SUBSURFACE

2012 PRESSURE FALLOFF TEST AND BOTTOM-HOLE PRESSURE SURVEY ON GAINES WELL NO. 3

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO
PROJECT NO. 70D6835

SUBMITTED:
FEBRUARY 2013

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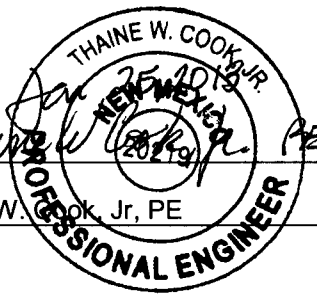
I Thaine W Cook, Jr, PE certify that the following is accurate:

1. I or my agent have visited and examined the Navajo WDW Gaines #3 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 _____ Title: Principal Consultant

Name Thane W. Cook, Jr, PE Date: 1/25/2013

New Mexico PE # 20219

EXECUTIVE SUMMARY

Subsurface Construction Corp (Subsurface) was contracted by Navajo Refining Company (Navajo) to perform a pressure falloff test and bottom-hole pressure survey on Navajo's Gaines Well No. 3. The test was performed in accordance with The New Mexico Oil Conservation Division (OCD) falloff test guidelines (*New Mexico Oil Conservation Division UIC Class I Well Fall-Off Test Guidance, December 3, 2007*).

The test provides the state regulatory agency with the necessary information to access the validity of requested or existing injection well permit conditions and satisfy the permitting objective of protecting the underground sources of drinking water (USDW). Specifically, 40 CFR Part 146 states "The Director shall require monitoring of the pressure buildup in the injection zone annually, including at a minimum, a shutdown of the well for a time sufficient to conduct a valid observation of the pressure fall-off curve". (40 CFR § 146.13 for Non-Hazardous Class I Wells)

The falloff testing was conducted according to the test plan submitted to and approved by the OCD. The test plan stated that all offset wells that inject into the injection interval would be shut-in for the duration of the test period. The testing consisted of a 31-hour injection period and a 36-hour falloff period. Bottom-hole gauges were also placed in the offset wells: Mewbourne Well No. 1 and Chukka Well No. 2. These wells are owned by Navajo and are also used to inject plant waste into the same injection interval as Gaines Well No. 3.

As prescribed by the guidelines, this report discusses supporting and background information for Gaines Well No. 3, the one-mile area of review (updated since the falloff testing performed on January 21-28, 2012), and geology. In addition, information on the offset wells is provided. Daily testing activities and the point of shut-in is also provided. The pressure falloff testing and analysis results are discussed in Section 15.

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: WDW-3 UICI-8-0
b. Well Classification: Class I Non-Hazardous
c. Well Name and Number: Gaines Well No. 3
d. API Number: 30-015-26575
e. Well Legal Location: 760 FSL, 2250 FWL

3. CURRENT WELLBORE SCHEMATIC

The Gaines Well No. 3 wellbore schematic is presented in Figure 1. The schematic contains data, as requested by the guidelines and includes the following:

a. Tubing: 4-1/2-inch, 11.6 pound per foot, steel construction, API grade J-55, with long thread connections (LTC).
b. Packer: Arrow X-1, 7-inch by 2-7/8-inch set in tension (37,000 pounds) at 7,575 feet.
c. Tubing Length: 7,568 feet with a 0.54-foot, 4-1/2-inch by 2-7/8-inch crossover in the top of the packer. 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 four 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. 13-3/8-inch, 54.5 pound per foot, steel construction, API grade J-55, with short thread connections (STC), set at a depth of 400 feet. The casing was cemented to the surface with 425 sacks of cement. The casing was set in

open hole with a diameter of 17.5 inches. This information was obtained from OCD records.

ii. 9-5/8-inch, 36 pound per foot, steel construction, API grade J-55, STC, set at a depth of 2,600 feet. The casing was cemented to the surface with 1,025 sacks of cement. The casing was set in open hole with a diameter of 12.25 inches. This information was obtained from OCD records.

iii. 7-inch, 26 pound per foot and 29 pound per foot, steel construction, API grade N-80 and P-110, STC, set at a depth of 9,450 feet. The casing was cemented with 1,350 sacks of cement to 900 feet from surface. The casing was set in open hole with a diameter of 8.75 inches. The top cement and weight of the pipe was verified with a CBL and caliper log run on October 13, 2006. The remainder of the information was obtained from OCD records.

iv. Below the cement plug at 9,022 feet is the top of a 4-1/2-inch liner. The liner is a string of 4-1/2-inch casing installed to a depth of 10,119 feet. There is a cast iron bridge plug set in the liner at 9,800 feet, which is above the original perforations, between 9,861 feet and 9,967 feet. The current injection interval is above the plug at 9,022 feet. The cement plug also isolates the lower section of the original wellbore. This information was obtained from OCD records.

e. The top of cement was determined from a CBL run in the 7-inch casing string on October 13, 2006. The top of cement in the 7-inch casing was found at 900 feet below the surface. The top of cement in the 9-5/8-inch and 13-3/8-inch casing strings was verified through OCD records and volume calculations.

f. The 7-inch casing was perforated on October 14 and October 15, 2006. The casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,660 feet and 8,450 feet and from 8,540 feet to 8,620 feet.

g. The total depth of the well is 10,119 feet with the plug back depth at 9,022 feet. On November 25, 2012, fill was tagged at 8,972 feet.

h. The bottom-hole pressure gauges consisted of two memory readout (MRO) backup pressure gauges. The MROs were placed at 7,660 feet (top of the perforations) and at 7,658 feet.

4. ELECTRIC LOG ENCOMPASSING THE COMPLETED INTERVAL

The dual induction log is presented in Appendix A and encompasses the completed interval between 7,660 feet and 8,620 feet. The dual induction log was submitted to the OCD with the original permit after the well was drilled by the Mewbourne Oil 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 in Appendix B and encompasses the completed interval between 7,660 feet and 8,620 feet. The neutron density log was submitted to the OCD with the original permit after the well was drilled by Mewbourne Oil Company. The log was resubmitted to the OCD when the well was re-permitted as a Class I injection well. The 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 Gaines Well No. 3 was recompleted in October 2006, prior to the issuance of the current well testing guidelines (December 3, 2007). At the time, no directives were in place to test formation fluids or derive formation characteristics from cores. However, reservoir fluid samples were obtained and the density and 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 2.9×10^{-6} psi^{-1}. The formation pore volume compressibility was estimated using Appendix D (Figure G.5 SPE Monograph 1). This value was 5.5×10^{-6} psi^{-1}. The total system compressibility is the sum of the fluid compressibility and the pore volume compressibility, 8.4×10^{-6} psi^{-1}. The temperature used with the correlations was recorded during the temperature survey conducted in the Gaines Well No. 3 on October 13, 2006, and included in this report as Appendix E.

b. Formation Fluid Viscosity with Reference Temperature:

The formation fluid had a 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 2.9×10^{-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 well as of November 21, 2012, was 2,785,671,081 gallons. The volume of fluid injected into the Mewbourne Well No. 1 was 1,476,423,515 gallons. The volume of fluid injected into the Chukka Well No. 2 was 901,814,426 gallons. The volume of fluid injected into the Gaines Well No. 3 was 407,433,140 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 Gaines Well No. 3 buildup and falloff testing. The upper gauge was used as a backup gauge. The downhole MRO gauges were set at 7,658 feet and 7,660 feet. Bottom-hole MRO pressure gauges were also placed in each of the offset wells (Mewbourne Well No. 1 and Chukka Well No. 2). The pressure gauges were set at 7,924 feet in the Mewbourne Well No. 1 and at 7,570 feet in the Chukka Well No. 2.

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

In the Gaines Well No. 3, 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. 76222 and 75900) 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. 3. Both gauges were sapphire crystal gauges with Serial Nos. 76120 and 76077. Both gauges were manufactured by Spartek Systems.

In the Chukka Well No. 2, two MRO pressure gauges were used to monitor the bottom-hole pressure and temperature during the testing of the Gaines Well No. 3. Both gauges were sapphire crystal gauges with Serial Nos. 76171 and 76404. Both gauges were manufactured by Spartek Systems.

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

In Gaines Well No. 3, the MRO pressure gauges, Serial Nos. 76222 and 75900, has 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. 76120 and 76077, 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 Chukka Well No. 2, the MRO pressure gauges, Serial Nos. 76171 and 76404 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 2012, 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 2011 report.

No new fresh water wells were reported within the search area since the submittal of the 2011 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 XIII 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.

Twenty-eight (28) wells were found in which the owner had changed. One (1) new plugged and abandoned oil and gas well was found. Two wells were placed in temporarily abandoned status. Four (4) wells were found that were returned to production status. Six (6) wells were found that had been recompleted.

There were twenty-nine (29) 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 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. Chukka Well No. 2 is listed at ID No. 120 in Table II and no changes have occurred to this well. The wellbore schematics for the Mewbourne Well No. 1 and Chukka Well No. 2 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., pinch outs, 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 Chukka Well No. 2. 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 7,900 feet from Gaines Well No. 3, the test well. The Chukka Well No. 2 is approximately 3,130 feet from the Gaines Well No. 3.

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 Chukka Well No. 2 were shut-in during the buildup and falloff portions of the testing. Bottom-hole pressure gauges were lowered into each well approximately 48 hours before shutting in the Gaines Well No. 3. The bottom-hole pressure and temperature data are graphically depicted in Figure 2 for the Mewbourne Well No. 1 and Figure 5 for the Chukka Well No. 2.

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

The offset wells were shut in prior to beginning the 31-hour injection period and remained shut-in during the 36 hour falloff portion of the testing.

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 bottomhole gauges were placed into the wells on November 20, 2012, and the 48 hour injection monitoring period portion of the testing started on November 20, 2012, at 12:17 p.m. and continued until November 22, 2012, at 12:19 p.m. On November 22, 2012, at 12:19 p.m. the Mewbourne Well No. 1 and Chukka Well No. 2 were shut-in and the 31 hour buildup portion for Gaines Well No. 3 was started. The buildup portion of the testing ended at 07:28 p.m. on November 23, 2012, and Gaines Well No. 3 was shut-in with both of the offset wells remaining shut-in for the duration of the 36 hour falloff portion of the testing. The falloff test ended on November 25, 2012 at 07:30 a.m. On November 25, 2012 at 07:30 a.m., seven-minute gradient stops were made while pulling out of the wellbore with the pressure gauges. At 11:00 a.m., on

November 25, 2012, all wells were turned over to Navajo plant operations personnel.

b. Time of the injection period:

The buildup portion of the testing began on November 20, 2012, when the injection rate was set at an average injection rate of 186 gallons per minute (gpm). The injection rate was held constant for 6.48 hours. The injection period used in the pressure falloff analysis was 7,186 hours, which includes the total volume since the last falloff test.

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 31-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 3,994.72 psia and 93.22°F, respectively.

e. Total shut-in time:

The Gaines Well No. 3 was shut-in for a total of 36.17 hours.

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

The final static pressure at 7660 feet was 3,944.78 psia. The final temperature was 102.19 °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 Gaines Well No. 3, there are two, 4-inch motor controlled valves installed on the incoming pipeline before the pod filters. Two 4-inch valves are installed between the pod filters and the wellhead. There is one, 6-inch valve installed in the main line between the pod filters and the wellhead. A 4-1/16-inch wing valve is installed on the wellhead. 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.

15. PRESSURE FALLOFF ANALYSIS

The following discussion of the analysis of the pressure data recorded during the falloff testing of the Gaines Well No. 3 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 (304 days) since the January 21-28, 2012 falloff testing. 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 (36 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 0.020 hours. Radial flow begins at an elapsed shut in time of 4.65 hours and continues until 7.15 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 187.64 and continues until a Horner time of 129.26, 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 3.18364 psi/cycle (OCD Guideline Section IX.15.c). The measured injection rate prior to shut in was 6,378.07 bbl/day (186.03 gpm).

An estimate of mobility-thickness (transmissibility, OCD Guideline Section IX.15.d), kh/μ, for the reservoir was determined to be 325,751 md-ft/cp from the following equation:

$$\frac{kh}{\mu} = 162.6\,\frac{qB}{m}$$

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

$$\frac{kh}{\mu} = 162.6\,\frac{(6{,}378.07)(1.0)}{(3.18364)}$$

$$= 325{,}751$$

The permeability-thickness (flow capacity, OCD Guideline Section IX.15.i), kh, was determined to be 185,678 md-ft by multiplying the mobility-thickness, kh/μ, by the viscosity of the formation fluid (see Section 6), μ,of 0.57 centipoise:

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

$$= 325,751 \text{ x } 0.57$$

$$= 185,678 \text{ md} - \text{ft}$$

The reservoir permeability (OCD Guideline Section IX.15.e) using the total thickness (see Section 5 and Section 11) of 175 feet was 1,061 md:

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

$$= \frac{185,678}{175}$$

$$= 1,061 \text{ md}$$

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 408,256,644 gallons of waste has been injected into Gaines Well No. 3 (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 996 feet:

$$r_{waste} = \left(\frac{(0.13368)(408,256,644)}{(\pi)(175)(0.10)} \right)^{1/2}$$

$$= 996 \ feet$$

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

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

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 0.42 hours:

$$t_{waste} = 948\frac{(0.10)(0.57)(8.4x10^{-6})(996)^2}{1{,}061}$$

$$= 0.42$$

Since the time required to pass through the waste is less than the 4.95 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:

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

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 3,994.72 psia. The pressure determined by extrapolating the radial flow semi-log line to a Δt of one hour, p_{1hr}, was 3,950.50 psia (calculated from the analysis software). The wellbore radius, r_w, is 0.3246 feet (completion records). Using these values in addition to the previously discussed parameters results in a skin of:

$$s = 1.151\left[\left[\frac{3{,}994.72 - 3{,}950.50}{3.18364}\right] - \log\left(\frac{1{,}061}{(0.10)(0.57)\left(8.4x10^{-6}\right)(0.3246)^2}\right) + 3.23\right]$$

$$= 7.82$$

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 21.6 psi:

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

$$= 0.869\,(3.18364)\,(7.82)$$

$$= 21.6\ psi$$

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
Δp_{skin}	=	pressure change due to skin damage

Using the previously determined parameters, the flow efficiency was calculated to be 0.57:

$$E = \frac{3{,}994.72 - 21.6 - 3{,}944.78}{3{,}994.72 - 3{,}944.78}$$

$$= 0.57$$

The radius of investigation (OCD Guideline Section IX.15.a) was calculated using the analysis software and was determined to be 8,210 feet at an elapsed shut in time of 36.17 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 = constant

$$0.029\sqrt{\frac{1{,}061(36.17)}{0.10(0.57)\left(8.4x10^{-6}\right)}}$$

$R_{inv} = 8{,}210\ ft$

As indicated on Figure 14, the pressure data departs the radial flow region at an elapsed time from shut in of 7.15 hours. Another change in slope is seen at an elapsed time from shut in of 14.06 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 Gaines Well No. 3 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. The pressure and rate data used in the Hall plot analysis was obtained from (September 23, 2012 to October 22, 2012). Data after October 22, 2012 had unrealistic values at several data points, this appeared to be a wireless communication interference glitch in the gathering system.

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 November 25. 2012, a static pressure gradient survey was conducted while pulling the pressure gauges out of the well. Static gradient stops were conducted at 7,660 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 7,660 feet, was measured after the well had been shut-in for 2 days and was 3,944.78 psia and

102.19 °F, respectively. The gradient survey is summarized in Table XI. The data are depicted graphically in Figure 18.

16. 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	Mewbourne 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

TABLE II
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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
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
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

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
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
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

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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
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
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

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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
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	S90E	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
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

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
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
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	7355	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

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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
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
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	30-015-40187	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	

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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
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	O			
993	30-015-32307	4	1	18S	27E	330N	990W	AAO FEDERAL NO. 1	APACHE CORPORATION	O		PERMIT TO DRILL	
994	30-015-32959	E	1	18S	27E	1650N	875W	AAO FEDERAL NO. 5	APACHE CORPORATION	O		PERMIT TO DRILL	
995	30-015-33473	G	1	18S	27E	1750N	1650E	AAO FEDERAL NO. 7	APACHE CORPORATION	O		PERMIT TO DRILL	
996	30-015-33784	H	1	18S	27E	1650N	330E	AAO FEDERAL NO. 8	APACHE CORPORATION	O		PERMIT TO DRILL	
997	30-015-34071	F	1	18S	27E	2169N	1963W	AAO FEDERAL NO. 6	APACHE CORPORATION	O		PERMIT TO DRILL	
998	30-015-34555	M	1	18S	27E	890S	660W	AAO FEDERAL NO. 11	APACHE CORPORATION	O		PERMIT TO DRILL	
999	30-015-34576	K	1	18S	27E	2060S	2160W	AAO FEDERAL NO. 10	APACHE CORPORATION	O		PERMIT TO DRILL	
1000	30-015-00735	K	2	18S	27E	1980S	1830W	EMPIRE ABO UNIT NO. 14B	APACHE CORPORATION	O		PERMIT TO DRILL	
1001	30-015-22777	M	2	18S	27E	10S	640W	EMPIRE ABO UNIT NO. 134	APACHE CORPORATION	O		PERMIT TO DRILL	
1002	30-015-22824	M	2	18S	27E	800S	950W	EMPIRE ABO UNIT NO. 133	APACHE CORPORATION	O		PERMIT TO DRILL	
1003	30-015-22952	K	2	18S	27E	1310S	1400W	EMPIRE ABO UNIT NO. 142A	APACHE CORPORATION	O		PERMIT TO DRILL	
1004	30-015-39956	G	36	17S	27E	2176N	1858E	KIOWA STATE NO. 8	COG OPERATING, LLC	O		ACTIVE	4/30/2012
1005	30-015-40428	M	36	17S	27E	200S	485W	BIG BOY STATE NO. 2	COG OPERATING, LLC	O		PERMIT TO DRILL	
1006	30-015-40429	M	36	17S	27E	492S	806W	BIG BOY STATE NO. 4	COG OPERATING, LLC	O		PERMIT TO DRILL	
1007	30-015-39898	A	1	18S	27E	1258E	1005E	EMPIRE ABO UNIT NO. 412	APACHE CORPORATION	O		PERMIT TO DRILL	
1008	30-015-39899	3	1	18S	27E	1305N	2535W	EMPIRE ABO UNIT NO. 413	APACHE CORPORATION	O		PERMIT TO DRILL	
1009	30-015-39900	4	1	18S	27E	1120N	1205W	EMPIRE ABO UNIT NO. 414	APACHE CORPORATION	O		PERMIT TO DRILL	
1011	30-015-36564	O	30	17S	28E	330S	2210E	STALEY STATE NO. 9	LRE OPERATING, LLC	O		ACTIVE	5/5/2009
1012	30-015-37673	N	30	17S	28E	330S	1650W	STALEY STATE NO. 12	LRE OPERATING, LLC	O		ACTIVE	7/7/2010
1013	30-015-38203	P	30	17S	28E	330S	990W	MAPLE STATE NO. 8	COG OPERATING LLC	O		PERMIT TO DRILL	
1014	30-015-40026	N	30	17S	28E	330S	2410W	STALEY STATE No. 17	LRE OPERATING, LLC	O		ACTIVE	4/4/2012
1015	30-015-39011	O	31	17S	28E	11905	1320E	EMPIRE ABO UNIT NO. 419	APACHE CORPORATION	O		T/A	11/7/2011
1016	30-015-39020	O	31	17S	28E	140S	2560E	EMPIRE ABO UNIT NO. 408	APACHE CORPORATION	O		ACTIVE	11/9/2011
1017	30-015-40257	D	31	17S	28E	184N	257W	BIG GIRL 31 STATE NO. 1	COG OPERATING, LLC	O		PERMIT TO DRILL	
1018	30-015-40258	D	31	17S	28E	195N	990W	BIG GIRL 31 STATE NO. 2	COG OPERATING, LLC	O		PERMIT TO DRILL	
1019	30-015-40259	G	31	17S	28E	2160N	2310E	BIG GIRL 31 STATE NO. 5	COG OPERATING, LLC	O		PERMIT TO DRILL	
1020	30-015-40260	D	31	17S	28E	1155N	990W	BIG GIRL 31 STATE NO. 7	COG OPERATING, LLC	O		PERMIT TO DRILL	
1021	30-015-40409	L	31	17S	28E	1920S	330W	BIG GIRL 31 STATE NO. 9H	COG OPERATING, LLC	O		PERMIT TO DRILL	
1022	30-015-40410	M	31	17S	28E	615S	10W	BIG GIRL 31 STATE NO. 11H	COG OPERATING, LLC	O		PERMIT TO DRILL	
1023	30-015-39927	K	32	17S	28E	17505	1765W	AA STATE NO. 2	APACHE CORPORATION	O		PERMIT TO DRILL	
1024	30-015-40339	D	32	17S	28E	990N	330W	ENRON STATE No. 18	LRE OPERATING, LLC	O		PERMIT TO DRILL	

TABLE III

Well Changes in the Combined One Mile Area of Review Since the 2011 Annual Report for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes	Change of Owner	P&A	T&A	Prod	Recomp	New	Total
5	30 015 00690	G	36	17S	27E	1830 FNL & 2205 FEL	Conklin #2	G & C Service	Recompletion: Install 4-1/2" liner to 480 ft and cement in place with 100 sks. Well is back in production					1		
6	30 015 00667	G	36	17S	27E	2310FNL & 2310 FEL	South Red lake Grayburg Unit #01	Legacy Reserves Operating LP	Changed owner from Fairway Resources Operating Inc to Legacy Reserves Operating LP	1						
47	30 015 10833	I	31	17S	28E	1980 FSL & 660 FEL	Northwest Artesia Unit No. 10	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
61	30 015 20042	O	31	17S	28E	990 FSL & 660 FEL	Northwest Artesia Unit No. 11	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
70	30 015 20043	M	32	17S	28E	990 FSL & 760 FWL	Northwest Artesia Unit No. 12	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
82	30 015 02602	F	05	18S	28E	1650 FNL & 1650 FWL	Empire Abo Unit No. 026D	Apache Corporation	Recompletion: Added perforations in Upper Abo formation at 5969'-5980', 6018'-6030', 6080'-6095' with 2 SPF and acidized.					1		
83	30 015 25522	L	05	18S	28E	2240 FSL & 400 FWL	Walter Solt State No. 001	Walter Solt, LLC	Changed to production 9/20/11. This is a SWD well. Perfs from 7518' to 7812'				1			
87	30 015 20019	A	06	18S	28E	330 FNL & 330 FEL	Northwest Artesia Unit No. 16	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
355	30 015 00676	M	36	17S	27E	330 FNL & 990 FWL	Empire Abo unit # 17	Apache Corporation	Recompletion: Perforate Abo shale at 5330'-5332', 5380'-5382',5430'-5432' with 4 SPF, frac the new perfs,					1		
765	30 015 00724	1	02	18S	27E	990 FNL & 330 FEL	Empira Abo Unit No. 16B	Apache Corporation	Recompletion: Perforate Abo shale at 5444'-5446',5480'-5482',5512'-5514', 5290'-5292', 5340'-5342',5392'-5394' with 4 SPF acidize and frac.					1		
797	30 015 22885	O	02	18S	27E	1040 FSL & 2025 FEL	Empire Abo Unit No. 155	Apache Corporation	Recompletion: Perforate Abo shale at 5795'-8505', 5811'-5816', 5860'-5869', 5890'-5900', 5909'-5920', 5950'-5955' with 2 SPF and 120 deg phasing and acidize perfs. Well placed back into T&A status.					1		
814	30 015 22051	K	02	18S	27E	1370 FSL & 2445 FWL	Empire Abo Unit No. 141A	Apache Corporation	P&A: set CIBP at 5625 ft and fill wellbore with cement.		1	1		1		
911	30 015 31123	H	36	17S	27E	1980 FNL & 760 FEL	No Bluff 36 State Com #2	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
917	30 015 30784	A	31	17S	28E	330 FNL & 480 FEL	NW State No. 12	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
918	30 015 30893	A	31	17S	28E	973 FNL & 959 FEL	NW State No. 28	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
919	30 015 32162	D	31	17S	28E	460 FNL & 990 FWL	Enron State No. 4	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
920	30 015 30783	H	31	17S	28E	1650 FNL & 330 FEL	NW State No. 11	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
921	30 015 30849	I	31	17S	28E	2310 FSL & 270 FEL	NW State No. 9	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
922	30 015 30760	P	31	17S	28E	735 FSL & 330 FEL	NW State No. 10	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
923	30 015 31920	D	32	17S	28E	990 FNL & 990 FWL	Enron State No. 2	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC. Recompletion: Perforations in the Glorieta/Yeso at 3350'-3765' with 47 holes.	1				1		
924	30 015 30781	K	32	17S	28E	1900 FSL & 2146 FWL	NW State No. 5	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
925	30 015 30777	L	32	17S	28E	2310 FSL & 990 FWL	NW State No. 6	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
926	30 015 30685	M	32	17S	28E	990 FSL & 990 FWL	NW State No. 7	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
927	30 015 30815	N	32	17S	28E	1090 FSL & 2126 FWL	NW State No. 8	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
938	30 015 30785	A	06	18S	28E	430 FNL & 330 FEL	NW State #015	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
954	30 015 35050	D	32	17S	28E	330 FNL & 500 FWL	Enron State No. 12	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
961	30 015 36978	D	31	17S	28E	990 FNL & 330 FWL	Enron State No. 15	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
962	30 015 36554	L	32	17S	28E	1770 FSL & 550 FWL	NW State No. 29	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
963	30 015 36989	K	32	17S	28E	1630 FSL & 1710 FWL	NW State No. 30	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
964	30 015 37057	N	32	17S	28E	330 FSL & 1750 FWL	NW State No. 31	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
965	30 015 37058	M	32	17S	28E	330 FSL & 330 FWL	NW State No. 32	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1						
967	30 015 38420	M	36	17S	27E	840 FSL & 425 FWL	Kiowa State No. 3	Cog Operating LLC	NEW: Drilled to TD of 4873',perforated at 3770'-4020', 4080'-4330', 4390'-4640' all at 1 SPF and in the Yeso formation. Completed on 11/11/11						1	
969	30 015 39321	M	36	17S	27E	990 FSL & 890 FWL	Big Boy State No. 1	Cog Operating LLC	NEW: Drilled to TD of 5030', perforations at 3755'-3980', 4040'-4290', 4350'-4600' 1 SPF in Yeso formation. Completed on 12/19/11						1	
970	30 015 39322	M	36	17S	27E	840 FSL & 425 FWL	Big Boy State No. 3	Cog Operating LLC	NEW: Drilled to TD of 5015', perforations at 3740'-3990', 4050'-4300',4360'-4610' 1 SPF in Yeso formation. Completed on 1/10/12						1	
971	30 015 39323	O	36	17S	27E	870 FSL & 1560 FEL	Big Boy State No. 5	Cog Operating LLC	NEW: Drilled to TD of 4953', perforations at 4375'-4600', 4090'-4315', 3805'-4030', 3410'-3660' 1 SPF in Yeso formation. Completed on 5-21-12.						1	
972	30 015 39324	O	36	17S	27E	480 FSL & 2210 FEL	Big Boy State No. 6	Cog Operating LLC	NEW: Drilled to TD of 5072', perforations at 3430'-3680', 3780'-4030', 4090'-4340',4400'-4650' 1 SPF in Yeso formation. Completed on 1-19-12						1	
973	30 015 39325	O	36	17S	27E	990 FSL & 2210 FEL	Big Boy State No. 7	Cog Operating LLC	NEW: Drilled to TD of 5120', perforations at 3360'-3615', 3795'-4020', 4080'-4305',4365'-4590' 1 SPF in Yeso formation. Completed on 1-30-12						1	

TABLE III

Well Changes in the Combined One Mile Area of Review Since the 2011 Annual Report for Navajo's WDW-1, WDW-2, and WDW-3

ID	API No.	Unit	Sect	Town	Range	Footages	Well Name	Operator	Changes	Change of Owner	P&A	T&A	Prod	Recomp	New	Total
975	30 015 39401	P	36	17S	27E	1110 FSL & 630 FEL	Empire Abo Unit No. 417	Apache Corp	NEW: Drilled to TD of 6300', perforations at 5734'-5831' 2 SPF in Abo formation. Completed on 3-21-12						1	
976	30 015 39009	G	02	18S	27E	1650 FNL & 2430 FEL	Empire Abo Unit No. 415	Apache Corp	NEW: Drilled to TD to 6300', perforations at 5386'-5700' 2 SPF in Abo formation. Completed on 1-17-12						1	
977	30 015 39066	E	02	18S	27E	2420 FNL & 185 FWL	Empire Abo Unit No. 416	Apache Corp	NEW: Permit to Drill, changed surface hole location.						1	
981	30 015 38512	D	31	17S	28E	990 FNL & 940 FWL	Enron State No. 16	LRE Operating, LLC	Changed to production on 10/2/2011. Perfs at 3215'-3543'. Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1			1			
985	30 015 38513	J	32	17S	28E	2310 FSL & 2032 FEL	Jeffer 32 State No. 3	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC	1					1	
986	30 015 39006	J	32	17S	28E	2400 FSL & 2450 FEL	Empire Abo Unit No. 407	Apache Corp	Changed to production on 12/17/2011. Perfs at 5836'-6030' in Abo Formation				1		1	
990	30 015 39021	D	06	18S	28E	40 FNL & 145 FWL	Empire Abo Unit No. 411	Apache Corp	New drill. Changed to production. Perforations in th Abo at 5774'-5938' (2 SPF, 188 holes). Started production on 1/14/2012.				1			
1004	30 015 39956	G	36	17S	27E	2176 FNL & 1858 FEL	Kiowa State No. 8	Coq Operating LLC	NEW: Drilled to TD of 4900', perforations at 3260'-3510', 3765'-3990', 4050'-4300', 4360'-4610' 1 SPF in Yeso formation. Completed on 4-30-12						1	
1005	30 015 40428	M	36	17S	27E	200 FSL & 485 FWL	Big Boy State No. 2	Coq Operating LLC	NEW: Permit To Drill						1	
1006	30 015 40429	M	36	17S	27E	492 FSL & 806 FWL	Big Boy State No. 4	Coq Operating LLC	NEW: Permit To Drill						1	
1007	30 015 39898	A	01	18S	27E	1258 FNL & 1005 FEL	Empire Abo Unit No. 412	Apache Corp	NEW: Permit To Drill						1	
1008	30 015 39899	3	01	18S	27E	1305 FNL & 2535 FWL	Empire Abo Unit No. 413	Apache Corp	NEW: Permit To Drill						1	
1009	30 015 39900	4	01	18S	27E	1120 FNL & 1205 FWL	Empire Abo Unit No. 414	Apache Corp	NEW: Permit To Drill						1	
1011	30 015 36564	O	30	17S	28E	330 FSL & 2210 FEL	Staley State No. 9	LRE Operating, LLC	NEW to AOR.Perforations: 3666'-3942'. Changed operator from Lime Rock Resources to LRE Operating, LLC	1					1	
1012	30 015 37673	N	30	17S	28E	330 FSL & 1650 FWL	Staley State No. 12	LRE Operating, LLC	NEW to AOR. Perforations in Yeso: 3623'-3859', 3924'-4222', 4290'-4598'. Changed operator from Lime Rock Resources to LRE Operating, LLC	1					1	
1013	30 015 38203	M	30	17S	28E	330 FSL & 990 FWL	Maple State No. 8	Coq Operating LLC	NEW to AOR. Permit to drill.						1	
1014	30 015 40026	N	30	17S	28E	330 FSL & 2410 FWL	Staley State No. 17	LRE Operating, LLC	NEW: Drilled to TD of 5108'. Perforations in Yeso: 3318'-3574' (45 holes), 3634'-3928' (40 holes), 4013'-4280' (40 holes), 4345'-4680' (44 holes) at 2 SPF. Completed on 4-4-12.						1	
1015	30 015 39011	O	31	17S	28E	1190 FSL & 1320 FEL	Empire Abo Unit No. 419	Apache Corp	NEW to AOR: Well drilled to TD of 6310' on 11-7-11. Perforated in Abo at 5810'-5920'. Well was temporarily abandoned on 7-5-12 due to lack of production.			1			1	
1016	30 015 39020	O	31	17S	28E	140 FSL & 2560 FEL	Empire Abo Unit No. 408	Apache Corp	NEW to AOR: Well drilled to TD of 6273' on 11-9-11. Perforated in Abo at 5770'-5780', 5786', 5790', 5798'-5803', 5820'-5838', 5846'-5860', 5866'-5876', 5904'-5924', 5940'-5962', 6022'-6032' with 2 SPF and acidized.						1	
1017	30 015 40257	D	31	17S	28E	184 FNL & 257 FWL	Big Girl 31 State No. 1	Coq Operating LLC	NEW: Permit To Drill						1	
1018	30 015 40258	D	31	17S	28E	195 FNL & 990 FWL	Big Girl 31 State No. 2	Coq Operating LLC	NEW: Permit To Drill						1	
1019	30 015 40259	G	31	17S	28E	2160 FNL & 2310 FEL	Big Girl 31 State No. 5	Coq Operating LLC	NEW: Permit To Drill						1	
1020	30 015 40260	D	31	17S	28E	1155 FNL & 990 FWL	Big Girl 31 State No. 7	Coq Operating LLC	NEW: Permit To Drill						1	
1021	30 015 40409	L	31	17S	28E	1920 FSL & 330 FWL	Big Girl 31 State No. 9H	Coq Operating LLC	NEW: Permit To Drill						1	
1022	30 015 40410	M	31	17S	28E	615 FSL & 10 FWL	Big Girl 31 State No. 11H	Coq Operating LLC	NEW: Permit To Drill						1	
1023	30 015 39927	K	32	17S	28E	1750 FSL & 1765 FWL	AA State No. 2	Apache Corp	NEW: Permit To Drill						1	
1024	30 015 40339	D	32	17S	28E	990 FNL & 330 FWL	Enron State No. 18	LRE Operating, LLC	NEW: Permit To Drill						1	

TABLE IV
Wells that have been Plugged and Abandoned since the 2011 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	Change of Owner	P&A	T&A	Prod	Recomp	New	Total
814	30 015 22051	K	02	18S	27E	1370 FSL & 2445 FWL	Empire Abo Unit No. 141A	Apache Corporation	P&A: set CIBP at 5625 ft and fill wellbore with cement.		1					

TABLE V

Wells that have been Temporally Abandoned since the 2011 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	Change of Owner	P&A	T&A	Prod	Recomp	New	Total
797	30 015 22885	O	02	18S	27E	1040 FSL & 2025 FEL	Empire Abo Unit No. 155	Apache Corporation	Perforate Abo shale at 5795'-8505', 5811'-5816', 5860'-5869', 5890'-5900', 5909'-5920', 5950'-5955' with 2 SPF and 120 deg phasing and acidize perfs. Well placed back into T&A status.			1		1		
1015	30 015 39011	O	31	17S	28E	1190 FSL & 1320 FEL	Empire Abo Unit No. 419	Apache Corp	NEW to AOR: Well drilled to TD of 6310' on 11-7-11. Perforated in Abo at 5810'-5920'. Well was temporarily abandoned on 7-5-12 due to lack of production.			1			1	

TABLE VI
Wells that have been put back into Production Since the 2011 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	Change of Owner	P&A	T&A	Prod	Recomp	New	Total
981	30 015 38512	D	31	17S	28E	990 FNL & 940 FWL	Enron State No. 16	LRE Operating, LLC	Changed to production on 10/2/2011. Perfs at 3215'-3543'				1			
986	30 015 39006	J	32	17S	28E	2400 FSL & 2450 FEL	Empire Abo Unit No. 407	Apache Corp	Changed to production on 12/17/2011. Perfs at 5836'-6030' in Abo Formation				1		1	
83	30 015 25522	L	05	18S	28E	2240 FSL & 400 FWL	Walter Solt State No. 001	Walter Solt, LLC	Changed to production 9/20/11. This is a SWD well. Perfs from 7518' to 7812'				1			
990	30 015 39021	D	06	18S	28E	40 FNL & 145 FWL	Empire Abo Unit No. 411	Apache Corp	New drill. Changed to production. Perforations in th Abo at 5774'-5938' (2 SPF, 188 holes). Started production on 1/14/2012.				1			

TABLE VII
Wells that have been Recompleted in Upper Zones since the 2011 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	Change of Owner	P&A	T&A	Prod	Recomp	New	Total
355	30 015 00676	M	36	17S	27E	330 FNL & 990 FWL	Empire Abo unit # 17	Apache Corporation	Perforate Abo shale at 5330'-5332', 5380'-5382',5430'-5432' with 4 SPF, frac the new perfs,					1		
5	30 015 00690	G	36	17S	27E	1830 FNL & 2205 FEL	Conklin #2	G & C Service	Install 4-1/2" liner to 480 ft and cement in place with 100 sks. Well is back in production					1		
765	30 015 00724	1	02	18S	27E	990 FNL & 330 FEL	Empire Abo Unit No. 16B	Apache Corporation	Perforate Abo shale at 5444'-5446',5480'-5482',5512'-5514', 5290'-5292', 5340'-5342',5392'-5394' with 4 SPF acidize and frac.					1		
797	30 015 22885	O	02	18S	27E	1040 FSL & 2025 FEL	Empire Abo Unit No. 155	Apache Corporation	Perforate Abo shale at 5795'-8505', 5811'-5816', 5860'-5869', 5890'-5900', 5909'-5920', 5950'-5955' with 2 SPF and 120 deg phasing and acidize perfs. Well placed back into T&A status.			1		1		
923	30 015 31920	D	32	17S	28E	990 FNL & 990 FWL	Enron State No. 2	LRE Operating, LLC	Changed owner from Lime Rock Resources A, LP to LRE Operating, LLC. Perforations in the Glorieta/Yeso at 3350'-3765' with 47 holes.	1				1		
82	30 015 02602	F	05	18S	28E	1650 FNL & 1650 FWL	Empire Abo Unit No. 026D	Apache Corporation	Added perforations in Upper Abo formation at 5969'-5980', 6018'-6030', 6080'-6095' with 2 SPF and acidized.					1		

TABLE VIII
Newly Drilled Wells in the Area of Review since the 2011 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	Change of Owner	P&A	T&A	Prod	Recomp	New	Total
967	30 015 38420	M	36	17S	27E	840 FSL & 425 FWL	Kiowa State No. 3	Cog Operating LLC	NEW: Drilled to TD of 4873',perforated at 3770'-4020', 4080'-4330', 4390'-4640' all at 1 SPF and in the Yeso formation. Completed on 11/11/11						1	
969	30 015 39321	M	36	17S	27E	990 FSL & 890 FWL	Big Boy State No. 1	Cog Operating LLC	NEW: Drilled to TD of 5030', perforations at 3755'-3980', 4040'-4290', 4350'-4600' 1 SPF in Yeso formation. Completed on 12/19/11						1	
970	30 015 39322	M	36	17S	27E	840 FSL & 425 FWL	Big Boy State No. 3	Cog Operating LLC	NEW: Drilled to TD of 5015', perforations at 3740'-3990', 4050'-4300',4360'-4610' 1 SPF in Yeso formation. Completed on 1/10/12						1	
971	30 015 39323	O	36	17S	27E	870 FSL & 1560 FEL	Big Boy State No. 5	Cog Operating LLC	NEW: Drilled to TD of 4953', perforations at 4375'-4600', 4090'-4315', 3805'-4030', 3410'-3660' 1 SPF in Yeso formation. Completed on 5-21-12.						1	
972	30 015 39324	O	36	17S	27E	460 FSL & 2210 FEL	Big Boy State No. 6	Cog Operating LLC	NEW: Drilled to TD of 5072', perforations at 3430'-3680', 3780'-4030', 4090'-4340',4400'-4650' 1 SPF in Yeso formation. Completed on 1-19-12						1	
973	30 015 39325	O	36	17S	27E	990 FSL & 2210 FEL	Big Boy State No. 7	Cog Operating LLC	NEW: Drilled to TD of 5120', perforations at 3360'-3615', 3795'-4020', 4080'-4305',4365'-4590' 1 SPF in Yeso formation. Completed on 1-30-12						1	
975	30 015 39401	P	36	17S	27E	1110 FSL & 630 FEL	Empire Abo Unit No. 417	Apache Corp	NEW: Drilled to TD of 6300', perforations at 5734'-5831' 2 SPF in Abo formation. Completed on 3-21-12						1	
1004	30 015 39956	G	36	17S	27E	2176 FNL & 1858 FEL	Kiowa State No. 8	Cog Operating LLC	NEW: Drilled to TD of 4900', perforations at 3260'-3510', 3765'-3990', 4050'-4300', 4360'-4610' 1 SPF in Yeso formation. Completed on 4-30-12						1	
1005	30 015 40428	M	36	17S	27E	200 FSL & 485 FWL	Big Boy State No. 2	Cog Operating LLC	NEW: Permit To Drill						1	
1006	30 015 40429	M	36	17S	27E	492 FSL & 806 FWL	Big Boy State No. 4	Cog Operating LLC	NEW: Permit To Drill						1	
1007	30 015 39898	A	01	18S	27E	1258 FNL & 1005 FEL	Empire Abo Unit No. 412	Apache Corp	NEW: Permit To Drill						1	
1008	30 015 39899	3	01	18S	27E	1305 FNL & 2535 FWL	Empire Abo Unit No. 413	Apache Corp	NEW: Permit To Drill						1	
1009	30 015 39900	4	01	18S	27E	1120 FNL & 1205 FWL	Empire Abo Unit No. 414	Apache Corp	NEW: Permit To Drill						1	
976	30 015 39009	G	02	18S	27E	1650 FNL & 2430 FEL	Empire Abo Unit No. 415	Apache Corp	NEW: Drilled to TD to 6300', perforations at 5386'-5700' 2 SPF in Abo formation. Completed on 1-17-12						1	
977	30 015 39066	E	02	18S	27E	2420 FNL & 185 FWL	Empire Abo Unit No. 416	Apache Corp	NEW: Permit to Drill, changed surface hole location.						1	
1011	30 015 36564	O	30	17S	28E	330 FSL & 2210 FEL	Staley State No. 9	LRE Operating, LLC	NEW to AOR.Perforations: 3686'-3942'. Changed operator from Lime Rock Resources to LRE Operating, LLC	1					1	
1012	30 015 37673	N	30	17S	28E	330 FSL & 1650 FWL	Staley State No. 12	LRE Operating, LLC	NEW to AOR. Perforations in Yeso: 3623'-3859', 3924'-4222', 4290'-4598'. Changed operator from Lime Rock Resources to LRE Operating, LLC	1					1	
1013	30 015 38203	M	30	17S	28E	330 FSL & 990 FWL	Maple Stete No. 8	Cog Operating LLC	NEW to AOR. Permit to drill.						1	
1014	30 015 40026	N	30	17S	28E	330 FSL & 2410 FWL	Staley State No. 17	LRE Operating, LLC	NEW: Drilled to TD of 5108'. Perforations in Yeso: 3318'-3574' (45 holes), 3634'-3928' (40 holes), 4013'-4280' (40 holes), 4345'-4680' (44 holes) at 2 SPF. Completed on 4-4-12.						1	
1015	30 015 39011	O	31	17S	28E	1190 FSL & 1320 FEL	Empire Abo Unit No. 419	Apache Corp	NEW to AOR: Well drilled 11-7-11. TD at 6310'. Perforated in Abo at 5810'-5920'. Well was temporarily abandoned on 7-5-12 due to lack of production.			1			1	
1016	30 015 39020	O	31	17S	28E	140 FSL & 2560 FEL	Empire Abo Unit No. 408	Apache Corp	NEW to AOR: Well drilled to TD of 6273' on 11-9-11. Perforated in Abo at 5770'-5780', 5786', 5790', 5798'-5803', 5820'-5838', 5846'-5860', 5866'-5876', 5904'-5924', 5940'-5962', 6022'-6032' with 2 SPF and acidized.						1	
1017	30 015 40257	D	31	17S	28E	184 FNL & 257 FWL	Big Girl 31 State No. 1	Cog Operating LLC	NEW: Permit To Drill						1	
1018	30 015 40258	D	31	17S	28E	195 FNL & 990 FWL	Big Girl 31 State No. 2	Cog Operating LLC	NEW: Permit To Drill						1	
1019	30 015 40259	G	31	17S	28E	2160 FNL & 2310 FEL	Big Girl 31 State No. 5	Cog Operating LLC	NEW: Permit To Drill						1	
1020	30 015 40260	D	31	17S	28E	1155 FNL & 990 FWL	Big Girl 31 State No. 7	Cog Operating LLC	NEW: Permit To Drill						1	
1021	30 015 40409	L	31	17S	28E	1920 FSL & 330 FWL	Big Girl 31 State No. 9H	Cog Operating LLC	NEW: Permit To Drill						1	
1022	30 015 40410	M	31	17S	28E	615 FSL & 10 FWL	Big Girl 31 State No. 11H	Cog Operating LLC	NEW: Permit To Drill						1	
1023	30 015 39927	K	32	17S	28E	1750 FSL & 1765 FWL	AA State No. 2	Apache Corp	NEW: Permit To Drill						1	
1024	30 015 40339	D	32	17S	28E	990 FNL & 330 FWL	Enron State No. 18	LRE Operating, LLC	NEW: Permit To Drill						1	

TABLE IX

FIGURES INCLUDED IN THE REPORT

Figure	Description	OCD Reference
1	Gaines Well #3 Schematic	Section VI.1 and IX.3
2	Plot of Bottom Hole Pressure and Temperature Data Chukka Well #2	n/a
3	Mewbourne Well #1 Schematic	n/a
4	Chukka Well #2 Schematic	n/a
5	Plot of Bottom Hole Pressure and Temperature Data Mewbourne Well #1	n/a
6	Midland Map of One Mile Area of Review	n/a
7	Gaines Well #3 Wellhead Schematic	Section IX.14
8	Diagram of Valve Locations for Shut-in on Gaines Well #3	Section IX.14
9	Gaines Well #3 Test Overview	Section IX.18.f
10	Gaines Well #3 Cartesian Plot of Bottom-Hole Pressure and Temperature vs. Time	Section IX.18.a
11	Gaines Well #3 Cartesian Plot of Injection Rate vs. Time	Section IX.18.b
12	Gaines Well #3 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	Gaines Well #3 Derivative Log-Log Plot	Section IX.18.c
15	Gaines Well #3 Superposition Horner (Semi-Log) Plot	Section IX.18.d
16	Gaines Well #3 Expanded Superposition Horner (Semi-Log) Plot	Section IX.18.d
17	Gaines Well #3 Hall Plot	Section IX.18.h
18	Gaines Well #3 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
November 20 - 25, 2012	1,248 md	383,087 md-ft/cp	8.34	3,941.88 psia	8,972 feet
January 22 - 27, 2012	597 md	183,293 md-ft/cp	27.26	3,792.34 psia	8,986 feet
November 10 - 13, 2010	568 md	174,376 md-ft/cp	14.64	3,622.16 psia	8,986 feet
August 27 – 30, 2009	719 md	233,008 md-ft/cp	54.07	3,475.68 psia	8,986 feet
April 1 – 2, 2008	1,322 md	321,411 md-ft/cp	107	3,430.27 psia	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 – GAINES WELL #3
November 25, 2012

Depth (ft)	Pressure (psia)	Pressure Gradient (psi/ft)	Temperature (°F)
7660	3944.78	0.435	102.19
7000	3657.82	0.434	106.37
6000	3223.48	0.434	101.32
5000	2789.15	0.434	96.65
4000	2354.73	0.434	92.49
3000	1920.57	0.434	88.76
2000	1486.92	0.434	84.84
1000	1053.18	0.441	80.90
0	611.97	0.00	71.79

FIGURES

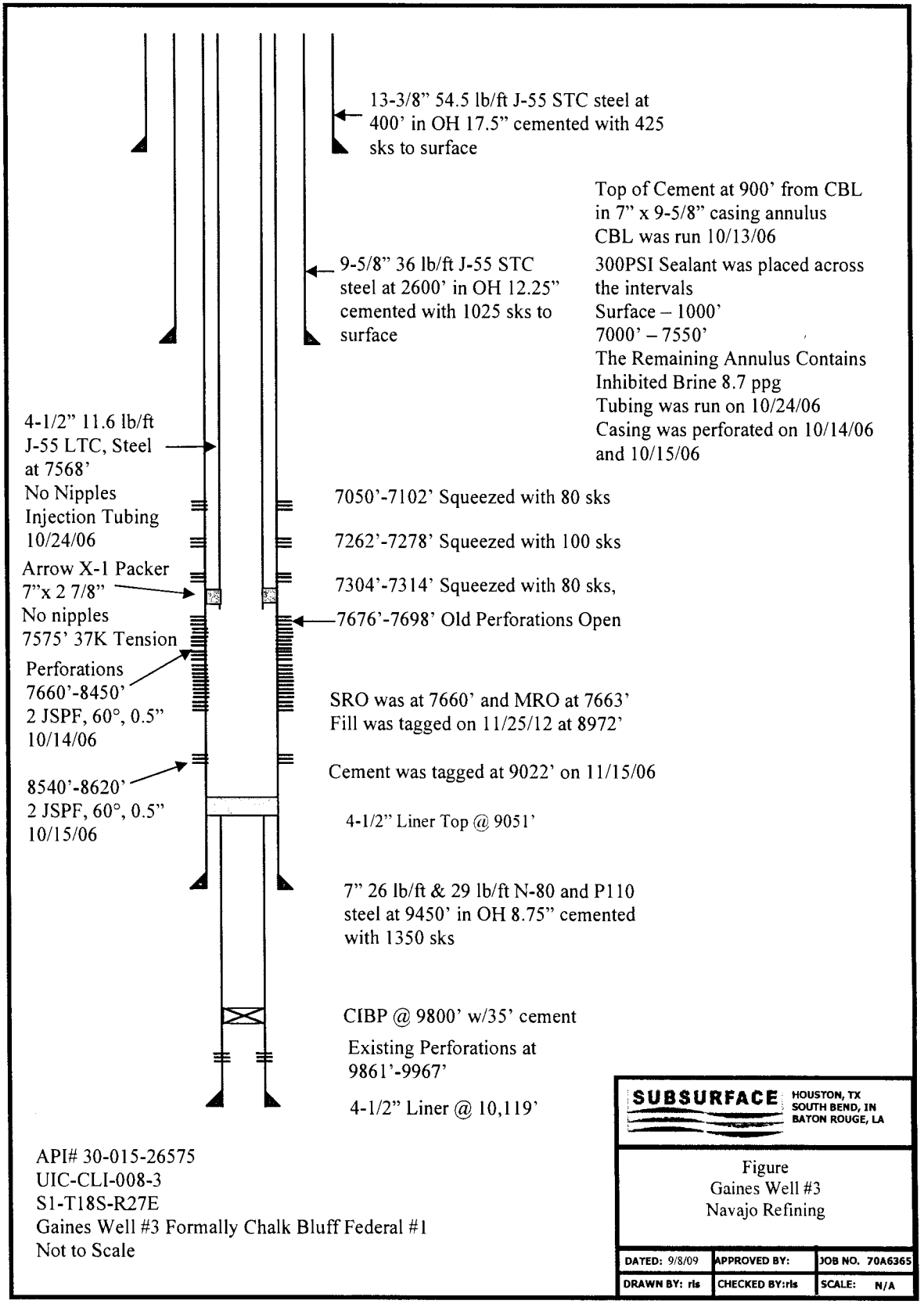

13-3/8" 54.5 lb/ft J-55 STC steel at 400' in OH 17.5" cemented with 425 sks to surface
Top of Cement at 900' from CBL in 7" x 9-5/8" casing annulus CBL was run 10/13/06
9-5/8" 36 lb/ft J-55 STC steel at 2600' in OH 12.25" cemented with 1025 sks to surface
300PSI Sealant was placed across the intervals
Surface – 1000'
7000' – 7550'
The Remaining Annulus Contains Inhibited Brine 8.7 ppg
Tubing was run on 10/24/06
Casing was perforated on 10/14/06 and 10/15/06
4-1/2" 11.6 lb/ft J-55 LTC, Steel at 7568'
No Nipples
Injection Tubing 10/24/06
7050'-7102' Squeezed with 80 sks
7262'-7278' Squeezed with 100 sks
Arrow X-1 Packer 7"x 2 7/8"
No nipples
7575' 37K Tension
7304'-7314' Squeezed with 80 sks,
7676'-7698' Old Perforations Open
Perforations 7660'-8450' 2 JSPF, 60°, 0.5" 10/14/06
SRO was at 7660' and MRO at 7663'
Fill was tagged on 11/25/12 at 8972'
Cement was tagged at 9022' on 11/15/06
8540'-8620' 2 JSPF, 60°, 0.5" 10/15/06
4-1/2" Liner Top @ 9051'
7" 26 lb/ft & 29 lb/ft N-80 and P110 steel at 9450' in OH 8.75" cemented with 1350 sks
CIBP @ 9800' w/35' cement
Existing Perforations at 9861'-9967'
4-1/2" Liner @ 10,119'
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 1

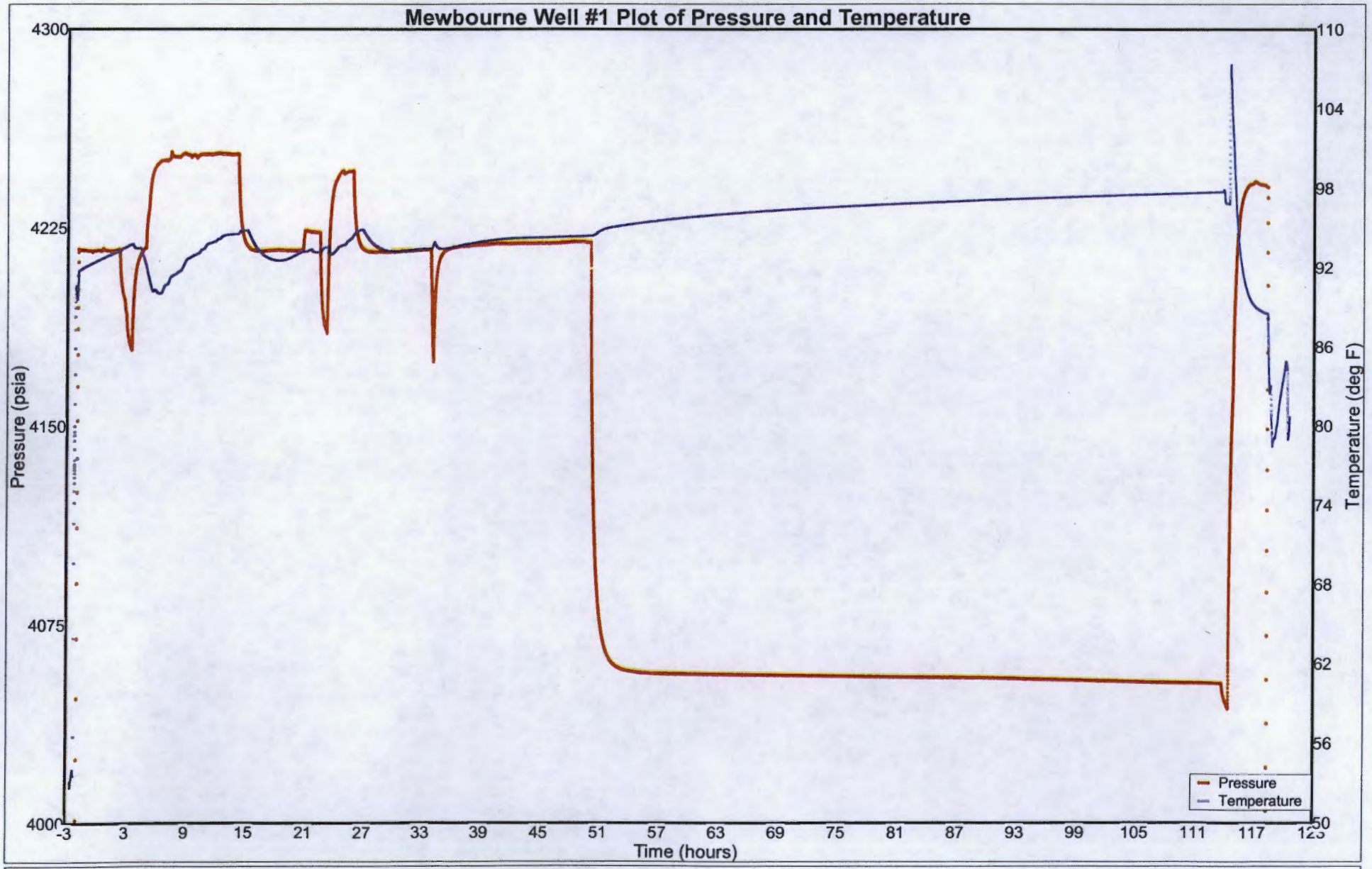
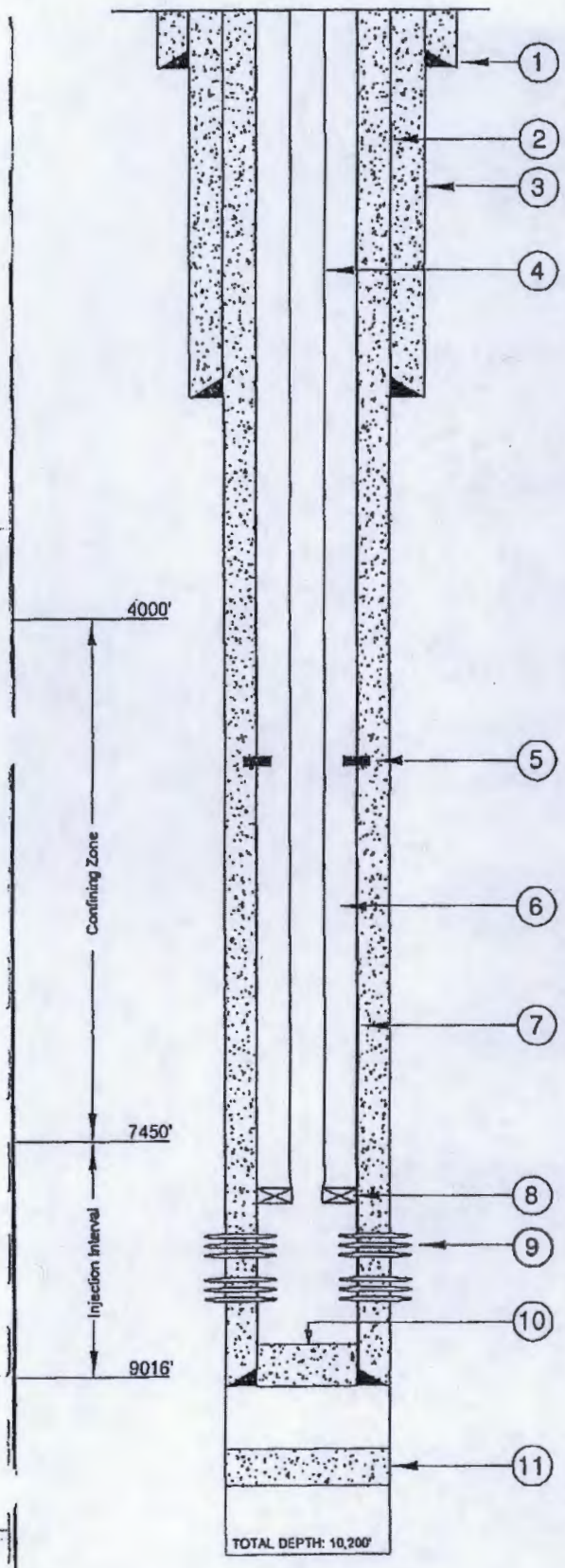

Mewbourne Well #1 Plot of Pressure and Temperature
Pressure (psia)
Temperature (deg F)
Time (hours)
4300
4225
4150
4075
4000
110
104
98
92
86
80
74
68
62
56
50
-3
3
9
15
21
27
33
39
45
51
57
63
69
75
81
87
93
99
105
111
117
123
Pressure
Temperature

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

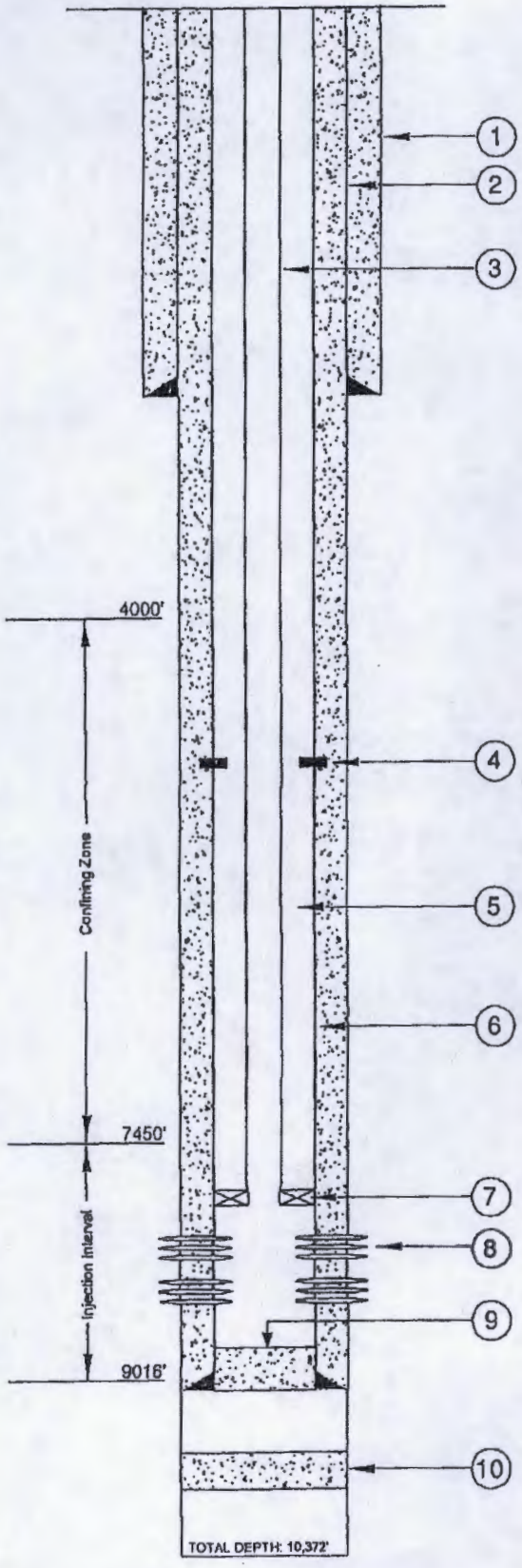
HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

BELOW GROUND DETAILS
WASTE DISPOSAL WELL NO. 1

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

FIGURE 3



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 Techni-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: 7005256
DRAWN BY: WDL	APPROVED BY:	DWG. NO:

FIGURE 4

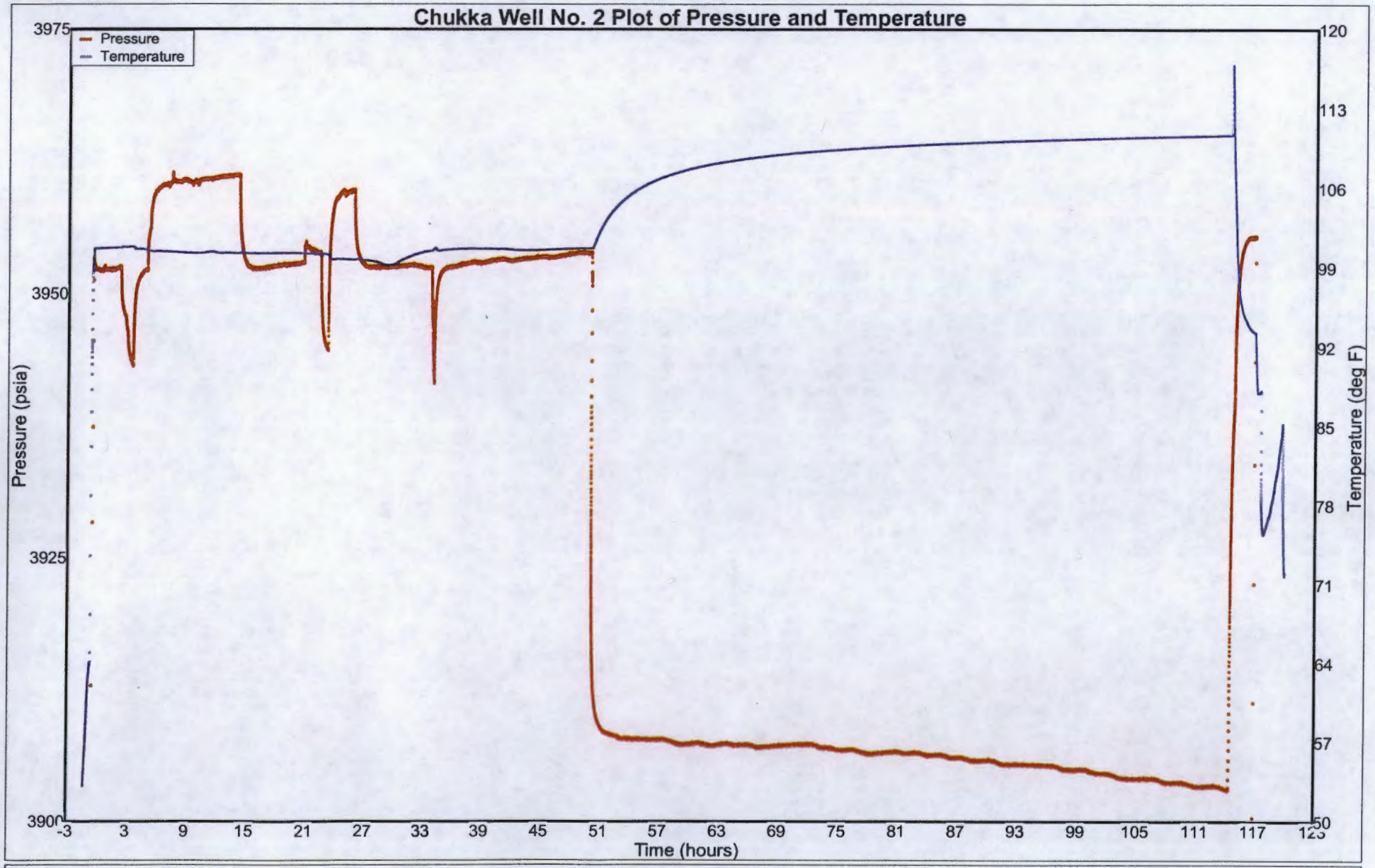
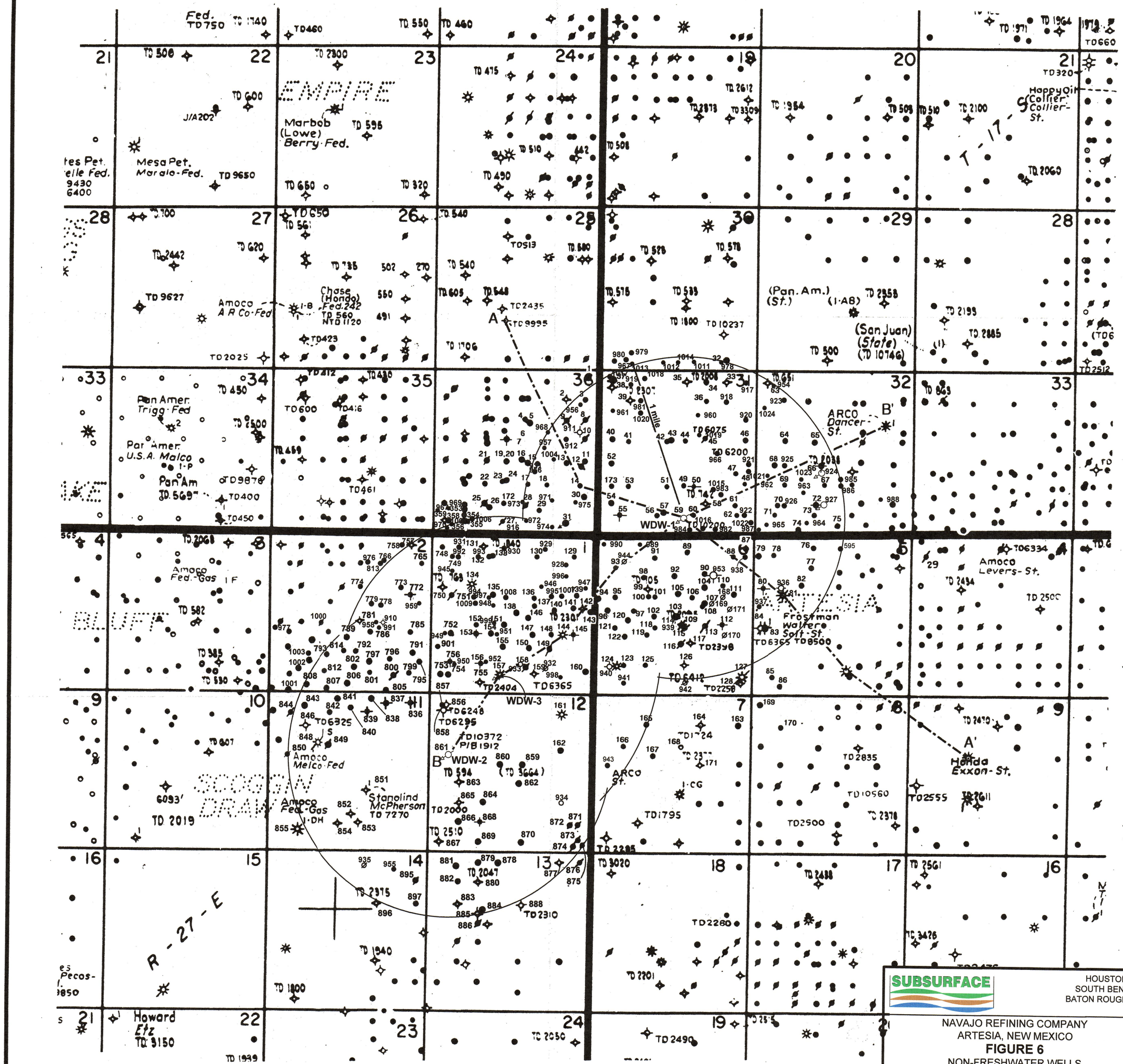

Chukka Well No. 2 Plot of Pressure and Temperature
Pressure
Temperature
Pressure (psia)
Temperature (deg F)
Time (hours)
3975
3950
3925
3900
120
113
106
99
92
85
78
71
64
57
50
-3
3
9
15
21
27
33
39
45
51
57
63
69
75
81
87
93
99
105
111
117
123

FIGURE 5



SUBSURFACE

HOUSTON, TX
SOUTH BEND, IN
BATON ROUGE, LA

NAVAJO REFINING COMPANY
ARTESIA, NEW MEXICO

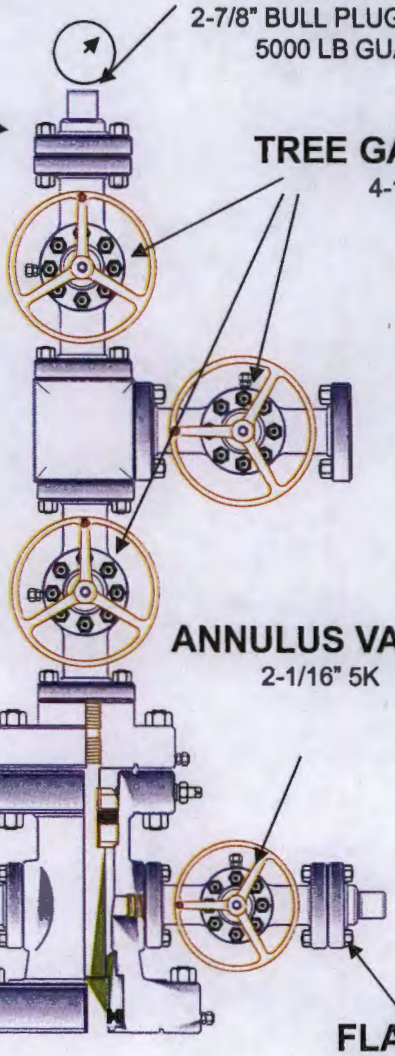
FIGURE 6

NON-FRESHWATER WELLS
IN THE AREA OF REVIEW

DATE: 12/14/12	CHECK BY: TJJ	JOB NO.: 70D6835
DRAWN BY: RLS	APPROVED BY: TJJ	DWG NO: 2012

SUBSURFACE TECHNOLOGY

WELL: NAVAJO REFINING WDW #3



TOP CONNECTION
4-1/2" EUE, 2-7/8" 8rd
2-7/8" BULL PLUG 1/2" NPT
5000 LB GUAGE

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

TREE GATE VALVES
4-1/16" 3K

UPPER TREE ASSEMBLY
A5PP,4-1/2",7-1/16" 3K X 4-1/16" 3K

ANNULUS VALVE
2-1/16" 5K

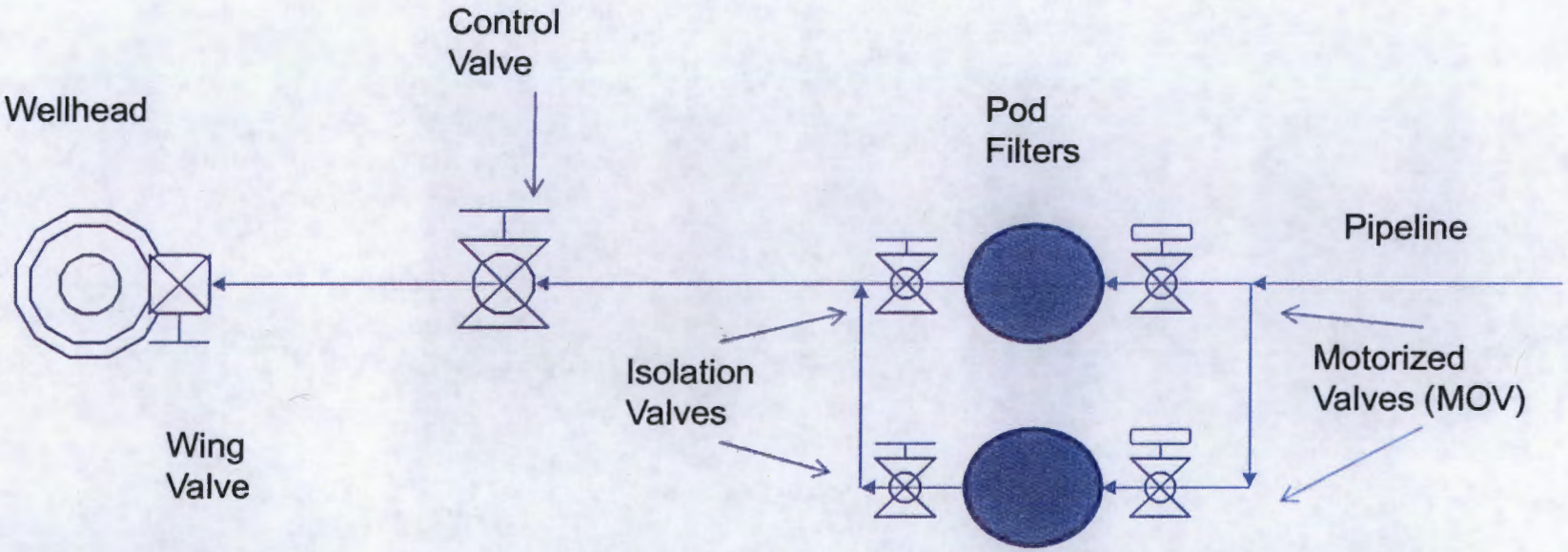
ANNULUS VALVE
2" BALL VALVE 3K

FLANGE
2-1/16" 5K X 2" LP 5K

SUPERIOR WELLHEAD

FIGURE 7

FIGURE 8
Gaines Well #3
Diagram of Shut-in Valve Control



At Shut-in
- Close MOV
- Close Wing Valve
- Close Isolation Valves
- Close Control Valve
- Drain POD Filters

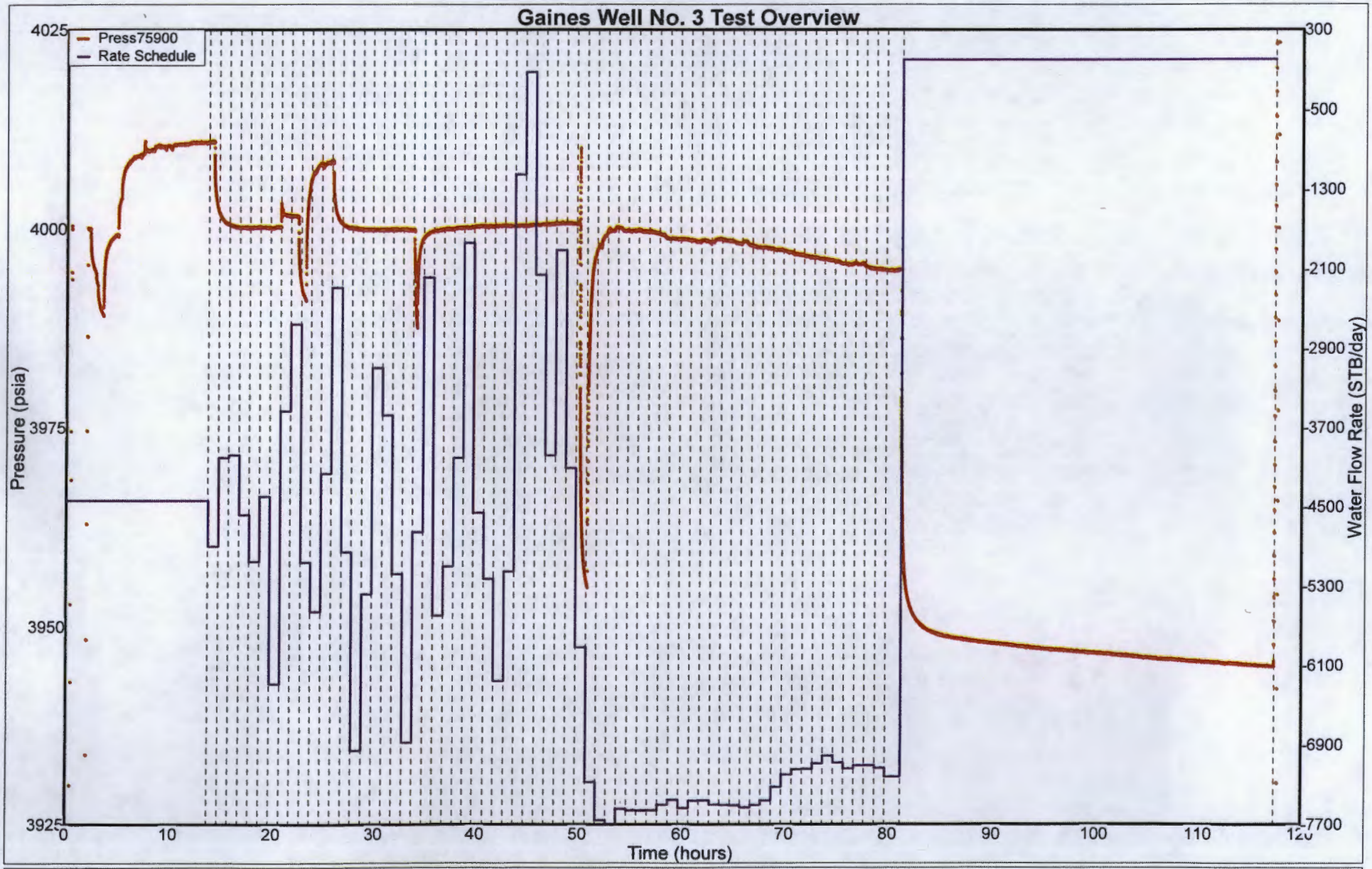

Gaines Well No. 3 Test Overview
Press75900
Rate Schedule
Pressure (psia)
Water Flow Rate (STB/day)
Time (hours)
4025
4000
3975
3950
3925
300
-500
-1300
-2100
-2900
-3700
-4500
-5300
-6100
-6900
-7700
0
10
20
30
40
50
60
70
80
90
100
110

FIGURE 9

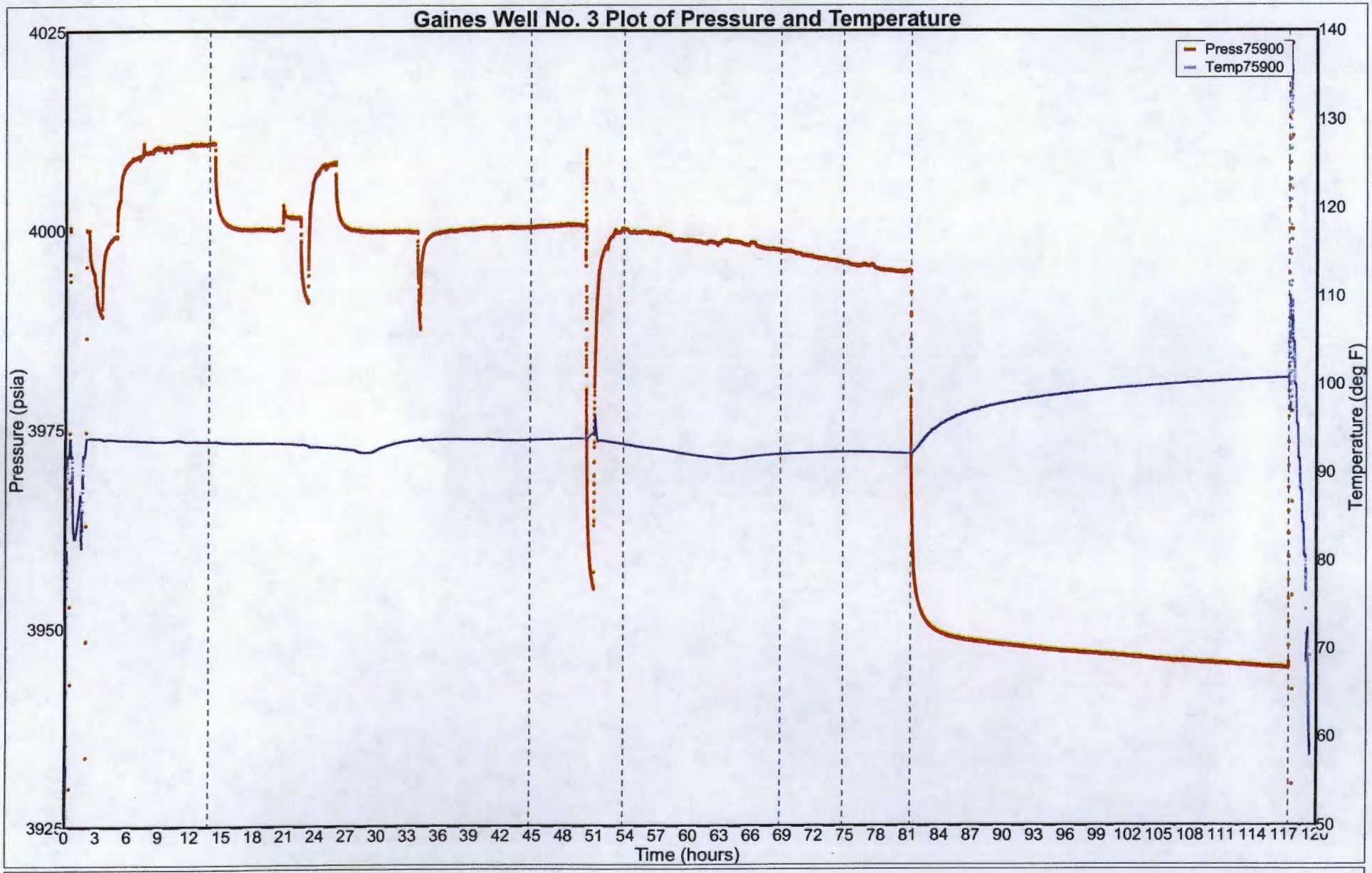

Gaines Well No. 3 Plot of Pressure and Temperature
Press75900
Temp75900
Pressure (psia)
Temperature (deg F)
Time (hours)
4025
4000
3975
3950
3925
140
130
120
110
100
90
80
70
60
50
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78 81 84 87 90 93 96 99 102 105 108 111 114 117 120

FIGURE 10

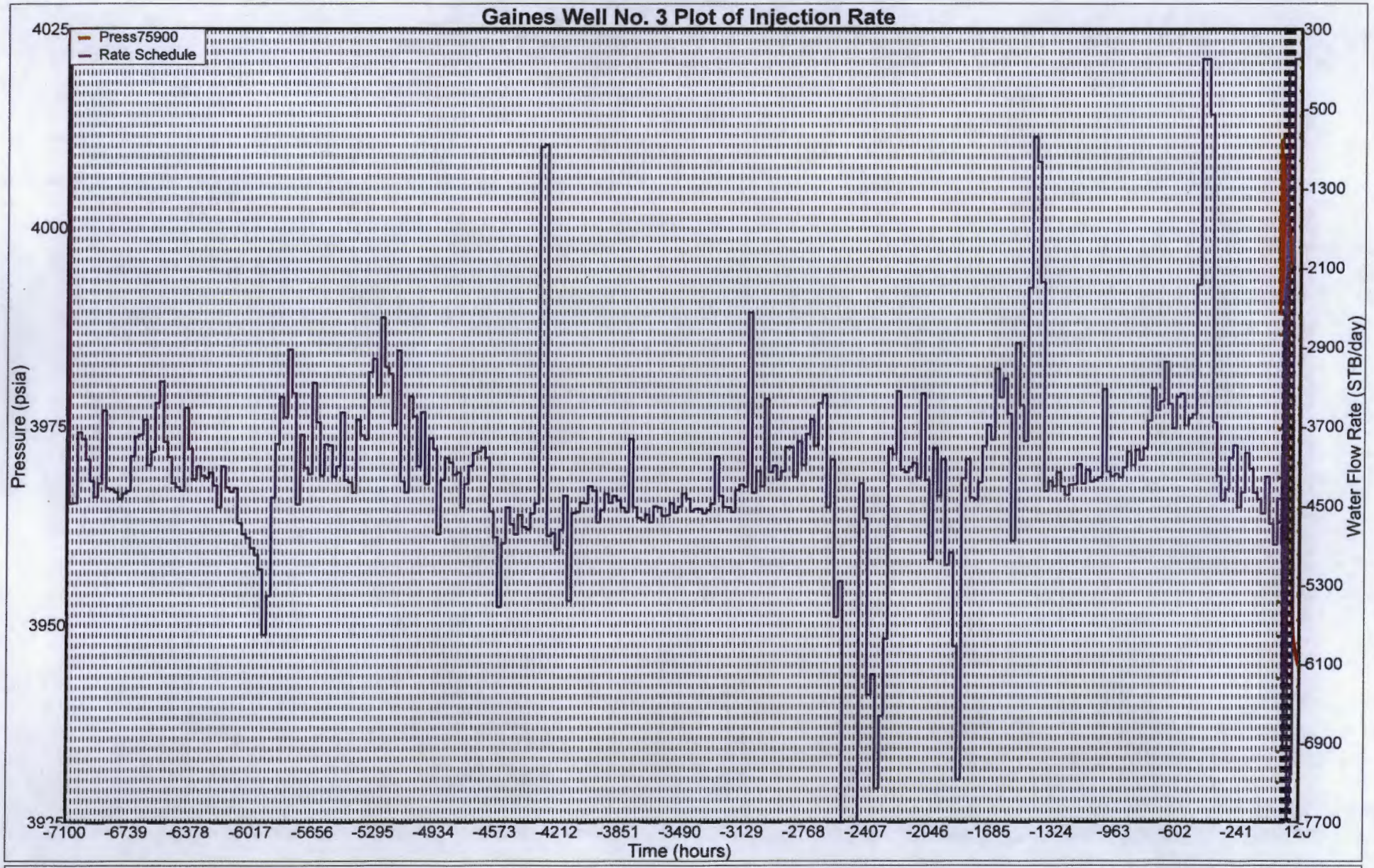

Gaines Well No. 3 Plot of Injection Rate
Press75900
Rate Schedule
Pressure (psia)
Water Flow Rate (STB/day)
Time (hours)
4025
4000
3975
3950
3925
300
500
1300
2100
2900
3700
4500
5300
6100
6900
7700
-7100
-6739
-6378
-6017
-5656
-5295
-4934
-4573
-4212
-3851
-3490
-3129
-2768
-2407
-2046
-1685
-1324
-963
-602
-241

FIGURE 11

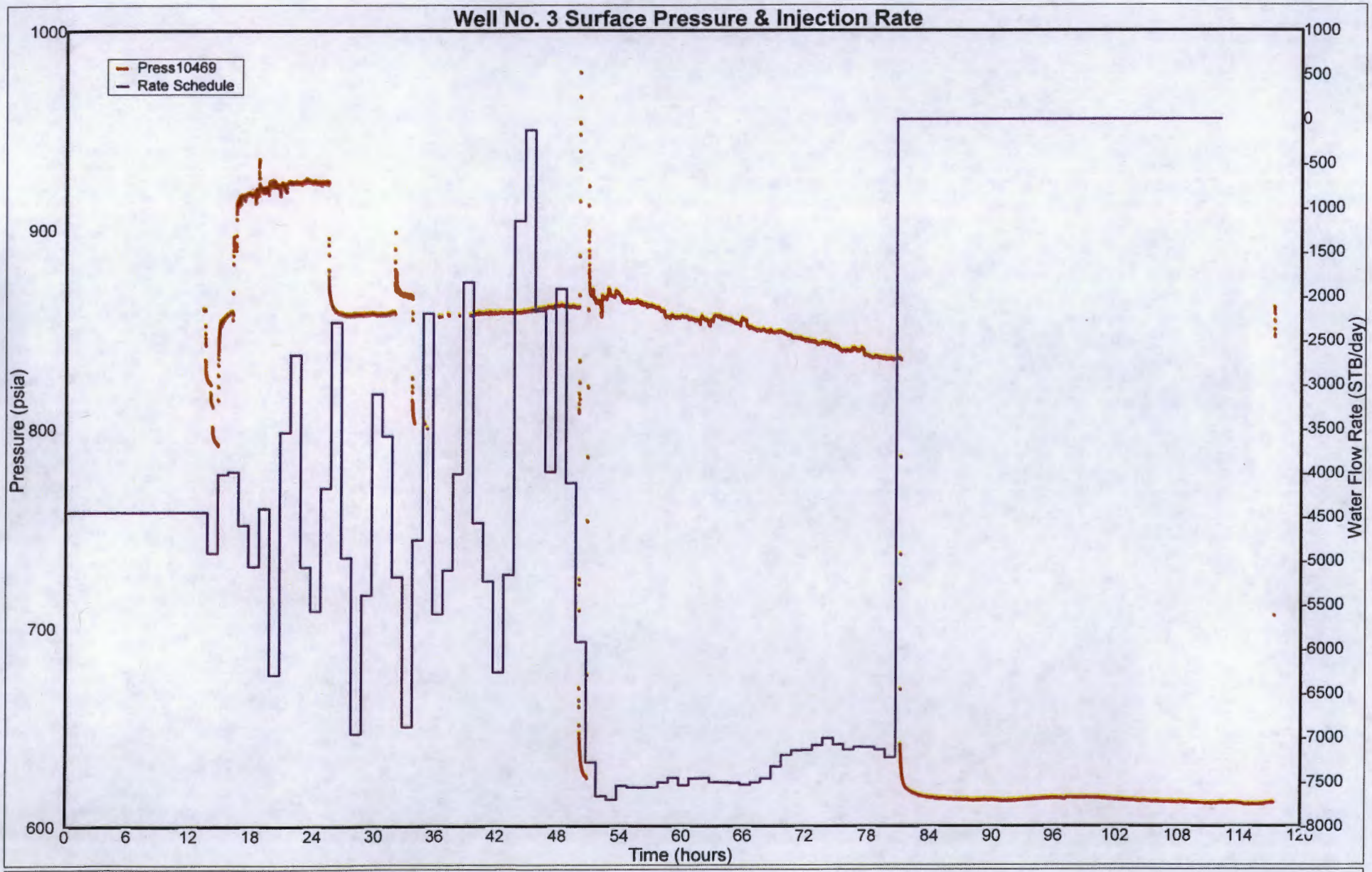

Well No. 3 Surface Pressure & Injection Rate
Press10469
Rate Schedule
Pressure (psia)
Water Flow Rate (STB/day)
Time (hours)
1000
900
800
700
600
0
6
12
18
24
30
36
42
48
54
60
66
72
78
84
90
96
102
108
114
500
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
-4500
-5000
-5500
-6000
-6500
-7000
-7500
-8000

FIGURE 12

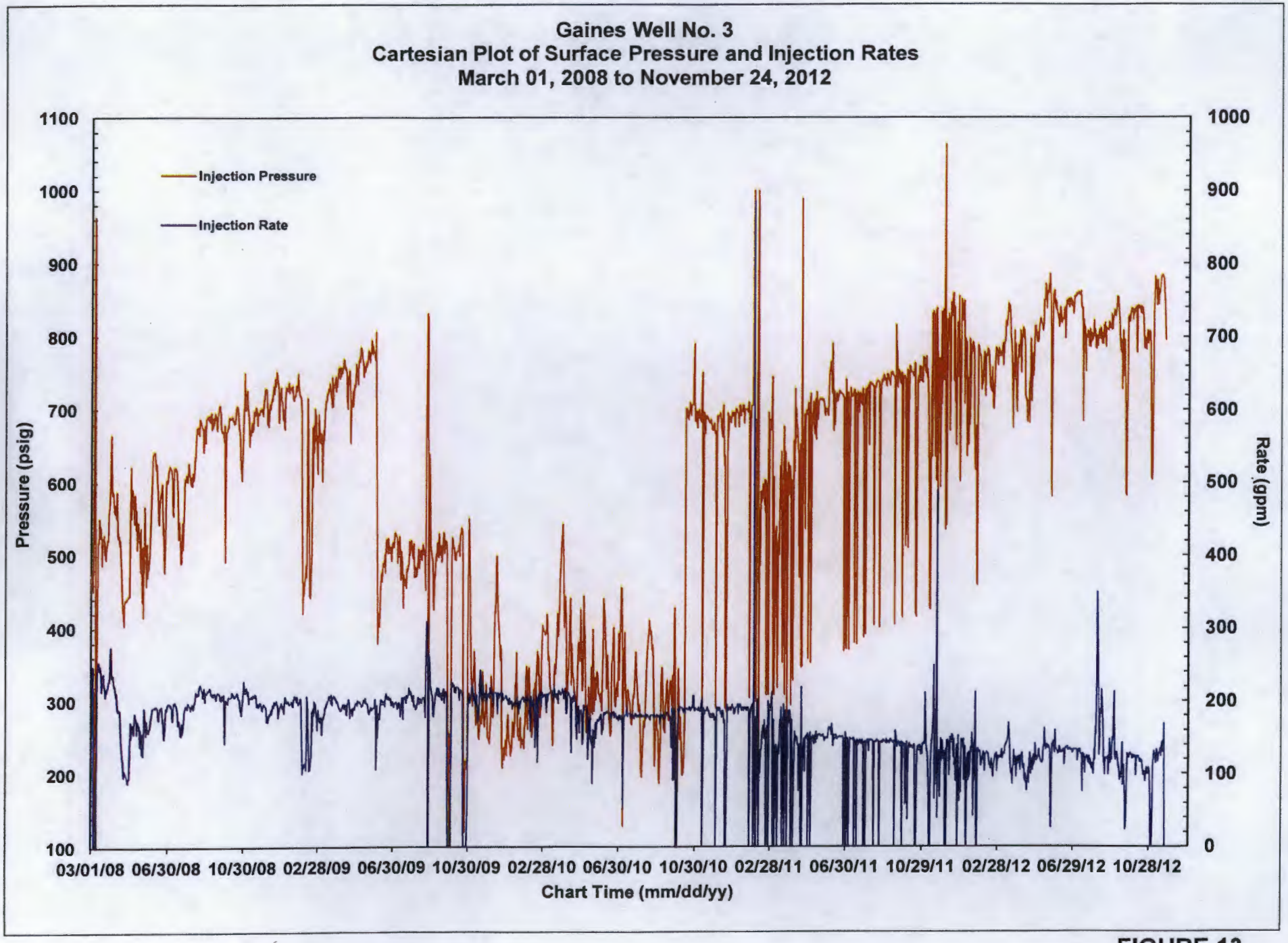

Gaines Well No. 3
Cartesian Plot of Surface Pressure and Injection Rates
March 01, 2008 to November 24, 2012
Injection Pressure
Injection Rate
Pressure (psig)
Rate (gpm)
1100
1000
900
800
700
600
500
400
300
200
100
1000
900
800
700
600
500
400
300
200
100
0
03/01/08 06/30/08 10/30/08 02/28/09 06/30/09 10/30/09 02/28/10 06/30/10 10/30/10 02/28/11 06/30/11 10/29/11 02/28/12 06/29/12 10/28/12
Chart Time (mm/dd/yy)

FIGURE 13

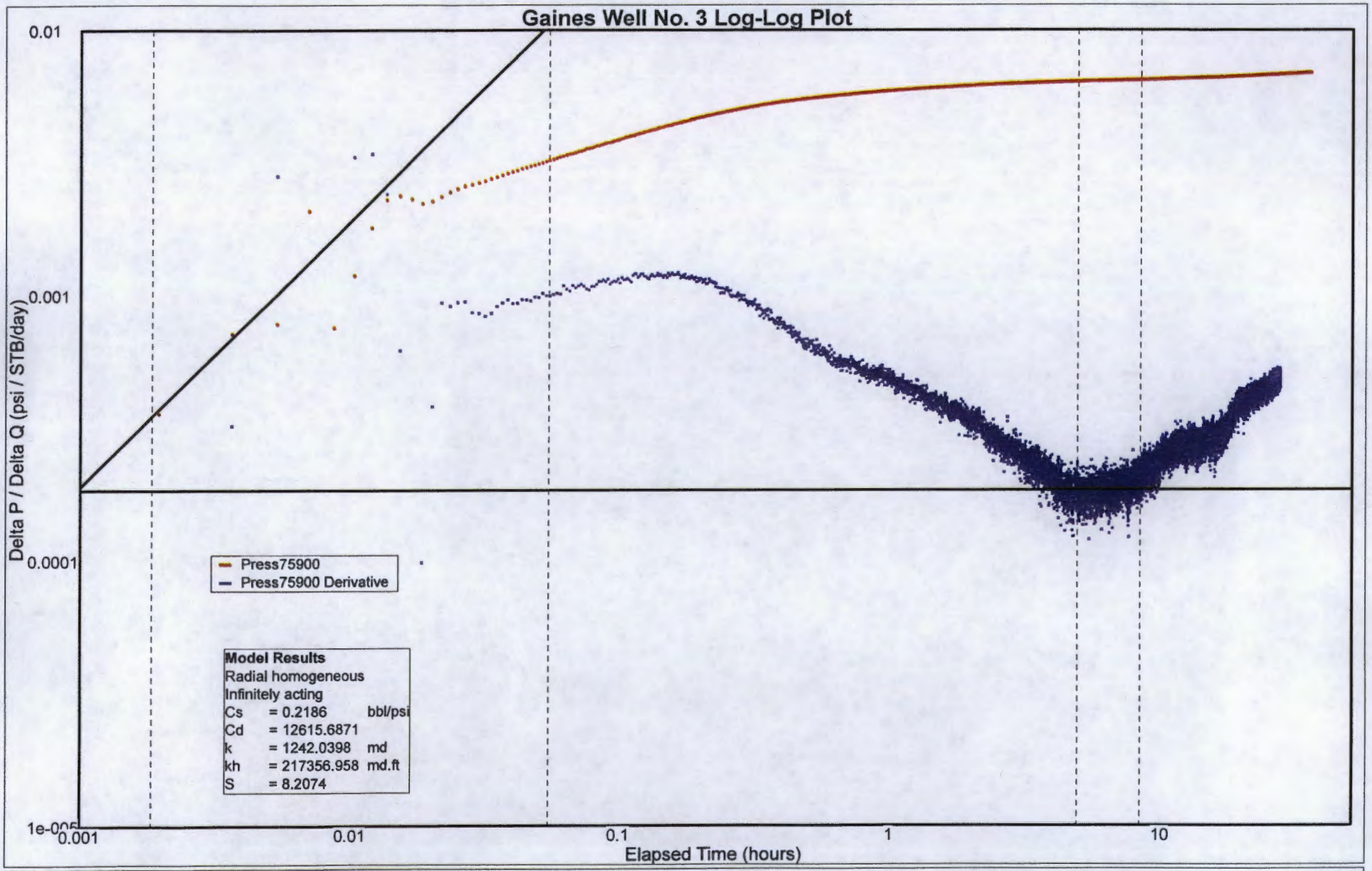

Gaines Well No. 3 Log-Log Plot
0.01
0.001
0.0001
1e-005
Delta P / Delta Q (psi / STB/day)
0.001
0.01
0.1
1
10
Elapsed Time (hours)
Press75900
Press75900 Derivative
Model Results
Radial homogeneous
Infinitely acting
Cs = 0.2186 bbl/psi
Cd = 12615.6871
k = 1242.0398 md
kh = 217356.958 md.ft
S = 8.2074

FIGURE 14

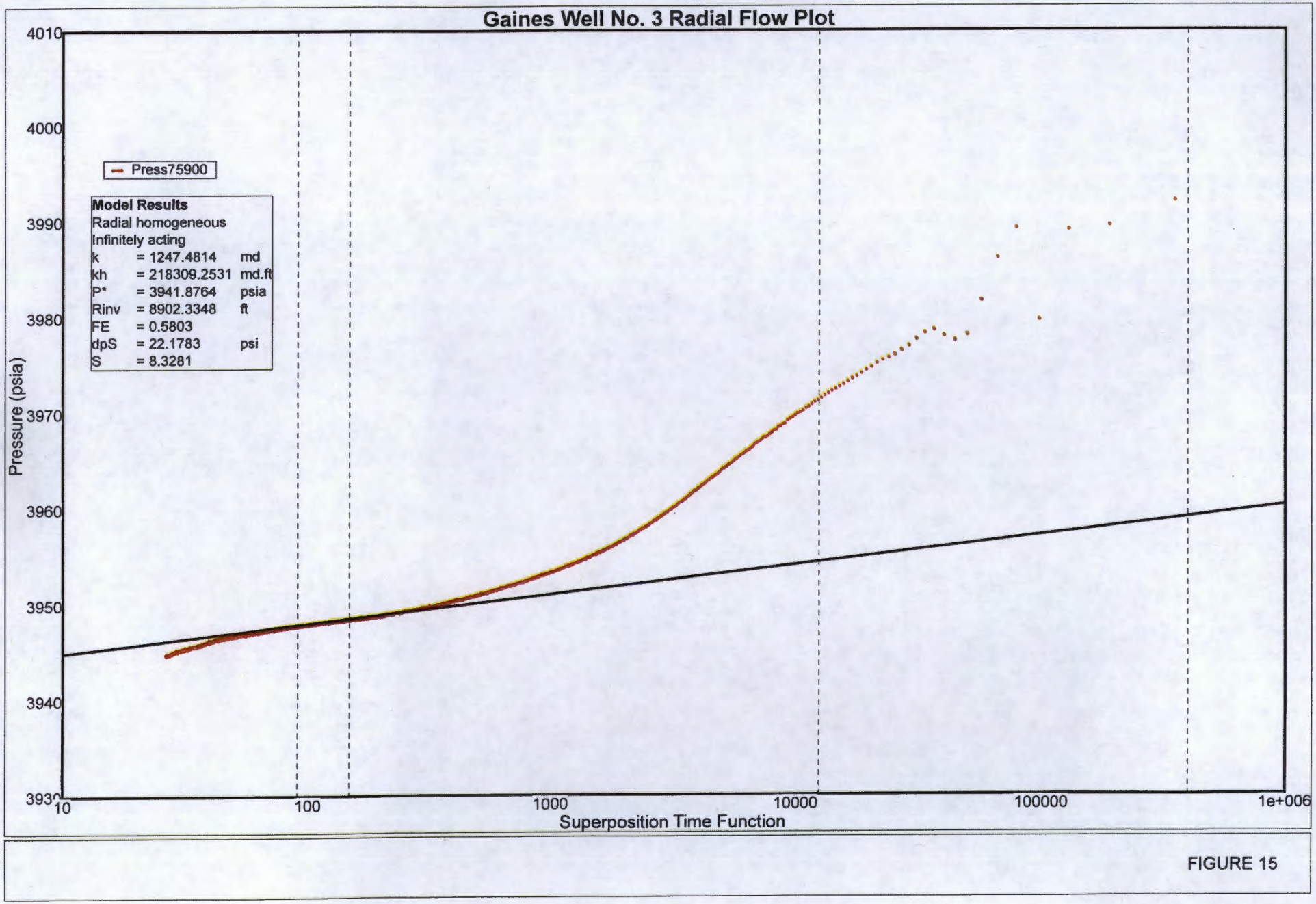

Gaines Well No. 3 Radial Flow Plot
Press75900
Model Results
Radial homogeneous
Infinitely acting
k = 1247.4814 md
kh = 218309.2531 md.ft
P* = 3941.8764 psia
Rinv = 8902.3348 ft
FE = 0.5803
dpS = 22.1783 psi
S = 8.3281
Pressure (psia)
4010
4000
3990
3980
3970
3960
3950
3940
3930
10
100
1000
10000
100000
1e+006
Superposition Time Function

FIGURE 15

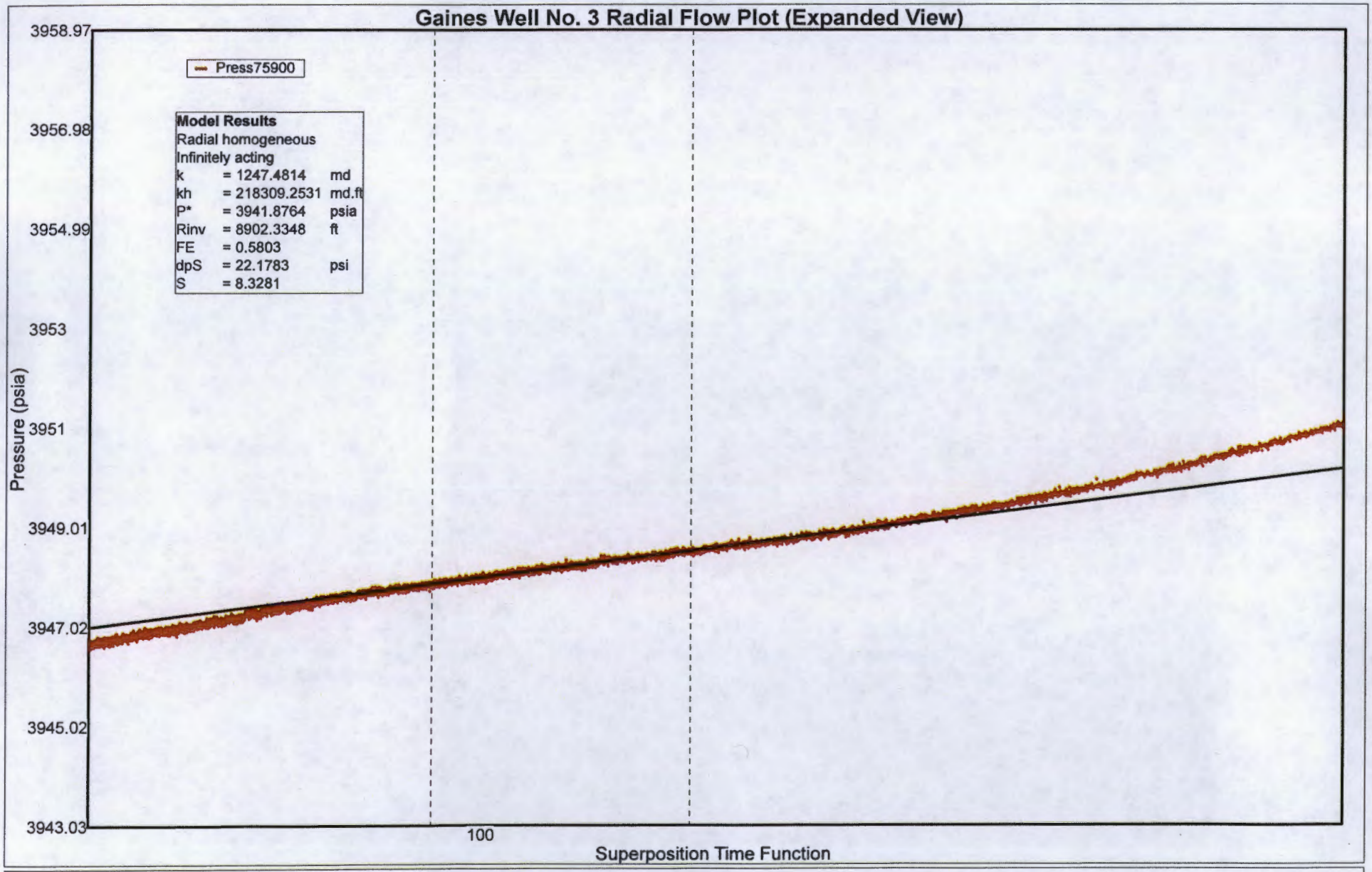

Gaines Well No. 3 Radial Flow Plot (Expanded View)
Press75900
Model Results
Radial homogeneous
Infinitely acting
k = 1247.4814 md
kh = 218309.2531 md.ft
P* = 3941.8764 psia
Rinv = 8902.3348 ft
FE = 0.5803
dpS = 22.1783 psi
S = 8.3281
3958.97
3956.98
3954.99
3953
3951
3949.01
3947.02
3945.02
3943.03
Pressure (psia)
100
Superposition Time Function

FIGURE 16

Navajo Refining Company
Gaines Well No. 3
September 23, 2012 to October 22, 2012
Hall Plot

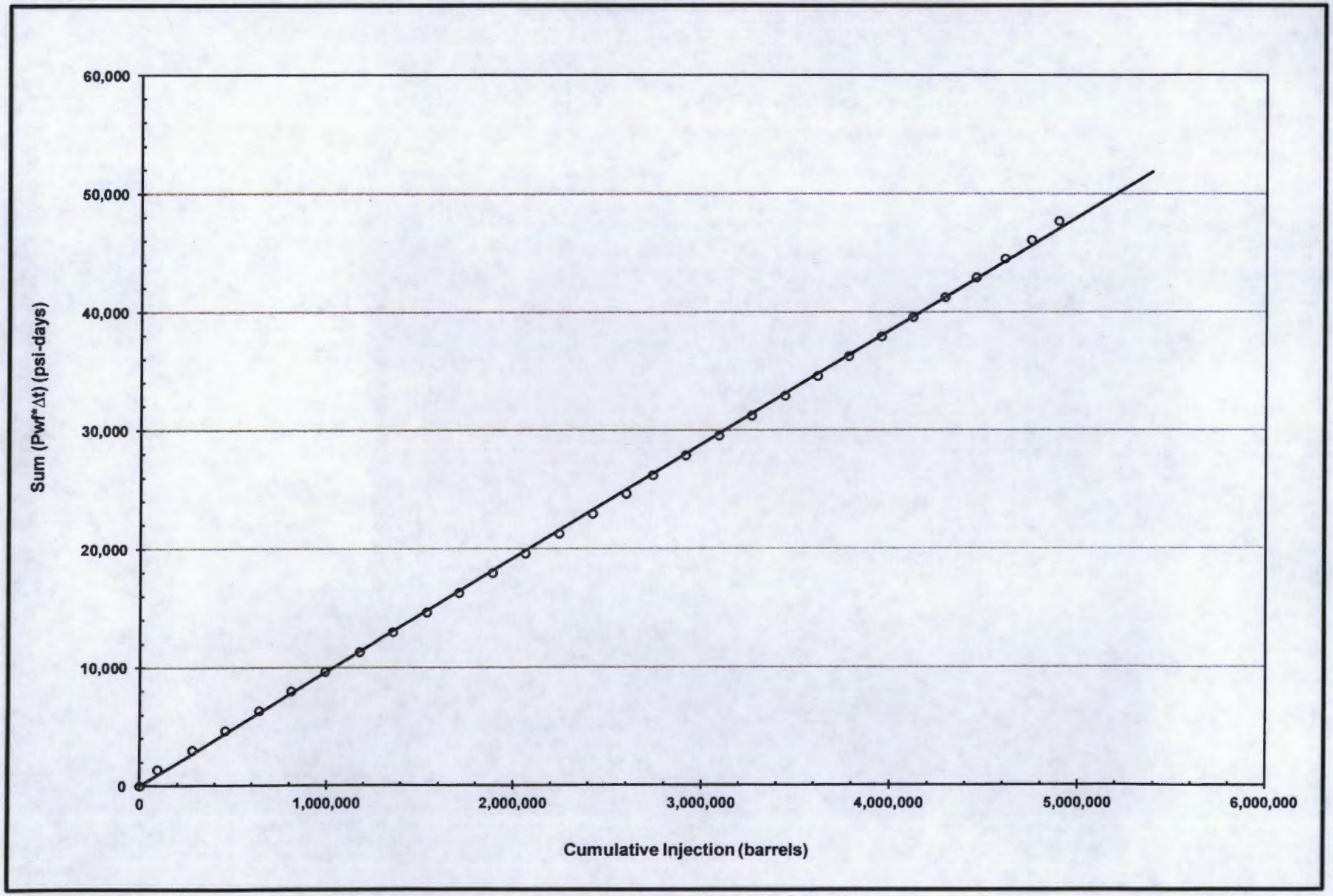


FIGURE 17

Navajo Refining Company
Static Pressure Gradient Survey
Gaines Well No. 3
November 25, 2012

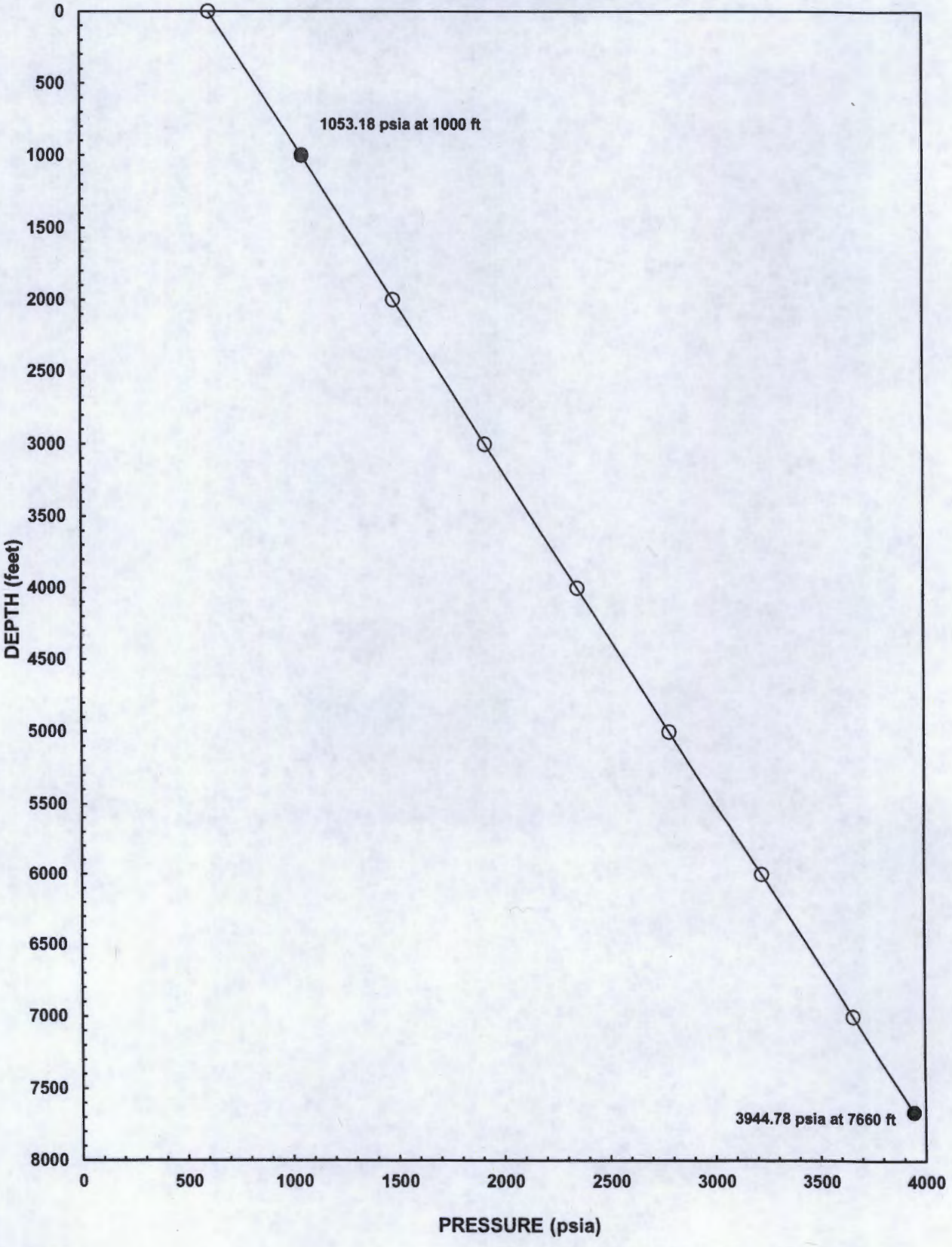


FIGURE 18

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

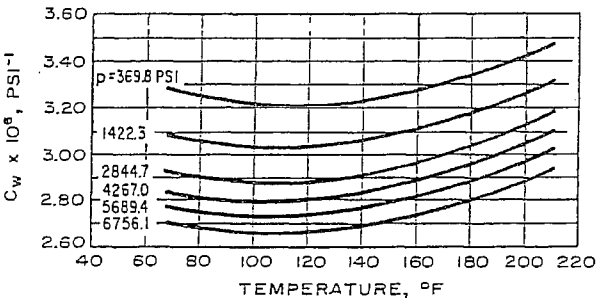


Fig. D.16 Average compressibility of distilled water. After Long and Chierici.[13]

Source: Earlougher, 1977, Advances in Well Test Analysis

COMPRESSIBILITY OF PORE VOLUME AND DISTILLED WATER

APPENDIX D

COMPRESSIBILITY OF PORE VOLUME

APPENDIX D

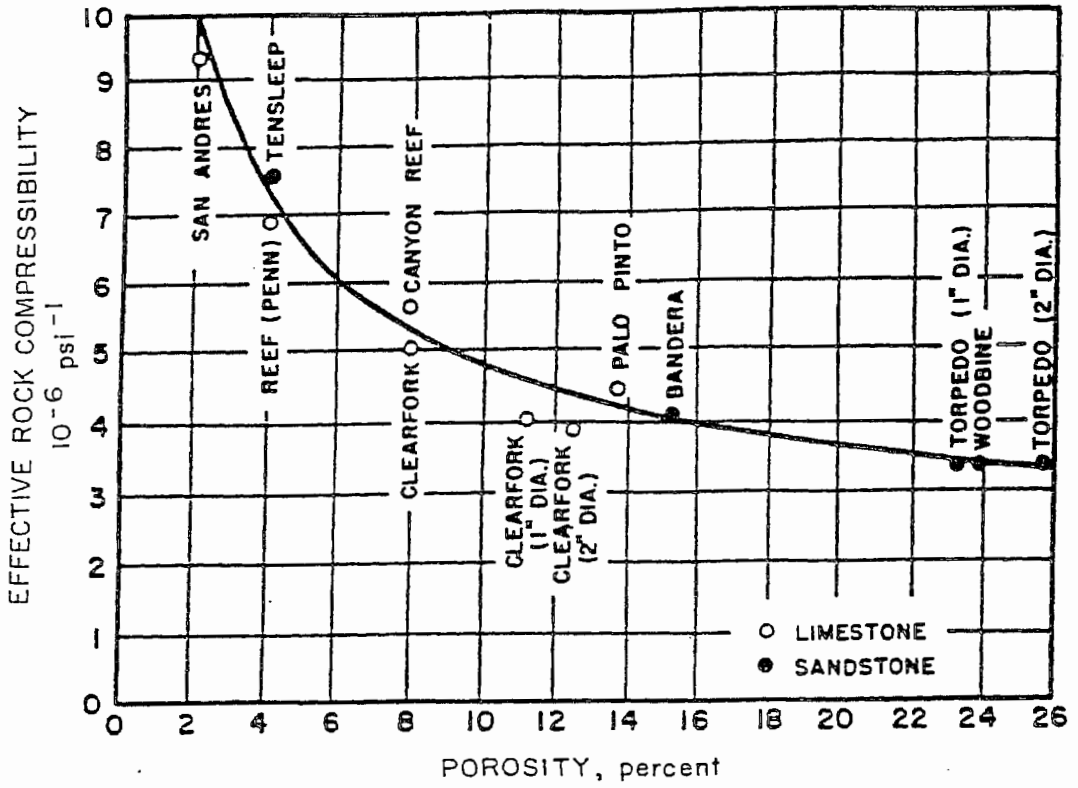


Fig. G.5 Effective formation (rock) compressibility. From Hall, *Trans.*, AIME (1953) 198, 309.

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

APPENDIX E

GAINES WELL NO. 3 - 2006 TEMPERATURE LOG SECTIONS FROM 7,660 FEET TO 8,620 FEET

SUBSURFACE

APPENDIX F

WATER VISCOSITIES AT VARIOUS SALINITIES AND TEMPERATURES

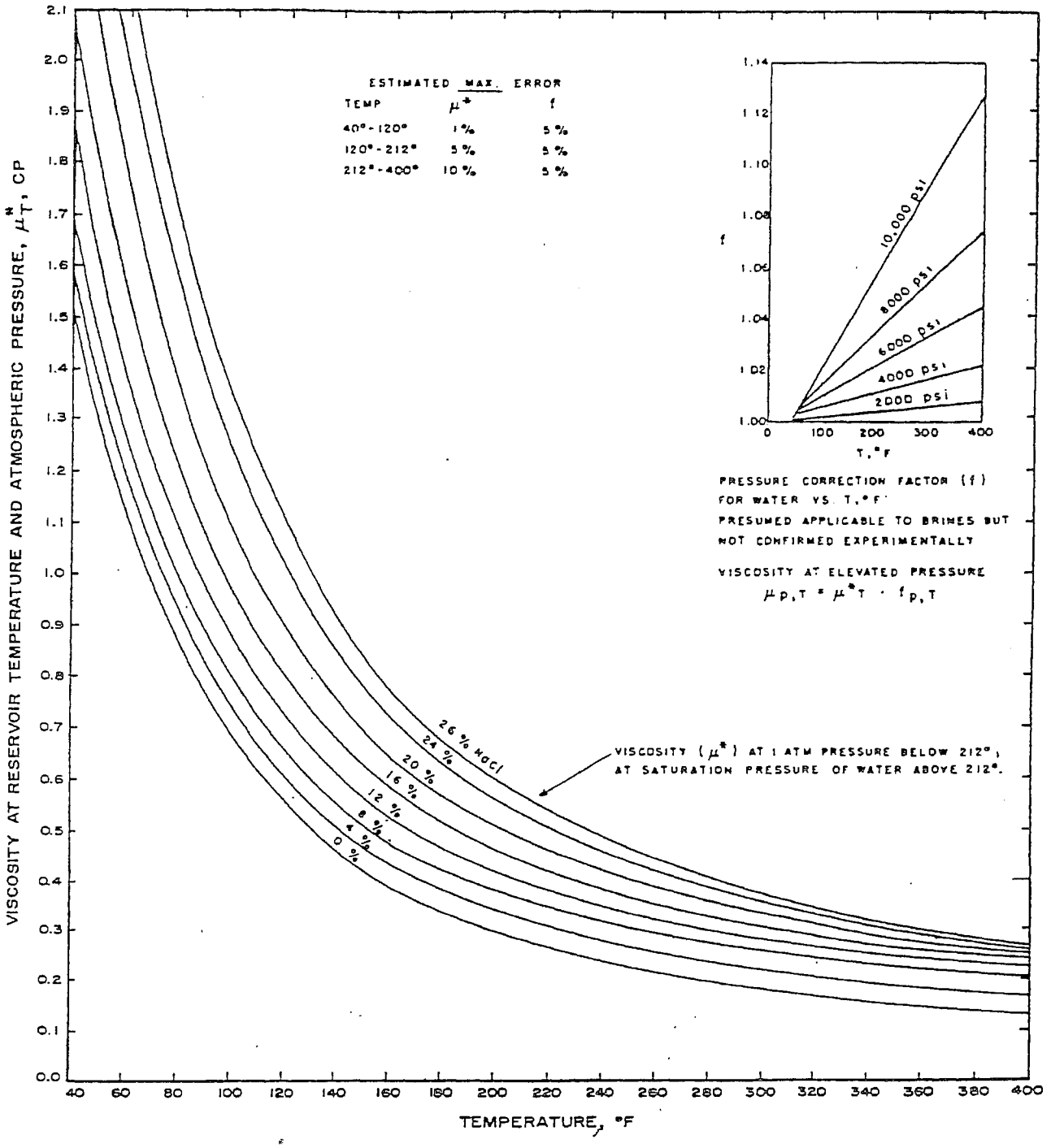


Fig. D.35 Water viscosity at various salinities and temperatures. After Matthews and Russell, data of Chesnut.[18]

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

APPENDIX G

DAILY RATE HISTORY DATA

APPENDIX G: Daily Rate History Data

Date	Time	Hours	Press.	Rate
mm/dd/yy	hh:mm:ss	Δt	psig	bpd
01/30/2012	00:00:00	-7090.303	773.61	-4409.786
01/31/2012	00:00:00	-7066.303	776.01	-4473.167
02/01/2012	00:00:00	-7042.303	771.04	-4468.002
02/02/2012	00:00:00	-7018.303	726.61	-3758.746
02/03/2012	00:00:00	-6994.303	731.86	-3824.789
02/04/2012	00:00:00	-6970.303	738.20	-4032.320
02/05/2012	00:00:00	-6946.303	759.85	-4249.288
02/06/2012	00:00:00	-6922.303	778.69	-4408.423
02/07/2012	00:00:00	-6898.303	765.49	-4272.629
02/08/2012	00:00:00	-6874.303	719.28	-3540.337
02/09/2012	00:00:00	-6850.303	775.68	-4318.411
02/10/2012	00:00:00	-6826.303	775.41	-4333.149
02/11/2012	00:00:00	-6802.303	773.48	-4357.696
02/12/2012	00:00:00	-6778.303	783.49	-4429.738
02/13/2012	00:00:00	-6754.303	780.93	-4372.004
02/14/2012	00:00:00	-6730.303	779.13	-4345.998
02/15/2012	00:00:00	-6706.303	749.05	-3998.057
02/16/2012	00:00:00	-6682.303	730.74	-3800.907
02/17/2012	00:00:00	-6658.303	729.19	-3780.643
02/18/2012	00:00:00	-6634.303	724.40	-3632.220
02/19/2012	00:00:00	-6610.303	758.21	-4087.643
02/20/2012	00:00:00	-6586.303	741.83	-3952.959
02/21/2012	00:00:00	-6562.303	701.93	-3463.071
02/22/2012	00:00:00	-6538.303	700.54	-3248.311
02/23/2012	00:00:00	-6514.303	734.09	-3853.577
02/24/2012	00:00:00	-6490.303	763.65	-4006.014
02/25/2012	00:00:00	-6466.303	785.37	-4269.420
02/26/2012	00:00:00	-6442.303	778.38	-4308.229
02/27/2012	00:00:00	-6418.303	781.03	-4342.942
02/28/2012	00:00:00	-6394.303	761.25	-3513.198
02/29/2012	00:00:00	-6370.303	763.74	-3923.296
03/01/2012	00:00:00	-6346.303	783.64	-4229.865
03/02/2012	00:00:00	-6322.303	776.54	-4102.147
03/03/2012	00:00:00	-6298.303	773.27	-4189.224
03/04/2012	00:00:00	-6274.303	779.64	-4214.573
03/05/2012	00:00:00	-6250.303	774.39	-4161.394
03/06/2012	00:00:00	-6226.303	777.76	-4290.779
03/07/2012	00:00:00	-6202.303	791.43	-4512.663
03/08/2012	00:00:00	-6178.303	760.78	-4102.071
03/09/2012	00:00:00	-6154.303	779.85	-4310.548
03/10/2012	00:00:00	-6130.303	792.99	-4354.583
03/11/2012	00:00:00	-6106.303	794.44	-4318.431
03/12/2012	01:00:00	-6081.303	819.71	-4668.948
03/13/2012	01:00:00	-6057.303	821.60	-4777.228
03/14/2012	01:00:00	-6033.303	813.80	-4819.127
03/15/2012	01:00:00	-6009.303	830.22	-4919.952
03/16/2012	01:00:00	-5985.303	842.59	-4989.429
03/17/2012	01:00:00	-5961.303	845.08	-5135.721
03/18/2012	01:00:00	-5937.303	833.39	-5795.903
03/19/2012	01:00:00	-5913.303	842.20	-5400.926
03/20/2012	01:00:00	-5889.303	798.38	-4412.812
03/21/2012	01:00:00	-5865.303	796.07	-3874.498
03/22/2012	01:00:00	-5841.303	770.40	-3402.455
03/23/2012	01:00:00	-5817.303	733.24	-3605.559
03/24/2012	01:00:00	-5793.303	675.12	-2929.349
03/25/2012	01:00:00	-5769.303	737.30	-3367.552
03/26/2012	01:00:00	-5745.303	807.85	-4480.145
03/27/2012	01:00:00	-5721.303	741.19	-3783.048
03/28/2012	01:00:00	-5697.303	790.48	-4116.149
03/29/2012	01:00:00	-5673.303	718.11	-4177.389
03/30/2012	01:00:00	-5649.303	696.69	-3263.465
03/31/2012	01:00:00	-5625.303	747.71	-3656.300
04/01/2012	01:00:00	-5601.303	788.60	-4192.107
04/02/2012	01:00:00	-5577.303	777.66	-3880.695
04/03/2012	01:00:00	-5553.303	770.77	-3890.767
04/04/2012	01:00:00	-5529.303	782.34	-4204.524
04/05/2012	01:00:00	-5505.303	807.74	-4098.682
04/06/2012	01:00:00	-5481.303	750.74	-3560.427
04/07/2012	01:00:00	-5457.303	797.72	-4237.130
04/08/2012	01:00:00	-5433.303	803.61	-4261.483
04/09/2012	01:00:00	-5409.303	812.23	-4362.243
04/10/2012	01:00:00	-5385.303	796.14	-3631.922
04/11/2012	01:00:00	-5361.303	809.11	-3786.409
04/12/2012	01:00:00	-5337.303	784.19	-3826.903
04/13/2012	01:00:00	-5313.303	718.80	-3155.924
04/14/2012	01:00:00	-5289.303	714.45	-3022.817
04/15/2012	01:00:00	-5265.303	715.49	-3384.310
04/16/2012	01:00:00	-5241.303	682.58	-2605.576
04/17/2012	01:00:00	-5217.303	711.10	-3103.792
04/18/2012	01:00:00	-5193.303	705.02	-3172.269
04/19/2012	01:00:00	-5169.303	739.19	-3683.980
04/20/2012	01:00:00	-5145.303	681.34	-2939.667
04/21/2012	01:00:00	-5121.303	786.39	-4250.512
04/22/2012	01:00:00	-5097.303	796.96	-4361.853
04/23/2012	01:00:00	-5073.303	711.40	-3397.060
04/24/2012	01:00:00	-5049.303	736.23	-3600.891
04/25/2012	01:00:00	-5025.303	777.38	-4101.487
04/26/2012	01:00:00	-5001.303	747.33	-3557.351
04/27/2012	01:00:00	-4977.303	795.24	-4280.462
04/28/2012	01:00:00	-4953.303	813.39	-3819.677
04/29/2012	01:00:00	-4929.303	815.28	-3927.580
04/30/2012	01:00:00	-4905.303	806.98	-4783.891
05/01/2012	01:00:00	-4881.303	793.21	-4233.303
05/02/2012	01:00:00	-4857.303	805.52	-4016.888
05/03/2012	01:00:00	-4833.303	793.24	-4062.940
05/04/2012	01:00:00	-4809.303	797.15	-4185.806
05/05/2012	01:00:00	-4785.303	810.60	-4162.542
05/06/2012	01:00:00	-4761.303	821.18	-4519.160
05/07/2012	01:00:00	-4737.303	825.11	-4278.010
05/08/2012	01:00:00	-4713.303	823.12	-4096.842
05/09/2012	01:00:00	-4689.303	818.34	-3968.044
05/10/2012	01:00:00	-4665.303	815.46	-3950.521
05/11/2012	01:00:00	-4641.303	807.52	-3913.740
05/12/2012	01:00:00	-4617.303	815.80	-4013.246
05/13/2012	01:00:00	-4593.303	849.56	-4554.058
05/14/2012	01:00:00	-4569.303	849.99	-4814.136
05/15/2012	01:00:00	-4545.303	871.71	-5515.844
05/16/2012	01:00:00	-4521.303	871.49	-4877.062
05/17/2012	01:00:00	-4497.303	838.00	-4515.181
05/18/2012	01:00:00	-4473.303	854.85	-4684.270
05/19/2012	01:00:00	-4449.303	857.57	-4783.352
05/20/2012	01:00:00	-4425.303	871.93	-4590.649
05/21/2012	01:00:00	-4401.303	858.98	-4711.998
05/22/2012	01:00:00	-4377.303	885.89	-4737.894
05/23/2012	01:00:00	-4353.303	855.43	-4575.327
05/24/2012	01:00:00	-4329.303	843.10	-4475.745
05/25/2012	01:00:00	-4305.303	607.64	-0889.383
05/26/2012	01:00:00	-4281.303	580.38	-0868.264
05/27/2012	01:00:00	-4257.303	858.00	-4802.286
05/28/2012	01:00:00	-4233.303	854.76	-4772.676
05/29/2012	01:00:00	-4209.303	862.55	-4934.529
05/30/2012	01:00:00	-4185.303	845.83	-4741.606

APPENDIX G: Daily Rate History Data

Date	Time	Hours	Press.	Rate
mm/dd/yy	hh:mm:ss	Δt	psig	bpd
05/31/2012	01:00:00	-4161.303	837.19	-4397.542
06/01/2012	01:00:00	-4137.303	849.46	-5456.057
06/02/2012	01:00:00	-4113.303	835.24	-4570.113
06/03/2012	01:00:00	-4089.303	831.94	-4560.165
06/04/2012	01:00:00	-4065.303	824.24	-4465.450
06/05/2012	01:00:00	-4041.303	829.92	-4472.899
06/06/2012	01:00:00	-4017.303	813.20	-4303.052
06/07/2012	01:00:00	-3993.303	819.70	-4345.115
06/08/2012	01:00:00	-3969.303	840.12	-4665.109
06/09/2012	01:00:00	-3945.303	830.01	-4541.609
06/10/2012	01:00:00	-3921.303	818.19	-4377.266
06/11/2012	01:00:00	-3897.303	823.76	-4468.714
06/12/2012	01:00:00	-3873.303	820.70	-4398.917
06/13/2012	01:00:00	-3849.303	824.71	-4446.153
06/14/2012	01:00:00	-3825.303	835.81	-4518.936
06/15/2012	01:00:00	-3801.303	839.32	-4562.949
06/16/2012	01:00:00	-3777.303	797.51	-3824.790
06/17/2012	01:00:00	-3753.303	841.36	-4514.425
06/18/2012	01:00:00	-3729.303	849.14	-4619.238
06/19/2012	01:00:00	-3705.303	849.11	-4641.463
06/20/2012	01:00:00	-3681.303	843.20	-4587.037
06/21/2012	01:00:00	-3657.303	850.76	-4662.738
06/22/2012	01:00:00	-3633.303	838.98	-4505.818
06/23/2012	01:00:00	-3609.303	841.15	-4517.329
06/24/2012	01:00:00	-3585.303	850.20	-4599.952
06/25/2012	01:00:00	-3561.303	851.87	-4594.095
06/26/2012	01:00:00	-3537.303	841.36	-4475.657
06/27/2012	01:00:00	-3513.303	849.47	-4566.806
06/28/2012	01:00:00	-3489.303	842.09	-4504.803
06/29/2012	01:00:00	-3465.303	830.70	-4377.876
06/30/2012	01:00:00	-3441.303	839.39	-4427.800
07/01/2012	01:00:00	-3417.303	855.39	-4555.109
07/02/2012	01:00:00	-3393.303	855.18	-4532.143
07/03/2012	01:00:00	-3369.303	854.43	-4534.867
07/04/2012	01:00:00	-3345.303	859.42	-4575.104
07/05/2012	01:00:00	-3321.303	856.83	-4542.917
07/06/2012	01:00:00	-3297.303	858.46	-4479.357
07/07/2012	01:00:00	-3273.303	861.28	-4004.123
07/08/2012	01:00:00	-3249.303	855.88	-4400.931
07/09/2012	01:00:00	-3225.303	856.18	-4511.034
07/10/2012	01:00:00	-3201.303	857.52	-4514.057
07/11/2012	01:00:00	-3177.303	861.78	-4561.633
07/12/2012	01:00:00	-3153.303	841.07	-4340.300
07/13/2012	01:00:00	-3129.303	837.08	-4287.867
07/14/2012	01:00:00	-3105.303	838.76	-4308.865
07/15/2012	01:00:00	-3081.303	683.85	-2556.436
07/16/2012	01:00:00	-3057.303	823.02	-4366.865
07/17/2012	01:00:00	-3033.303	798.14	-4150.242
07/18/2012	01:00:00	-3009.303	812.75	-4302.157
07/19/2012	01:00:00	-2985.303	752.23	-3422.506
07/20/2012	01:00:00	-2961.303	800.46	-4159.375
07/21/2012	01:00:00	-2937.303	798.20	-4097.718
07/22/2012	01:00:00	-2913.303	807.83	-4234.631
07/23/2012	01:00:00	-2889.303	803.74	-4151.762
07/24/2012	01:00:00	-2865.303	785.69	-3911.875
07/25/2012	01:00:00	-2841.303	786.17	-3908.734
07/26/2012	01:00:00	-2817.303	810.40	-4205.992
07/27/2012	01:00:00	-2793.303	786.11	-3849.631
07/28/2012	01:00:00	-2769.303	805.81	-4090.068
07/29/2012	01:00:00	-2745.303	793.40	-3777.728
07/30/2012	01:00:00	-2721.303	799.89	-3629.286
07/31/2012	01:00:00	-2697.303	795.48	-3896.261
08/01/2012	01:00:00	-2673.303	821.94	-3466.121
08/02/2012	01:00:00	-2649.303	804.95	-3385.527
08/03/2012	01:00:00	-2625.303	809.21	-4513.739
08/04/2012	01:00:00	-2601.303	785.33	-4032.927
08/05/2012	01:00:00	-2577.303	782.87	-5621.241
08/06/2012	01:00:00	-2553.303	801.95	-5259.664
08/07/2012	01:00:00	-2529.303	787.29	-8006.035
08/08/2012	01:00:00	-2505.303	795.13	-11969.19
08/09/2012	01:00:00	-2481.303	808.92	-9429.196
08/10/2012	01:00:00	-2457.303	799.98	-8535.789
08/11/2012	01:00:00	-2433.303	795.87	-4274.589
08/12/2012	01:00:00	-2409.303	811.58	-4627.530
08/13/2012	01:00:00	-2385.303	800.92	-6416.447
08/14/2012	01:00:00	-2361.303	790.07	-6209.942
08/15/2012	01:00:00	-2337.303	804.81	-7364.778
08/16/2012	01:00:00	-2313.303	789.60	-6633.633
08/17/2012	01:00:00	-2289.303	815.05	-5844.037
08/18/2012	01:00:00	-2265.303	798.62	-3925.091
08/19/2012	01:00:00	-2241.303	819.50	-3980.201
08/20/2012	01:00:00	-2217.303	786.40	-3348.035
08/21/2012	01:00:00	-2193.303	812.37	-4134.490
08/22/2012	01:00:00	-2169.303	810.91	-4159.631
08/23/2012	01:00:00	-2145.303	808.82	-4107.942
08/24/2012	01:00:00	-2121.303	808.11	-4069.029
08/25/2012	01:00:00	-2097.303	814.79	-4219.228
08/26/2012	01:00:00	-2073.303	820.32	-3370.875
08/27/2012	01:00:00	-2049.303	810.83	-4237.715
08/28/2012	01:00:00	-2025.303	814.23	-5044.752
08/29/2012	01:00:00	-2001.303	808.89	-3919.848
08/30/2012	01:00:00	-1977.303	830.30	-4401.945
08/31/2012	01:00:00	-1953.303	810.23	-4031.630
09/01/2012	01:00:00	-1929.303	821.58	-5097.823
09/02/2012	01:00:00	-1905.303	827.93	-4972.282
09/03/2012	01:00:00	-1881.303	836.19	-5919.601
09/04/2012	01:00:00	-1857.303	833.77	-7278.093
09/05/2012	01:00:00	-1833.303	827.32	-4223.599
09/06/2012	01:00:00	-1809.303	833.07	-4029.447
09/07/2012	01:00:00	-1785.303	854.03	-4414.508
09/08/2012	01:00:00	-1761.303	854.09	-4435.550
09/09/2012	01:00:00	-1737.303	853.47	-4261.376
09/10/2012	01:00:00	-1713.303	829.69	-3898.578
09/11/2012	01:00:00	-1689.303	819.82	-3683.911
09/12/2012	01:00:00	-1665.303	796.58	-3835.785
09/13/2012	01:00:00	-1641.303	778.02	-3121.655
09/14/2012	01:00:00	-1617.303	795.94	-3408.045
09/15/2012	01:00:00	-1593.303	780.48	-3222.037
09/16/2012	01:00:00	-1569.303	726.98	-3572.798
09/17/2012	01:00:00	-1545.303	808.20	-4852.365
09/18/2012	01:00:00	-1521.303	745.19	-2863.842
09/19/2012	01:00:00	-1497.303	795.88	-3488.628
09/20/2012	01:00:00	-1473.303	793.74	-3845.670
09/21/2012	01:00:00	-1449.303	696.79	-2308.585
09/22/2012	01:00:00	-1425.303	582.19	-0786.258
09/23/2012	01:00:00	-1401.303	580.71	-1036.385
09/24/2012	01:00:00	-1377.303	679.41	-2248.788
09/25/2012	01:00:00	-1353.303	826.46	-4350.337
09/26/2012	01:00:00	-1329.303	823.16	-4252.028
09/27/2012	01:00:00	-1305.303	828.46	-4300.615
09/28/2012	01:00:00	-1281.303	819.87	-4161.371
09/29/2012	01:00:00	-1257.303	830.41	-4306.218

APPENDIX G: Daily Rate History Data

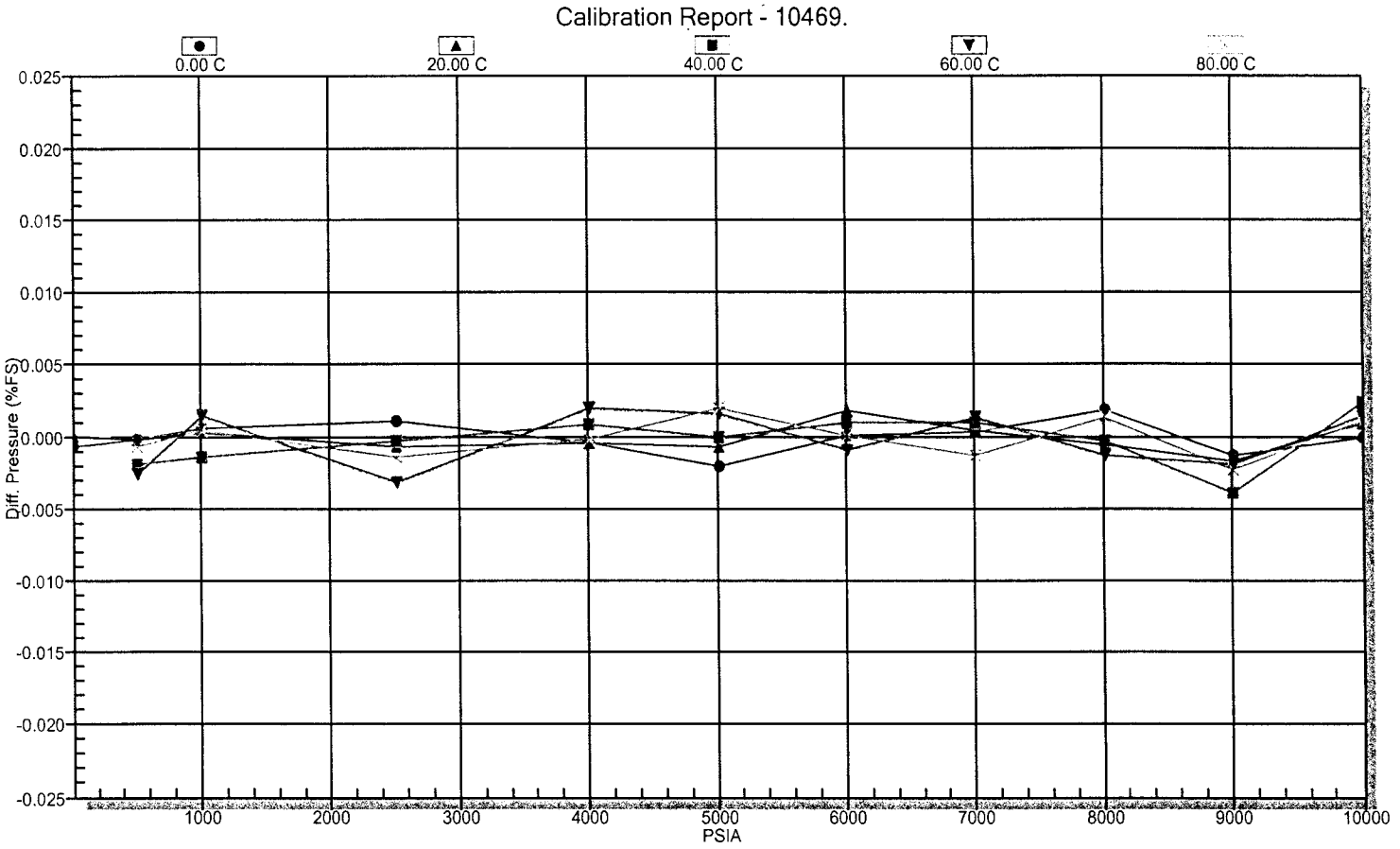
Date	Time	Hours	Press.	Rate
mm/dd/yy	hh:mm:ss	Δt	psig	bpd
09/30/2012	01:00:00	-1233.303	837.15	-4392.004
10/01/2012	01:00:00	-1209.303	837.52	-4289.329
10/02/2012	01:00:00	-1185.303	835.44	-4283.845
10/03/2012	01:00:00	-1161.303	821.76	-4084.694
10/04/2012	01:00:00	-1137.303	837.48	-4277.054
10/05/2012	01:00:00	-1113.303	829.86	-4136.867
10/06/2012	01:00:00	-1089.303	837.07	-4256.772
10/07/2012	01:00:00	-1065.303	840.19	-4238.429
10/08/2012	01:00:00	-1041.303	841.25	-4212.671
10/09/2012	01:00:00	-1017.303	777.82	-3329.365
10/10/2012	01:00:00	-0993.303	833.76	-4155.972
10/11/2012	01:00:00	-0969.303	841.55	-4201.137
10/12/2012	01:00:00	-0945.303	838.37	-4179.417
10/13/2012	01:00:00	-0921.303	841.05	-4212.000
10/14/2012	01:00:00	-0897.303	840.48	-4112.470
10/15/2012	01:00:00	-0873.303	831.23	-3955.925
10/16/2012	01:00:00	-0849.303	840.61	-4089.274
10/17/2012	01:00:00	-0825.303	830.45	-3935.879
10/18/2012	01:00:00	-0801.303	838.76	-4040.485
10/19/2012	01:00:00	-0777.303	832.52	-3921.825
10/20/2012	01:00:00	-0753.303	811.11	-3643.641
10/21/2012	01:00:00	-0729.303	783.37	-3317.693
10/22/2012	01:00:00	-0705.303	798.72	-3535.919
10/23/2012	01:00:00	-0681.303	790.69	-3446.835
10/24/2012	01:00:00	-0657.303	781.98	-3053.905
10/25/2012	01:00:00	-0633.303	801.62	-3472.704
10/26/2012	01:00:00	-0609.303	807.82	-3717.661
10/27/2012	01:00:00	-0585.303	789.58	-3404.394
10/28/2012	01:00:00	-0561.303	792.76	-3371.629
10/29/2012	01:00:00	-0537.303	807.22	-3690.169
10/30/2012	01:00:00	-0513.303	804.93	-3618.861
10/31/2012	01:00:00	-0489.303	803.34	-3580.948
11/01/2012	01:00:00	-0465.303	726.53	-2274.250
11/02/2012	01:00:00	-0441.303	605.22	0000.000
11/03/2012	01:00:00	-0417.303	603.04	0000.000
11/04/2012	01:00:00	-0393.303	633.25	-0561.143
11/05/2012	00:00:00	-0370.303	832.10	-3662.737
11/06/2012	00:00:00	-0346.303	845.98	-4204.050
11/07/2012	00:00:00	-0322.303	882.13	-4446.004
11/08/2012	00:00:00	-0298.303	867.50	-4335.537
11/09/2012	00:00:00	-0274.303	875.68	-4019.268
11/10/2012	00:00:00	-0250.303	842.18	-3893.703
11/11/2012	00:00:00	-0226.303	878.25	-4516.016
11/12/2012	00:00:00	-0202.303	862.87	-4364.202
11/13/2012	00:00:00	-0178.303	843.49	-3967.714
11/14/2012	00:00:00	-0154.303	862.78	-4125.237
11/15/2012	00:00:00	-0130.303	857.76	-4367.144
11/16/2012	00:00:00	-0106.303	871.83	-4433.917
11/17/2012	00:00:00	-0082.303	881.69	-4577.610
11/18/2012	00:00:00	-0058.303	882.90	-4207.928
11/19/2012	00:00:00	-0034.303	884.04	-4682.280
11/20/2012	00:00:00	-0010.303	880.43	-4893.967
11/21/2012	00:00:00	0013.697	917.31	-4430.843
11/21/2012	01:00:00	0014.697	882.12	-4890.869
11/21/2012	02:00:00	0015.697	851.82	-4001.861
11/21/2012	03:00:00	0016.697	850.98	-3974.381
11/21/2012	04:00:00	0017.697	851.17	-4575.774
11/21/2012	05:00:00	0018.697	851.79	-5043.825
11/21/2012	06:00:00	0019.697	851.29	-4390.750
11/21/2012	07:00:00	0020.697	853.11	-6279.776
11/21/2012	08:00:00	0021.697	862.39	-3534.504
11/21/2012	09:00:00	0022.697	838.37	-2659.147
11/21/2012	10:00:00	0023.697	854.65	-5052.645
11/21/2012	11:00:00	0024.697	902.46	-5549.817
11/21/2012	12:00:00	0025.697	902.20	-4161.117
11/21/2012	13:00:00	0026.697	855.52	-2292.679
11/21/2012	14:00:00	0027.697	850.00	-4949.363
11/21/2012	15:00:00	0028.697	849.82	-6949.411
11/21/2012	16:00:00	0029.697	849.08	-5371.194
11/21/2012	17:00:00	0030.697	849.18	-3097.427
11/21/2012	18:00:00	0031.697	849.82	-3571.772
11/21/2012	19:00:00	0032.697	849.97	-5165.252
11/21/2012	20:00:00	0033.697	849.38	-6866.262
11/21/2012	21:00:00	0034.697	824.12	-4746.300
11/21/2012	22:00:00	0035.697	848.82	-2187.113
11/21/2012	23:00:00	0036.697	850.14	-5583.500
11/22/2012	00:00:00	0037.697	850.83	-5090.802
11/22/2012	01:00:00	0038.697	851.00	-4001.514
11/22/2012	02:00:00	0039.697	851.44	-1838.694
11/22/2012	03:00:00	0040.697	852.02	-4552.411
11/22/2012	04:00:00	0041.697	852.12	-5214.653
11/22/2012	05:00:00	0042.697	852.12	-6246.601
11/22/2012	06:00:00	0043.697	852.30	-5141.917
11/22/2012	07:00:00	0044.697	852.17	-1150.925
11/22/2012	08:00:00	0045.697	852.22	-0122.508
11/22/2012	09:00:00	0046.697	852.91	-2160.921
11/22/2012	10:00:00	0047.697	853.11	-3976.571
11/22/2012	11:00:00	0048.697	853.63	-1913.230
11/22/2012	12:00:00	0049.697	853.08	-4104.187
11/22/2012	13:00:00	0050.697	691.14	-5908.229
11/22/2012	14:00:00	0051.697	839.23	-7273.335
11/22/2012	15:00:00	0052.697	856.28	-7656.818
11/22/2012	16:00:00	0053.697	859.99	-7695.447
11/22/2012	17:00:00	0054.697	857.29	-7541.508
11/22/2012	18:00:00	0055.697	856.28	-7557.784
11/22/2012	19:00:00	0056.697	855.33	-7560.837
11/22/2012	20:00:00	0057.697	854.29	-7556.858
11/22/2012	21:00:00	0058.697	850.73	-7502.837
11/22/2012	22:00:00	0059.697	849.63	-7452.315
11/22/2012	23:00:00	0060.697	849.04	-7534.634
11/23/2012	00:00:00	0061.697	847.97	-7461.191
11/23/2012	01:00:00	0062.697	847.89	-7456.048
11/23/2012	02:00:00	0063.697	849.52	-7500.077
11/23/2012	03:00:00	0064.697	848.81	-7504.121
11/23/2012	04:00:00	0065.697	847.21	-7509.502
11/23/2012	05:00:00	0066.697	846.99	-7529.399
11/23/2012	06:00:00	0067.697	844.09	-7504.864
11/23/2012	07:00:00	0068.697	843.49	-7460.594
11/23/2012	08:00:00	0069.697	842.19	-7324.310
11/23/2012	09:00:00	0070.697	840.66	-7196.556
11/23/2012	10:00:00	0071.697	838.66	-7145.782
11/23/2012	11:00:00	0072.697	837.19	-7140.101
11/23/2012	12:00:00	0073.697	836.11	-7086.646
11/23/2012	13:00:00	0074.697	834.82	-7009.248
11/23/2012	14:00:00	0075.697	832.87	-7078.729
11/23/2012	15:00:00	0076.697	832.44	-7138.433
11/23/2012	16:00:00	0077.697	832.40	-7108.222
11/23/2012	17:00:00	0078.697	829.65	-7109.845
11/23/2012	18:00:00	0079.697	829.21	-7137.064
11/23/2012	19:00:00	0080.697	829.00	-7223.422

APPENDIX H

GAUGE CALIBRATION SHEETS

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: 10469

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 = 681904	ft0 = 125193	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 12.825395	0.06135181202	0.000723885587	5.089702876E-06	1.279137902E-08
B 4.352505487	-0.003791521532	-1.282245198E-06	-1.198154782E-08	-2.382083001E-11
C -1.268952652E-05	1.105665746E-09	-7.976268291E-10	-1.571765592E-12	3.353848599E-15
D 7.059185814E-10	3.309431345E-12	2.435522112E-13	6.755648057E-16	-2.718418398E-19

Temperature (C) STANDARD FIT COEFFICIENTS

A 0.3779180527

B -0.3675073048

C -0.0001174302267

D -4.486565358E-07

0 points eliminated.
Error File: Gauge # 10469

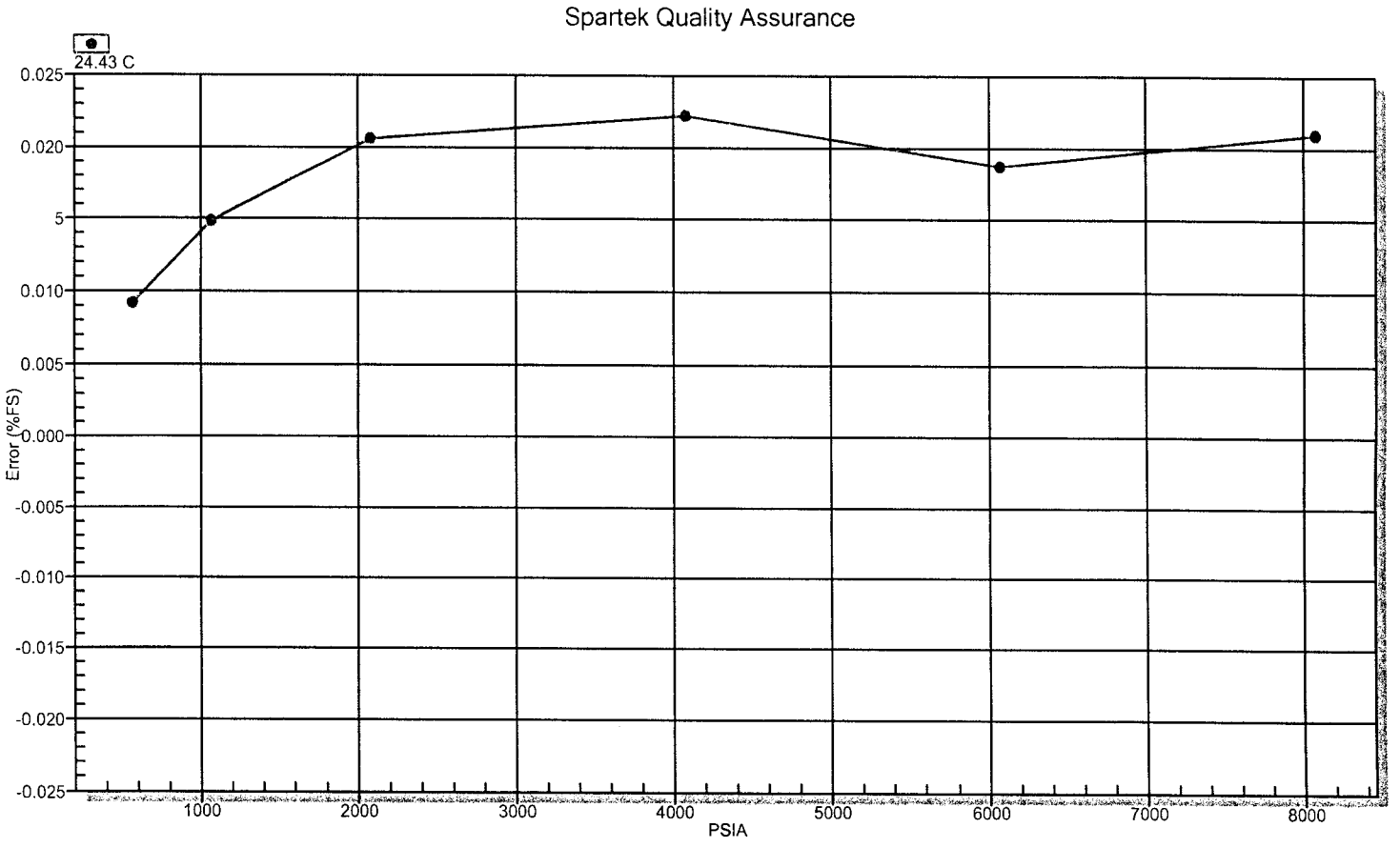
Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
12.90	0.00	681904.25	125193.63	-0.06
513.00	0.00	693401.00	125212.38	-0.01
1013.20	0.00	704911.50	125229.86	0.07
2513.60	0.00	739496.63	125275.94	0.11
4014.00	0.00	774157.56	125308.16	-0.03
5014.20	0.00	797300.75	125324.34	-0.20
6014.50	0.00	820480.25	125334.92	0.02
7014.80	0.00	843677.00	125340.63	0.04
8015.10	0.00	866906.38	125349.03	0.19
9015.40	0.00	890118.63	125339.88	-0.12
10015.70	0.00	913346.88	125325.22	0.00
12.90	20.00	681947.88	119680.09	0.01
513.00	20.00	692921.00	119692.95	-0.01
1013.20	20.00	703908.13	119707.59	0.04
2513.60	20.00	736920.00	119752.48	-0.06
4014.00	20.00	770024.38	119802.47	-0.04
5014.20	20.00	792120.38	119815.14	-0.06
6014.50	20.00	814255.38	119830.11	0.19
7014.80	20.00	836402.81	119839.64	0.05
8015.10	20.00	858556.06	119835.69	-0.05
9015.40	20.00	880728.06	119832.69	-0.17
10015.70	20.00	902915.13	119824.03	0.10
0.00	40.00	681701.25	114083.73	0.24
513.00	40.00	692451.31	114099.14	-0.19
1013.20	40.00	702954.31	114113.41	-0.14
2513.60	40.00	734521.81	114154.09	-0.03
4014.00	40.00	766172.50	114186.94	0.09
5014.20	40.00	787311.25	114209.83	-0.01
6014.50	40.00	808474.00	114219.17	0.10
7014.80	40.00	829665.81	114235.03	0.10
8015.10	40.00	850862.13	114238.73	-0.02
9015.40	40.00	872067.25	114240.69	-0.39
10015.70	40.00	893296.31	114236.67	0.23
0.00	60.00	681726.81	108548.77	0.18
513.00	60.00	692015.81	108573.03	-0.26
1013.20	60.00	702075.31	108576.72	0.15
2513.60	60.00	732284.06	108613.19	-0.31
4014.00	60.00	762604.13	108652.50	0.20
5014.20	60.00	782847.81	108671.53	0.16
6014.50	60.00	803111.31	108682.59	-0.09
7014.80	60.00	823414.25	108699.11	0.13
8015.10	60.00	843718.31	108707.09	-0.13
9015.40	60.00	864034.38	108709.61	-0.19
10015.70	60.00	884368.06	108711.72	0.15
0.00	80.00	681709.88	103183.42	0.05
513.00	80.00	691586.50	103212.05	-0.06
1013.20	80.00	701230.06	103211.28	0.06
2513.60	80.00	730209.25	103240.66	-0.14
4014.00	80.00	759279.50	103274.42	-0.02
5014.20	80.00	778703.13	103297.84	0.20
6014.50	80.00	798139.00	103308.17	0.02
7014.80	80.00	817602.50	103322.56	-0.12
8015.10	80.00	837091.06	103334.30	0.14
9015.40	80.00	856572.13	103337.64	-0.23
10015.70	80.00	876075.81	103339.88	0.11

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

Pressure Gauge
Certificate of Conformance

MODEL	0	REVISION	0
SERIAL NUMBER	10469	DEADWEIGHT USED	Piston Cylinder No. 528
CALIBRATED	Mar 07/01	E.U.B. CERT. DATE	May 09 2006
PRESSURE RANGE	10015.70 psi	TEMPERATURE RANGE	80.00 Deg. C

ACCURACY
As shown in the graph below, this Spartek Gauge conformed to within +/- 0.025 %F.S. of the pressure standard used in calibration, which is accurate to within +/- 0.01% of reading. This gives an overall accuracy of +/-(0.025%F.S. + 0.01% of reading)



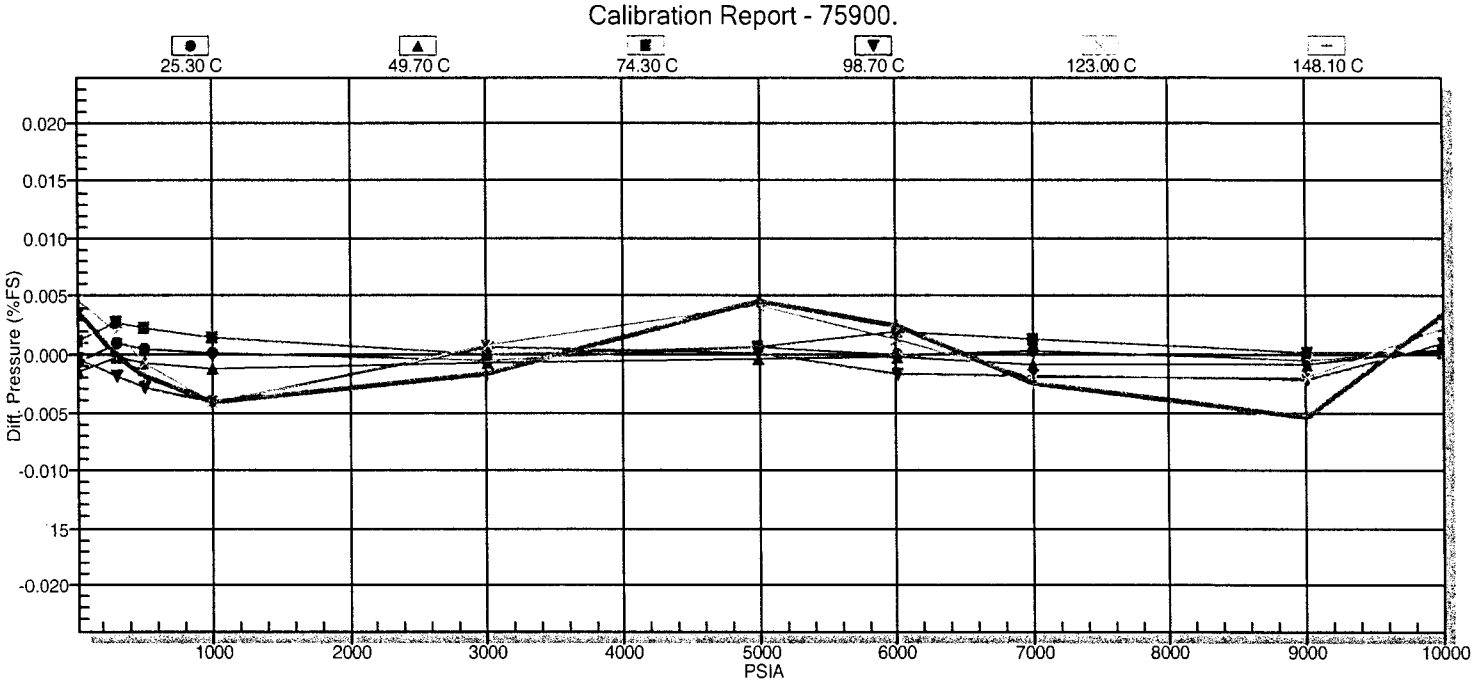
Accepted By: _____

Date: Thursday, May 29, 2008

SPARTEK SYSTEMS
GEOPHYSICAL INSTRUMENTATION
"Providing our customers with Best in Class Technology"

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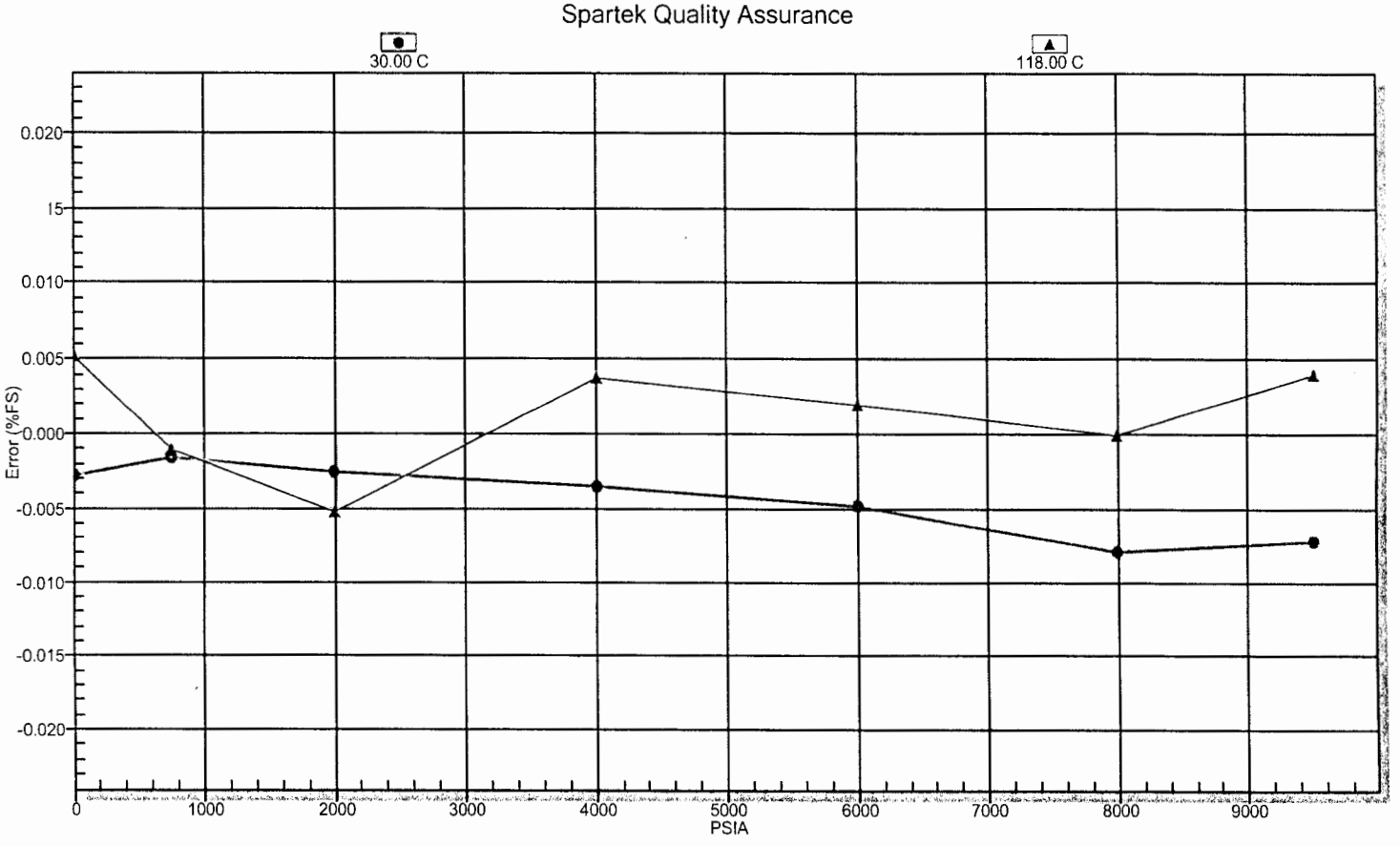
Pressure Gauge Certificate of Conformance

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: _____

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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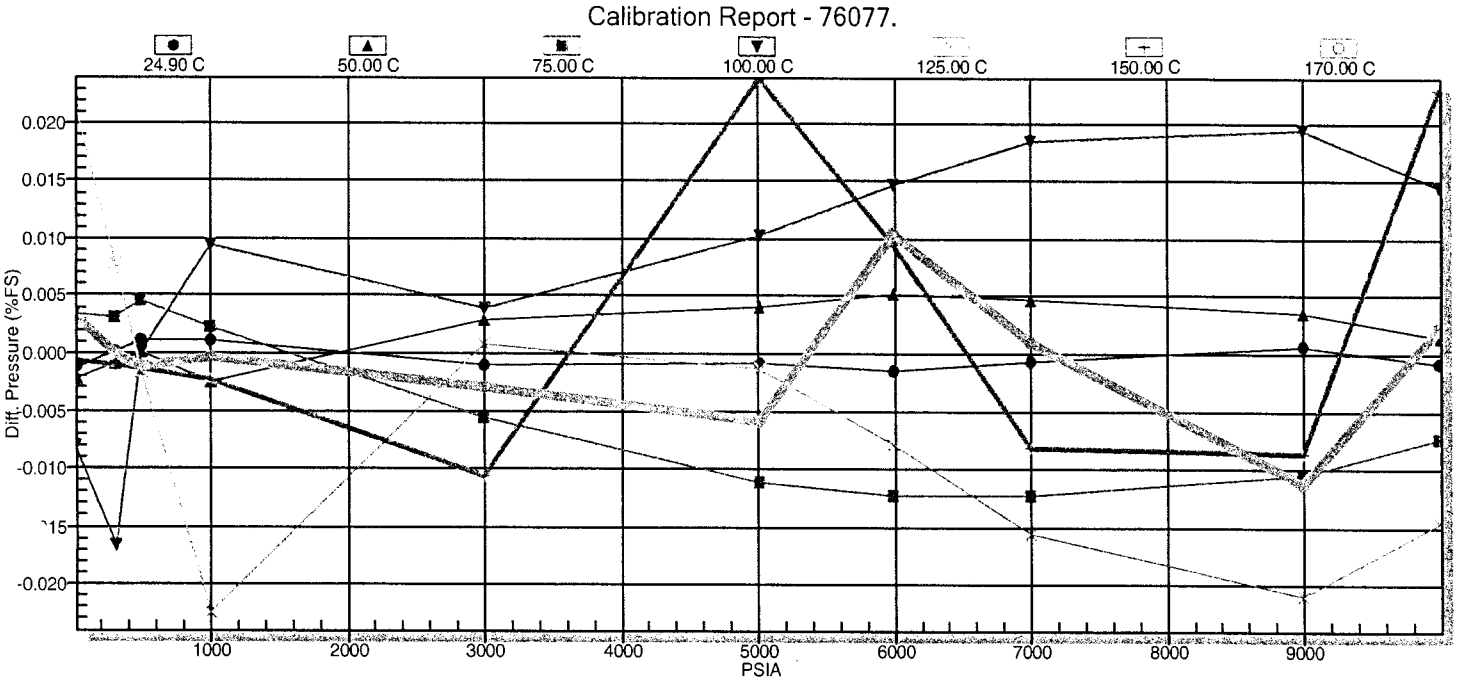
Pressure Gauge Certificate of Calibration



GAUGE NUMBER: 76077

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp	Pressure Equation:
Fit Order:	3	5	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 = 696205	ft0 = 150709	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 13.0136963	-0.01597146349	-0.003409903515	-3.126272132E-05	-1.079801947E-07
B -1.20366904E-10	2.566524369	-0.00181832986	6.893628782E-06	6.462276628E-08
C 2.439273265E-10	2.918895194E-13	2.465612196E-06	-2.155514842E-07	-6.037720502E-09
D -5.390582477E-11	-1.859576295E-13	-2.104819019E-16	3.934133943E-10	4.404493663E-11

Temperature (C) STANDARD FIT COEFFICIENTS

A 25.09298827

B -0.3345891166

C 0.0002234251032

D 3.202327425E-07

0 points eliminated.
Error File: Gauge # 76077

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.14	24.90	696205.67	150709.75	-0.11
304.14	24.90	707549.00	150725.00	0.02
492.97	25.10	714910.33	150735.25	0.12
1002.43	25.00	734759.00	150758.25	0.11
2996.09	25.00	812351.33	150789.25	-0.10
5006.81	24.90	890382.33	150760.25	-0.08
5993.35	24.90	928536.00	150727.00	-0.14
6998.81	25.00	967319.00	150681.50	-0.07
8995.36	25.00	1043926.00	150543.75	0.07
9997.60	25.00	1082145.33	150451.25	-0.09
13.14	50.00	696469.67	143706.00	-0.22
304.14	50.00	707208.67	143719.50	-0.08
492.98	50.00	714178.00	143728.25	0.02
1002.44	50.00	732959.67	143746.50	-0.24
2996.11	50.00	806452.67	143774.75	0.29
5006.82	50.00	880374.67	143759.25	0.40
5993.37	50.00	916544.67	143735.25	0.53
6998.82	50.00	953316.00	143701.00	0.47
8995.37	50.00	1025999.00	143592.50	0.36
9997.62	50.00	1062286.33	143521.00	0.14
13.13	75.00	696703.67	136798.75	0.35
304.13	75.00	706894.67	136809.25	0.32
492.96	75.00	713514.00	136819.25	0.47
1002.42	75.00	731349.67	136839.00	0.23
2996.09	75.00	801097.67	136866.25	-0.56
5006.80	75.00	871290.00	136856.25	-1.11
5993.35	75.10	905646.00	136839.00	-1.22
6998.80	75.10	940581.67	136810.00	-1.23
8995.35	75.00	1009673.33	136724.25	-1.05
9997.60	75.00	1044186.67	136663.75	-0.74
13.09	100.00	696777.00	130141.75	-0.81
304.09	100.00	706451.00	130154.00	-1.65
492.93	100.00	712802.00	130163.25	0.01
1002.38	100.00	729812.67	130178.00	0.95
2996.04	100.10	796156.67	130204.00	0.40
5006.74	100.00	862936.00	130200.25	1.03
5993.28	100.00	895628.00	130188.25	1.47
6998.73	100.00	928874.67	130163.75	1.84
8995.27	100.00	994653.67	130090.75	1.94
9997.52	100.00	1027532.67	130041.50	1.46
13.05	125.00	697214.67	123832.75	2.18
304.05	125.10	706374.67	123836.75	0.78
492.88	125.00	712319.00	123847.00	-0.17
1002.33	125.00	728379.00	123862.25	-2.24
2996.00	125.10	791594.67	123885.25	0.09
5006.69	125.10	855234.67	123884.00	-0.14
5993.24	125.10	886388.00	123871.75	-0.79
6998.69	125.00	918084.00	123856.00	-1.55
8995.23	124.90	980807.67	123795.50	-2.09
9997.47	125.00	1012148.67	123744.50	-1.45
13.03	150.00	697797.67	117358.25	-0.07
304.02	150.10	706476.33	117368.25	-0.10
492.86	150.00	712115.67	117374.50	-0.13
1002.32	150.00	727356.33	117391.50	-0.23
2995.98	150.00	787272.67	117411.75	-1.07
5006.68	150.00	848086.67	117414.00	2.39
5993.23	149.90	877838.33	117409.25	0.94
6998.68	150.00	908103.67	117395.75	-0.82
8995.23	150.00	968022.33	117346.50	-0.87
9997.48	149.90	997991.00	117315.25	2.29
12.99	170.00	698213.00	111793.50	0.33
303.99	169.80	706531.33	111800.50	-0.01
492.82	170.10	711940.67	111810.00	-0.11
1002.28	170.00	726572.33	111814.00	-0.03
2995.95	169.90	784153.00	111836.25	-0.29
5006.65	170.10	842570.67	111840.25	-0.60
5993.20	169.90	871331.00	111837.50	1.04
6998.64	169.90	900556.33	111835.25	0.09
8995.20	169.90	958388.00	111791.00	-1.14

9997.44	170.10	987328.67	111770.50	0.23

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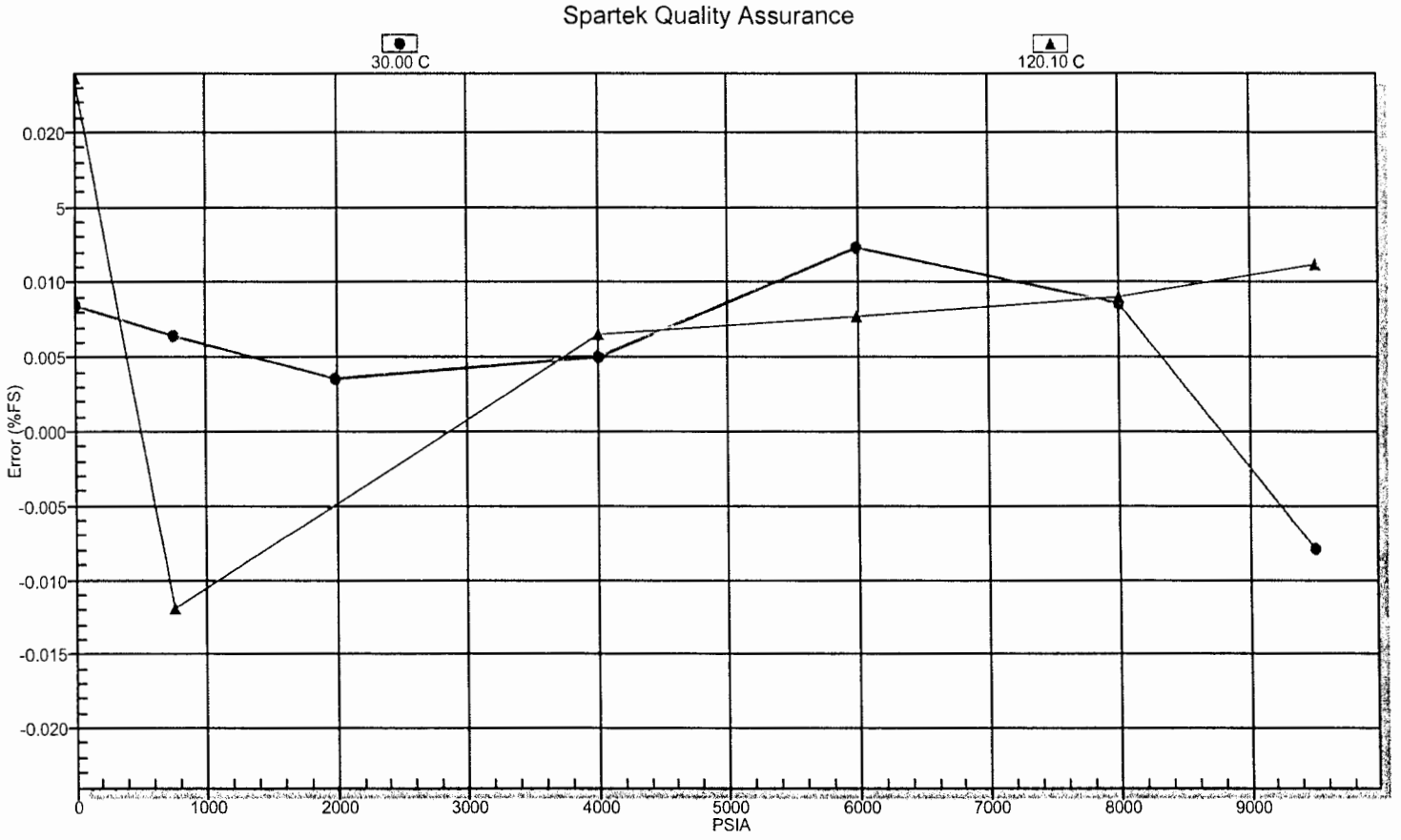
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76077	CALIBRATION DATE	JUN 30/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.14 - 9997.60 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	24.90 - 170.00 °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: _____ Date: JUL 07/11

Ramp report: Serial # 76077
Gauge range = 9997.621 PSI. Max. DIFF. = 2.399
Ramp check result: PASS, Max Err = 0.024% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9504.50	9503.71	9504.65	-0.79	0.0079	30.00	30.46
8006.05	8006.91	8006.20	0.86	0.0086	30.10	30.10
5993.35	5994.57	5993.45	1.23	0.0123	29.90	29.74
4003.83	4004.33	4003.72	0.50	0.0050	30.00	29.58
1993.77	1994.14	1993.62	0.36	0.0036	29.90	29.60
755.13	755.78	754.91	0.65	0.0065	29.90	29.71
13.15	14.00	13.54	0.85	0.0085	29.90	29.79
9504.52	9505.64	9504.44	1.12	0.0112	120.10	119.78
8006.07	8006.98	8006.00	0.91	0.0091	119.90	119.74
5993.36	5994.14	5993.25	0.78	0.0078	120.10	119.68
4003.84	4004.51	4003.68	0.66	0.0066	120.00	119.72
755.13	753.95	754.68	-1.18	0.0118	120.00	119.95
13.15	15.52	12.27	2.37	0.0237	119.90	120.06

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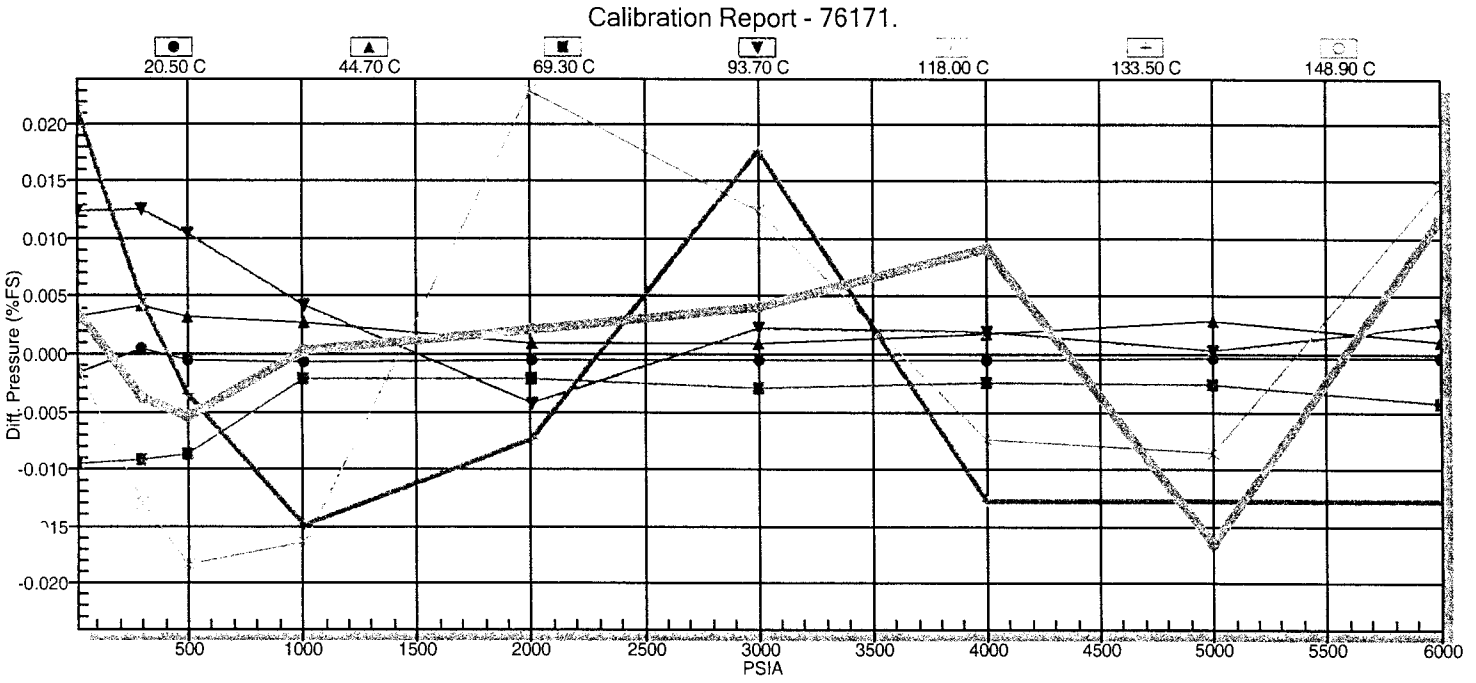
Pressure Gauge Certificate of Calibration



GAUGE NUMBER: 76171

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 = 680467	ft0 = 147715	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 12.95713534	0.07176652475	-0.0008403552752	-8.075479491E-06	-1.986285576E-08
B 2.154114143	-0.001777116361	-1.031398656E-07	2.568332342E-09	2.000963373E-11
C -6.280010174E-06	1.532672175E-08	2.116426596E-10	-1.074931629E-12	-9.914299177E-15
D 1.137635017E-10	-5.275689956E-12	-7.935964758E-14	-5.228817887E-18	1.711892186E-18

Temperature (C) STANDARD FIT COEFFICIENTS

A 20.61027667

B -0.3623574837

C -8.529409921E-06

D -2.511062843E-07

1 points eliminated.
Error File: Gauge # 76171

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.06	20.50	680467.00	147715.50	-0.10
296.86	20.50	693654.00	147727.50	0.03
500.40	20.60	703112.33	147738.50	-0.03
1003.35	20.60	726518.33	147758.00	-0.04
2001.27	20.50	773055.67	147771.75	-0.03
3003.39	20.60	819897.67	147764.75	-0.03
4002.65	20.50	866697.00	147742.75	-0.03
4998.57	20.50	913386.67	147693.50	-0.02
6000.93	20.60	960410.33	147625.75	-0.02
13.10	44.70	680768.00	141068.25	0.20
296.90	44.70	693270.33	141080.50	0.26
500.44	44.70	702238.67	141087.00	0.20
1003.39	44.80	724427.33	141101.50	0.17
2001.31	44.80	768537.33	141122.50	0.06
3003.43	44.70	812931.33	141120.75	0.06
4002.70	44.80	857273.67	141100.50	0.11
4998.61	44.70	901516.00	141060.75	0.18
6000.97	44.80	946061.00	141001.25	0.07
13.13	69.30	680937.67	134383.25	-0.57
296.93	69.30	692819.67	134394.75	-0.55
500.47	69.30	701347.33	134402.00	-0.52
1003.42	69.20	722449.00	134418.00	-0.13
2001.35	69.20	764348.33	134434.00	-0.13
3003.46	69.20	806496.00	134435.25	-0.18
4002.73	69.20	848587.33	134421.00	-0.15
4998.64	69.30	890582.00	134391.25	-0.16
6001.00	69.30	932873.67	134344.25	-0.26
13.14	93.70	681100.33	127945.00	0.75
296.94	93.80	692402.67	127954.00	0.76
500.48	93.70	700509.00	127960.75	0.62
1003.43	93.70	720558.33	127975.50	0.26
2001.35	93.70	760419.00	127992.50	-0.25
3003.47	93.70	800560.33	127995.75	0.14
4002.73	93.80	840625.33	127986.00	0.12
4998.64	93.80	880583.33	127962.50	0.02
6001.00	93.70	920816.33	127925.50	0.15
13.11	118.00	681374.00	121840.00	-0.07
296.91	118.00	692059.00	121851.25	-0.77
500.45	118.00	699740.67	121856.00	-1.10
1003.40	118.00	718797.33	121866.75	-0.98
2001.32	118.00	756833.67	121885.00	1.38
3003.43	118.00	795057.00	121890.00	0.74
4002.70	118.10	833236.67	121886.75	-0.44
4998.61	118.00	871355.00	121872.00	-0.51
6000.96	118.20	909727.67	121839.25	0.87
13.09	133.50	681887.33	118155.00	1.30
296.89	133.50	692163.67	118162.00	0.28
500.43	133.50	699561.33	118167.00	-0.20
1003.38	133.50	717922.33	118176.25	-0.90
2001.29	133.50	754648.33	118191.75	-0.44
3003.41	133.50	791796.67	118199.25	1.06
4002.67	133.50	828849.00	118197.75	-0.77
6000.94	133.40	903068.67	118156.25	-0.77
13.04	148.90	682634.67	114532.25	0.23
296.84	148.90	692500.00	114542.25	-0.22
500.37	149.00	699611.67	114551.00	-0.32
1003.32	148.90	717301.33	114561.75	0.02
2001.24	148.80	752726.00	114581.00	0.13
3003.36	148.80	788649.33	114587.00	0.24
4002.61	148.90	824690.00	114587.75	0.55
4998.53	148.90	860606.00	114579.50	-0.99
6000.88	148.90	896784.00	114562.00	0.70

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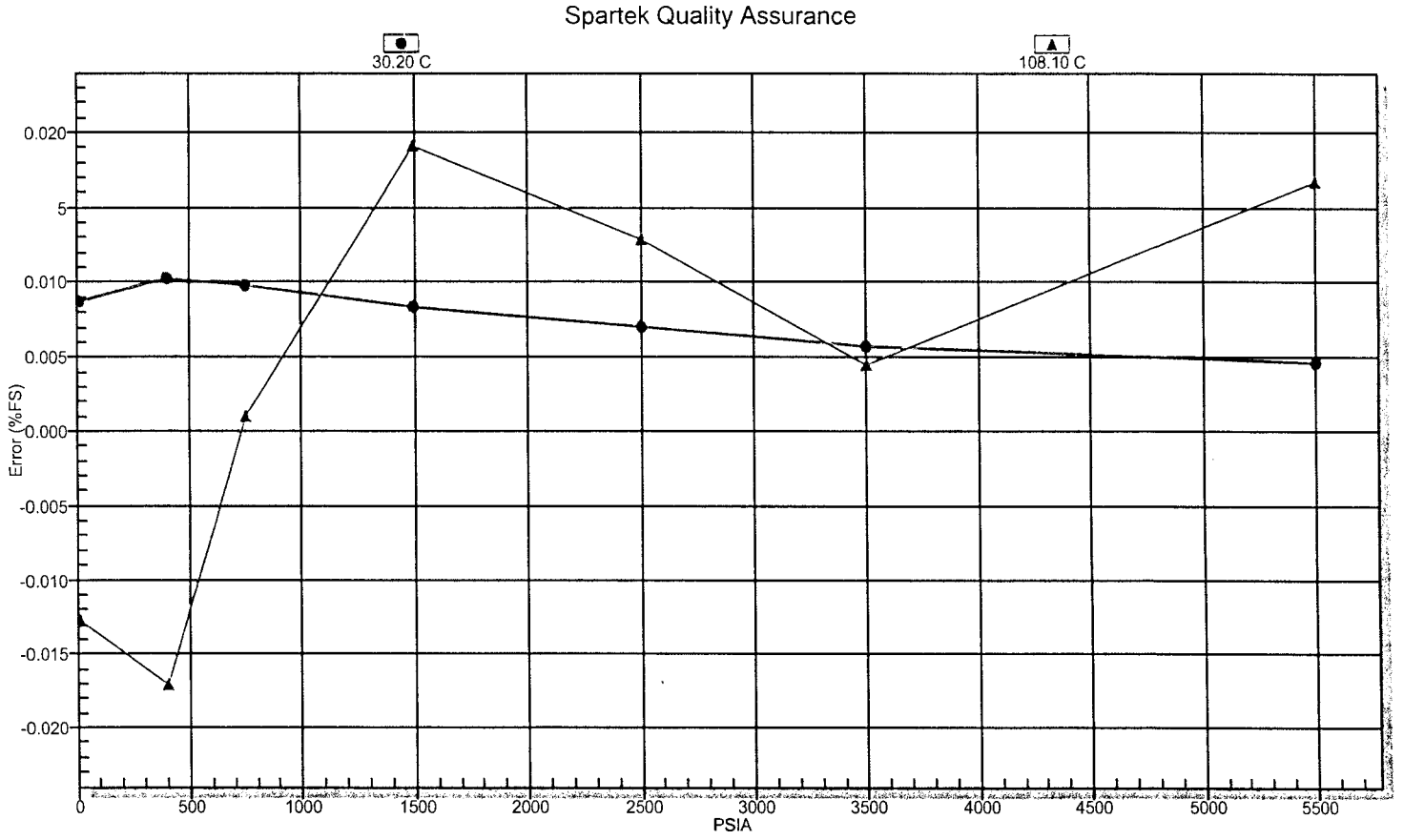
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76171	CALIBRATION DATE	AUG 23/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.06 - 6000.93 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	20.50 - 148.90 °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: AUG 25/11

Ramp report: Serial # 76171
Gauge range = 6001.001 PSI. Max. DIFF. = 1.440
Ramp check result: PASS, Max Err = 0.019% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
5500.38	5500.66	5501.26	0.28	0.0046	30.20	30.24
3498.99	3499.33	3499.82	0.35	0.0058	30.10	30.03
2502.86	2503.28	2503.69	0.42	0.0070	30.30	30.01
1497.38	1497.89	1498.19	0.50	0.0084	30.20	30.06
747.03	747.62	747.70	0.59	0.0099	30.10	30.14
398.54	399.16	399.15	0.62	0.0103	30.40	30.18
13.09	13.62	13.51	0.53	0.0088	30.40	30.27
5500.41	5501.41	5501.33	1.00	0.0167	108.10	107.93
3499.02	3499.29	3499.87	0.27	0.0045	108.10	107.91
2502.89	2503.67	2503.71	0.78	0.0129	108.30	108.03
1497.41	1498.56	1498.15	1.15	0.0192	108.20	108.16
747.06	747.13	747.78	0.06	0.0011	108.20	108.25
398.59	397.56	399.23	-1.02	0.0171	108.30	108.34
13.14	12.37	13.52	-0.76	0.0127	108.30	108.41

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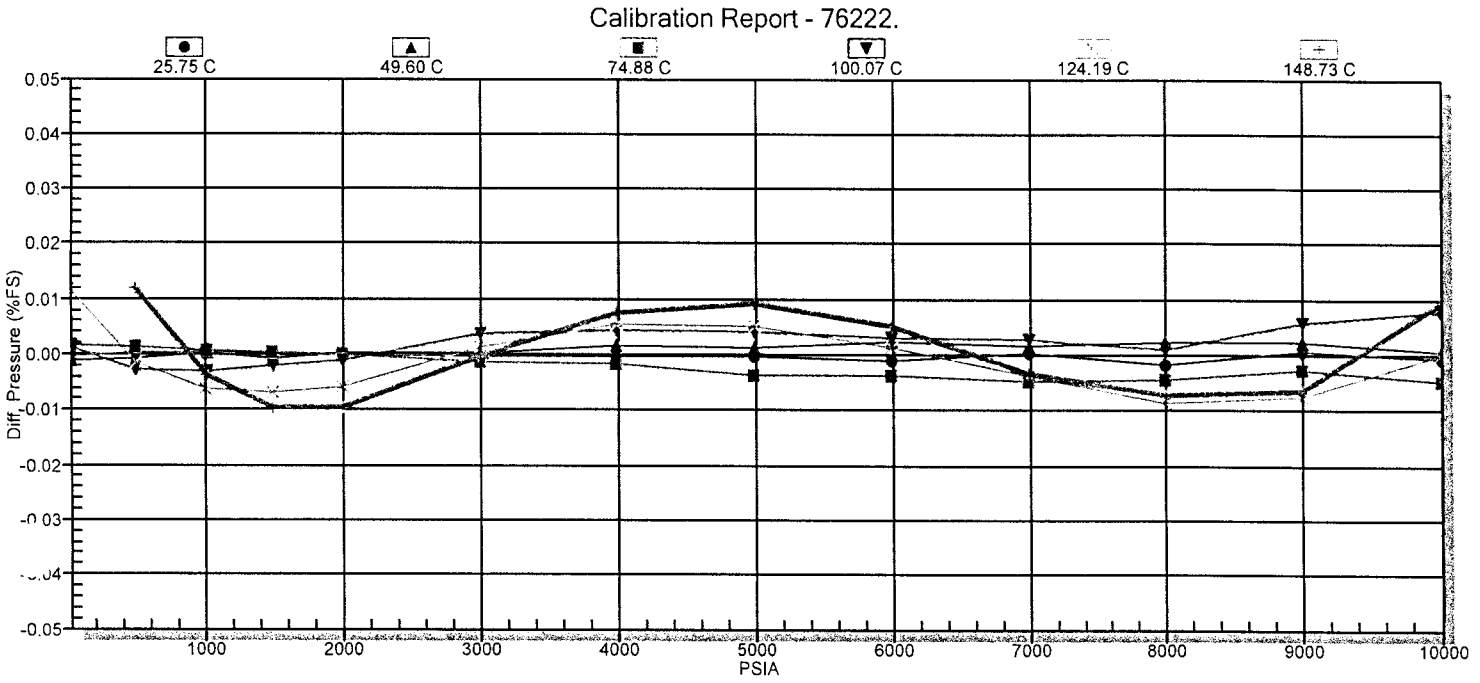
Pressure Gauge Certificate of Calibration



GAUGE NUMBER: 76222

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 = 698327	ft0 = 159453	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 13.05800257	0.1550681824	0.0006833249363	2.19782565E-06	8.269551256E-10
B 2.854184739	-0.002379161074	-1.638722057E-06	-8.649890759E-09	-6.29832023E-12
C -1.178183015E-06	1.345414041E-08	2.427442915E-10	9.381777193E-13	-1.191484389E-15
D 1.263008801E-10	-3.100118503E-12	-2.427153497E-14	-6.139178868E-17	3.924538304E-19

Temperature (C) STANDARD FIT COEFFICIENTS

A 25.75469192

B -0.3633286108

C -6.566361962E-05

D -2.760684325E-07

1 points eliminated.
Error File: Gauge # 76222

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.09	25.75	698327.17	159453.75	-0.03
492.51	25.72	715129.67	159474.13	0.04
1001.56	25.72	732975.83	159494.13	0.03
1495.01	25.77	750275.83	159493.50	0.03
2002.94	25.72	768096.67	159516.50	-0.01
3005.19	25.79	803241.67	159505.50	-0.05
3992.87	25.73	837912.83	159525.88	-0.02
4994.64	25.81	873012.50	159487.75	-0.04
5995.35	25.74	908100.00	159475.75	-0.10
6996.40	25.82	943107.83	159416.13	0.03
8000.38	25.77	978228.50	159380.00	-0.16
9002.18	25.81	1013174.83	159307.63	0.08
10004.62	25.80	1048082.50	159233.38	-0.05
13.12	49.60	698587.67	152837.63	-0.11
492.55	49.57	714537.33	152858.75	-0.06
1001.60	49.58	731480.17	152876.13	0.03
1495.04	49.62	747897.83	152874.63	-0.05
2002.98	49.57	764819.50	152903.00	0.05
3005.21	49.64	798178.50	152893.00	0.03
3992.91	49.59	831087.83	152913.50	0.17
4994.64	49.66	864404.50	152879.88	0.13
5995.39	49.59	897727.50	152880.38	0.24
6996.39	49.66	930964.00	152830.25	0.18
8000.42	49.60	964332.83	152808.25	0.25
9002.17	49.67	997501.33	152739.63	0.24
10004.66	49.63	1030695.17	152690.38	0.05
13.10	74.88	698768.00	145756.00	0.16
492.52	74.89	713897.00	145774.13	0.14
1001.58	74.87	729964.50	145789.75	0.06
1495.02	74.90	745540.17	145787.50	0.03
2002.95	74.86	761587.00	145814.88	0.00
3005.20	74.95	793226.50	145805.38	-0.14
3992.88	74.84	824435.83	145829.38	-0.18
4994.63	74.95	856037.17	145802.25	-0.36
5995.36	74.88	887638.67	145806.75	-0.38
6996.39	74.99	919165.17	145762.88	-0.49
8000.39	74.92	950816.33	145748.50	-0.43
9002.17	74.94	982293.50	145691.00	-0.28
10004.63	74.96	1013784.00	145651.88	-0.46
13.10	100.07	698950.83	138858.50	0.12
492.52	100.06	713301.17	138874.13	-0.28
1001.57	100.05	728559.50	138890.50	-0.29
1495.02	100.09	743354.67	138885.88	-0.21
2002.95	100.02	758602.50	138917.63	-0.10
3005.20	100.13	788678.17	138905.50	0.36
3992.88	100.05	818340.33	138931.63	0.44
4994.63	100.10	848379.00	138905.75	0.42
5995.35	100.04	878422.50	138919.63	0.31
6996.39	100.15	908394.00	138879.13	0.29
8000.38	100.05	938484.17	138875.50	0.10
9002.17	100.14	968418.67	138825.50	0.59
10004.60	100.08	998375.67	138800.88	0.78
13.08	124.19	699238.00	132521.75	1.19
492.50	124.16	712859.58	132533.25	-0.12
1001.55	124.18	727362.92	132543.19	-0.63
1495.00	124.17	741447.25	132551.75	-0.68
2002.93	124.16	755961.92	132561.31	-0.58
3005.18	124.20	784642.50	132570.69	0.14
3992.85	124.19	812924.83	132578.19	0.56
4994.62	124.19	841609.17	132579.06	0.52
5995.32	124.21	870251.92	132574.75	0.12
6996.38	124.22	898891.42	132567.13	-0.36
8000.35	124.19	927574.42	132546.13	-0.84
9002.17	124.20	956168.17	132519.13	-0.74
10004.58	124.19	984745.00	132489.00	0.01
492.51	148.73	712581.17	126354.88	1.20
1001.56	148.74	726337.50	126362.75	-0.37
1495.01	148.73	739721.50	126369.13	-0.96
2002.94	148.72	753538.33	126379.00	-0.96

3005.19	148.73	780871.83	126372.38	-0.03
3992.86	148.70	807879.67	126394.50	0.75
4994.63	148.70	835288.83	126402.25	0.92
5995.34	148.70	862658.33	126394.38	0.52
6996.40	148.72	890034.50	126393.63	-0.33
8000.37	148.71	917466.00	126379.75	-0.71
9002.20	148.74	944809.33	126364.88	-0.66
10004.61	148.71	972130.00	126339.00	0.92

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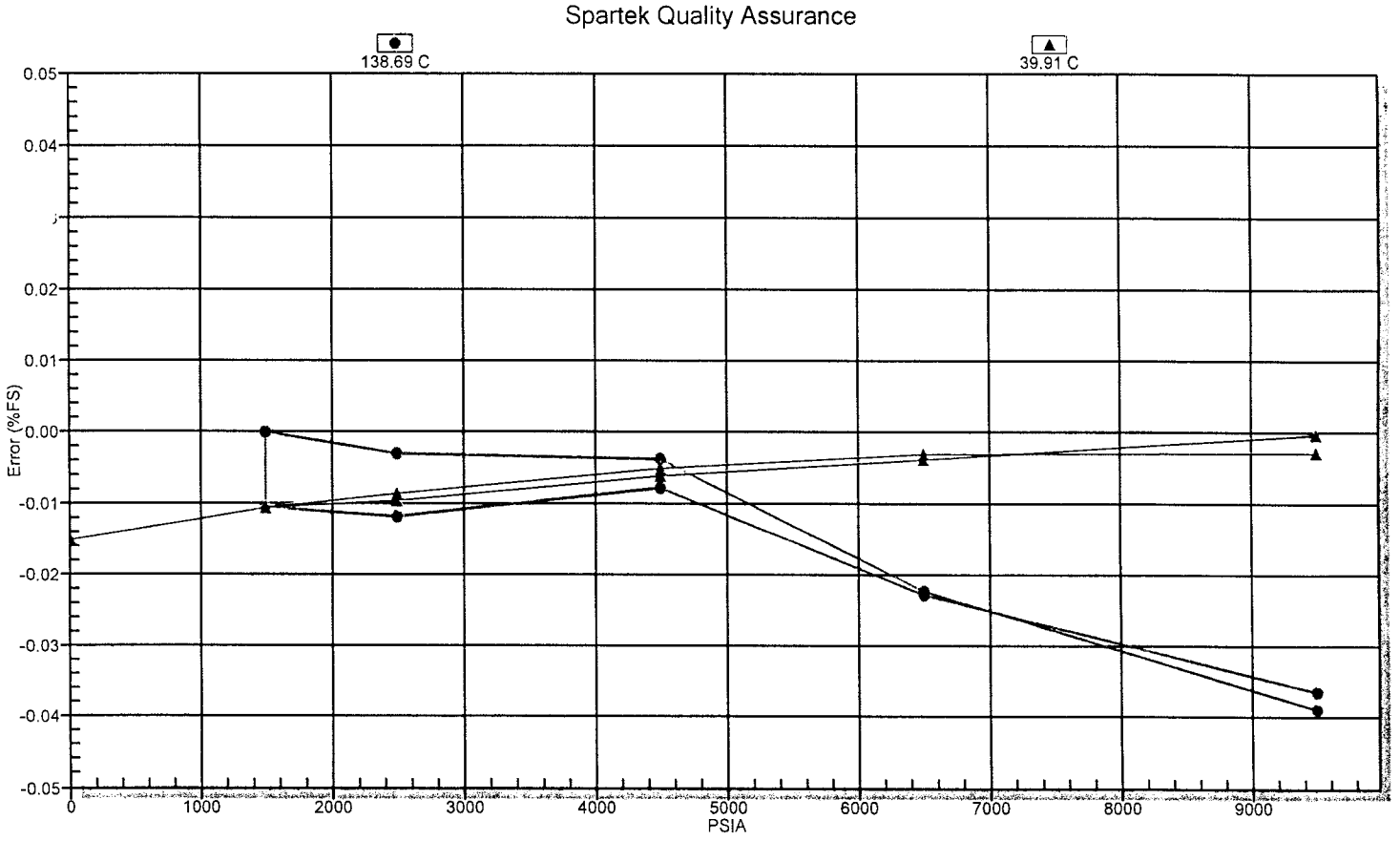
Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76222	CALIBRATION DATE	MAY 28/12
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.09 - 10004.62 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.75 - 148.73 °C	TRACEABILITY DOC.	CAL-STANDARD-001

ACCURACY

As shown in the graph below, this Spartek Gauge conformed to within +/- 0.050 %F.S. of the pressure standard used in calibration, which is accurate to within +/- 0.01% of reading. This gives an overall accuracy of +/-(0.050%F.S. + 0.01% of reading)



Accepted By: _____

Date: JUN 01/12

Ramp report: Serial # 76222
Gauge range = 10004.660 PSI. Max. DIFF. = 5.002
Ramp check result: PASS, Max Err = 0.039% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9496.45	9492.56	9496.11	-3.90	0.0389	138.69	138.49
6503.08	6500.87	6502.55	-2.22	0.0221	138.69	138.20
4499.30	4498.94	4498.84	-0.36	0.0036	138.83	138.18
2497.26	2496.96	2496.73	-0.30	0.0030	138.88	138.29
1494.95	1494.94	1494.41	-0.01	0.0001	138.94	138.39
1494.96	1493.91	1494.44	-1.05	0.0105	138.97	138.48
2497.28	2496.11	2496.73	-1.17	0.0117	139.08	138.47
4499.32	4498.54	4498.77	-0.78	0.0078	139.10	138.45
6503.09	6500.82	6502.51	-2.27	0.0227	139.14	138.53
9496.46	9492.81	9496.16	-3.64	0.0364	139.15	138.74
9496.48	9496.19	9495.91	-0.28	0.0028	39.91	40.38
6503.12	6502.82	6502.42	-0.30	0.0030	39.89	39.79
4499.34	4498.83	4498.69	-0.51	0.0051	39.82	39.61
2497.29	2496.44	2496.59	-0.85	0.0085	39.79	39.59
1494.98	1493.92	1494.37	-1.05	0.0105	39.79	39.65
13.06	11.56	12.17	-1.50	0.0150	39.81	39.81
1494.98	1493.92	1494.28	-1.05	0.0105	39.84	39.68
2497.30	2496.36	2496.68	-0.94	0.0094	39.85	39.62
4499.33	4498.74	4498.72	-0.59	0.0059	39.85	39.64
6503.10	6502.73	6502.48	-0.37	0.0037	39.85	39.80
9496.47	9496.46	9496.07	-0.02	0.0002	39.89	40.35

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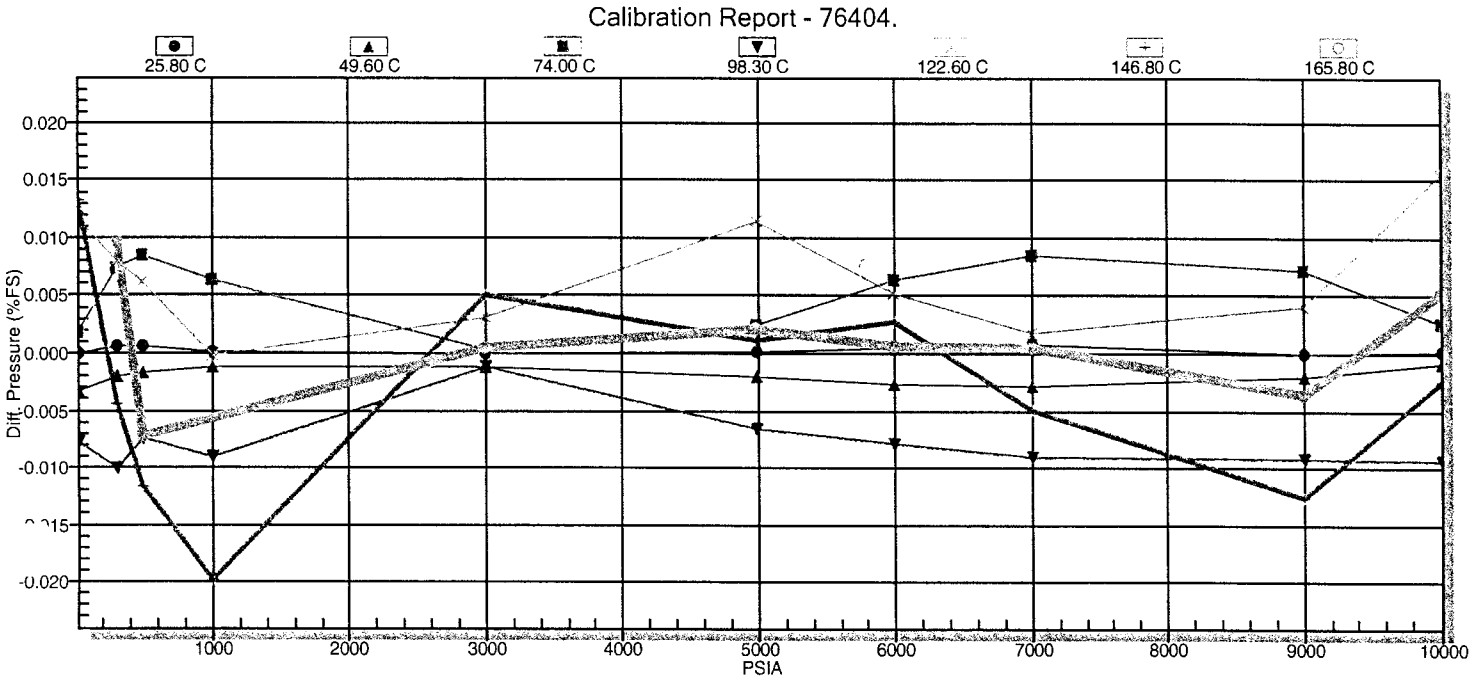
Pressure Gauge Certificate of Calibration



GAUGE NUMBER: 76404

2-D POLYNOMIAL LMS CURVEFIT

Source of f:	Pres	Temp	Pressure Equation:
Fit Order:	3	5	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 = 679762	ft0 = 147934	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 12.99794347	0.2330350417	0.001448503543	8.059807097E-06	2.546076087E-08
B 3.425793327E-11	2.732094734	-0.002470381242	-2.808599563E-06	-1.357774352E-08
C -9.364561627E-12	7.798827128E-15	-5.296904725E-06	1.130329865E-07	2.416253335E-09
D 1.471188786E-11	3.328730054E-14	2.832889781E-17	1.145768863E-10	-2.228504448E-11

Temperature (C) STANDARD FIT COEFFICIENTS

A 25.84508201

B -0.3744317269

C 1.894632477E-05

D -1.71314099E-07

2 points eliminated.
Error File: Gauge # 76404

Pressure psi	Temperature Deg. C	Count (Pres)	Count (Temp)	DIFF (press) psi
13.02	25.80	679762.67	147934.25	0.00
303.29	25.60	690391.67	147943.75	0.06
492.47	25.70	697321.33	147956.75	0.06
1001.53	25.90	715981.67	147982.75	0.02
3005.18	25.90	789576.33	148010.25	0.00
4994.65	25.80	862809.33	147991.25	0.02
5995.36	25.90	899684.00	147968.00	0.05
6996.43	25.80	936553.00	147921.25	0.08
9002.25	25.80	1010378.00	147797.25	0.00
10004.67	25.90	1047231.00	147721.25	0.02
13.02	49.60	680117.67	141661.00	-0.33
303.29	49.70	690206.67	141675.25	-0.20
492.47	49.60	696783.67	141683.50	-0.16
1001.53	49.60	714492.00	141701.50	-0.12
3005.19	49.50	784326.67	141739.00	-0.11
4994.66	49.60	853811.33	141729.00	-0.20
5995.37	49.50	888789.67	141709.00	-0.26
6996.44	49.60	923776.33	141674.25	-0.28
9002.26	49.60	993832.67	141572.75	-0.20
10004.68	49.60	1028780.33	141499.50	-0.08
13.03	74.00	680338.67	135239.25	0.17
303.29	74.00	689952.67	135250.25	0.73
492.48	74.00	696212.67	135257.25	0.86
1001.53	74.00	713046.00	135275.25	0.64
3005.19	74.00	779388.33	135308.25	0.03
4994.65	74.10	845380.33	135306.25	0.25
5995.37	74.00	878599.00	135288.75	0.64
6996.44	74.00	911827.67	135262.50	0.86
9002.26	74.00	978373.33	135182.50	0.73
10004.67	74.20	1011573.67	135120.00	0.26
13.04	98.30	680447.67	129003.25	-0.77
303.31	98.30	689578.33	129014.00	-0.99
492.49	98.30	695543.67	129019.75	-0.73
1001.55	98.30	711576.00	129037.50	-0.90
3005.20	98.30	774797.33	129066.25	-0.12
4994.67	98.30	837614.67	129069.25	-0.65
5995.38	98.30	869227.00	129056.75	-0.79
6996.45	98.30	900849.67	129035.50	-0.90
9002.27	98.40	964183.67	128969.00	-0.92
10004.69	98.40	995802.33	128923.25	-0.93
13.05	122.60	680623.67	123046.00	1.17
303.32	122.70	689309.33	123054.00	0.80
492.50	122.60	694975.33	123060.50	0.63
1001.56	122.60	710227.67	123076.50	-0.01
3005.21	122.70	770470.33	123108.75	0.31
4994.68	122.60	830430.67	123115.50	1.15
5995.39	122.60	860569.67	123102.75	0.53
6996.47	122.60	890723.33	123084.75	0.17
9002.28	122.70	951127.00	123039.00	0.42
10004.70	122.70	981270.67	122997.75	1.55
13.06	146.80	680801.33	117455.75	1.33
303.34	146.90	689032.33	117466.50	-0.43
492.51	146.80	694413.33	117474.25	-1.17
1001.58	146.70	708942.33	117488.25	-1.99
3005.22	146.70	766486.00	117519.75	0.51
4994.69	146.80	823742.67	117526.75	0.12
5995.40	146.80	852585.67	117520.50	0.27
6996.46	146.80	881413.33	117509.50	-0.49
9002.28	146.90	939126.33	117469.75	-1.27
10004.68	146.80	967923.00	117434.25	-0.25
303.32	165.80	689042.00	113002.50	0.97
492.50	165.90	694186.67	113010.00	-0.72
3005.21	165.90	763520.67	113055.25	0.04
4994.67	165.90	818745.33	113066.25	0.21
5995.38	165.90	846580.33	113067.00	0.07
6996.44	165.90	874446.00	113064.75	0.06
9002.25	165.80	930216.00	113036.50	-0.36
10004.67	165.90	958059.00	113016.00	0.53

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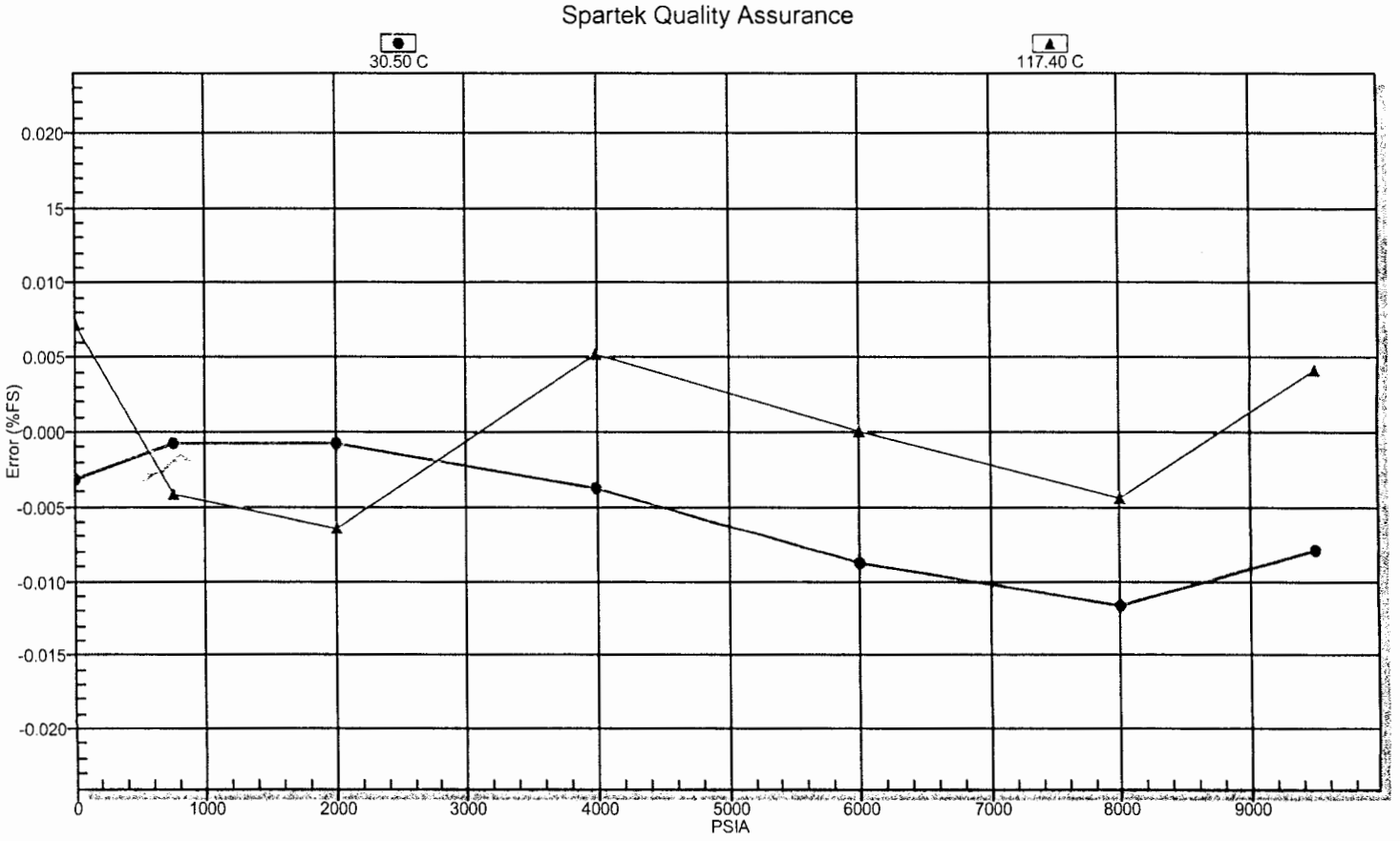
Fax (403) 887-4050
URL www.sparteksystems.com

Pressure Gauge Certificate of Conformance

SERIAL NUMBER	76404	CALIBRATION DATE	JUN 11/11
MODEL NUMBER	0 FF0	PRESSURE REFERENCE	NIST Traceable
PRESSURE RANGE	13.02 - 10004.67 psi	TEMP. REFERENCE	NIST Traceable
TEMP. RANGE	25.80 - 165.80 °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: JUN 14/11

Ramp report: Serial # 76404
Gauge range = 10004.700 PSI. Max. DIFF. = 2.401
Ramp check result: PASS, Max Err = 0.012% F.S.

DW Pressure	Gauge Pressure	RPM4 Pressure	Differential	%F.S.	Oven Temp.	Gauge Temp.
9496.60	9495.81	9496.38	-0.79	0.0079	30.50	31.01
8000.40	7999.24	8000.21	-1.16	0.0116	30.60	30.69
5995.36	5994.48	5994.98	-0.88	0.0088	30.40	30.38
3992.86	3992.49	3992.50	-0.37	0.0037	30.30	30.22
2002.91	2002.85	2002.60	-0.07	0.0007	30.60	30.27
753.95	753.88	753.61	-0.07	0.0007	30.60	30.39
13.02	12.70	12.51	-0.32	0.0032	30.60	30.53
9496.60	9497.03	9496.30	0.42	0.0042	117.40	117.41
8000.41	7999.97	8000.16	-0.44	0.0044	117.50	117.35
5995.36	5995.38	5994.97	0.02	0.0002	117.50	117.29
3992.87	3993.39	3992.50	0.52	0.0052	117.60	117.39
2002.92	2002.29	2002.55	-0.63	0.0063	117.60	117.57
753.95	753.54	753.61	-0.41	0.0041	117.60	117.73
13.02	13.75	12.49	0.73	0.0073	117.80	117.87

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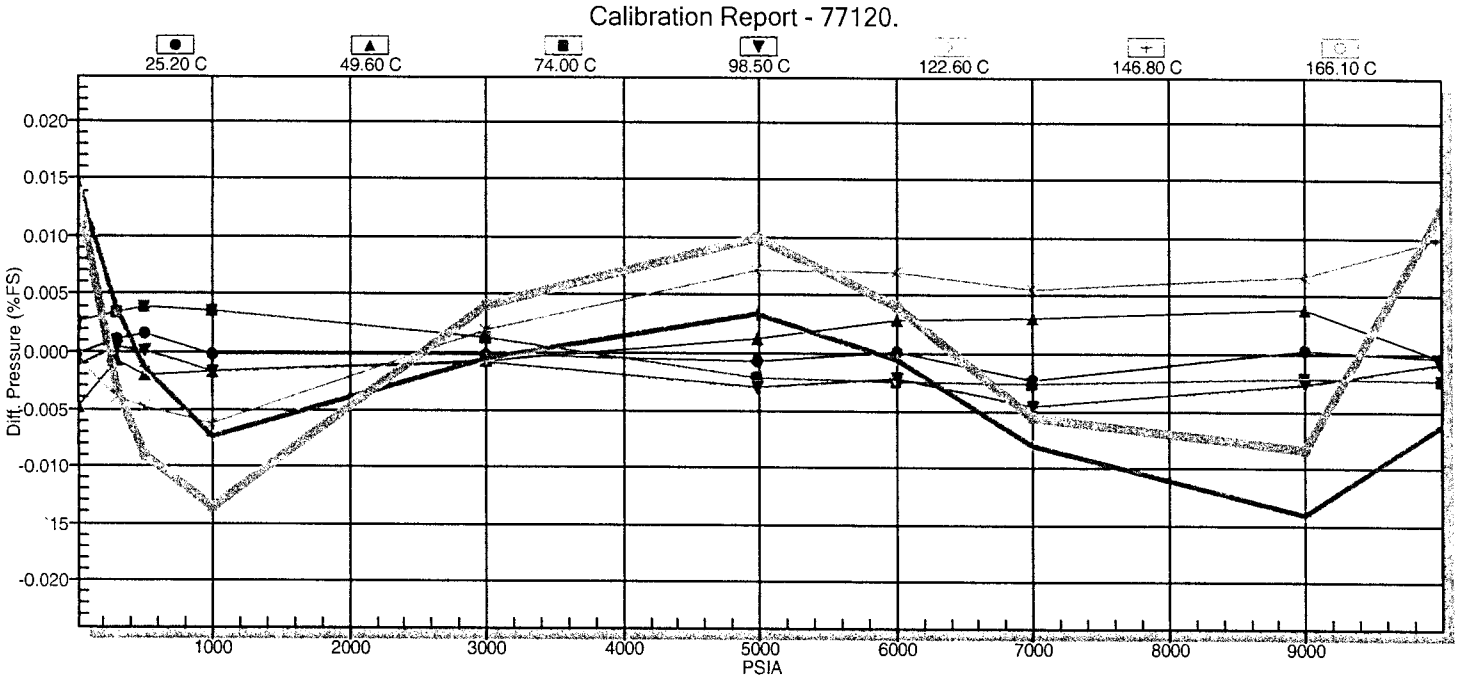
Pressure Gauge Certificate of Calibration



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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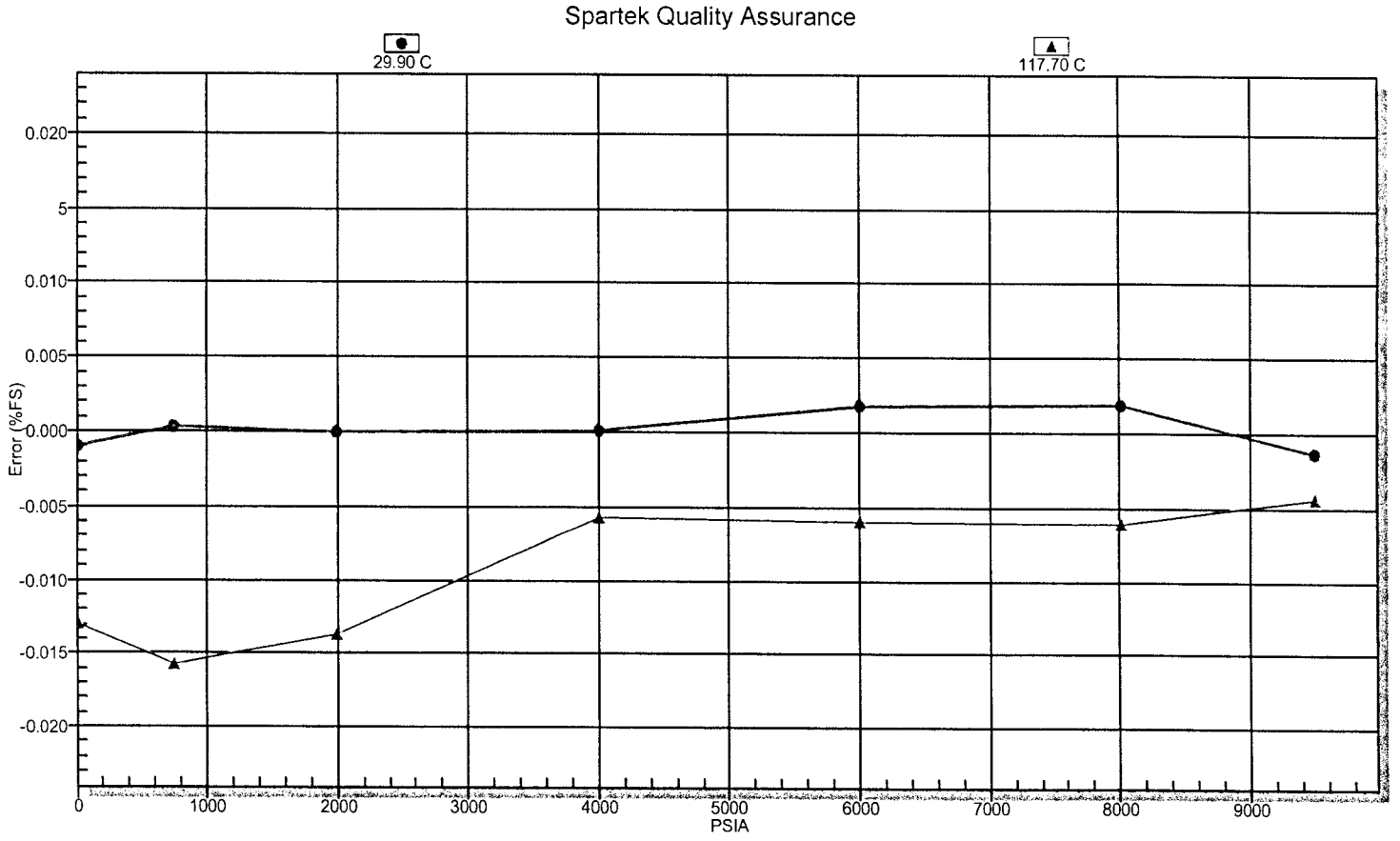
URL www.sparteksystems.com

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

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
WU-16J

DEC 6 2012

CERTIFIED MAIL 7009 1680 0000 7661 6119
RETURN RECEIPT REQUESTED

Ms. Marcelyn Boone
Ineos USA LLC
Post Office Box 628
Lima, Ohio 45802-0628

Subject: Second Notice of Deficiency of Petition for Exemption from the Land Disposal Restrictions under the Hazardous and Solid Waste Amendments of the Resource Conservation and Recovery Act

Dear Ms. Boone:

The Underground Injection Control Branch has completed its initial technical review of the responses Ineos provided to the first notice of deficiency. Considerable progress has been made in resolving the issues we raised. However, Ineos's responses leave some issues unresolved which must be addressed for us to complete our review. The enclosure with this letter describes the unresolved deficiencies. It includes issues raised by Lawrence Berkeley National Laboratory (LBNL) that need further discussion. We would like an initial response by March 31, 2013. If you are unable to address all our concerns by then, please include an estimated date for response to any remaining issues in the initial response.

If you have any questions or concerns about the issues raised in either the EPA or LBNL review, please contact Dr. Stephen Roy of my staff by telephone at (312) 886-6556 or by email to roy.stephen@epa.gov.

Sincerely yours,

Diane Rzeznik

for Rebecca Harvey, Chief
Underground Injection Control Branch

Enclosures

Cc: Chuck Lowe, Ohio Environmental Protection Agency (by email)

Review of Underground Injection Control (UIC) Land Ban Petition for Ineos Well Nos. 1, 2, 3 and 4, Ineos USA LLC, Lima, Ohio

EPA will verify that all relevant references have been submitted or are available to EPA to be part of the administrative record of this decision. If any references are missing, EPA will inform Ineos.

Note: Identification numbers are the same as those used in the first Notice of Deficiency to make it easier to identify issues and responses.

Section I. Administrative
2. I.A Statement of Certification is not signed.

9. Ineos's response stated that "The maximum assumed concentrations listed in Tables I.E-2c and VI.A.3(b)iv.d-1 are greater than the annual average concentrations in Tables I.E-1 and I.E-1A." This may be true in general. However, Acrylamide for 2001 is shown as 170477.25 mg/l in Table I.E-1 but the value in Table VI.1.3(b)iv.d-1 is 1500 mg/l. Please reconcile.

Table I.E-1A is missing several analytes found in Table I.E-1: several forms of cyanide, acrylic acid, crotonaldehyde (all non-detects), nicotinonitrile and methyl pyridine, all of which have model-based limits (cyanide as specific compounds). Please document that the model-based limits are met in all cases.

13.1.a Omitting testing for D001 is acceptable – it will not be included in the list of approved waste codes.

13.1.b: Ineos states that through process knowledge, the concentrations of Cd, Pb, Hg, Se, Ag and CCl_4 are lower than the maximum assumed concentrations shown for these constituents in Table 3 and elsewhere. Can Ineos document this?

13.4 Ineos states that through process knowledge, the concentrations of the twelve analytes listed in this comment all have model-based concentration limits are lower than the maximum assumed concentrations shown for these constituents in Table 3 and elsewhere. Can Ineos document this?

13.6 Ineos states that through process knowledge, the concentrations of the constituents found in Table 2 (Waste Codes ...) but not in Table 6 (Sampling and Testing Frequency) are lower than the maximum assumed concentrations shown for these constituents in Table 3 and elsewhere. Can Ineos document this?

17. "Net permeable thickness is verified during annual pressure falloff testing. (p. 8)" Please explain how this is done.

24. The response states that "Waste viscosity measurements are compiled in Table VI.B-1 and in Table II.E.4(b)ii-1..." It is not clear which tables are intended since there is no table with the first number (there a Table VI.B.1.1-1 but it contains Historical and Future Injection Rates for

Modeling) and the second table (Injectate Analytical Results Comparison Table) does not contain any measurements of viscosity. Please clarify.

27. Text of response (15 miles) and revised petition text (10 miles) differ in radius of cone of influence that would cause concern. Please reconcile.

29. Please explain why sections A1 Title and Approval Sheet and A3 Distribution List are "Not applicable for this QAPP"? The Title and Approval Sheet documents the institutional chain of command that reviewed and approved the plan. The Distribution List ensures that all who are responsible for implementing the QAPP received copies.

31. The minor revision to the text does not address the concerns. Only two parameters (net permeable thickness and permeability) include any discussion about corrective action. Rather than require additional revision at this time, Ineos should note that 40 CFR 148.23(b) states that "Whenever the Director determines that the bases for approval of a [no-migration] petition may no longer be valid, the Director shall require a new demonstration in accordance with §148.20."

32. Deletion of the paragraph in question does not resolve the issue. How does Ineos know whether the surface casing and intermediate casing are adequately cemented?

36. Ineos did not discuss the uncertainty in TDS. Since it is a calculated number, its value is uncertain to the same degree as the measured anion and cation concentrations on which it is based. Although the agreement of the measured viscosity with a calculated viscosity is close, it is not perfect. (The calculator at www.crewes.org/ResearchLinks/ExplorerPrograms/FlProp/FluidProp.htm calculates a viscosity of 1.174 cP for T = 70°F, P = 1 atm and salinity of 100,800 mg/l.) The issue is not that the value calculated by this program does not match the measured value exactly – it is that other brine properties are heavily based on this single parameter and the uncertainty in this parameter impacts these other values. Please discuss the uncertainty in TDS, the extent to which the parameters that depend on it are uncertain and the impacts to modeling output.

Section II. Injection Well Design, Construction, Monitoring & Operation
No outstanding issues.

Section III. Geology
60. This section is improved but a question remains. Comparing the initial and revised versions of Fig. III.I-3, the labels "No Pore Pressure" and "With Pore Pressure" have switched between the Mohr circles. It appears these are total stresses and effective stresses. Please explain.

66. If deepest well in the area is 475 ft, why was 400 ft chosen as the base of the lowermost USDW?

Section IV. Area of Review
No outstanding issues.

Section V. Reservoir Tests and Logs

No outstanding issues.

Section VI. Computer Modeling
88. Ineos documents that reducing compressibility by 33% increased the cone of influence by 2.6% but does not discuss what impact this parameter has on plume size. Please discuss this and explain why no sensitivity runs were made for this parameter on plume size.

LBNL COMMENTS

1. Correction to the text was not made.

2 & 4. Over the life of the injection operation, by how much will temperature in the injected zone change? How much impact would this have on temperature-dependent properties and resultant cone of influence and plume size?

15. Please substantiate the statement that "The volume and range of available data will not result in a much different picture of permeability areally."

20. Ineos responded to only the first part of the LBNL comment (related to the equation at the bottom of page VI-36 being applicable only at constant temperature). The LBNL comment also noted that when both temperature and pressure are changing, the term involving thermal expansivity cannot be ignored. Please respond to this issue.

21. Note that change to Table VI.A.3(b)iv.d-1 was not made: units were not added to HBL column. However, since the response states that the units are mg/l, there is no need to reprint the table.

28. In response to this item, Ineos states that "... the latest field data taken are consistent with data referred to by Gupta in references" but Ineos did not use nor investigate what impact using Gupta's value of 1.5 ft/yr for interstitial velocity would be. Please explain. In addition, in what way would the suggested simulation suggested by LBNL be "overly conservative"?

29. Ineos did not explain why the approach recommended by LBNL was not used. Please explain more clearly what differences would be expected if LBNL's approach had been used. In addition, LBNL's question about interstitial velocity in individual horizontal layers was not answered clearly. Please provide additional explanation.

33. How would using 0.1 ft for the transverse dispersivity change model outputs?

36. LBNL's comment referred to conservatism but Ineos's response dealt with realism. Please address the issue of truly conservative results for the lateral movement and pressurization models.

37. Ineos responded to LBNL's comment by deleting the footnote to Table VI.A.3(a)-1. However, I haven't found a description of how the k_v numbers were derived. Page VI-66 includes a discussion of vertical permeability in the Arrestment Interval but the numbers in Table

VI.A.3(a)-1 are for the Injection Interval. Please identify where this is discussed or provide a discussion.

39. Ineos states that "Realistic values should stay within the data range." This assumes that full range of data has been sampled, which may not be true here –higher permeabilities could exist within the area if there are sand lenses or fractures, for example. The revised text of the petition indicates that the low set for permeability comes from calibration and the high set which is 20% greater, then increased by a factor of 10. Please clarify how this responds to LBNL's comment.
41. Please discuss the impact of porosity on the projected plume dimensions, pressurization and vertical permeation. How is ignoring this uncertainty (even if small) conservative?

44. Please demonstrate that the use of initial concentrations that are four times the maximum observed concentrations is comparably conservative to varying diffusion coefficients as suggested by LBNL. The text of the petition (page VI-67) indicates that diffusion coefficients were varied by ±8% for sensitivity analyses. Please indicate where the results of this sensitivity analysis are discussed.

45. Ineos did not clearly respond to LBNL's question. Which parameters were actually adjusted to get the final match?

47. Ineos did not clearly respond to the issue raised by LBNL, only stating that Section VI.B.2 required no additional explanation. Please respond to the issue raised by the LBNL reviewer.

48. Note that the model *underpredicted* concentrations in observed in EC1 and MS2, although when aggregated over the different layers, the average is an overprediction. Please discuss the implications of this underprediction.

49. EPA does not agree with Ineos's interpretation that LBNL's comment implied that the calibration effort was flawed. The LBNL reviewer only suggested that describing the results as "excellent" might be unwarranted. However, EPA does not require an additional response from Ineos.

51. Ineos did not respond to LBNL's issue that to obtain a truly conservative extent of pressurization requires simultaneous change in multiple parameters, not by varying a single parameter at a time.

52. Please document the statement that the stepwise integration of the equation 17 results in a permeation distance of 30 to 35 ft.

53. Response refers to item #17, which tabulates the sensitivity runs for plume migration. Rather than simply stating that "Sensitivity studies to address permeability heterogeneities were not done", Ineos should discuss to what extent permeability heterogeneities are likely to change lateral plume migration.

54. Ineos did not respond to LBNL's issue that sensitivity to porosity is different when considering transport and pressurization. Please discuss this issue.

55. Ineos did not respond to LBNL's issue that demonstration of the conservativeness of the analytical solution has not been demonstrated, as discussed in #44 above.

56. Ineos did not respond to LBNL's concerns. Please discuss what difference using an analytical solution assuming finite formation thickness would make.

57. Ineos did not respond to LBNL's concerns, which were about the impact of dispersion on pressure-driven vertical permeation. The 2011 revision to the petition now shows that the waste front could rise to only six feet below the top of the arrestment interval (page VI-88). This is not a wide margin of error. Please discuss the vertical migration of waste due to the combination of vertical permeation, dispersion and diffusion and the uncertainties in these estimates.

LBNL Recommendations
1. For the record, Ineos should justify its statement that the simulator used in the petition is sufficient.

4. Ineos's response is acceptable but if future testing includes the possibility of testing such as the LBNL reviewer recommends, the company should consider doing so.

9. Ineos did not address LBNL's concern; however, if it is demonstrated that Ineos's approach is truly conservative (see #44 above), it will be adequate.

10. Ineos did not address LBNL's concern; however, if it is demonstrated that Ineos's approach is truly conservative (see #44 above), it will be adequate.

11. See #28 above.

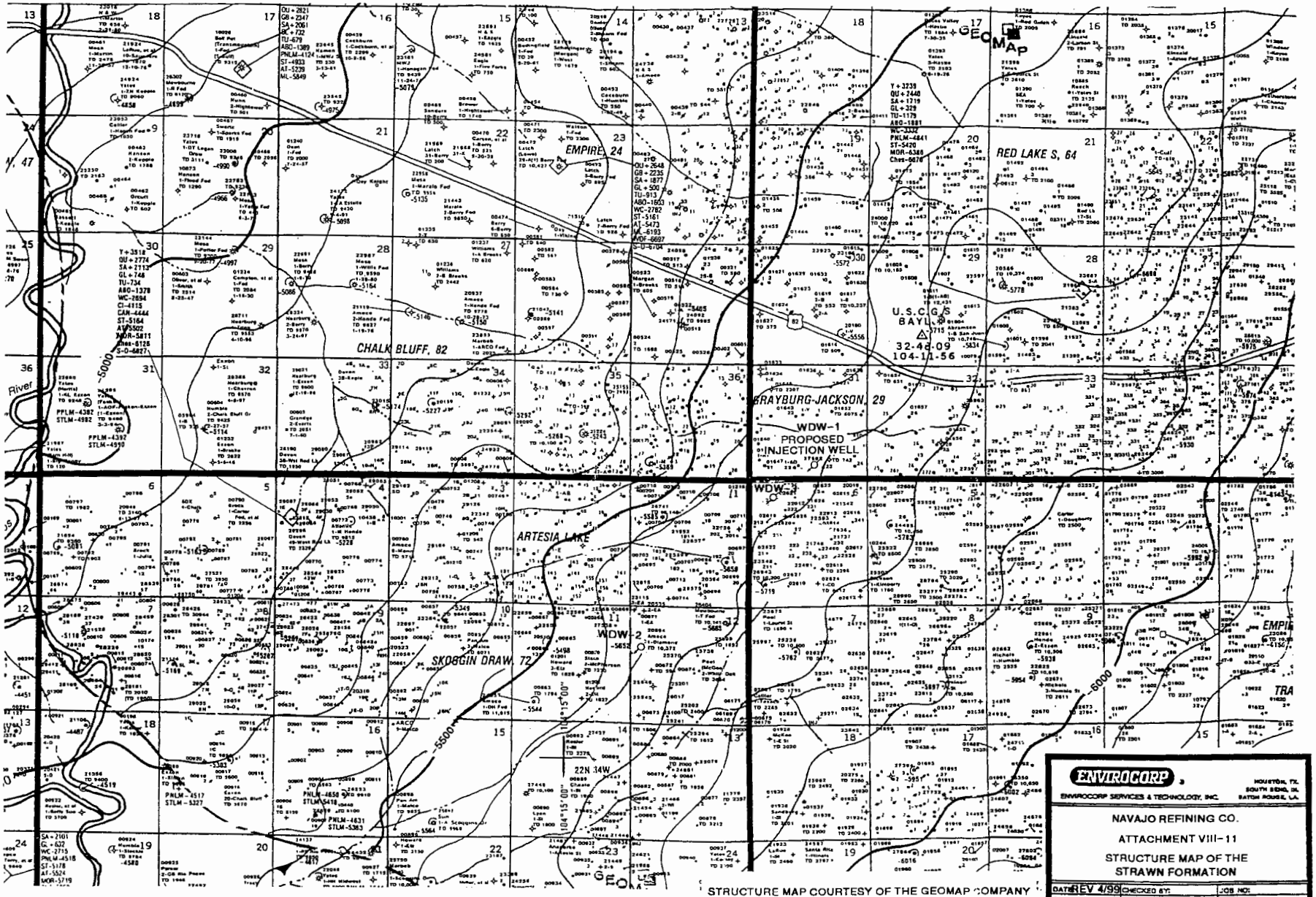
12. Ineos did not respond to LBNL's recommendation but this is discussed in other items above (e.g., #41).

13. See #51 above.

14. Ineos did not respond to the LBNL concern. The recommendation is about lateral dispersivity but the response is about longitudinal dispersivity. Please discuss what impact using a higher value of lateral dispersivity would make.

APPENDIX I

STRAWN STRUCTURE MAPS



STRUCTURE MAP COURTESY OF THE GEOMAP COMPANY
Poster July 1997

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

NAVAJO REFINING CO.

ATTACHMENT VIII-11

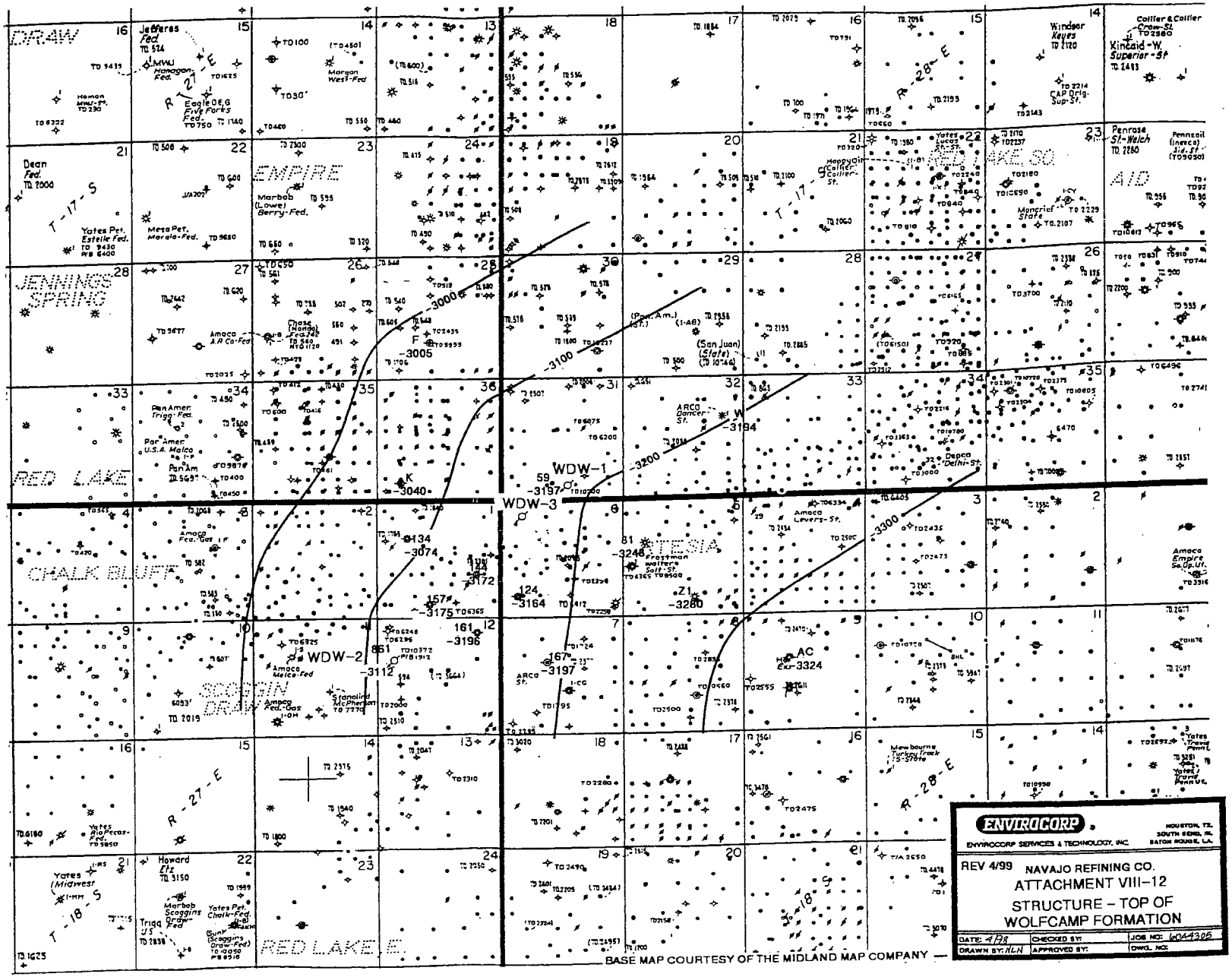
STRUCTURE MAP OF THE STRAWN FORMATION

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

APPENDIX I

APPENDIX J

WOLFCAMP STRUCTURE MAPS

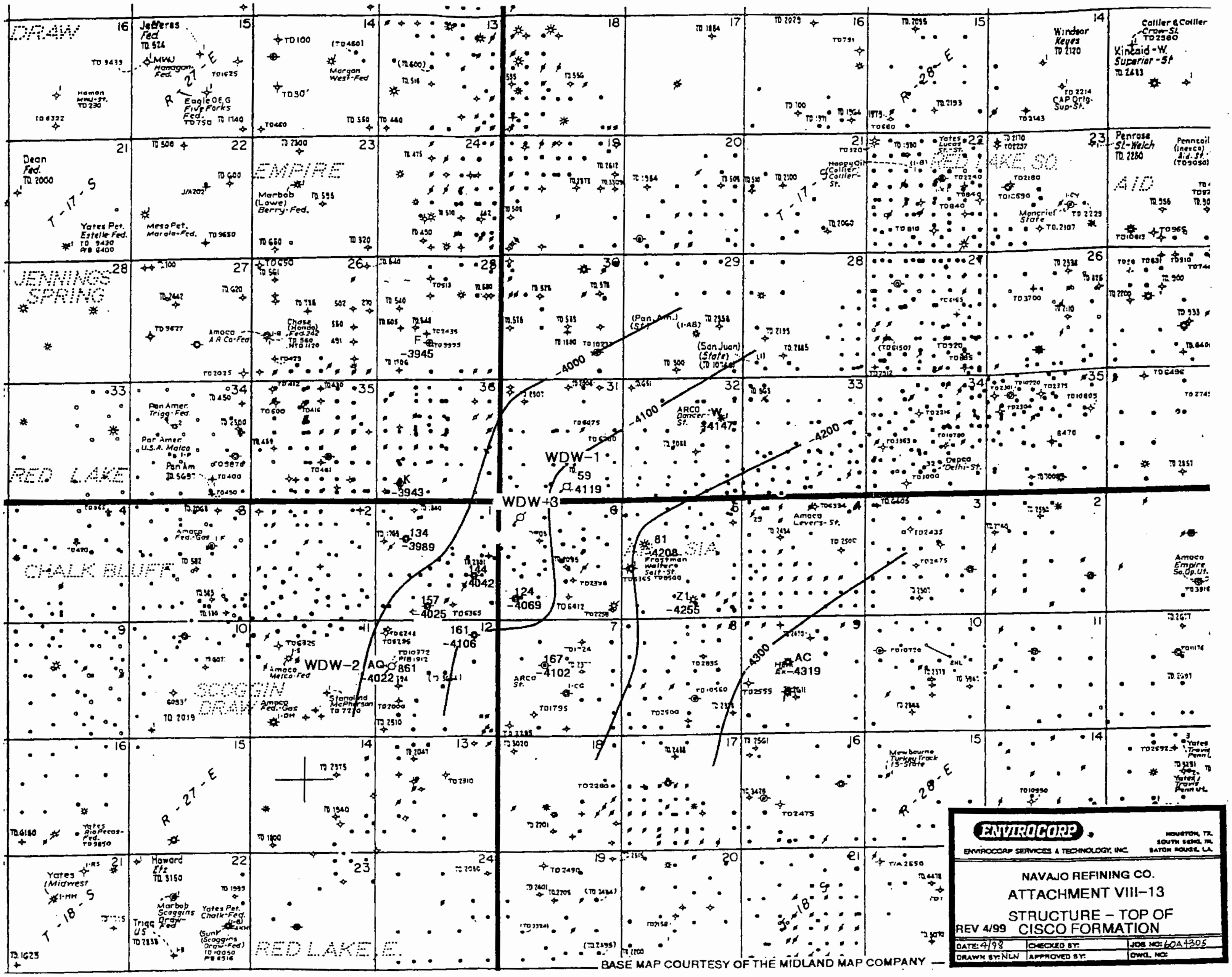


157 ID NO.
-4025 SUBSEA DEPTH

BASE MAP COURTESY OF THE MIDLAND MAP COMPANY

APPENDIX K

CISCO STRUCTURE MAPS



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:

157 – ID NO.
-4025 – SUBSEA DEPTH

APPENDIX K

APPENDIX L

CHRONOLOGY OF FIELD ACTIVITIES

APPENDIX L

CHRONOLOGY OF FIELD ACTIVITIES

November 19, 2012

Ted Jose:

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

November 20, 2012

Subsurface arrived at the Navajo Plant at 07:00 a.m. MST. Memory readout (MRO) gauges were placed into each well as follows:

Well No.1 ---- 2 MROs spotted on depth at 7924 feet 08:22 am MST
Well No.2 ---- 2 MROs spotted on depth at 7570 feet 09:45 am MST
Well No.3 ---- 2 MROs spotted on depth at 7660 feet 12:17 pm MST

Traveled from Artesia, New Mexico to Houston, Texas.

November 24, 2012

Traveled to Artesia, New Mexico, and contacted contractors.

November 25, 2012

At 06:55 a.m. MST, Subsurface and Pro-Well Testing arrived at Well No. 3. At 07:30 a.m. MST, wireline crew started out of Gaines Well No. 3 wellbore with MRO pressure gauges making seven minute gradient stops every 1,000 feet. Pro-Well Testing sent a second operator to pull gauges out of Chukka Well No. 2 and Mewbourne Well No. 1. At 07:50 a.m. MST, MRO pressure gauges in Well No. 2 were at surface. At 08:50 a.m. MST, MRO pressure gauges in Well No. 1 were at surface. At 09:26 a.m. MST, wireline crew was out of Well No. 3 wellbore and moved over to Well No. 2. At 10:17 a.m. MST, wireline crew was out of Well No. 2 wellbore and moved over to Well No. 1. At 11:00 a.m. MST, wireline crew was out of Well No. 1 wellbore and secured location. At 11:15 a.m. MST, Pro-Well Testing left the plant and Subsurface checked out with Navajo Control Room. Subsurface traveled from Artesia, New Mexico to Houston, Texas.

APPENDIX M

PANSYSTEM© ANALYSIS OUTPUT

Subsurface Technology, Inc	Report File:	2012 Gaines Well-3.pan
PanSystem Version 3.5		
Well Test Analysis Report		**APPENDIX M**

Company	Navajo Refining Company
Location	Artesia, New Mexico
Well	Gaines Well No. 3
Date	November 20 - 25, 2012
Gauge Type / Serial Number	Spartek / 75900
Guage Depth	7660 feet
Injection Interval	7660 feet to 8620 feet
Completion Type	Perforated
Top of Fill	8972 feet
Analyst	TLJ
Subsurface Project No.	70D6835

Subsurface Technology, Inc	Report File:	2012 Gaines Well-3.pan
PanSystem Version 3.5		
Well Test Analysis Report		

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	3941.365000 psia
Temperature	0.000000 deg F

Well Parameters Data

	Gaines Well No. 3
Well radius	0.3246 ft
Distance from observation to active well	0.000000 ft
Wellbore storage coefficient	1.380892 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	3622.870000 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	0.570 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 1 Model Data
Layer 1 Model Type : Radial homogeneous

	Layer 1
Permeability	1060.772914 md
Skin factor (Well 1)	7.823711

Rate Change Data

Time Hours	Pressure psia	Rate STB/day
-7090.303067	0.000000	-4409.785632
-7066.303067	0.000000	-4473.167080
-7042.303067	0.000000	-4468.002397
-7018.303067	0.000000	-3758.745701
-6994.303067	0.000000	-3824.789104
-6970.303067	0.000000	-4032.319527
-6946.303067	0.000000	-4249.287781
-6922.303067	0.000000	-4408.422536
-6898.303067	0.000000	-4272.628770
-6874.303067	0.000000	-3540.336905
-6850.303067	0.000000	-4318.410714
-6826.303067	0.000000	-4333.148578
-6802.303067	0.000000	-4357.696429
-6778.303067	0.000000	-4429.738095
-6754.303067	0.000000	-4372.003803
-6730.303067	0.000000	-4345.998264
-6706.303067	0.000000	-3998.057374
-6682.303067	0.000000	-3800.906581
-6658.303067	0.000000	-3780.642774
-6634.303067	0.000000	-3632.220155
-6610.303067	0.000000	-4087.643204
-6586.303067	0.000000	-3952.959325
-6562.303067	0.000000	-3463.070850
-6538.303067	0.000000	-3248.311425
-6514.303067	0.000000	-3853.576571
-6490.303067	0.000000	-4006.014220
-6466.303067	0.000000	-4269.420056
-6442.303067	0.000000	-4308.229497
-6418.303067	0.000000	-4342.941716
-6394.303067	0.000000	-3513.197917
-6370.303067	0.000000	-3923.295552
-6346.303067	0.000000	-4229.864914
-6322.303067	0.000000	-4102.146908
-6298.303067	0.000000	-4189.224289
-6274.303067	0.000000	-4214.572834
-6250.303067	0.000000	-4161.393684
-6226.303067	0.000000	-4290.779266
-6202.303067	0.000000	-4512.663029
-6178.303067	0.000000	-4102.070602
-6154.303067	0.000000	-4310.548115
-6130.303067	0.000000	-4354.583416

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-6106.303067	0.000000	-4318.430555
-6081.303067	0.000000	-4668.948413
-6057.303067	0.000000	-4777.227927
-6033.303067	0.000000	-4819.126819
-6009.303067	0.000000	-4919.951719
-5985.303067	0.000000	-4989.429481
-5961.303067	0.000000	-5135.720652
-5937.303067	0.000000	-5795.902695
-5913.303067	0.000000	-5400.926009
-5889.303067	0.000000	-4412.812004
-5865.303067	0.000000	-3874.497520
-5841.303067	0.000000	-3402.454861
-5817.303067	0.000000	-3605.558532
-5793.303067	0.000000	-2929.348628
-5769.303067	0.000000	-3367.552166
-5745.303067	0.000000	-4480.144841
-5721.303067	0.000000	-3783.047619
-5697.303067	0.000000	-4116.149058
-5673.303067	0.000000	-4177.389385
-5649.303067	0.000000	-3263.465278
-5625.303067	0.000000	-3656.299768
-5601.303067	0.000000	-4192.106812
-5577.303067	0.000000	-3880.695437
-5553.303067	0.000000	-3890.766865
-5529.303067	0.000000	-4204.523727
-5505.303067	0.000000	-4098.682126
-5481.303067	0.000000	-3560.427497
-5457.303067	0.000000	-4237.130208
-5433.303067	0.000000	-4261.483383
-5409.303067	0.000000	-4362.243304
-5385.303067	0.000000	-3631.922371
-5361.303067	0.000000	-3786.409226
-5337.303067	0.000000	-3826.902530
-5313.303067	0.000000	-3155.923528
-5289.303067	0.000000	-3022.816716
-5265.303067	0.000000	-3384.309606
-5241.303067	0.000000	-2605.575562
-5217.303067	0.000000	-3103.792328
-5193.303067	0.000000	-3172.269345
-5169.303067	0.000000	-3683.979663
-5145.303067	0.000000	-2939.666915

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-5121.303067	0.000000	-4250.512318
-5097.303067	0.000000	-4361.852596
-5073.303067	0.000000	-3397.059689
-5049.303067	0.000000	-3600.890625
-5025.303067	0.000000	-4101.486607
-5001.303067	0.000000	-3557.350860
-4977.303067	0.000000	-4280.461971
-4953.303067	0.000000	-3819.677166
-4929.303067	0.000000	-3927.579613
-4905.303067	0.000000	-4783.890956
-4881.303067	0.000000	-4233.302993
-4857.303067	0.000000	-4016.887814
-4833.303067	0.000000	-4062.939650
-4809.303067	0.000000	-4185.805556
-4785.303067	0.000000	-4162.541749
-4761.303067	0.000000	-4519.159970
-4737.303067	0.000000	-4278.009706
-4713.303067	0.000000	-4096.842092
-4689.303067	0.000000	-3968.043648
-4665.303067	0.000000	-3950.521329
-4641.303067	0.000000	-3913.740410
-4617.303067	0.000000	-4013.246495
-4593.303067	0.000000	-4554.058284
-4569.303067	0.000000	-4814.136476
-4545.303067	0.000000	-5515.843585
-4521.303067	0.000000	-4877.062417
-4497.303067	0.000000	-4515.180883
-4473.303067	0.000000	-4684.269693
-4449.303067	0.000000	-4783.351769
-4425.303067	0.000000	-4590.648727
-4401.303067	0.000000	-4711.997685
-4377.303067	0.000000	-4737.893932
-4353.303067	0.000000	-4575.327216
-4329.303067	0.000000	-4475.744957
-4305.303067	0.000000	-889.382854
-4281.303067	0.000000	-868.264054
-4257.303067	0.000000	-4802.285632
-4233.303067	0.000000	-4772.675682
-4209.303067	0.000000	-4934.528501
-4185.303067	0.000000	-4741.605903
-4161.303067	0.000000	-4397.541749
-4137.303067	0.000000	-5456.057209
-4113.303067	0.000000	-4570.113178
-4089.303067	0.000000	-4560.164517
-4065.303067	0.000000	-4465.450397
-4041.303067	0.000000	-4472.898892
-4017.303067	0.000000	-4303.051670
-3993.303067	0.000000	-4345.114997
-3969.303067	0.000000	-4665.109127

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-3945.303067	0.000000	-4541.608962
-3921.303067	0.000000	-4377.266038
-3897.303067	0.000000	-4468.714286
-3873.303067	0.000000	-4398.916667
-3849.303067	0.000000	-4446.152778
-3825.303067	0.000000	-4518.936343
-3801.303067	0.000000	-4562.948578
-3777.303067	0.000000	-3824.789600
-3753.303067	0.000000	-4514.424769
-3729.303067	0.000000	-4619.238095
-3705.303067	0.000000	-4641.462698
-3681.303067	0.000000	-4587.037450
-3657.303067	0.000000	-4662.738261
-3633.303067	0.000000	-4505.817543
-3609.303067	0.000000	-4517.329282
-3585.303067	0.000000	-4599.952381
-3561.303067	0.000000	-4594.095155
-3537.303067	0.000000	-4475.656829
-3513.303067	0.000000	-4566.805638
-3489.303067	0.000000	-4504.803406
-3465.303067	0.000000	-4377.875711
-3441.303067	0.000000	-4427.799851
-3417.303067	0.000000	-4555.108962
-3393.303067	0.000000	-4532.142857
-3369.303067	0.000000	-4534.867146
-3345.303067	0.000000	-4575.104051
-3321.303067	0.000000	-4542.917378
-3297.303067	0.000000	-4479.357391
-3273.303067	0.000000	-4004.122603
-3249.303067	0.000000	-4400.930721
-3225.303067	0.000000	-4511.033929
-3201.303067	0.000000	-4514.057374
-3177.303067	0.000000	-4561.633185
-3153.303067	0.000000	-4340.300347
-3129.303067	0.000000	-4287.867229
-3105.303067	0.000000	-4308.865245
-3081.303067	0.000000	-2556.436425
-3057.303067	0.000000	-4366.864997
-3033.303067	0.000000	-4150.242063
-3009.303067	0.000000	-4302.156746
-2985.303067	0.000000	-3422.505870
-2961.303067	0.000000	-4159.375165
-2937.303067	0.000000	-4097.718254
-2913.303067	0.000000	-4234.630870
-2889.303067	0.000000	-4151.761822
-2865.303067	0.000000	-3911.875083
-2841.303067	0.000000	-3908.734044
-2817.303067	0.000000	-4205.992064
-2793.303067	0.000000	-3849.631035

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-2769.303067	0.000000	-4090.067626
-2745.303067	0.000000	-3777.728092
-2721.303067	0.000000	-3629.285797
-2697.303067	0.000000	-3896.260582
-2673.303067	0.000000	-3466.120618
-2649.303067	0.000000	-3385.527364
-2625.303067	0.000000	-4513.738591
-2601.303067	0.000000	-4032.927249
-2577.303067	0.000000	-5621.241154
-2553.303067	0.000000	-5259.664435
-2529.303067	0.000000	-8006.034722
-2505.303067	0.000000	-1.1969e4
-2481.303067	0.000000	-9429.196015
-2457.303067	0.000000	-8535.789269
-2433.303067	0.000000	-4274.589187
-2409.303067	0.000000	-4627.530340
-2385.303067	0.000000	-6416.447338
-2361.303067	0.000000	-6209.942212
-2337.303067	0.000000	-7364.778191
-2313.303067	0.000000	-6633.633019
-2289.303067	0.000000	-5844.037450
-2265.303067	0.000000	-3925.090939
-2241.303067	0.000000	-3980.200893
-2217.303067	0.000000	-3348.035053
-2193.303067	0.000000	-4134.490493
-2169.303067	0.000000	-4159.631267
-2145.303067	0.000000	-4107.941915
-2121.303067	0.000000	-4069.029481
-2097.303067	0.000000	-4219.228009
-2073.303067	0.000000	-3370.875413
-2049.303067	0.000000	-4237.714567
-2025.303067	0.000000	-5044.752232
-2001.303067	0.000000	-3919.848049
-1977.303067	0.000000	-4401.945106
-1953.303067	0.000000	-4031.629795
-1929.303067	0.000000	-5097.822735
-1905.303067	0.000000	-4972.282176
-1881.303067	0.000000	-5919.600777
-1857.303067	0.000000	-7278.093089
-1833.303067	0.000000	-4223.599124
-1809.303067	0.000000	-4029.446511
-1785.303067	0.000000	-4414.507771
-1761.303067	0.000000	-4435.549520
-1737.303067	0.000000	-4261.375909
-1713.303067	0.000000	-3898.578125
-1689.303067	0.000000	-3683.911293
-1665.303067	0.000000	-3835.785136
-1641.303067	0.000000	-3121.655258
-1617.303067	0.000000	-3408.044974

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-1593.303067	0.000000	-3222.036954
-1569.303067	0.000000	-3572.798446
-1545.303067	0.000000	-4852.365245
-1521.303067	0.000000	-2863.842427
-1497.303067	0.000000	-3488.628390
-1473.303067	0.000000	-3845.670040
-1449.303067	0.000000	-2308.584739
-1425.303067	0.000000	-786.258267
-1401.303067	0.000000	-1036.384838
-1377.303067	0.000000	-2248.787864
-1353.303067	0.000000	-4350.337384
-1329.303067	0.000000	-4252.027612
-1305.303067	0.000000	-4300.615162
-1281.303067	0.000000	-4161.371114
-1257.303067	0.000000	-4306.218485
-1233.303067	0.000000	-4392.003968
-1209.303067	0.000000	-4289.329365
-1185.303067	0.000000	-4283.845403
-1161.303067	0.000000	-4084.694362
-1137.303067	0.000000	-4277.053654
-1113.303067	0.000000	-4136.866981
-1089.303067	0.000000	-4256.771825
-1065.303067	0.000000	-4238.428571
-1041.303067	0.000000	-4212.670635
-1017.303067	0.000000	-3329.365162
-993.303067	0.000000	-4155.972140
-969.303067	0.000000	-4201.136905
-945.303067	0.000000	-4179.416667
-921.303067	0.000000	-4211.999917
-897.303067	0.000000	-4112.470321
-873.303067	0.000000	-3955.924686
-849.303067	0.000000	-4089.273810
-825.303067	0.000000	-3935.878803
-801.303067	0.000000	-4040.484606
-777.303067	0.000000	-3921.825231
-753.303067	0.000000	-3643.641038
-729.303067	0.000000	-3317.692626
-705.303067	0.000000	-3535.918568
-681.303067	0.000000	-3446.835152
-657.303067	0.000000	-3053.904845
-633.303067	0.000000	-3472.704365
-609.303067	0.000000	-3717.660797
-585.303067	0.000000	-3404.394345
-561.303067	0.000000	-3371.629382
-537.303067	0.000000	-3690.169048
-513.303067	0.000000	-3618.861111
-489.303067	0.000000	-3580.948495
-465.303067	0.000000	-2274.249917
-441.303067	0.000000	0.000000

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
-417.303067	0.000000	0.000000
-393.303067	0.000000	-561.142857
-370.303067	0.000000	-3662.736524
-346.303067	0.000000	-4204.049686
-322.303067	0.000000	-4446.003886
-298.303067	0.000000	-4335.536789
-274.303067	0.000000	-4019.267692
-250.303067	0.000000	-3893.702794
-226.303067	0.000000	-4516.016286
-202.303067	0.000000	-4364.202216
-178.303067	0.000000	-3967.713790
-154.303067	0.000000	-4125.236773
-130.303067	0.000000	-4367.144428
-106.303067	0.000000	-4433.917163
-82.303067	0.000000	-4577.609706
-58.303067	0.000000	-4207.928241
-34.303067	0.000000	-4682.279845
-10.303067	0.000000	-4893.967427
13.696933	0.000000	-4430.842841
14.696933	0.000000	-4890.869047
15.696933	0.000000	-4001.861111
16.696933	0.000000	-3974.380952
17.696933	0.000000	-4575.773810
18.696933	0.000000	-5043.825395
19.696933	0.000000	-4390.750003
20.696933	0.000000	-6279.775794
21.696933	0.000000	-3534.503969
22.696933	0.000000	-2659.146827
23.696933	0.000000	-5052.644840
24.696933	0.000000	-5549.817460
25.696933	0.000000	-4161.117064
26.696933	0.000000	-2292.678572
27.696933	0.000000	-4949.363094
28.696933	0.000000	-6949.410713
29.696933	0.000000	-5371.194446
30.696933	0.000000	-3097.426587
31.696933	0.000000	-3571.771828
32.696933	0.000000	-5165.251984
33.696933	0.000000	-6866.261905
34.696933	0.000000	-4746.299603
35.696933	0.000000	-2187.113097
36.696933	0.000000	-5583.500001
37.696933	0.000000	-5090.801587
38.696933	0.000000	-4001.513890
39.696933	0.000000	-1838.694445
40.696933	0.000000	-4552.410714
41.696933	0.000000	-5214.652780
42.696933	0.000000	-6246.601189
43.696933	0.000000	-5141.916665

Rate Change Data (cont)

Time Hours	Pressure psia	Rate STB/day
44.696933	0.000000	-1150.924603
45.696933	0.000000	-122.507938
46.696933	0.000000	-2160.920635
47.696933	0.000000	-3976.571429
48.696933	0.000000	-1913.230159
49.696933	0.000000	-4104.186508
50.696933	0.000000	-5908.229237
51.696933	0.000000	-7273.334836
52.696933	0.000000	-7656.817656
53.696933	0.000000	-7695.447182
54.696933	0.000000	-7541.507504
55.696933	0.000000	-7557.783705
56.696933	0.000000	-7560.836821
57.696933	0.000000	-7556.857801
58.696933	0.000000	-7502.837465
59.696933	0.000000	-7452.314738
60.696933	0.000000	-7534.634129
61.696933	0.000000	-7461.191464
62.696933	0.000000	-7456.047954
63.696933	0.000000	-7500.076653
64.696933	0.000000	-7504.120751
65.696933	0.000000	-7509.502383
66.696933	0.000000	-7529.399096
67.696933	0.000000	-7504.863953
68.696933	0.000000	-7460.594025
69.696933	0.000000	-7324.309524
70.696933	0.000000	-7196.555801
71.696933	0.000000	-7145.782088
72.696933	0.000000	-7140.101012
73.696933	0.000000	-7086.646446
74.696933	0.000000	-7009.247622
75.696933	0.000000	-7078.728573
76.696933	0.000000	-7138.432635
77.696933	0.000000	-7108.222357
78.696933	0.000000	-7109.845013
79.696933	0.000000	-7137.063624
81.163328	3994.714412	-7223.421664
117.331986	3944.845354	0.000000

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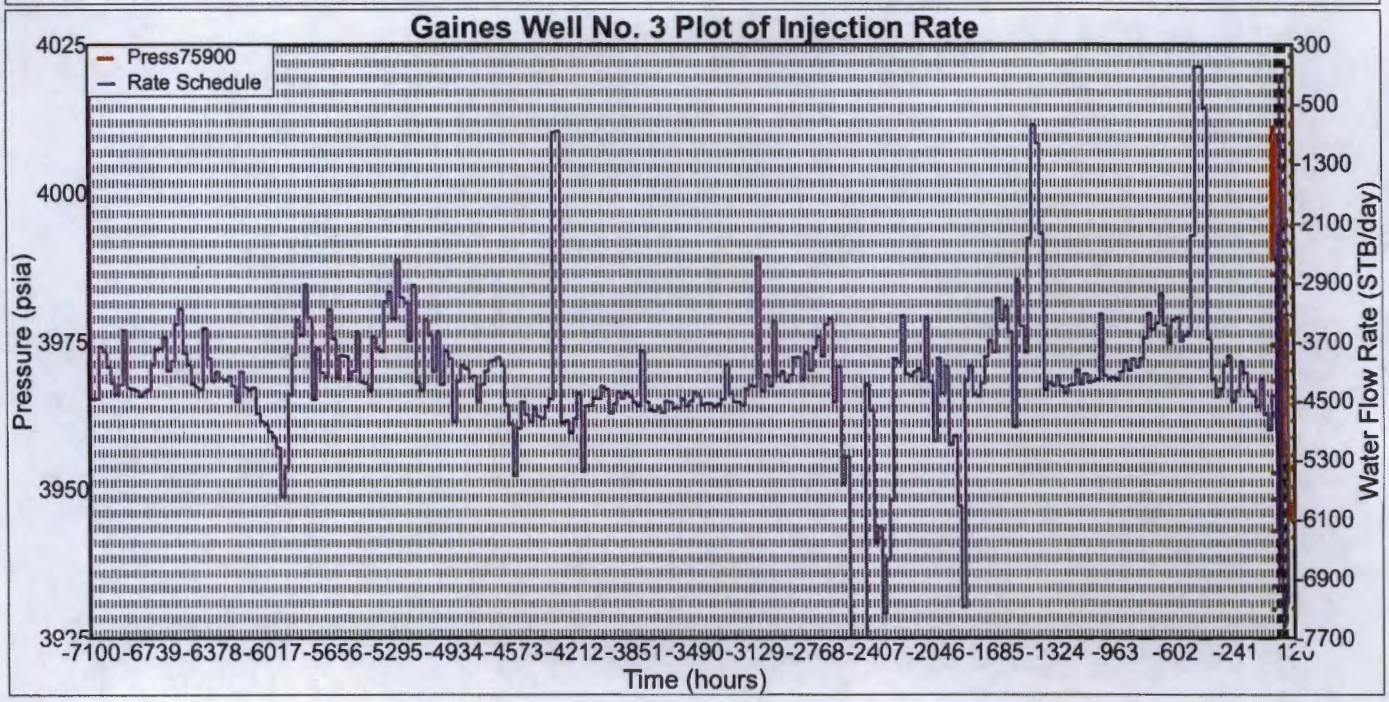
PanSystem Version 3.5

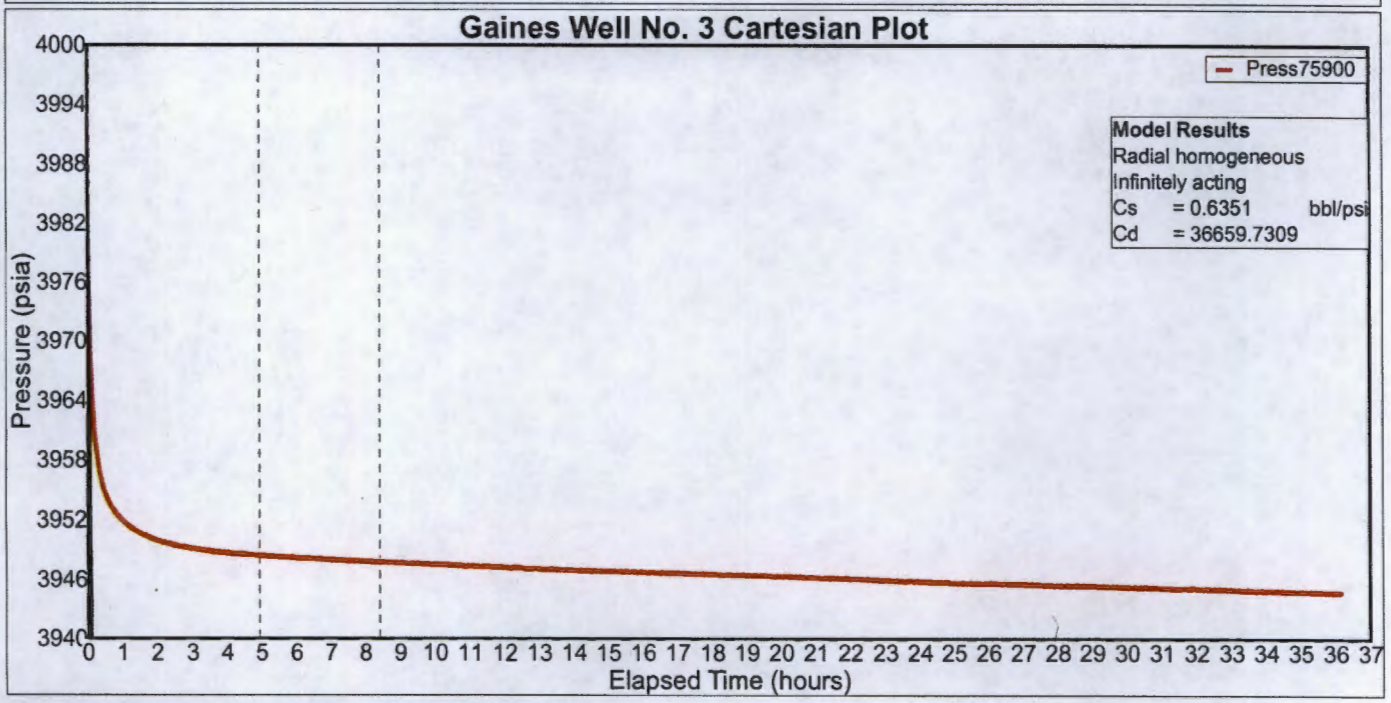
Well Test Analysis Report



Subsurface Technology, Inc | Report File: 2012 Gaines Well-3.pan

PanSystem Version 3.5

Well Test Analysis Report

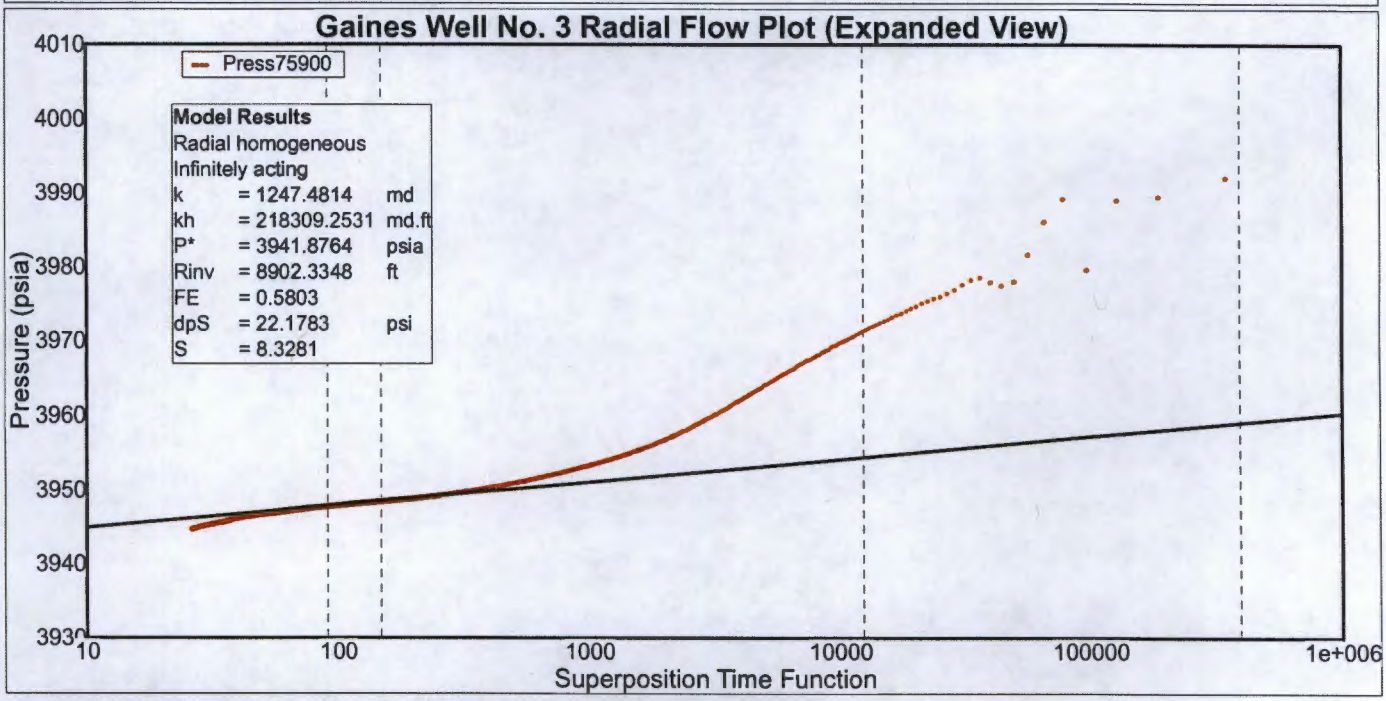


Gaines Well No. 3 Cartesian Plot Model Results
Radial homogeneous - Infinitely acting

Fair Wellbore Storage

	Value
Wellbore storage coefficient	0.635135 bbl/psi
Dimensionless wellbore storage	3.6660e4

Gaines Well No. 3 Cartesian Plot Line Details
Line type : Wellbore storage
Slope : -473.877
Intercept : 3989.37
Coefficient of Determination : 0.782288
Number of Intersections = 0



Gaines Well No. 3 Radial Flow Plot (Expanded View) Model Results

Radial homogeneous - Infinitely acting

Fair Wellbore Storage

	Value
Permeability	1247.481446 md
Permeability-thickness	2.1831e5 md.ft
Extrapolated pressure	3941.876440 psia
Radius of investigation	8902.334758 ft
Flow efficiency	0.580259
dP skin (constant rate)	22.178263 psi
Skin factor	8.328123

Gaines Well No. 3 Radial Flow Plot (Expanded View) Line Details

Line type : Radial flow

Slope : 3.06596

Intercept : 3941.88

Coefficient of Determination : 0.959738

	Radial flow
Extrapolated pressure	3941.876440 psia
Pressure at dt = 1 hour	3950.568604 psia

Number of Intersections = 0

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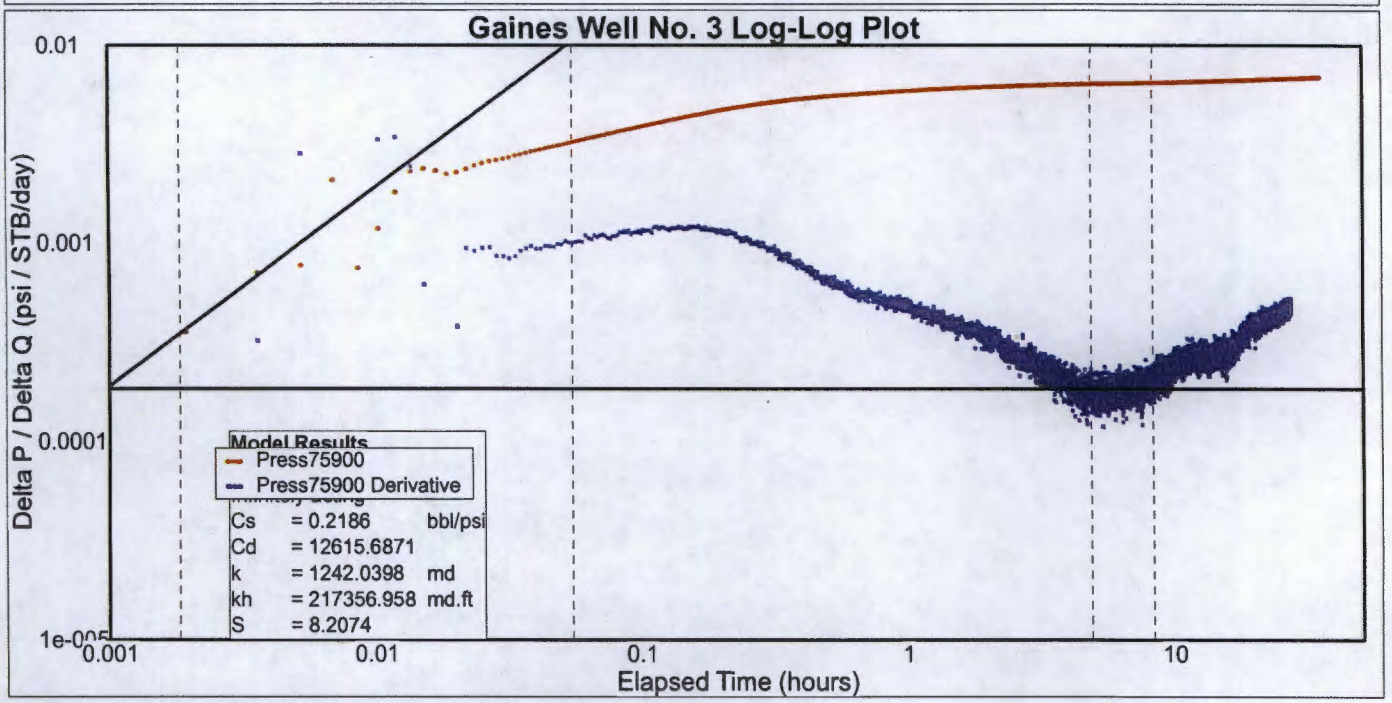
PanSystem Version 3.5

Well Test Analysis Report



Gaines Well No. 3 Log-Log Plot Model Results
Radial homogeneous - Infinitely acting

Fair Wellbore Storage

	Value
Wellbore storage coefficient	0.218569 bbl/psi
Dimensionless wellbore storage	1.2616e4
Permeability	1242.03976 md
Permeability-thickness	2.1736e5 md.ft
Skin factor	8.207439

Gaines Well No. 3 Log-Log Plot Line Details
Line type : Radial flow
Slope : 0
Intercept : 0.000185142
Coefficient of Determination : Not Used
Line type : Wellbore storage
Slope : 1
Intercept : 0.190634
Coefficient of Determination : Not Used
Number of Intersections = 0