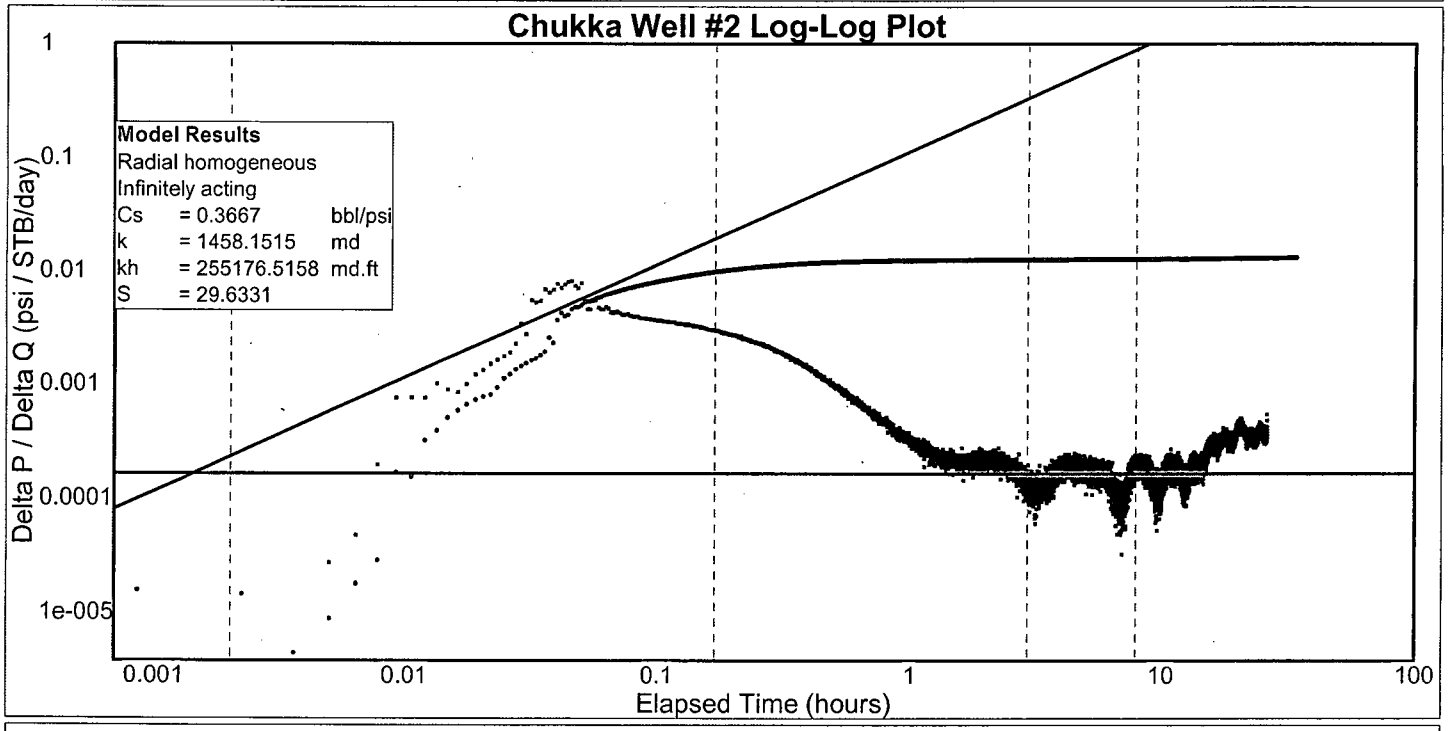


FIGURE 14

Chukka Well #2 Log-Log Plot Model Results
Radial homogeneous - Infinitely acting

Classic Wellbore Storage

	Value
Wellbore storage coefficient	0.366653 bbl/psi
Permeability	1458.151519 md
Permeability-thickness	2.5518e5 md.ft
Skin factor	29.633117

Chukka Well #2 Log-Log Plot Line Details
Line type : Radial flow
Slope : 0
Intercept : 0.000163236
Coefficient of Determination : Not Used
Line type : Wellbore storage
Slope : 1
Intercept : 0.11364
Coefficient of Determination : Not Used
Number of Intersections = 0

APPENDIX N

TEMPERATURE SURVEY, DATED OCTOBER 22, 2011

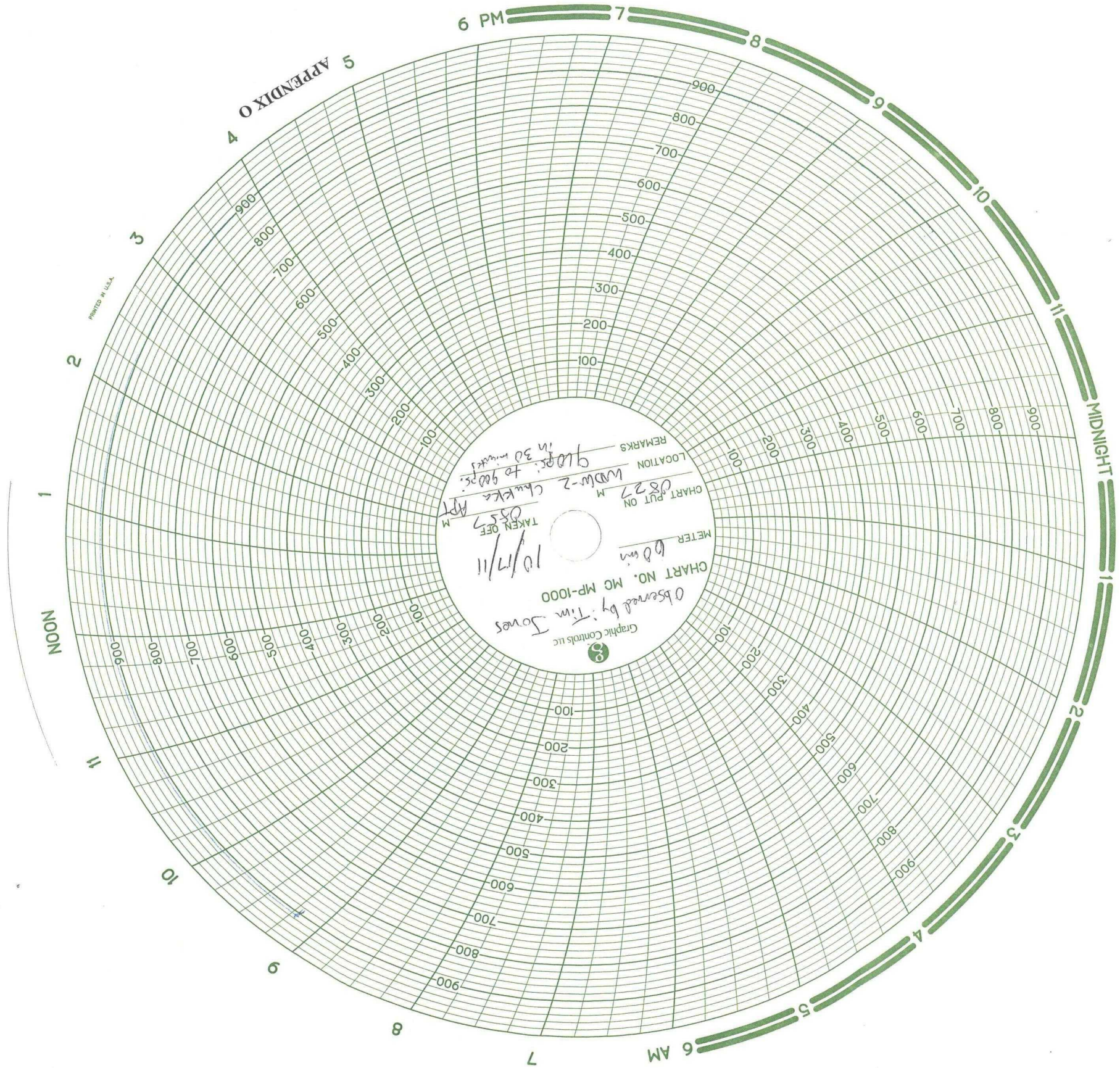
SUBSURFACE

APPENDIX O

CHART OF ANNULUS PRESSURE TEST AND CHART CERTIFICATION SHEET

SUBSURFACE

APPENDIX O


6 PM
7
8
9
10
11
MIDNIGHT
1
2
3
4
5
6 AM
7
8
9
10
11
NOON
100
200
300
400
500
600
700
800
900
Graphic Controls LLC
Observed by: Tim Jones
CHART NO. MC MP-1000
METER Bldg
CHART PUT ON M
LOCATION Bldg-2 Chiller Plant
REMARKS Pump #2 in service
TAKEN OFF M
10/17/11

METERING & TESTING SERVICES, INC.

SOPHISTICATED TOOLS TO PRODUCE WELLS MORE EFFICIENTLY

Well Checkers for the Permian Basin

METERING & TESTING
Certification

11300 West Interstate 20 East
Odessa, TX 79765
(432)563-1445

Company:	**Sub-Surfaace Tech.**	**Lease:**	N/A	**Date:**	10/14/2011
County:	Midland	**State:**	TX	**Location:**	N/A
Purchaser:	N/A	**Crystal Gauge SER:**	442385	**Station Number:**	N/A
Make of Meter:	Barton	**Serial Number:**	259-920	**Gas Gravity:**	N/A
Differential Range:	N/A	**Static Range:**	0-1000 PSI	**Temperature Range:**	N/A
Average Differential:	N/A	**Average Static:**	N/A	**Average Temperature:**	N/A
Line Size:	N/A	**Upstream:**	N/A	**Downstream:**	N/A
Orifice Size:	N/A	**Orifice Condition:**	N/A	**Seal Condition:**	N/A
Flange or Pipe Taps:	N/A	**Vanes:**	N/A	**Calculated Beta Ratio:**	N/A
Pen Arc:	OK	**Pen Drag:**	OK	**Clock Rotation:**	Programable

Calibration Data

Differential		
Found	**C/G**	**Left**
NA	**NA**	**NA**

Static		
Found	**C/G**	**Left**
0	**0**	**0**
100	100	100
300	300	300
500	500	500
700	700	700
900	900	900
1000	1000	1000

Temperature		
Found	**Therm**	**Left**
NA	**NA**	NA

Meter(was) in calabration as found

Tester: **Tester:** D. Franklin

Witness: **Witness**

Witness: **Witness:**