DOE F 4600.2
(5/09)
(All Other Editions are Obsolete)

ATTACHMENT 3
U.S. Department of Energy
FEDERAL ASSISTANCE REPORTING CHECKLIST
AND INSTRUCTIONS

1. Identification Number: **DE-FE0002056**	2. Program/Project Title: **Modeling CO2 Sequestration in Saline Aquifer and Depleted Oil Reservoir to Evaluate Regional CO2 Sequestration Potential of Ozark Plateau Aquifer System, South-Central Kansas**
3. Recipient: University of Kansas Center for Research	

4. Reporting Requirements:	Frequency	No. of Copies	Addresses
A. MANAGEMENT REPORTING			
☒ Progress Report	Q	Electronic Version to NETL>	FITS@NETL.DOE.GOV
☒ Special Status Report	A		
B. SCIENTIFIC/TECHNICAL REPORTING * (Reports/Products must be submitted with appropriate DOE F 241. The 241 forms are available at https://www.osti.gov/elink)			
Report/Product — Form			
☒ Final Scientific/Technical Report — DOE F 241.3	FG	Electronic Version to E-link>	http://www.osti.gov/elink-2413
☒ Conference papers/proceedings/etc.* — DOE F 241.3	A		http://www.osti.gov/elink-2413
☐ Software/Manual — DOE F 241.4			http://www.osti.gov/estsc/241-4pre.jsp
☒ Other (see special instructions) Topical — DOE F 241.3	A		
* *Scientific/technical conferences only*			
C. FINANCIAL REPORTING			
☒ SF-425, Federal Financial Report	Q, FG	Electronic Version To NETL>	FITS@NETL.DOE.GOV
D. CLOSEOUT REPORTING			
☐ Patent Certification	FC	Electronic Version To NETL>	FITS@NETL.DOE.GOV
☐ Property Certificate	FC		
☐ Other			
E. OTHER REPORTING			
☒ Annual Indirect Cost Proposal	A	Electronic Version To NETL>	FITS@NETL.DOE.GOV
☒ Annual Inventory Report of Federally Owned Property, if any	A		
☐ Other			
F. AMERICAN RECOVERY AND REINVESTMENT ACT REPORTING			
☐ Reporting and Registration Requirements			http://www.federalreporting.gov

FREQUENCY CODES AND DUE DATES:

A - As required; see attached text for applicability.
FG - Final; within ninety (90) calendar days after the project period ends.
FC - Final - End of Effort.
Q - Quarterly; within thirty (30) calendar days after end of the calendar quarter or portion thereof.
S - Semiannually; within thirty (30) calendar days after end of project year and project half-year.
YF - Yearly; 90 calendar days after the end of project year.
YP - Yearly Property - due 15 days after period ending 9/30.

QUARTERY PROGRESS REPORT

Award Number: DE-FE0002056

Recipient: University of Kansas Center for Research &
Kansas Geological Survey
1930 Constant Avenue
Lawrence, KS 66047

"Modeling CO2 Sequestration in Saline Aquifer and Depleted Oil Reservoir to Evaluate Regional CO2 Sequestration Potential of Ozark Plateau Aquifer System, South-Central Kansas"

Project Director/Principal Investigator: W. Lynn Watney
Principal Investigator: Jason Rush

Twelfth Quarter Progress Report

Date of Report: 11/1/12

Period Covered by the Report: July 1, 2012 through September 30, 2012

Contributors to this Report: John Doveton, Mina Fazelalavi, Martin Dubois, Paul Gerlach, Tom Hansen, Dennis Hedke, Eugene Holubnayak, Reza Maleki, Larry Nicholson, Jason Rush, Ray Sorenson, John Victorine, Lynn Watney, John Youle, Dana Wreath

EXECUTIVE SUMMARY

The project “Modeling CO2 Sequestration in Saline Aquifer and Depleted Oil Reservoir to Evaluate Regional CO2 Sequestration Potential of Ozark Plateau Aquifer System, South-Central Kansas” is focused on the Paleozoic-age Ozark Plateau Aquifer System (OPAS) in southern Kansas. OPAS is comprised of the thick and deeply buried Arbuckle Group saline aquifer and the overlying Mississippian carbonates that contain large oil and gas reservoirs. The study is collaboration between the KGS, Geology Departments at Kansas State University and The University of Kansas, BEREXCO, INC., Bittersweet Energy, Inc. Hedke-Saenger Geoscience, Ltd., Improved Hydrocarbon Recovery (IHR), Anadarko, Cimarex, Merit Energy, GloriOil, and Cisco.

The project has three areas of focus, 1) a field-scale study at Wellington Field, Sumner County, Kansas, 2) 25,000 square mile regional study of a 33-county area in southern Kansas, and 3) selection and modeling of a depleting oil field in the Chester/Morrow sandstone play in southwest Kansas to evaluate feasibility for CO2-EOR and sequestration capacity in the underlying Arbuckle saline aquifer. Activities at Wellington Field are carried out through BEREXCO, a subcontractor on the project who is assisting in acquiring seismic, geologic, and engineering data for analysis. Evaluation of Wellington Field will assess miscible CO2-EOR potential in the Mississippian tripolitic chert reservoir and CO2 sequestration potential in the underlying Arbuckle Group saline aquifer. Activities in the regional study are carried out through Bittersweet Energy. They are characterizing the Arbuckle Group (saline) aquifer in southern Kansas to estimate regional CO2 sequestration capacity. Supplemental funding has expanded the project area to all of southwest Kansas referred to as the Western Annex. IHR is managing the Chester/Morrow play for CO2-EOR in the western Annex while Bittersweet will use new core and log data from basement test and over 200 mi2 of donated 3D seismic. IHR is managing the industrial partnership including Anadarko Petroleum Corporation, Cimarex Energy Company, Cisco Energy LLC, Glori Oil Ltd., and Merit Energy Company. Project is also supported by Sunflower Electric Power Corporation.

PROJECT STATUS

Subtasks completed to date include:

Task Name	Planned Start Date	Actual Start Date	Planned Finish Date	Actual Finish Date	% Complete
1.0 Project Management & Planning	12/8/2009	12/08/09	12/7/2012		55%
2.0 Characterize the OPAS (Ozark Plateau Aquifer System)	1/1/2010	01/01/10	6/30/2012		70%
3.0 Initial geomodel of Mississippian Chat & Arbuckle Group - Wellington field	1/1/2010	01/01/10	9/30/2010	09/30/10	100%
4.0 Preparation, Drilling, Data Collection, and Analysis - Well #1	9/15/2010	12/15/10	3/31/2011	08/30/11	100%
5.0 Preparation, Drilling, Data Collection and Analysis - Well #2	1/1/2011	02/20/11	6/30/2011	08/30/11	100%
6.0 Update Geomodels	5/1/2011	05/01/11	9/30/2011	10/31/12	100%
7.0 Evaluate CO2 Sequestration Potential in Arbuckle Group Saline Aquifer	8/1/2011	08/01/11	12/31/2011	10/31/12	100%
8.0 Evaluate CO2 Sequestration Potential in Depleted Wellington field	10/15/2011	10/15/11	3/31/2012	+++	85%
9.0 Characterize leakage pathways - risk assessment area	1/1/2010	01/01/10	6/30/2012	10/31/12	100%
10.0 Risk Assessment related to CO2-EOR and CO2 Sequestration in saline aquifer	6/1/2012	06/01/12	9/30/2012	**	70%
11.0 Produced water and wellbore management plans - Risk assessment area	1/1/2012	01/01/12	10/31/2012		80%
12.0 Regional CO2 sequestration potential in OPAS	8/1/2012		12/7/2012		70%
13.0 Regional source sink relationship	1/1/2010	1/1//2010	12/7/2012		50%
14.0 Technology Transfer	1/1/2010	01/01/10	12/7/2012		

Milestones – name, planned completion date, actual completion date, validation

FOA Milestone: Notification to Project Manager that activities to populate database with geologic characterization data has begun	12/31/2010	12/31/10	Completed, email summary
KGS Milestone 1.1: Hire geology consultants for OPAS modeling	3/31/2010	03/31/10	92% Completed*
KGS Milestone 1.2: Acquire/analyze seismic, geologic and engineering data - Wellington field	6/30/2010	06/30/10	Completed, quarterly rpt
KGS Milestone 1.3: Develop initial geomodel for Wellington field	9/30/2010	09/30/10	Completed, email summary
KGS Milestone 1.4: Locate and initiate drilling of Well #1 at Wellington field	12/31/2010	12/25/10	Completed, email summary
KGS Milestone 2.1: Complete Well#1 at Wellington - DST, core, log, case, perforate, test zones	3/31/2011	08/30/11	Completed, email summary
KGS Milestone 2.2: Complete Well#2 at Wellington - Drill, DST, log, case, perforate, test zones	6/30/2011	08/30/11	Completed, email summary
KGS Milestone 2.3: Update Wellington geomodels - Arbuckle & Mississippian	9/30/2011	10/31/12	completed
KGS Milestone 2.4: Evaluate CO2 Sequestration Potential of Arbuckle Group Saline Aquifer - Wellington field	12/31/2011	10/31/12	Completed
KGS Milestone 3.1: CO2 sequestration & EOR potential - Wellington field	3/31/2012		85% complete'++
KGS Milestone 3.2: Characterize leakage pathways - Risk assessment area	6/30/2012	10/31/12	Completed
KGS Milestone 3.3: Risk assessment related to CO2-EOR and CO2-sequestration	9/30/2012		80% complete++++
KGS Milestone 3.4: Regional CO2 Sequestration Potential in OPAS - 17 Counties	12/7/2012		60% complete

Key

++ See Milestone 2.4. Plan is to finish the task by 10/1/2012.
++++ Planned completion date was first quarter BP3, September 2012. We want to integrate more information about the shallow freshwater aquifers with the extensive subsurface maps and remote sensing.

Subtasks completed within current quarter:

Subtask 4.11. Geochemical analysis of water samples from drilling in Wellington Field and Subtask 4.12. Microbiological studies on produced water from Wellington Field. 4.13. Correlate log & core (Wellington) - extend to OPAS.

Subtasks in progress:

Task 2. -- Characterize the OPAS (Ozark Plateau Aquifer System) in final stage of log digitizing. Bittersweet team has embarked on standardizing stratigraphic nomenclature and classification so that petrophysical analysis by zone can be done consistently through the regional study area. Figure 1 shows the location of supertype and stratigraphic type wells on a structure map of the Arbuckle.

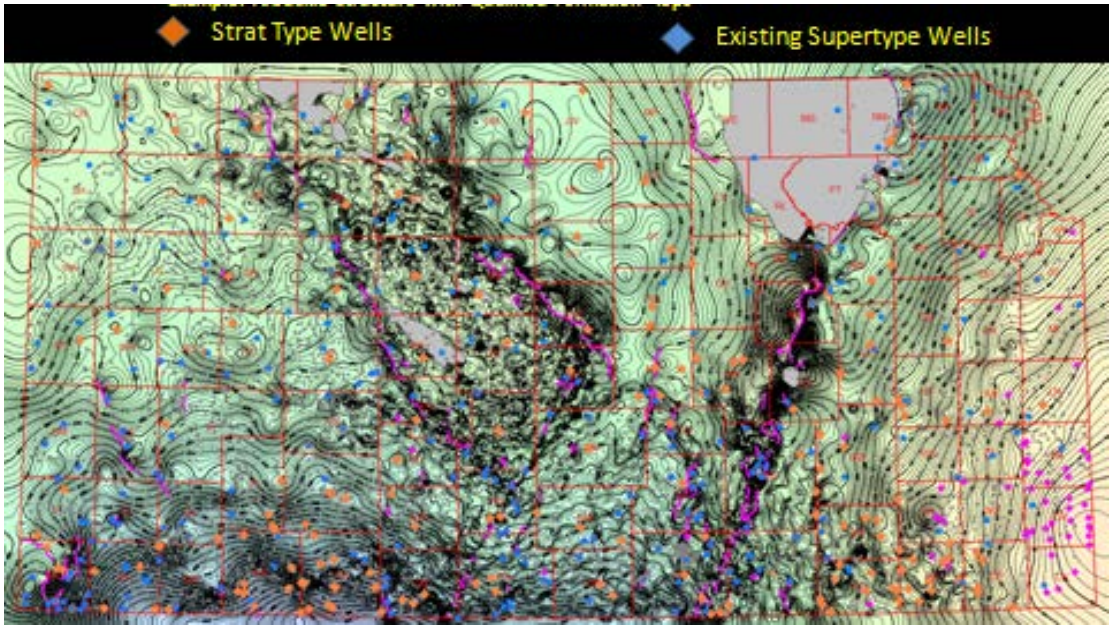


Figure 1. Top Arbuckle structure map of Kansas with the location of supertype wells and stratigraphic type wells.

Formation tops will be review by the team and some volunteer experts to refine stratigraphic tops for the set of stratigraphic type logs that have been selected and are being digitized so that petrophysical data can be distributed and correlated across the region in a consistent manner. The petrophysical web tools developed in this project will facilitate stratigraphic refinement using web tools to 1) select wells from a map, 2) review and select formation tops, 3) compare

correlations between wells, and 4) save results on web server for further review and finalizing (Figure 2).

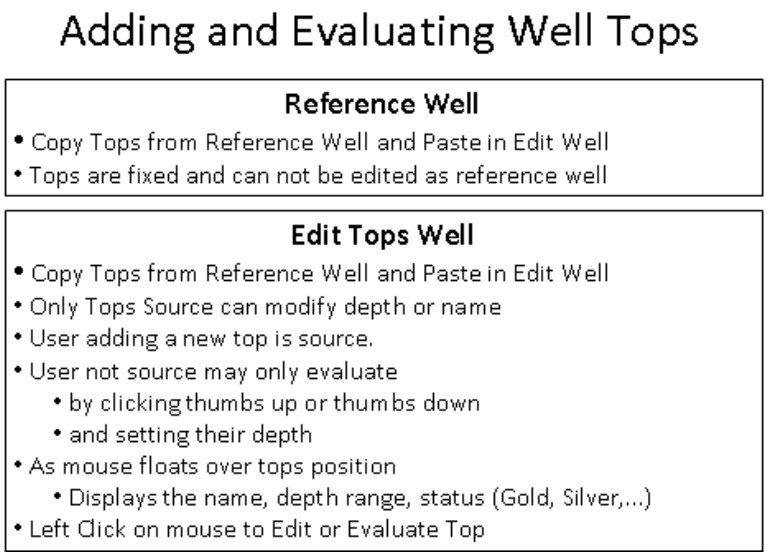


Figure 2. Procedure to add and evaluate stratigraphic tops for the type well project.

Work continues on refinements to web applications utilizing digital well data being generated by the project for use in the analysis of the digital log (LAS) dataset. A description of the various web apps to data are listed below in Figures 3 through 10.

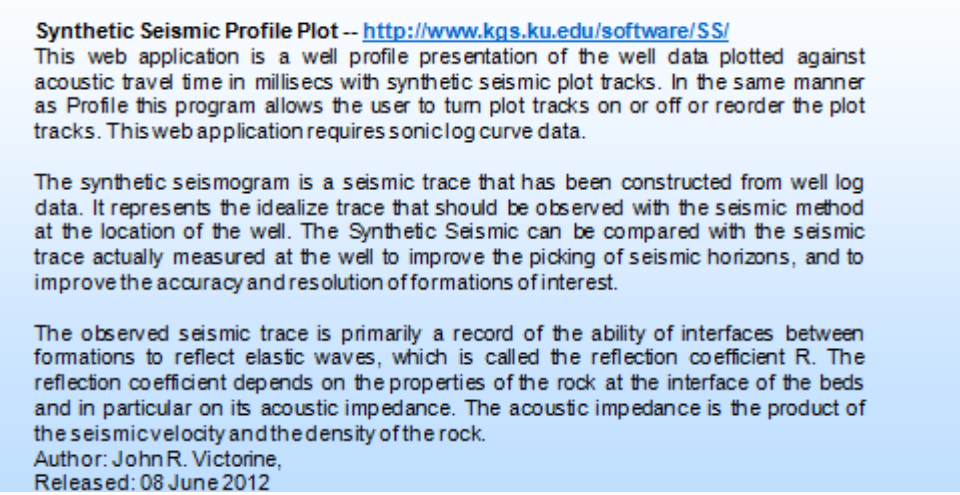


Figure 3. Synthetic profile plot was previous shown as a useful means to related well data to seismic time section.

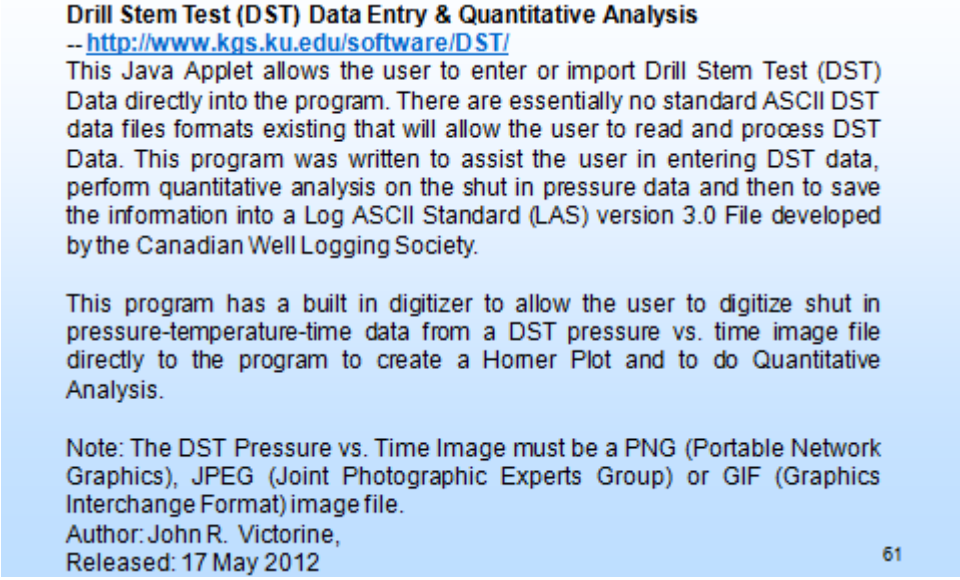


Figure 4. The drill stem test tool will derive k-h with a sufficiently long buildup time.

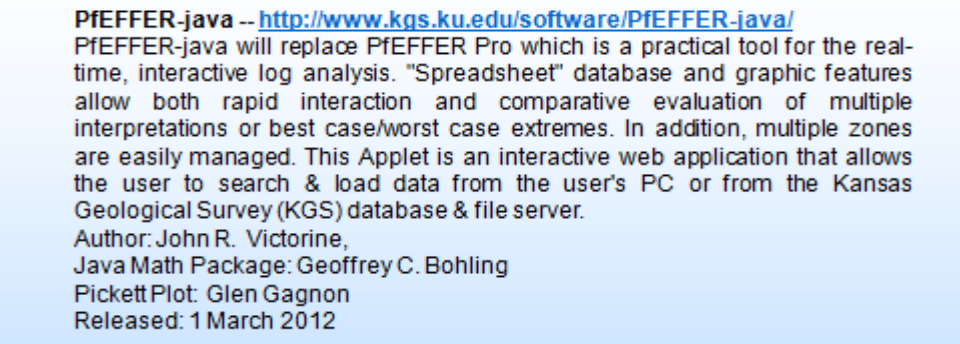


Figure 5. This log analysis tool evaluates hydrocarbon presence, obtains lithology, examines patterns of the petrophysical properties (eg. Use of Pickett cross plots to better understand reservoir architecture.

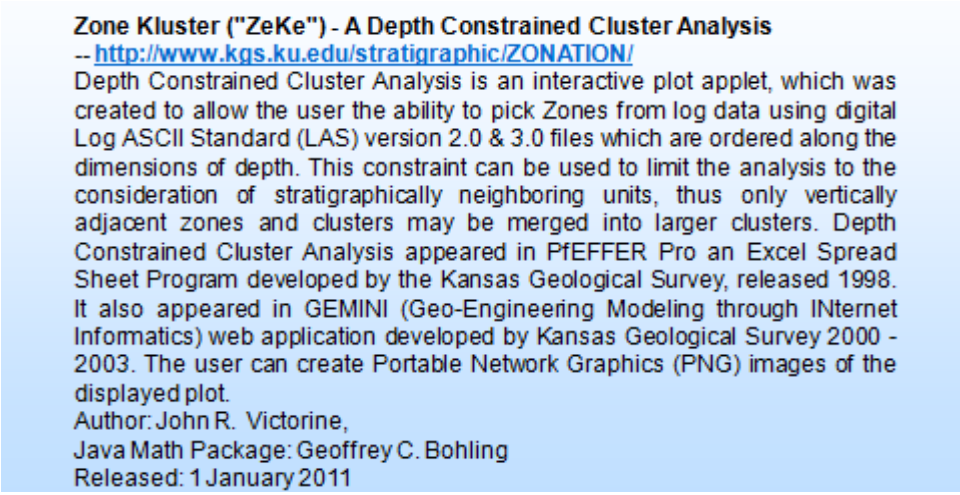


Figure 6. Depth constrained cluster analysis is incorporated into log analysis to help distinguish flow and hydrostratigraphic units.

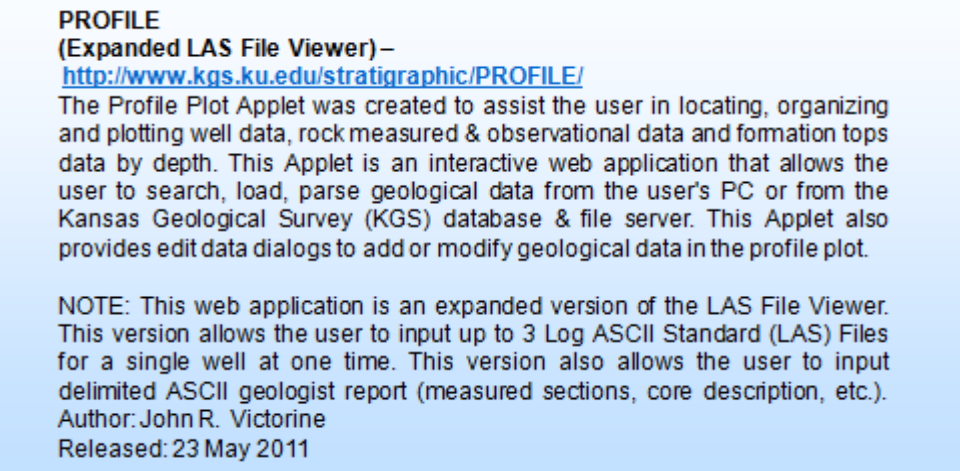


Figure 7. Profile is used as the primary means at the KGS to provide quick view of the digital well logs by reading LAS file and computing lithologies and allowing other depth related information to added to the display alongside log curves and images.

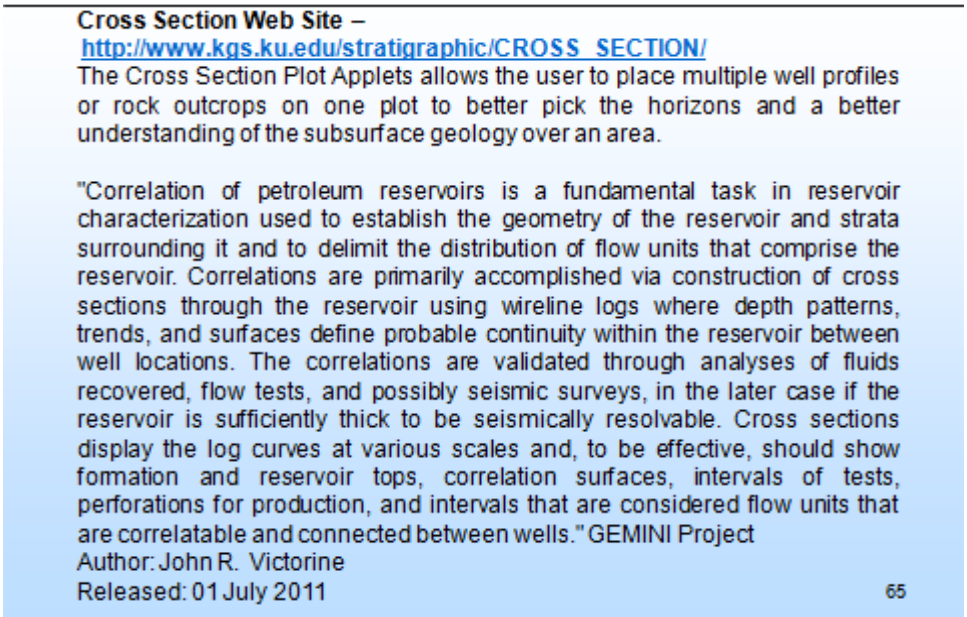


Figure 8. Cross section web application.

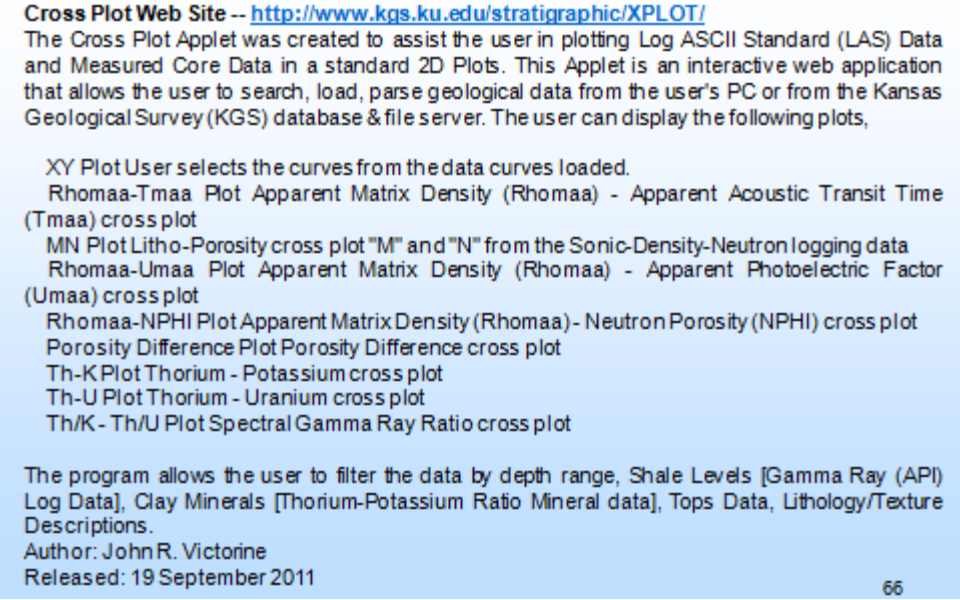


Figure 9. Cross section web application (continued)

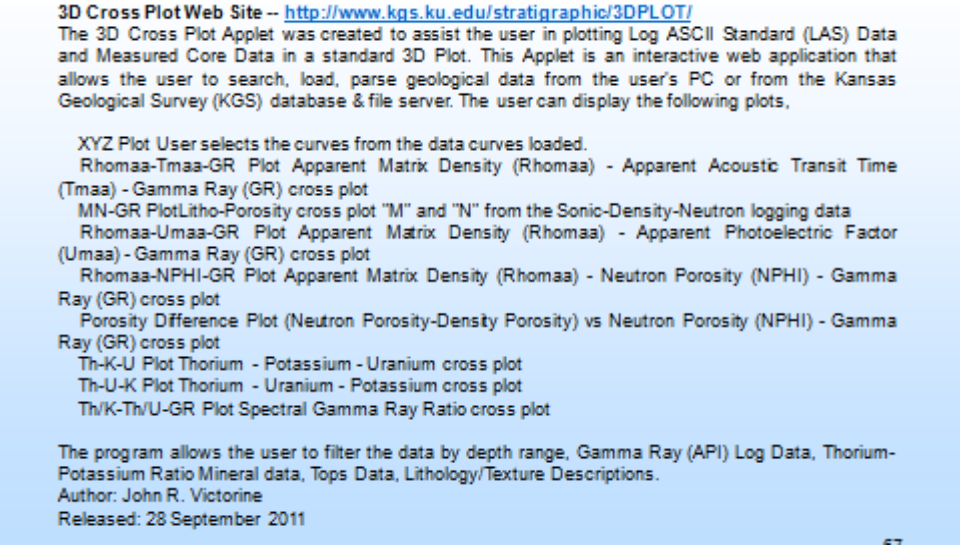


Figure 10. 3D cross plot was developed to look at the relationship with various petrophysical information to aid in interpreting the strata.

Task 6. – Completed initial versions of geomodels of Arbuckle and Mississippian at Wellington Field obtained preliminary simulations.

Well tests, core analyses, latest 3D seismic processing and interpretation, and log interpretation have led to creation of an intermediate geomodel of Mississippian oil reservoir, caprock interval, and Arbuckle saline formation. Preliminary simulation of CO2 injection into Arbuckle saline aquifer has been accomplished with the latest Petrel geomodels, porosity (Figure 11) and

permeability (Figure 12). Simulation of 40,000 metric tons of CO2 shows very small footprint and vertical extent (Figure 13).

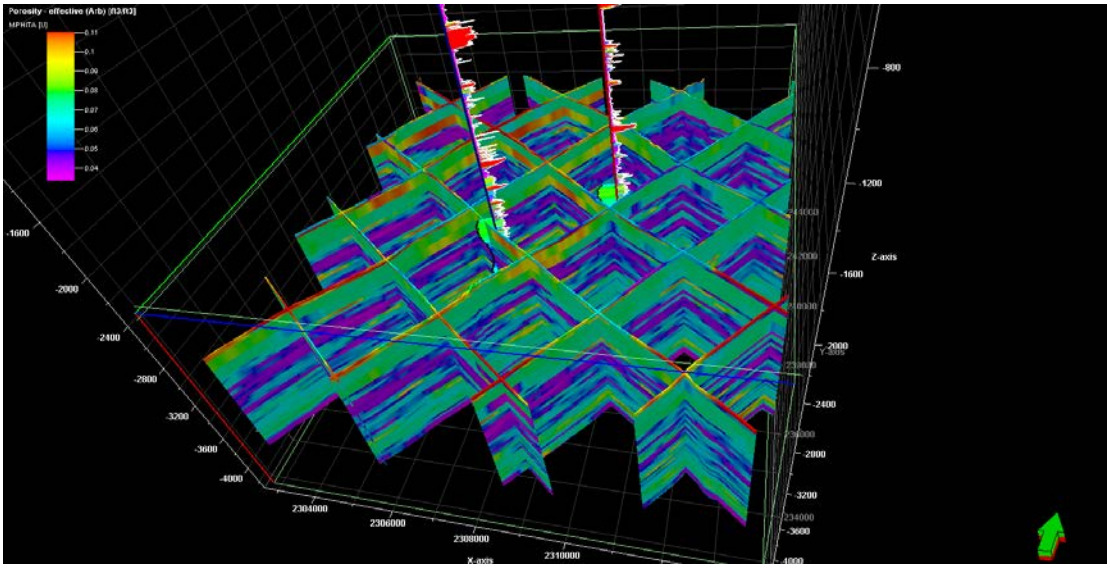


Figure 11. Porosity geomodel of Arbuckle saline aquifer at Wellington including two wells drilled in the project, Wellington #1-32 on the left and #1-28 on the right.

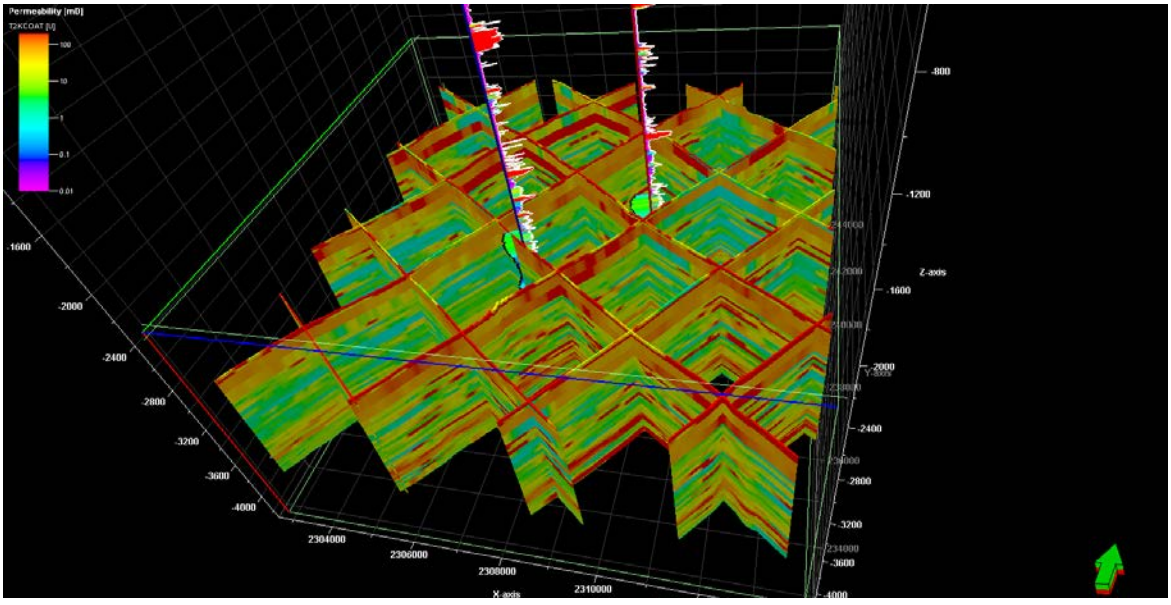


Figure 12. Permeability model of Arbuckle saline aquifer.

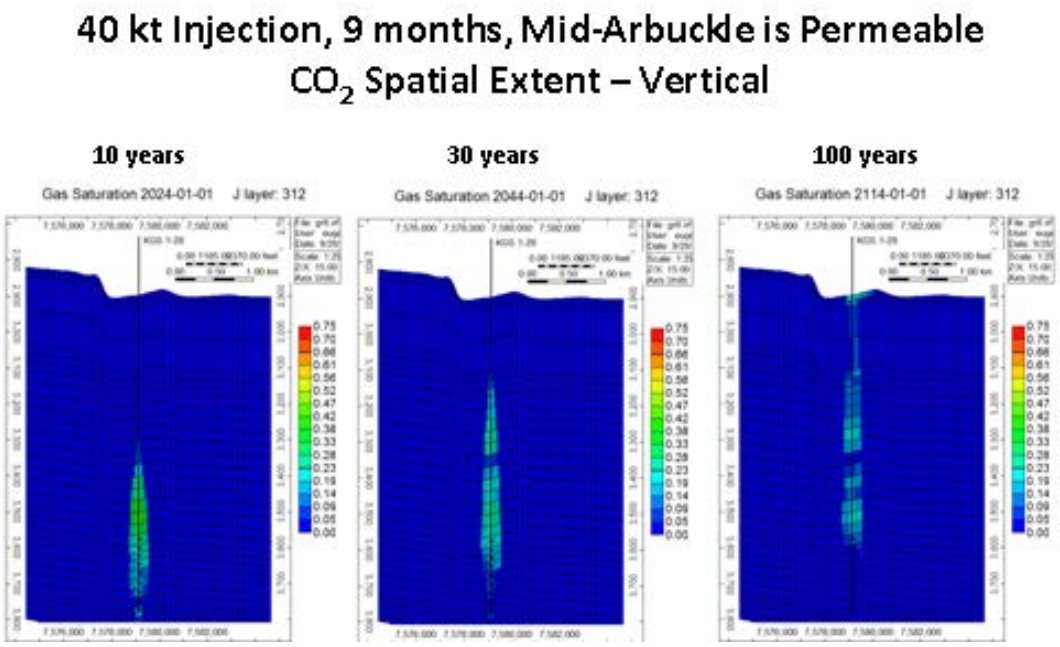


Figure 13. Simulation of 40,000 ton CO2 injection into lower 200 ft of more permeable lower Arbuckle saline aquifer. Mid Arbuckle, deemed an aquiclude based on petrophysical, geochemical, and microbial data, is considered leaky in this simulation. Very small scale injection has very small CO2 plume footprint. Plume migrates vertically from injection zone, but remains within the mid Arbuckle as it degrades over time.

Task 7. – Obtained initial estimates of regional carbon storage in Arbuckle saline aquifer in southern Kansas.

Initial estimates of CO2 capacity in the Arbuckle were discussed in previous quarterly report in early 2012. Steps are now being taken to move storage estimates from average values of the whole Arbuckle into distinct, correlatable flow and storage dominated stratigraphic units utilizing digital well data obtained in Task 2.

Task 16. -- Review and integrate regional (112 mi2) 3D seismic with well data and interpret structure and stratigraphic variability from basement to surface.

Seismic data has been assembled and interpreted from the western portion of the study area and was discussed in a previous quarterly report. Additional use of our regional mapping was accomplished in southwestern Kansas near the new basement test in Cutter Field to address the structural history and inferred stratigraphic control from the basement to the surface. Maps are based on the data assembled and interpreted for this project (Figures 14 through 27).

The structural evolution in Paleozoic and younger strata mapped in this study follows distinct patterns of re-occurring deformation that is controlled by deep-seated (Precambrian basement) structure. The episodic movement is strongly related to reactivation of old basement faults

leading to additional faulting or draping of the overlying strata. The regional seismic data has confirmed that some of the deformation is faulting as previously discussed. The height of most of the faulting can extends as high as lower Morrowan, but can be higher in the section. That analysis continues.

The faulting is primarily tied to apparent movement associated with a consistent set of northeast and northwest trending lineaments. In turn, the lineaments correlate closely to major basement structural features including a northeast trending Midcontinent Rift System (1.1 Ga age) that cross cuts the older, predominantly northwest trending accretionary terrane (1.6 Ga age). Tectonic activity in the late Paleozoic is coincident with the onset of the development/subsidence and wrench faulting of the Anadarko Basin immediately to the south. Later Laramide age (early Tertiary) uplift to the west appears to have led to additional, yet subtle movement. The following maps highlight a few prominent lineaments that generally can be seen between the structure and isopach maps. As regional stress changed due to nearby tectonic activity, the level of reactivation of the weak basement structures that correspond to the locations of the lineaments varied through time. The systematics of this structural deformation continues to be examined and is being used to assess impact on the CO2 leakage risk assessment.

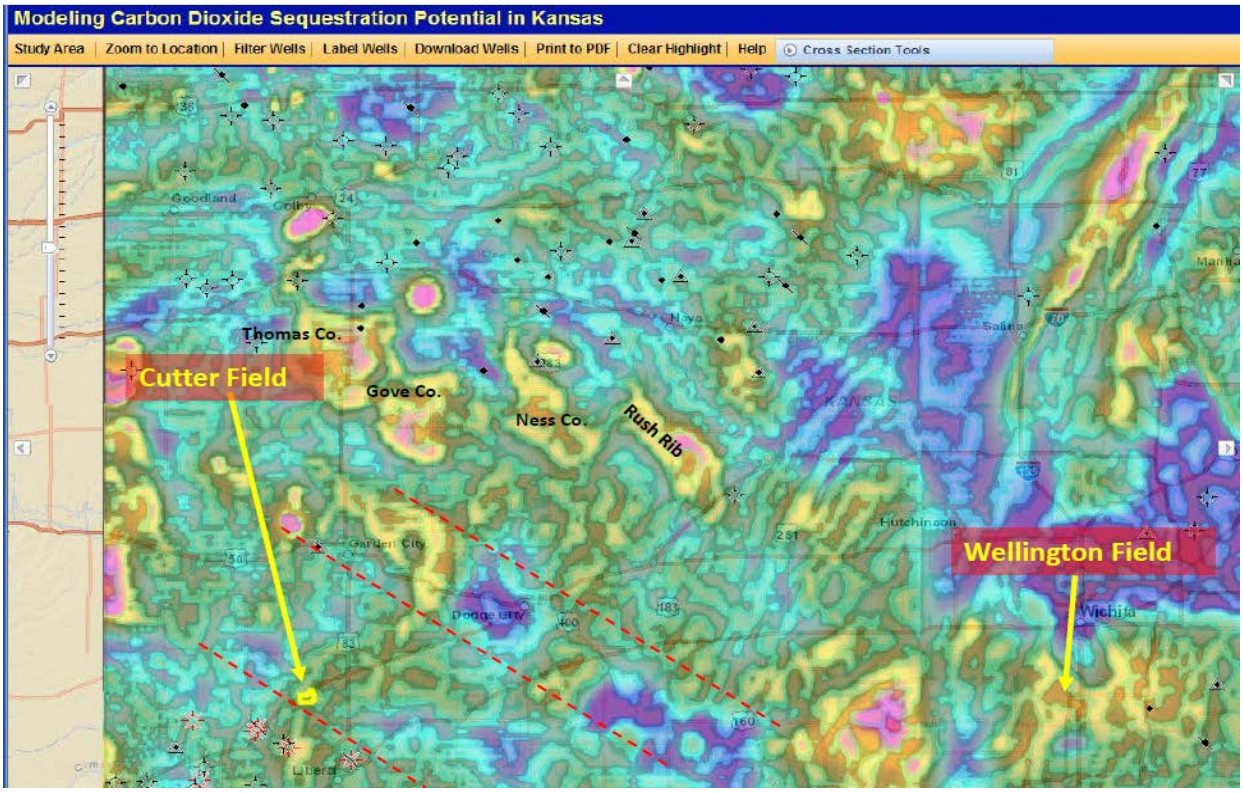


Figure 14. Total magnetic field, reduced to pole (910 m) combined with the tilt angle of the total magnetic field using a 2-10 mile filter.

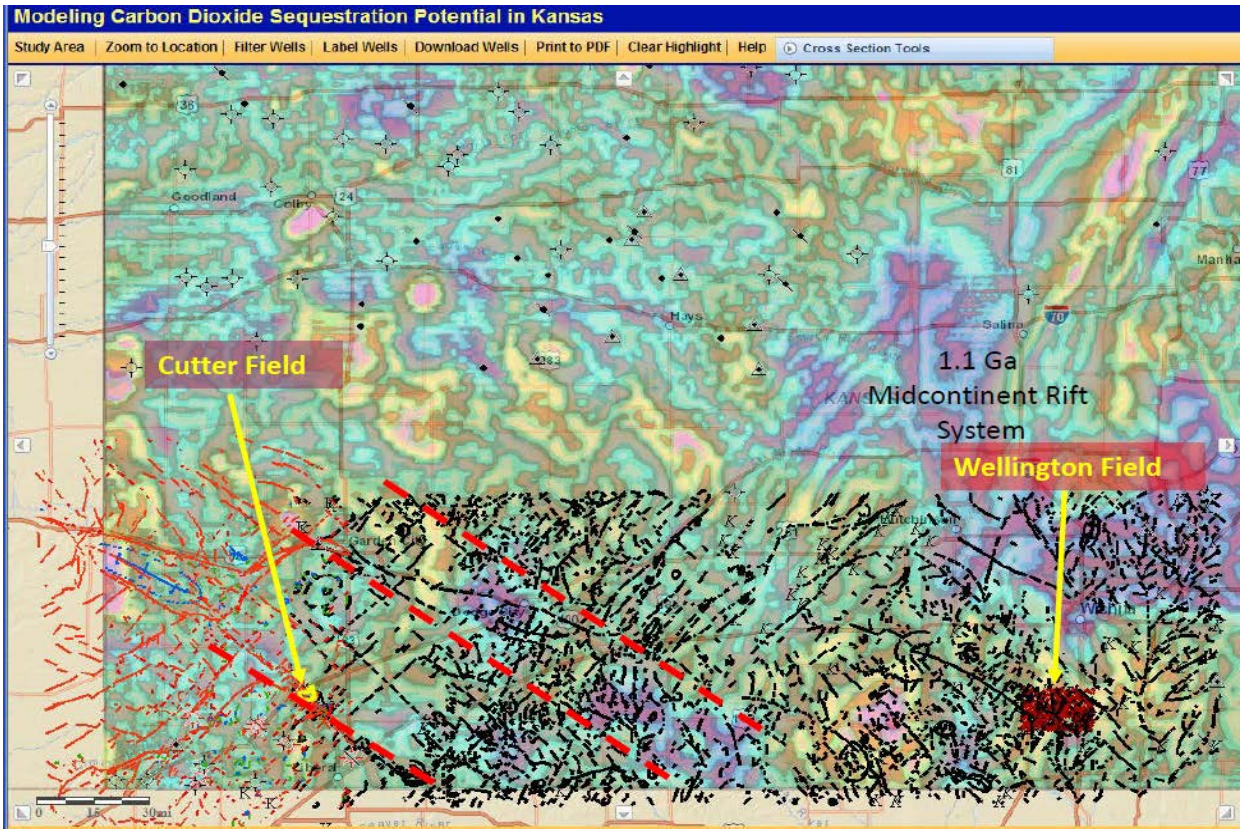


Figure 15. Surface lineaments added to map in Figure 14 showing correspondence of some surface lineaments to basement and overall NW and NE trends.

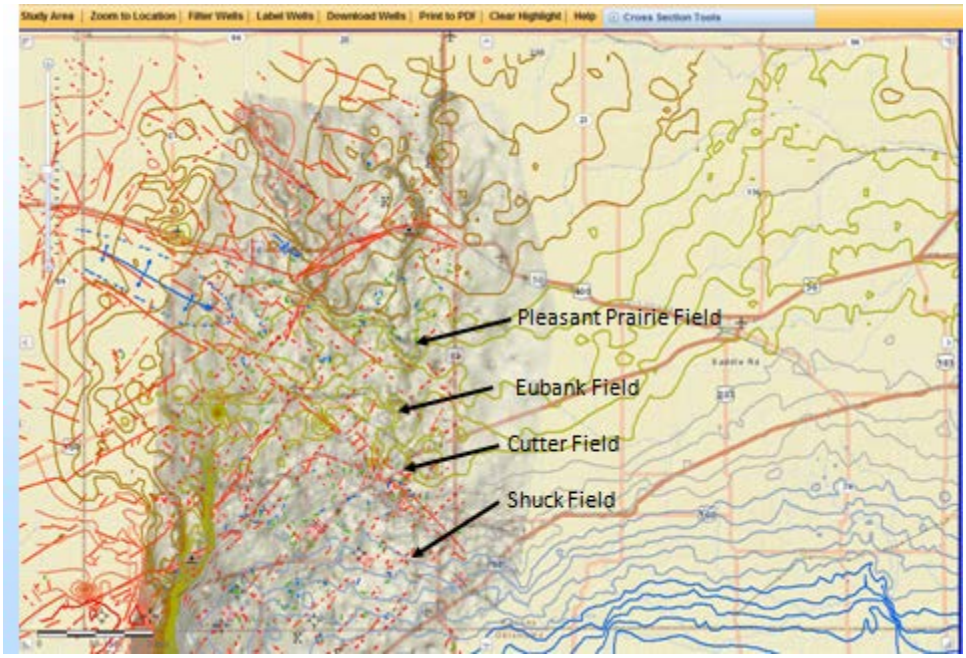


Figure 16. Top of Mississippian contours, surface lineaments, and curvature (gray scale) map of the top of the Lower Permian Ft. Riley Limestone that is located below thick

evaporites of same age. The evaporites are not breached and curvature and surface lineaments indicate likely localized bending or flexure.

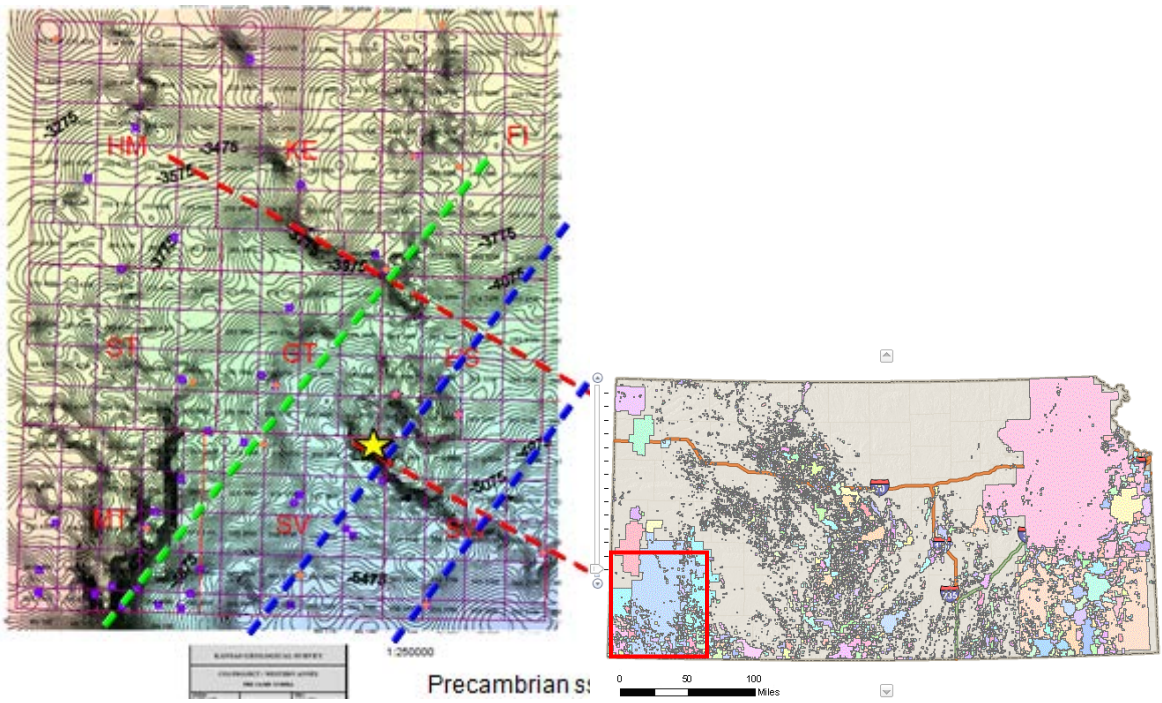


Figure 17. Top Precambrian subsea elevation map showing NE and NE trending lineaments that are also annotated on the following structural and isopach maps. Map includes six counties in SW Kansas which are part of the "Western Annex". Inset map to right shows the location of the mapped area outline by red box. The new basement test, Berexco Cutter KGS #1 is identified with the yellow star. The small squares on map represent 6 x 6 mile townships. Mapped area is 80 miles wide by 90 miles high. Cutter Field is located north of a NW trending basement fault (lower red dashed line) with paralleling fault to the north. NE trends delineate subdivisions of the shelf that generally fall in elevation to the southeast and south defining what is called the Hugoton Embayment, a northward extension of the Anadarko Basin.

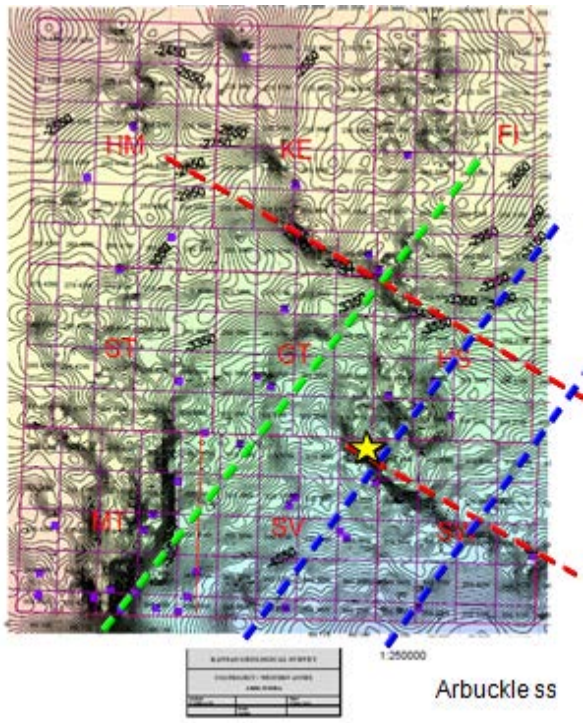


Figure 18. The structural configuration of the top of Arbuckle closely resembles that of the Precambrian structure. Map is annotated the same as Figure 17.

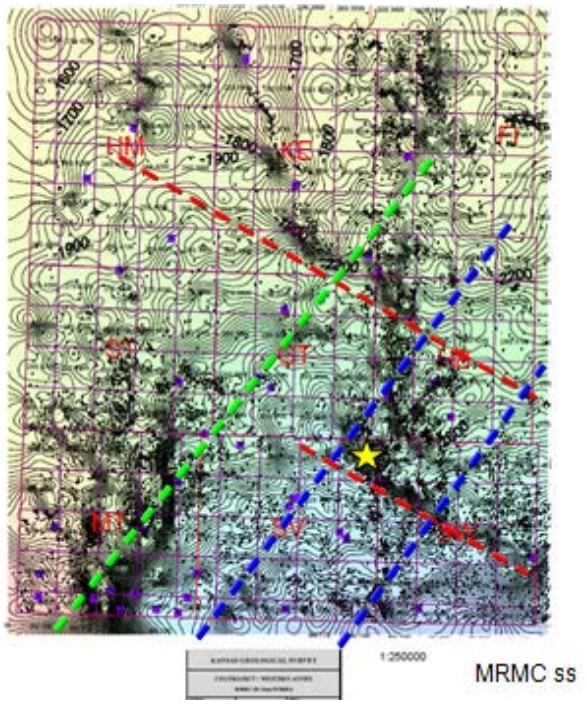


Figure 19. The structure top of Meramecian-age Mississippian carbonates. Northwest trending faults are noted in addition to strong curvature that extends north-south connecting the parallel northwest oriented faults. The incised valley of the Chesterian closely follows the north-south trend.

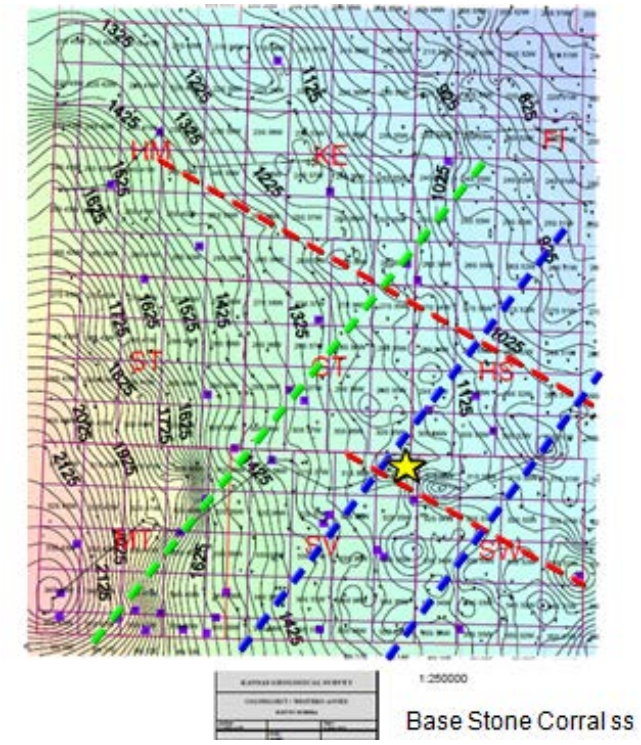


Figure 20. Structure at the top of the Lower Permian Stone Corral Formation is annotated with the same lineament features, but the does not shown abrupt slopes along the lineaments. Southern portion of NE trending green dashed lineament is location of abrupt flexural, down to the east off of the east flank of the Sierra Grande Uplift that lies west of the mapped area.

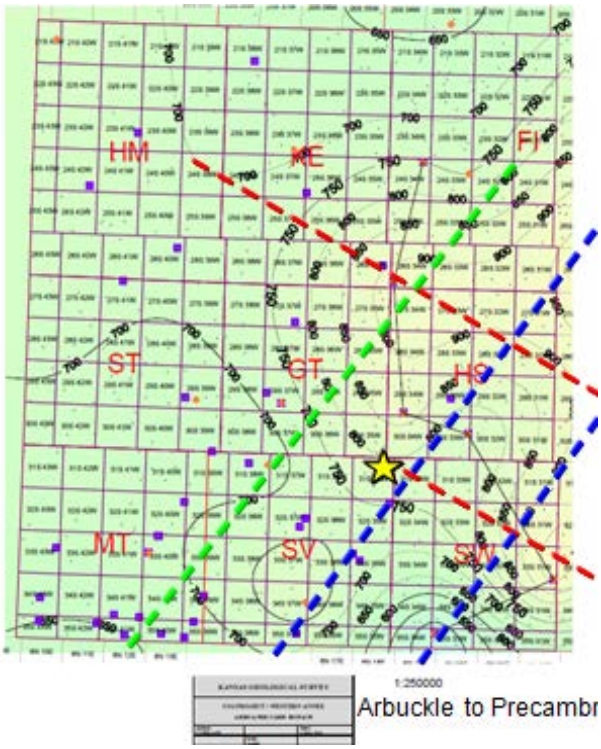


Figure 21. First of a series of isopach maps is the isopach of the Arbuckle Group. Interval thickens east and south on the map, closely following same lineaments shown in early maps.

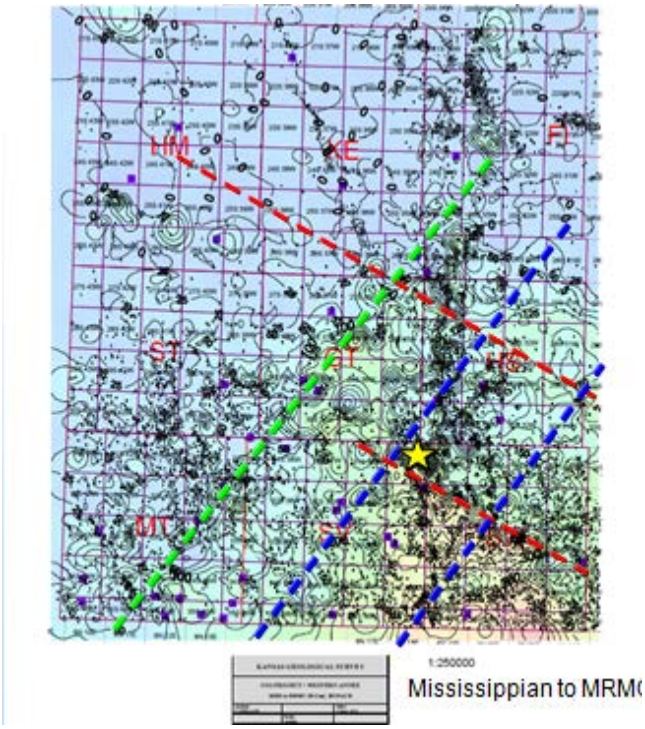


Figure 22. Isopach of the uppermost Mississippian strata, the Chesterian thickens into the southern end of the map, closely corresponding to lineaments that define area of regional change. The stratigraphic interval includes locally thick accumulation of sandstone and shale in the north-south oriented valley that passes east of the Cutter KGS #1 well. Incised valley broadens in the southeast edge to become a tidal dominated delta.

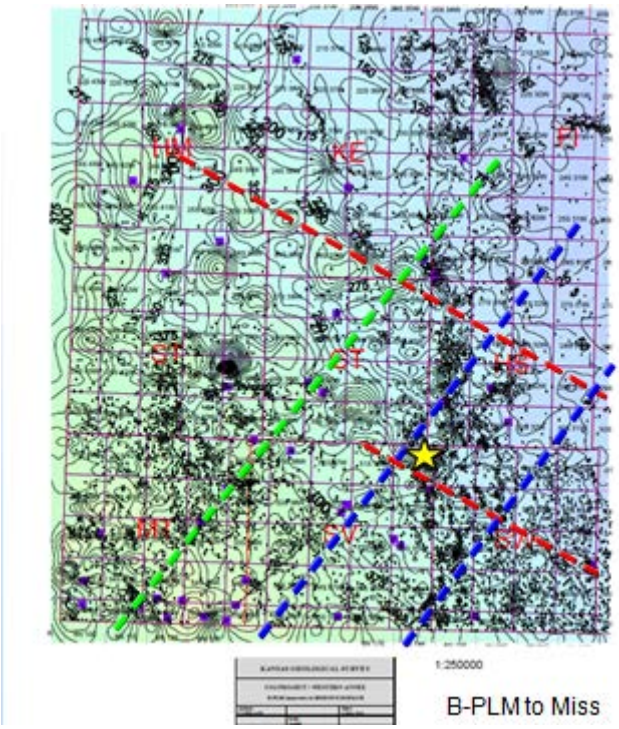


Figure 23. Isopach of the Lower Pennsylvanian Morrowan strata (25 ft contour interval) show broad thickening to the west, a noticeable shift in trend from isopach maps of deeper strata. Lineaments correspond only to subtle changes in thickness and suggest that basement structure was not undergoing significant reactivation.

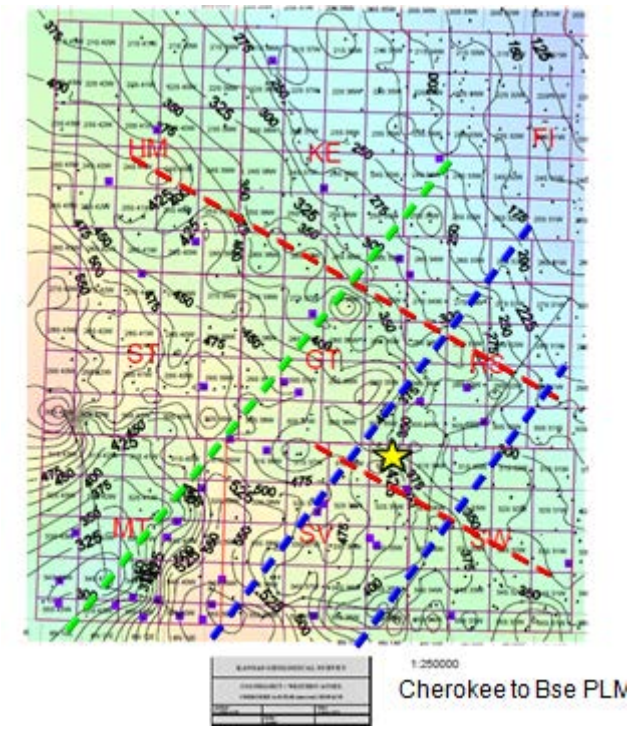


Figure 24. Isopach of the Middle Pennsylvanian Cherokee Group (25 ft contour interval) reveals an arcuate tend of thickening in the southwest sector around a thin extending east off the Sierra Grande Uplift. Lineaments noted loosely correlate with these thickness patterns whose edges are only more sharply defined in the southwest.

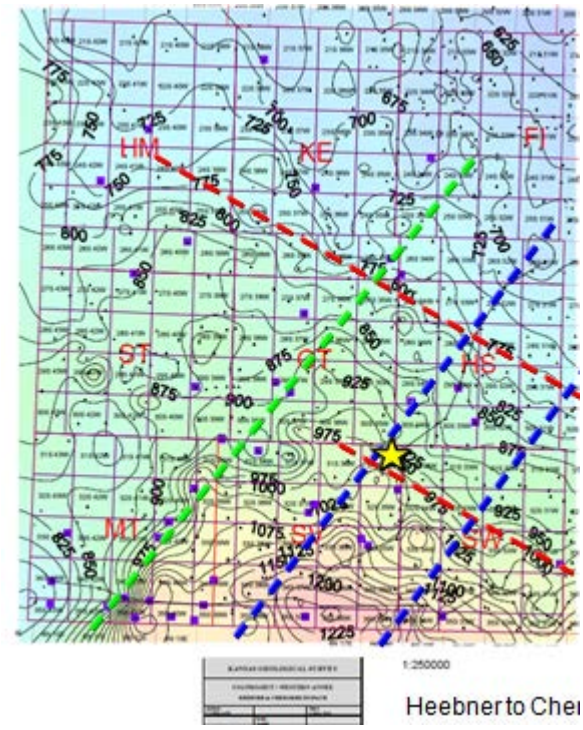


Figure 25. Isopach from the Upper Pennsylvanian Heebner Shale to the top of the Middle Pennsylvanian Cherokee Group (contour interval 25 ft). Thicker strata are again shifted to the southern portion of the Hugoton Embayment bordering the Anadarko Basin. Lineaments separate well defined areas of more abrupt change in thickness in what appears to be a reactivation of the southerly subsidence along basement structures.

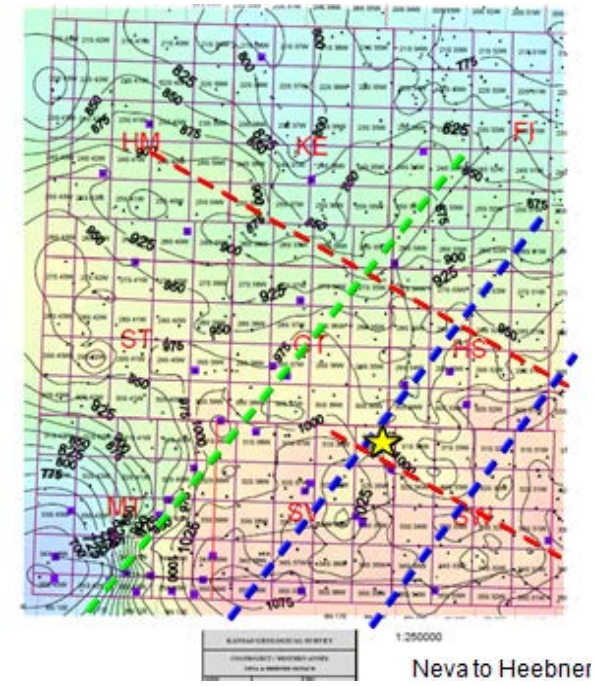


Figure 26. Isopach of the Lower Permian Neva to the Upper Pennsylvanian Heebner Shale (contour interval 25 ft). Lineaments again define areas of thickness change with abrupt thinning in extreme southwest east of the Sierra Grande Uplift.

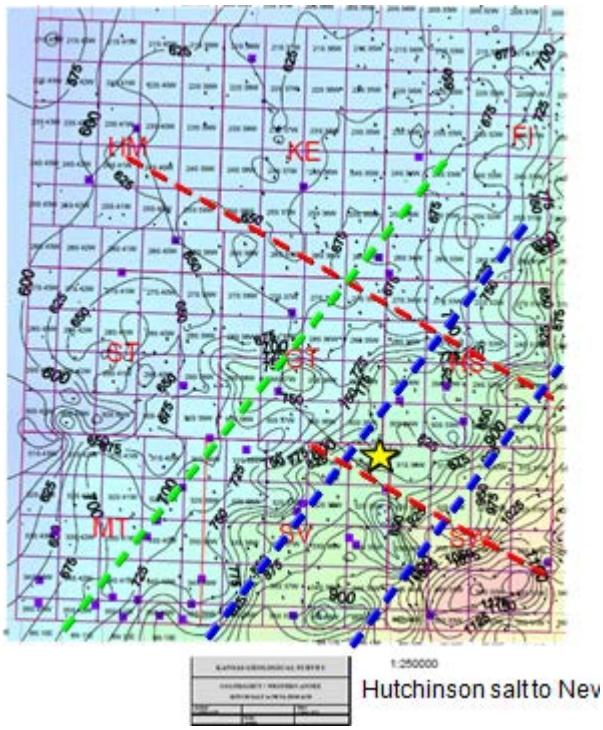


Figure 27. Isopach of the Lower Permian (Leonardian) Hutchinson Salt to the Lower Permian Neva Limestone reveals stepwise thickening to the southeast, closely corresponding to the lineaments. Contour interval is 25 ft. Thickening to southeast is accompanied by appearance and thickening of halite and anhydrite in the Hutchinson Salt Member. Change along lineaments is gradual.

Task 17. -- Collect new 2D shear and 3D multicomponent seismic data and drill test borehole #3 in Stevens County, Kansas.

The 3D seismic data were collected in July and August at Cutter Field prior to commencing drilling of borehole #3, the Berexco Cutter KGS #1. The 2D shear wave data were acquired in August. P-wave processing was to be completed by October and 2D shear processed by November. The 3D converted wave processing will also be completed in November. Interpretation is to be completed by December 2012.

The permitting for seismic was successfully accomplished (Figure 18) to allow acquisition area as planned (Figures 19 and 20). Recording and source parameters are defined in Figure 21.

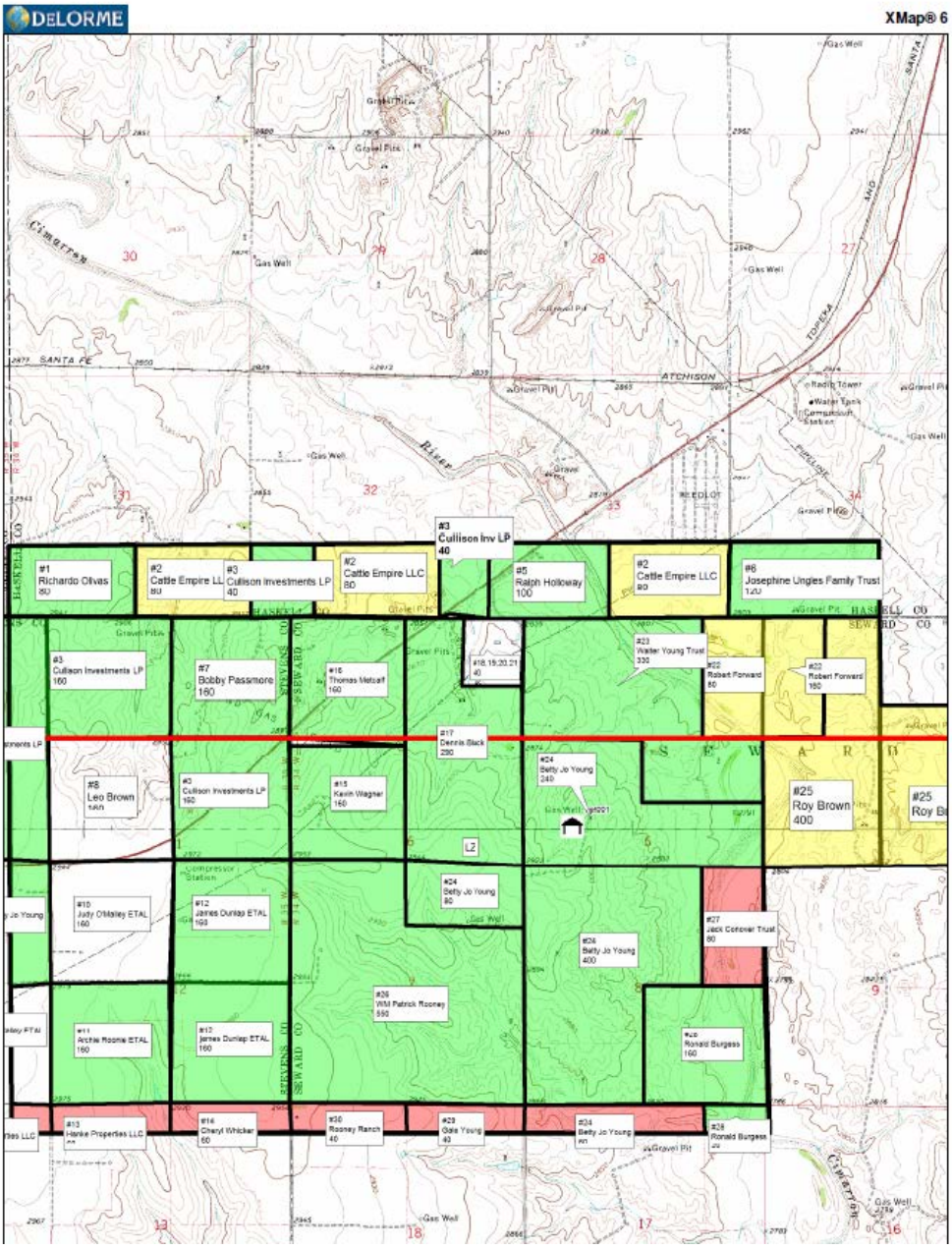


Figure 18. Seismic permitting map.

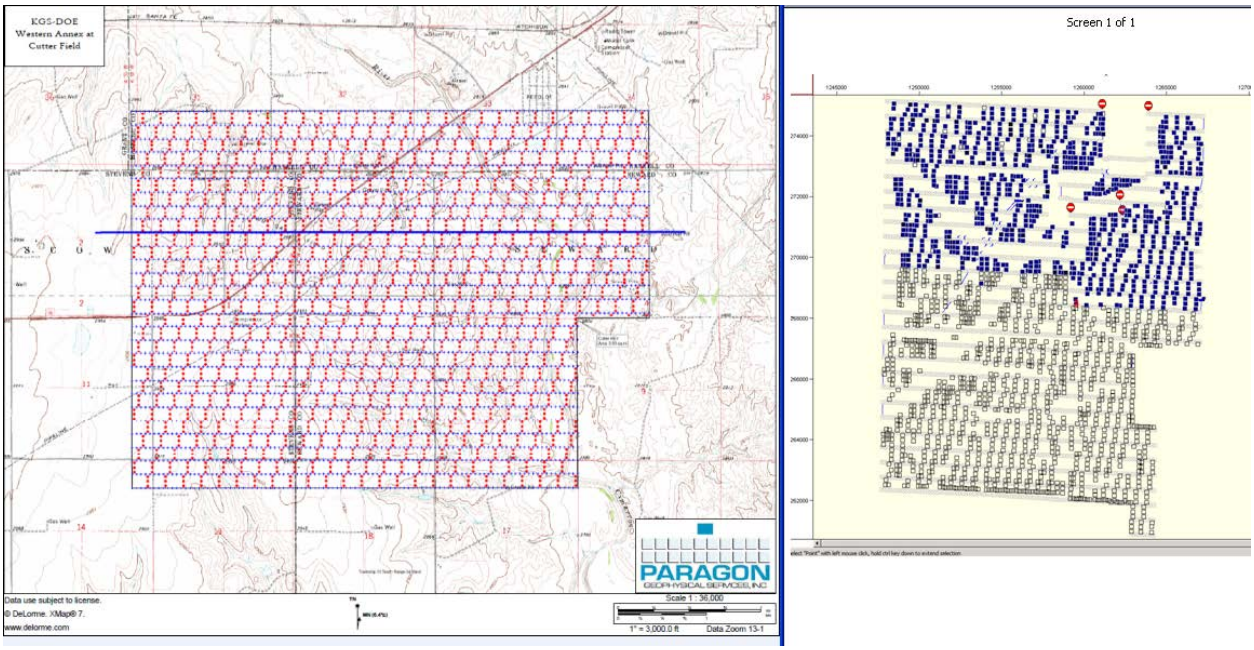


Figure 19. Spread design of the 3D seismic shown on the left. On right is the actual 3D acquisition. Breaks in the acquisition are for roads and pipeline right of ways. More details are shown in Figure 20.

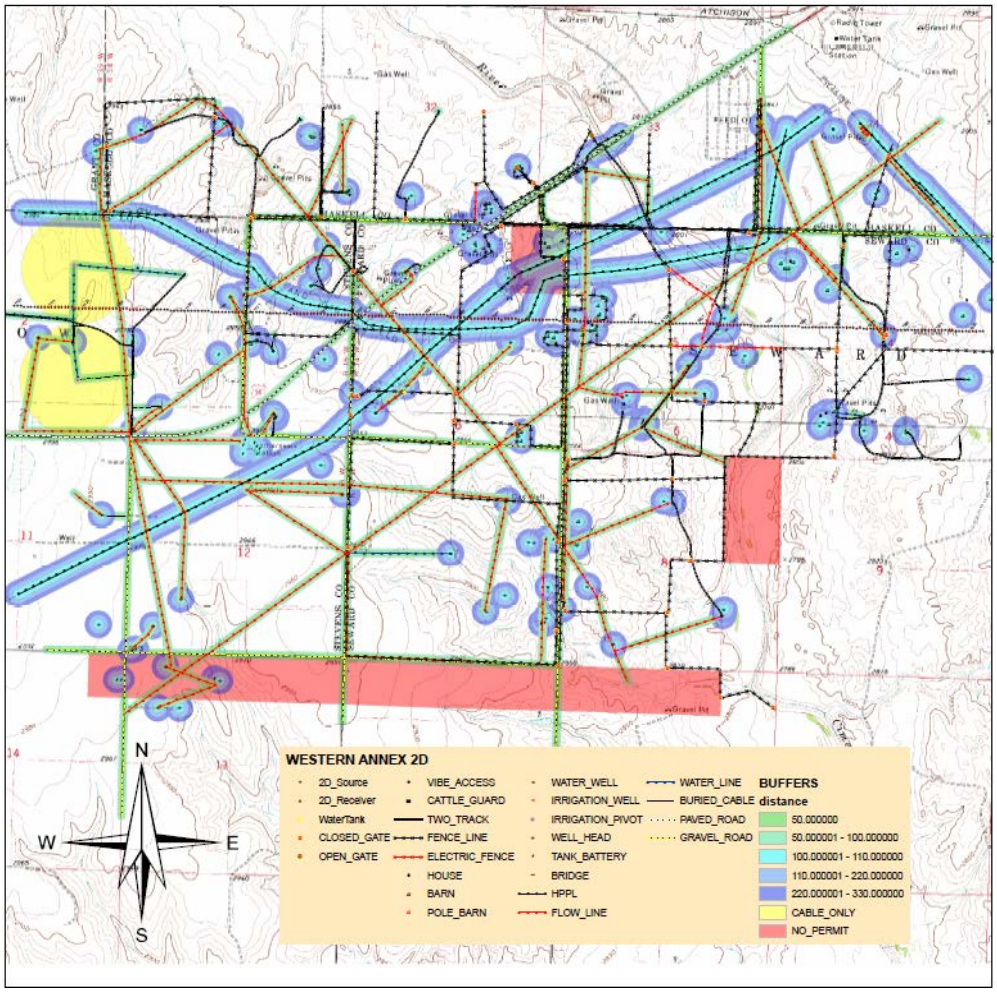
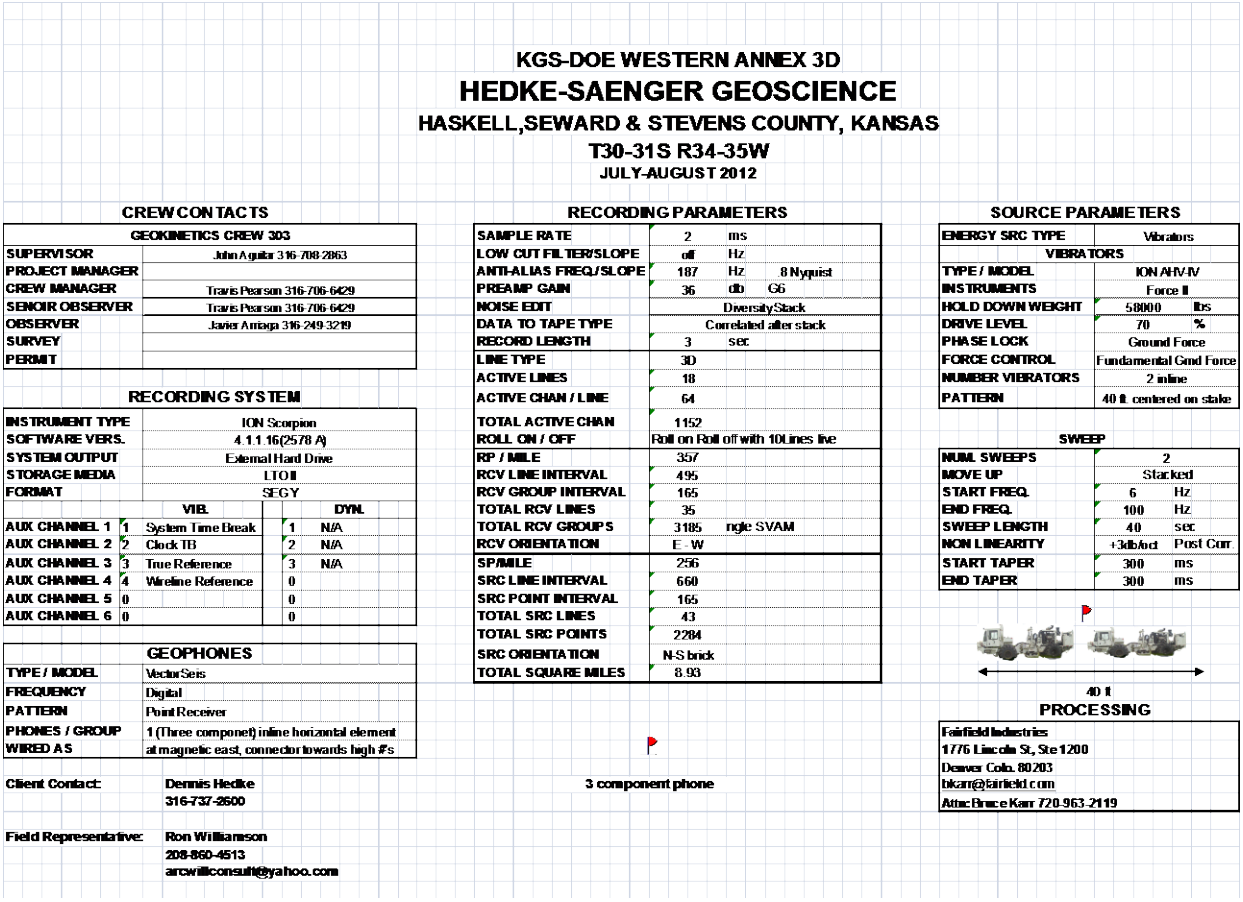


Figure 20. Source, receiver, buffers (blue and green) due to roads, wells, and pipelines. Red is no permit obtained. Yellow is cable only, no vib truck.



KGS-DOE WESTERN ANNEX 3D
HEDKE-SAENGER GEOSCIENCE
HASKELL,SEWARD & STEVENS COUNTY, KANSAS
T30-31S R34-35W
JULY-AUGUST 2012

CREW CONTACTS

GEOKINETICS CREW 303	
SUPERVISOR	John Aguilar 316-708-2863
PROJECT MANAGER	
CREW MANAGER	Travis Pearson 316-706-6429
SENOIR OBSERVER	Travis Pearson 316-706-6429
OBSERVER	Javier Arriaga 316-249-3219
SURVEY	
PERMIT	

RECORDING SYSTEM

INSTRUMENT TYPE	ION Scorpion			
SOFTWARE VERS.	4.1.1.16(2578.A)			
SYSTEM OUTPUT	External Hard Drive			
STORAGE MEDIA	LTO II			
FORMAT	SEGY			
	VIB.		DYN.	
AUX CHANNEL 1	1	System Time Break	1	N/A
AUX CHANNEL 2	2	Clock TB	2	N/A
AUX CHANNEL 3	3	True Reference	3	N/A
AUX CHANNEL 4	4	Wireline Reference	0	
AUX CHANNEL 5	0		0	
AUX CHANNEL 6	0		0	

GEOPHONES

TYPE / MODEL	VectorSeis
FREQUENCY	Digital
PATTERN	Point Receiver
PHONES / GROUP	1 (Three componet) inline horizontal element
WIRED AS	at magnetic east, connector towards high #'s

Client Contact: Dennis Hedke 316-737-2500

Field Representative: Ron Williamson 208-860-4513 arcwillconsult@yahoo.com

RECORDING PARAMETERS

SAMPLE RATE	2	ms	
LOW CUT FILTER/SLOPE	off	Hz	
ANTI-ALIAS FREQ./SLOPE	187	Hz	.8 Nyquist
PREAMP GAIN	36	db	G6
NOISE EDIT	Diversity Stack		
DATA TO TAPE TYPE	Correlated after stack		
RECORD LENGTH	3	sec	
LINE TYPE	3D		
ACTIVE LINES	18		
ACTIVE CHAN / LINE	64		
TOTAL ACTIVE CHAN	1152		
ROLL ON / OFF	Roll on Roll off with 10Lines live		
RP / MILE	357		
RCV LINE INTERVAL	495		
RCV GROUP INTERVAL	165		
TOTAL RCV LINES	35		
TOTAL RCV GROUPS	3185	ngle SVAM	
RCV ORIENTATION	E - W		
SP/MILE	256		
SRC LINE INTERVAL	660		
SRC POINT INTERVAL	165		
TOTAL SRC LINES	43		
TOTAL SRC POINTS	2284		
SRC ORIENTATION	N-S brick		
TOTAL SQUARE MILES	8.93		

3 component phone

SOURCE PARAMETERS

ENERGY SRC TYPE	Vibrators	
VIBRATORS		
TYPE / MODEL	ION AHV-IV	
INSTRUMENTS	Force II	
HOLD DOWN WEIGHT	58000	lbs
DRIVE LEVEL	70	%
PHASE LOCK	Ground Force	
FORCE CONTROL	Fundamental Gnd Force	
NUMBER VIBRATORS	2 inline	
PATTERN	40 ft centered on stake	

SWEEP

NUM. SWEEPS	2	
MOVE UP	Stacked	
START FREQ.	6	Hz
END FREQ.	100	Hz
SWEEP LENGTH	40	sec
NON LINEARITY	+3db/oct	Post Corr.
START TAPER	300	ms
END TAPER	300	ms

40 ft

PROCESSING

Fairfield Industries
1776 Lincoln St, Ste 1200
Denver Colo. 80203
bkarr@fairfield.com
Attn: Bruce Karr 720-963-2119

Figure 21. Recording and source parameters for the 3D seismic acquisition at Cutter Field.

The footprint of the 3D seismic includes an area on the west over Cutter Field with both thinner Chester and Morrow sandstones and the staked location of the Cutter well. The new seismic also includes the north-south oriented incised valley with thick sand that passed east of Cutter Field (Figures 22 and 23).

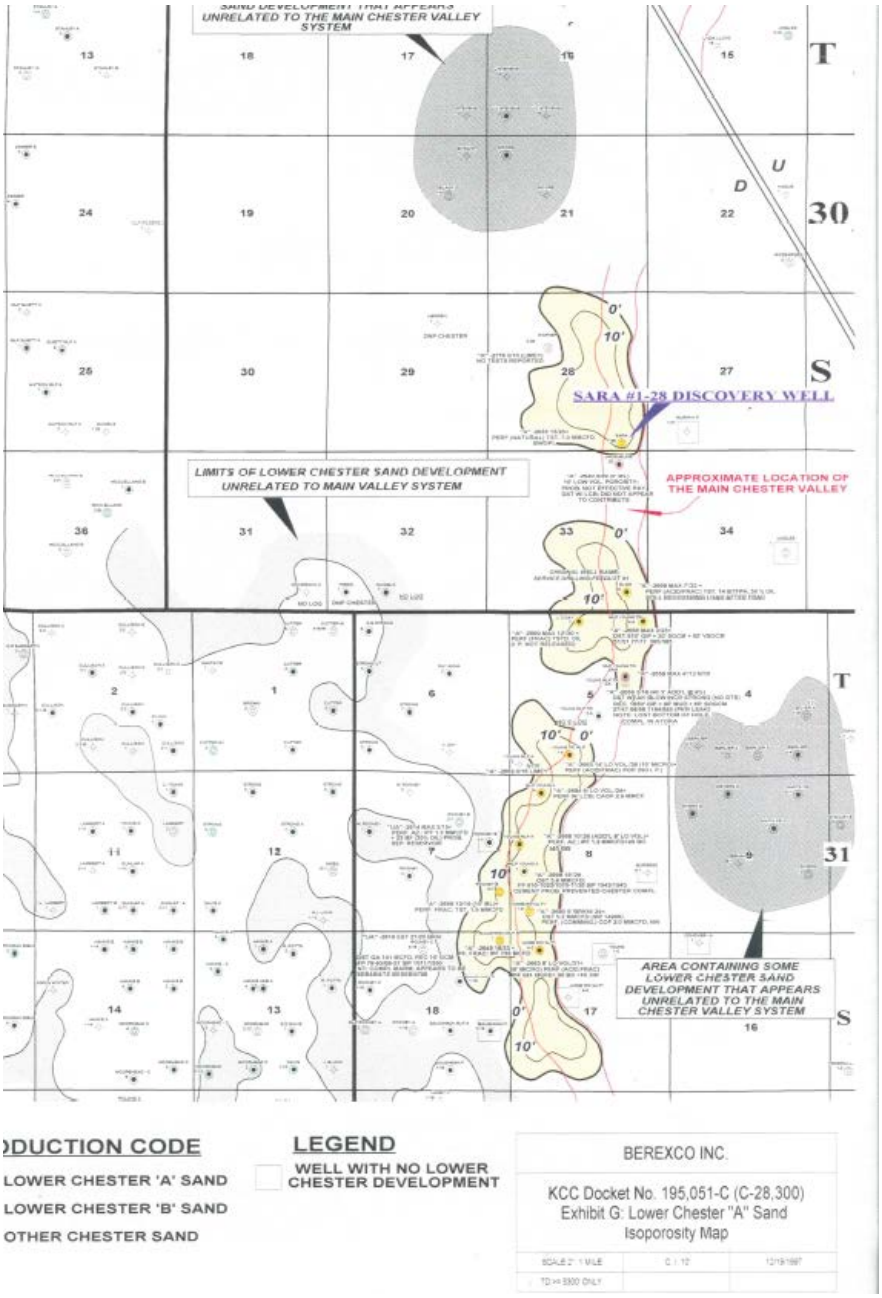


Figure 22. KC Docket from Berexco, LLC showing Lower Chester "A" sand isoporosity map delimiting thicker sandstone in the incised valley that is located in eastern portion of new acquisition of 3D seismic. Location of KGS Cutter #1 is shown in Section 1, situated 2 miles west of the incised valley.

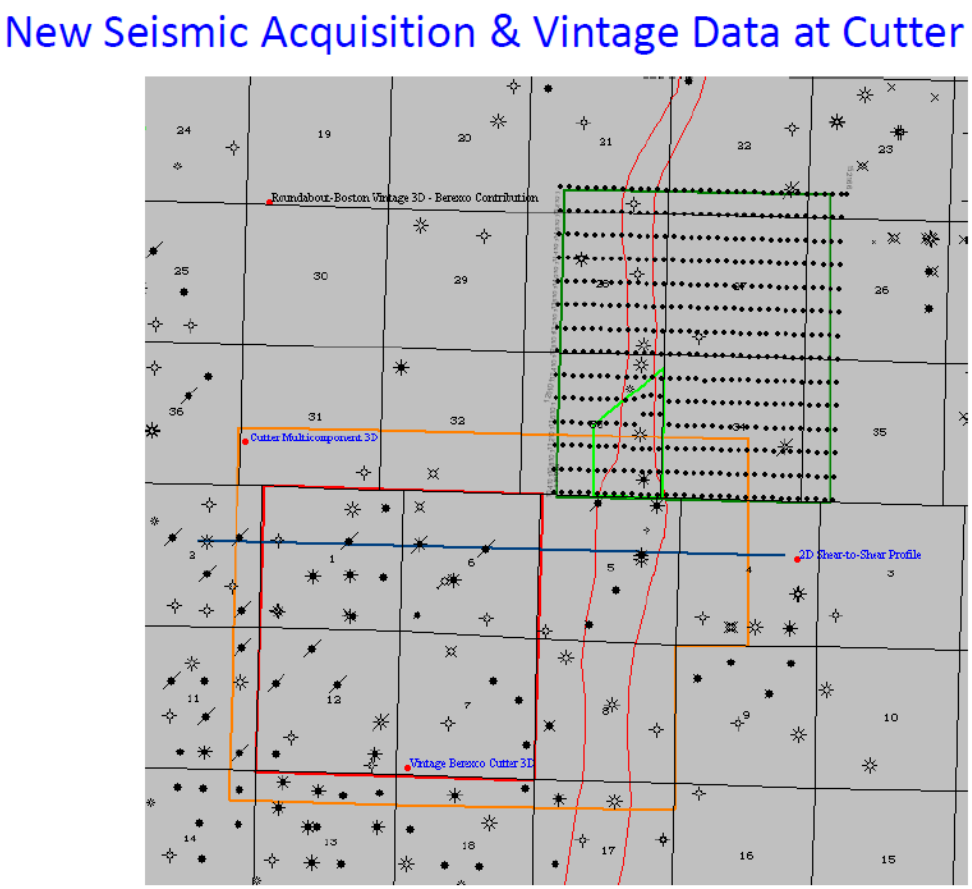


Figure 23. New seismic acquisition (orange outline) overlaps with vintage seismic on northeast side providing an extended view of the incised valley to the south. Another vintage seismic in red within the outline of the new seismic. New data will be notable improvement.

Drilling of Borehole #3, Berexco Cutter KGS #1

The Berexco Cutter KGS #1 is located 2440' FNL-1320' FEL Section 1-T31S-R35W, in the northeast corner of Stevens County, Kansas. Drilling commenced on July 29th. This location was the second and final calibration site in the 3-year program to evaluate carbon sequestration potential in southern Kansas.

This western Kansas well will be drilled in Cutter Field, operated by Berexco, LLC, Wichita, KS. The drilling selection process involved bids tendered by several of the companies who operate oil fields that are being characterized and modeled as part of the Southwest Kansas CO2 Initiative Consortium managed by Improved Hydrocarbon Recovery. Companies include Berexco, Cimarex, Elm II, GloriOil, Merit, and Anadarko who operate oil fields in this area

including Pleasant Prairie South, North Eubanks, Shuck, and Cutter. These industry partners donated seismic, well, and production data to make this evaluation possible and provide needed cost share. The concentration of these fields among others in this area could provide the basis for implementing commercial scale CO2 sequestration should evaluation be successful.

The drilling was preceded by acquisition of nearly 9 square miles of 3D multi-component seismic imaging by Paragon Geophysical and designed by Hedke-Saenger Geoscience Ltd., both from Wichita, KS. Seismic data will be used to map the rock properties around the new well. Existing data was also used to site the well on a structural high that would aid CO2 plume management.

The Cutter KGS #1 and new seismic data will be combined with over 120 square miles of seismic data donated by industry partners to the project to augment and enhance interpretations from the local scale and regional subsurface well based mapping.

The well was scheduled for 55 days of drilling by Berexco's drilling company Beredco, Inc., during which time approximately 1180 ft of core was planned starting in the Pennsylvanian Morrowan-age strata and the ending in the Precambrian basement, estimated to be located at 7550 ft beneath the surface (Figure 24). A total of 1046 ft of core was actually cut in this interval. Repeated jamming of the core bit in fractured porous intervals in the lower Arbuckle prevented continuously coring that interval and expended rig time. Decision was made to drill ahead just of the base of the Arbuckle to conserve on rig time so that a DST and full suite of logging could comfortably be acquired. Funds remaining for this well should be sufficient for testing the cased well for brine composition including both inorganic and microbial content.

Coring Schedule Cutter KGS #1
Est KB 2935'

Depth Interval	Footage	Formation	Core storage
5210-5290	80	Morrow	Alum Bbl
5400-5600	200	Chester	Boxes
6400-6800	400	Kinderhook/Viola/Upper Arb	Alum Bbl
6900-7200	300	Arbuckle	Boxes
7350-7550	200	Lower Arb	Alum Bbl
	1180		

Figure 24. Proposed coring program.

Coring was accomplished by Devilbiss Coring. Core was trucked to Houston core analysis by Weatherford Labs, extensive wireline logging by Halliburton, and analysis of fluids and rock by

Geology departments at Kansas State University and The University of Kansas will provide critical geologic, geochemical, and engineering data that will be used to evaluate recovery of incremental oil using CO2 from the field's sandstone reservoir, quantify the storage capacity of the underlying deep Arbuckle saline formation, and investigate properties of caprocks to contain and manage commercial quantities of CO2.

The analysis of the Cutter Field well parallels the study of Wellington Field in Sumner County in south-central Kansas. Wellington and Cutter field data will be integrated with subsurface mapping by Bittersweet Energy subcontractor over the 25,000 square miles between and beyond these two fields in southern Kansas (Figures 25 and 26). Regional mapping of rock properties is being used to develop new CO2 storage capacity estimates and establish a geologic framework that will aid potential future site selection for CO2 storage projects. Distance between fields is 200 miles.

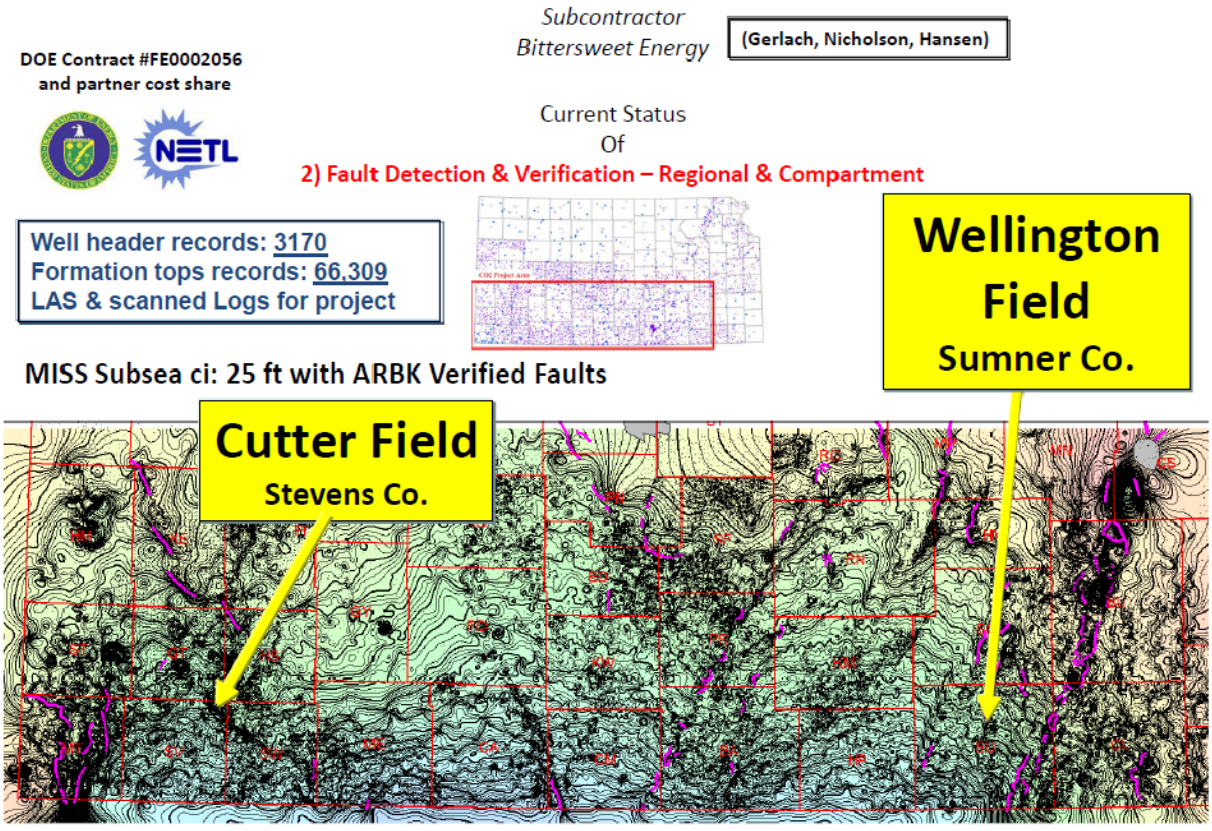


Figure 25. Mississippian structure map showing annotated with the locations of the Cutter and Wellington fields.

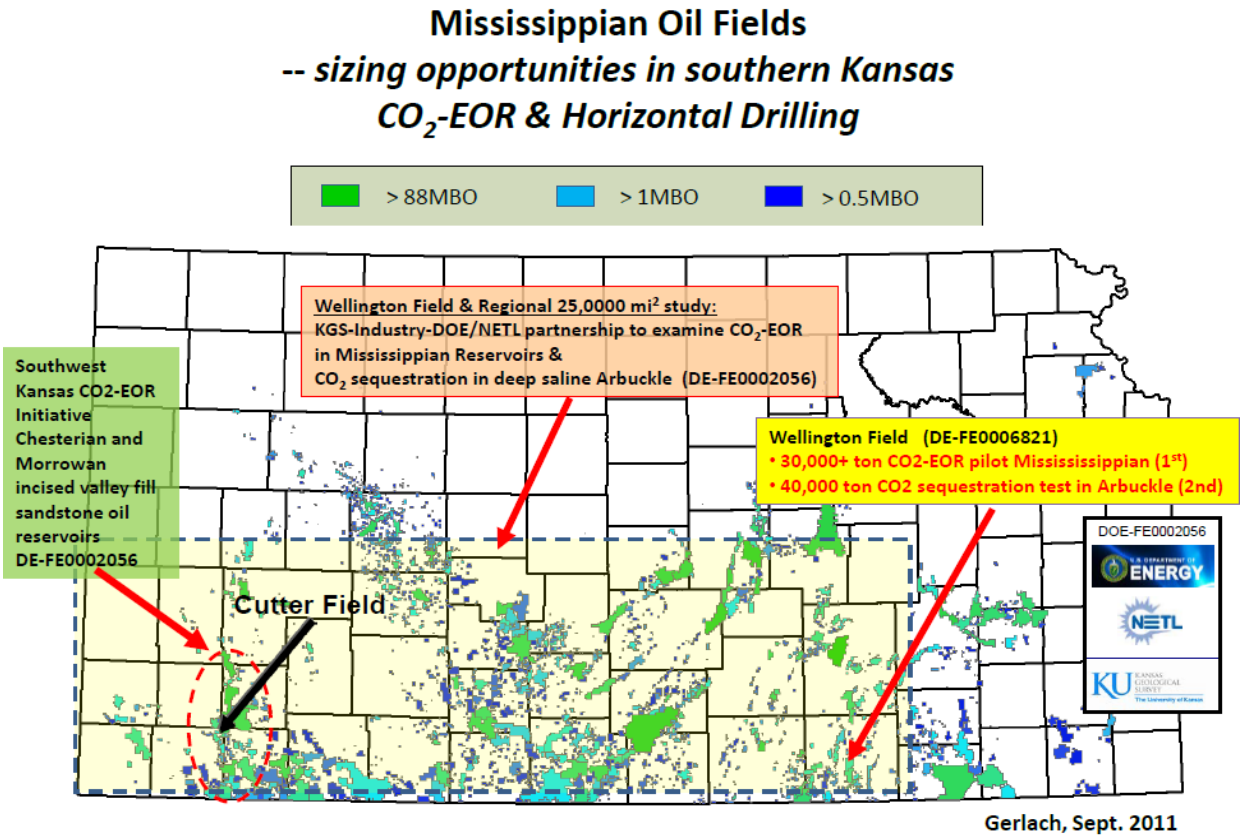
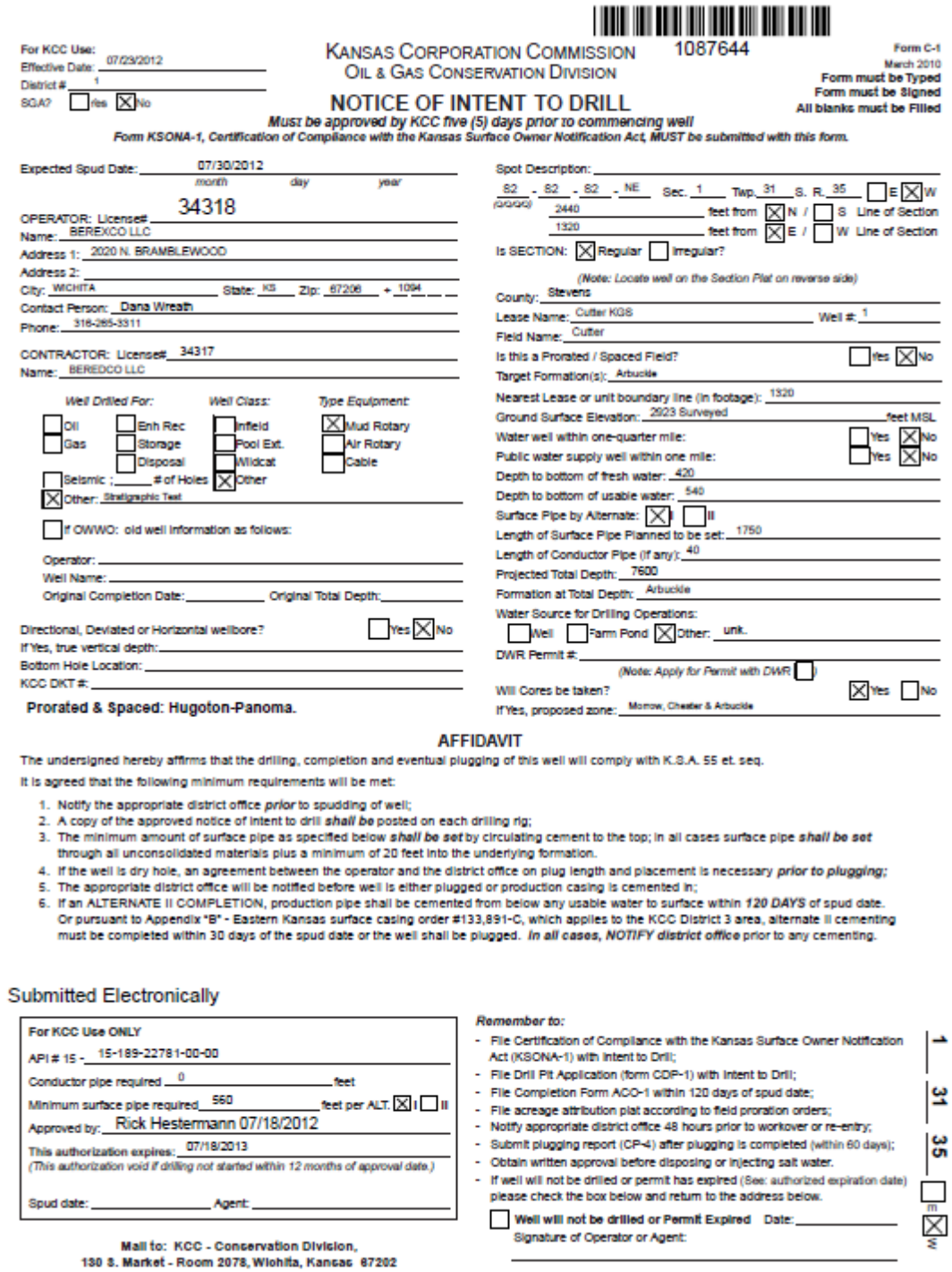


Figure 26. Mississippian oil fields compared by cumulative hydrocarbon produced and the location of the two fields being used as calibration points, Cutter and Wellington fields.

Intent to drill form for the Cutter well was filed and approved with the Kansas Corporation Commission (Figures 27 through 35) that includes information about the well and location maps.



For KCC Use:
Effective Date: 07/23/2012
District # 1
SGA? [ ] Yes [X] No

KANSAS CORPORATION COMMISSION
OIL & GAS CONSERVATION DIVISION

1087644

Form C-1
March 2010
Form must be Typed
Form must be Signed
All blanks must be Filled

NOTICE OF INTENT TO DRILL

Must be approved by KCC five (5) days prior to commencing well
Form KSONA-1, Certification of Compliance with the Kansas Surface Owner Notification Act, MUST be submitted with this form.

Expected Spud Date: 07/30/2012 (month / day / year)

OPERATOR: License# 34318
Name: BEREXCO LLC
Address 1: 2020 N. BRAMBLEWOOD
Address 2:
City: WICHITA State: KS Zip: 67206 + 1094
Contact Person: Dana Wreath
Phone: 316-265-3311

CONTRACTOR: License# 34317
Name: BEREDCO LLC

Well Drilled For: [ ] Oil [ ] Gas [ ] Enh Rec [ ] Storage [ ] Disposal [ ] Seismic ; # of Holes [X] Other: Stratigraphic Test
Well Class: [ ] Infield [ ] Pool Ext. [ ] Wildcat [X] Other
Type Equipment: [X] Mud Rotary [ ] Air Rotary [ ] Cable

[ ] If OWWO: old well information as follows:
Operator:
Well Name:
Original Completion Date: Original Total Depth:

Directional, Deviated or Horizontal wellbore? [ ] Yes [X] No
If Yes, true vertical depth:
Bottom Hole Location:
KCC DKT #:

Prorated & Spaced: Hugoton-Panoma.

Spot Description:
S2 - S2 - S2 - NE (Q/Q/Q/Q) Sec. 1 Twp. 31 S. R. 35 [ ] E [X] W
2440 feet from [X] N / [ ] S Line of Section
1320 feet from [X] E / [ ] W Line of Section
Is SECTION: [X] Regular [ ] Irregular?
(Note: Locate well on the Section Plat on reverse side)
County: Stevens
Lease Name: Cutter KGS Well #: 1
Field Name: Cutter
Is this a Prorated / Spaced Field? [ ] Yes [X] No
Target Formation(s): Arbuckle
Nearest Lease or unit boundary line (in footage): 1320
Ground Surface Elevation: 2923 Surveyed feet MSL
Water well within one-quarter mile: [ ] Yes [X] No
Public water supply well within one mile: [ ] Yes [X] No
Depth to bottom of fresh water: 420
Depth to bottom of usable water: 540
Surface Pipe by Alternate: [X] I [ ] II
Length of Surface Pipe Planned to be set: 1750
Length of Conductor Pipe (if any): 40
Projected Total Depth: 7600
Formation at Total Depth: Arbuckle
Water Source for Drilling Operations:
[ ] Well [ ] Farm Pond [X] Other: unk.
DWR Permit #:
(Note: Apply for Permit with DWR [ ])
Will Cores be taken? [X] Yes [ ] No
If Yes, proposed zone: Morrow, Chester & Arbuckle

AFFIDAVIT

The undersigned hereby affirms that the drilling, completion and eventual plugging of this well will comply with K.S.A. 55 et. seq.

It is agreed that the following minimum requirements will be met:

1. Notify the appropriate district office *prior* to spudding of well;
2. A copy of the approved notice of intent to drill ***shall be*** posted on each drilling rig;
3. The minimum amount of surface pipe as specified below ***shall be set*** by circulating cement to the top; in all cases surface pipe ***shall be set*** through all unconsolidated materials plus a minimum of 20 feet into the underlying formation.
4. If the well is dry hole, an agreement between the operator and the district office on plug length and placement is necessary ***prior to plugging;***
5. The appropriate district office will be notified before well is either plugged or production casing is cemented in;
6. If an ALTERNATE II COMPLETION, production pipe shall be cemented from below any usable water to surface within ***120 DAYS*** of spud date. Or pursuant to Appendix "B" - Eastern Kansas surface casing order #133,891-C, which applies to the KCC District 3 area, alternate II cementing must be completed within 30 days of the spud date or the well shall be plugged. ***In all cases, NOTIFY district office*** prior to any cementing.

Submitted Electronically

For KCC Use ONLY
API # 15 - 15-189-22781-00-00
Conductor pipe required 0 feet
Minimum surface pipe required 560 feet per ALT. [X] I [ ] II
Approved by: Rick Hestermann 07/18/2012
This authorization expires: 07/18/2013
(This authorization void if drilling not started within 12 months of approval date.)
Spud date: Agent:

Mail to: KCC - Conservation Division,
130 S. Market - Room 2078, Wichita, Kansas 67202

Remember to:
- File Certification of Compliance with the Kansas Surface Owner Notification Act (KSONA-1) with Intent to Drill;
- File Drill Pit Application (form CDP-1) with Intent to Drill;
- File Completion Form ACO-1 within 120 days of spud date;
- File acreage attribution plat according to field proration orders;
- Notify appropriate district office 48 hours prior to workover or re-entry;
- Submit plugging report (CP-4) after plugging is completed (within 60 days);
- Obtain written approval before disposing or injecting salt water.
- If well will not be drilled or permit has expired (See: authorized expiration date) please check the box below and return to the address below.

[ ] **Well will not be drilled or Permit Expired** Date:
Signature of Operator or Agent:

1 — 31 — 35 — m — [X] W

Figure 27. Intent to drill form for Cutter KGS #1 submitted to State of Kansas, page 1.

Side Two

1087644

For KCC Use ONLY
API # 15 - 15-189-22781-00-00

IN ALL CASES PLOT THE INTENDED WELL ON THE PLAT BELOW

In all cases, please fully complete this side of the form. Include items 1 through 5 at the bottom of this page.

Operator: BEREXCO LLC
Lease: Cutter KGS
Well Number: 1
Field: Cutter

Number of Acres attributable to well:
QTR/QTR/QTR/QTR of acreage: 82 - 82 - 82 - NE

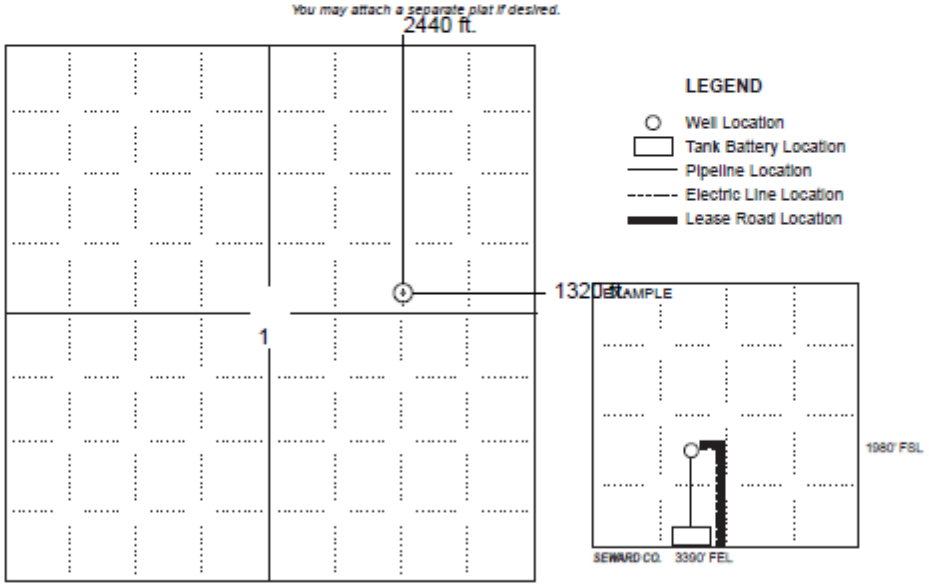
Location of Well: County: Stevens
2440 feet from ☒ N / ☐ S Line of Section
1320 feet from ☒ E / ☐ W Line of Section
Sec. 1 Twp. 31 S. R. 35 ☐ E ☒ W

Is Section: ☒ Regular or ☐ Irregular

If Section is Irregular, locate well from nearest corner boundary.
Section corner used: ☐ NE ☐ NW ☐ SE ☐ SW

PLAT

Show location of the well. Show footage to the nearest lease or unit boundary line. Show the predicted locations of lease roads, tank batteries, pipelines and electrical lines, as required by the Kansas Surface Owner Notice Act (House Bill 2032). You may attach a separate plat if desired.



NOTE: In all cases locate the spot of the proposed drilling locaton.

In plotting the proposed location of the well, *you must show*:

1. The manner in which you are using the depicted plat by identifying section lines, i.e. 1 section, 1 section with 8 surrounding sections, 4 sections, etc.
2. The distance of the proposed drilling location from the south / north and east / west outside section lines.
3. The distance to the nearest lease or unit boundary line (in footage).
4. If proposed location is located within a prorated or spaced field a certificate of acreage attribution plat must be attached: (CO-7 for oil wells; CG-8 for gas wells).
5. The predicted locations of lease roads, tank batteries, pipelines, and electrical lines.

Figure 28. Intent to drill form for Cutter KGS #1, page 2.

KANSAS CORPORATION COMMISSION
OIL & GAS CONSERVATION DIVISION

1087644

Form CDP-1
May 2010
Form must be Typed

APPLICATION FOR SURFACE PIT

Submit in Duplicate

Operator Name: BEREXCO LLC | License Number: 34318

Operator Address: 2020 N. BRAMBLEWOOD | WICHITA | KS | 67206

Contact Person: Dana Wreath | Phone Number: 316-265-3311

Lease Name & Well No.: Cutter KGS 1

Pit Location (QQQQ): S2 - S2 - S2 - NE

Sec. 1 Twp. 31 R. 35 ☐ East ☒ West

2440 Feet from ☒ North / ☐ South Line of Section

1320 Feet from ☒ East / ☐ West Line of Section

Stevens County

Type of Pit:
☐ Emergency Pit ☐ Burn Pit
☐ Settling Pit ☒ Drilling Pit
☐ Workover Pit ☐ Haul-Off Pit
(If WP Supply API No. or Year Drilled)

Pit is:
☒ Proposed ☐ Existing
If Existing, date constructed:

Pit capacity: 10250 (bbls)

Is the pit located in a Sensitive Ground Water Area? ☐ Yes ☒ No

Chloride concentration: _____ mg/l
(For Emergency Pits and Settling Pits only)

Is the bottom below ground level? ☒ Yes ☐ No

Artificial Liner? ☐ Yes ☒ No

How is the pit lined if a plastic liner is not used?
Bentonite Clay in freshwater drilling mud, native mud and clay.

Pit dimensions (all but working pits): 120 Length (feet) 120 Width (feet) ☐ N/A: Steel Pits

Depth from ground level to deepest point: 4 (feet) ☐ No Pit

If the pit is lined give a brief description of the liner material, thickness and installation procedure.

Describe procedures for periodic maintenance and determining liner integrity, including any special monitoring.

Distance to nearest water well within one-mile of pit: 3100 feet Depth of water well 460 feet

Depth to shallowest fresh water 200 feet.
Source of information:
☐ measured ☐ well owner ☐ electric log ☒ KDWR

Emergency, Settling and Burn Pits ONLY:

Producing Formation: _____

Number of producing wells on lease: _____

Barrels of fluid produced daily: _____

Does the slope from the tank battery allow all spilled fluids to flow into the pit? ☐ Yes ☐ No

Drilling, Workover and Haul-Off Pits ONLY:

Type of material utilized in drilling/workover: freshwater Bentonite/chemical mud.

Number of working pits to be utilized: 4

Abandonment procedure: Allow evaporation of liquid until bottom of pit is dry, then push in sides and backfill with drill cuttings in place. Finally level to contour of surrounding terrain, as close as possible to it's natural state.

Drill pits must be closed within 365 days of spud date.

Submitted Electronically

KCC OFFICE USE ONLY

☐ Liner ☐ Steel Pit ☐ RFAC ☐ RFAS

Date Received: 07/17/2012 Permit Number: 15-189-22781-00-00 Permit Date: 07/18/2012 Lease Inspection: ☐ Yes ☒ No

Mail to: KCC - Conservation Division, 130 S. Market - Room 2078, Wichita, Kansas 67202

Figure 29. Intent to drill form for Cutter KGS #1, page 3.

KANSAS CORPORATION COMMISSION
OIL & GAS CONSERVATION DIVISION

1087644

Form KSONA-1
July 2010
Form Must Be Typed
Form must be Signed
All blanks must be Filled

CERTIFICATION OF COMPLIANCE WITH THE KANSAS SURFACE OWNER NOTIFICATION ACT

This form must be submitted with all Forms C-1 (Notice of Intent to Drill); CB-1 (Cathodic Protection Borehole Intent); T-1 (Request for Change of Operator Transfer of Injection or Surface Pit Permit); and CP-1 (Well Plugging Application). Any such form submitted without an accompanying Form KSONA-1 will be returned.

Select the corresponding form being filed: ☒ **C-1** (Intent) ☐ **CB-1** (Cathodic Protection Borehole Intent) ☐ **T-1** (Transfer) ☐ **CP-1** (Plugging Application)

OPERATOR: License # 34318
Name: BEREXCO LLC
Address 1: 2020 N. BRAMBLEWOOD
Address 2:
City: WICHITA State: KS Zip: 67206 + 1094
Contact Person: Dana Wreath
Phone: (316) 265-3311 Fax: (316) 681-4731
Email Address: Dwreath@Berexco.Com

Well Location:
S2 S2 S2 NE Sec. 1 Twp. 31 S. R. 35 ☐ East ☒ West
County: Stevens
Lease Name: Cutter KGS Well #: 1

If filing a Form T-1 for multiple wells on a lease, enter the legal description of the lease below:

Surface Owner Information:
Name: Bobby D. Passmore & Carlis J. Passmore
Address 1: PO Box 297
Address 2:
City: Hugoton State: KS Zip: 67951 + 0297

When filing a Form T-1 involving multiple surface owners, attach an additional sheet listing all of the information to the left for each surface owner. Surface owner information can be found in the records of the register of deeds for the county, and in the real estate property tax records of the county treasurer.

If this form is being submitted with a Form C-1 (Intent) or CB-1 (Cathodic Protection Borehole Intent), you must supply the surface owners and the KCC with a plat showing the predicted locations of lease roads, tank batteries, pipelines, and electrical lines. The locations shown on the plat are preliminary non-binding estimates. The locations may be entered on the Form C-1 plat, Form CB-1 plat, or a separate plat may be submitted.

Select one of the following:

☒ I certify that, pursuant to the Kansas Surface Owner Notice Act (House Bill 2032), I have provided the following to the surface owner(s) of the land upon which the subject well is or will be located: 1) a copy of the Form C-1, Form CB-1, Form T-1, or Form CP-1 that I am filing in connection with this form; 2) if the form being filed is a Form C-1 or Form CB-1, the plat(s) required by this form; and 3) my operator name, address, phone number, fax, and email address.

☐ I have not provided this information to the surface owner(s). I acknowledge that, because I have not provided this information, the KCC will be required to send this information to the surface owner(s). To mitigate the additional cost of the KCC performing this task, I acknowledge that I am being charged a $30.00 handling fee, payable to the KCC, which is enclosed with this form.

If choosing the second option, submit payment of the $30.00 handling fee with this form. If the fee is not received with this form, the KSONA-1 form and the associated Form C-1, Form CB-1, Form T-1, or Form CP-1 will be returned.

Submitted Electronically

Mail to: KCC - Conservation Division, 130 S. Market - Room 2078, Wichita, Kansas 67202

Figure 30. Intent to drill form for Cutter KGS #1, page 4.

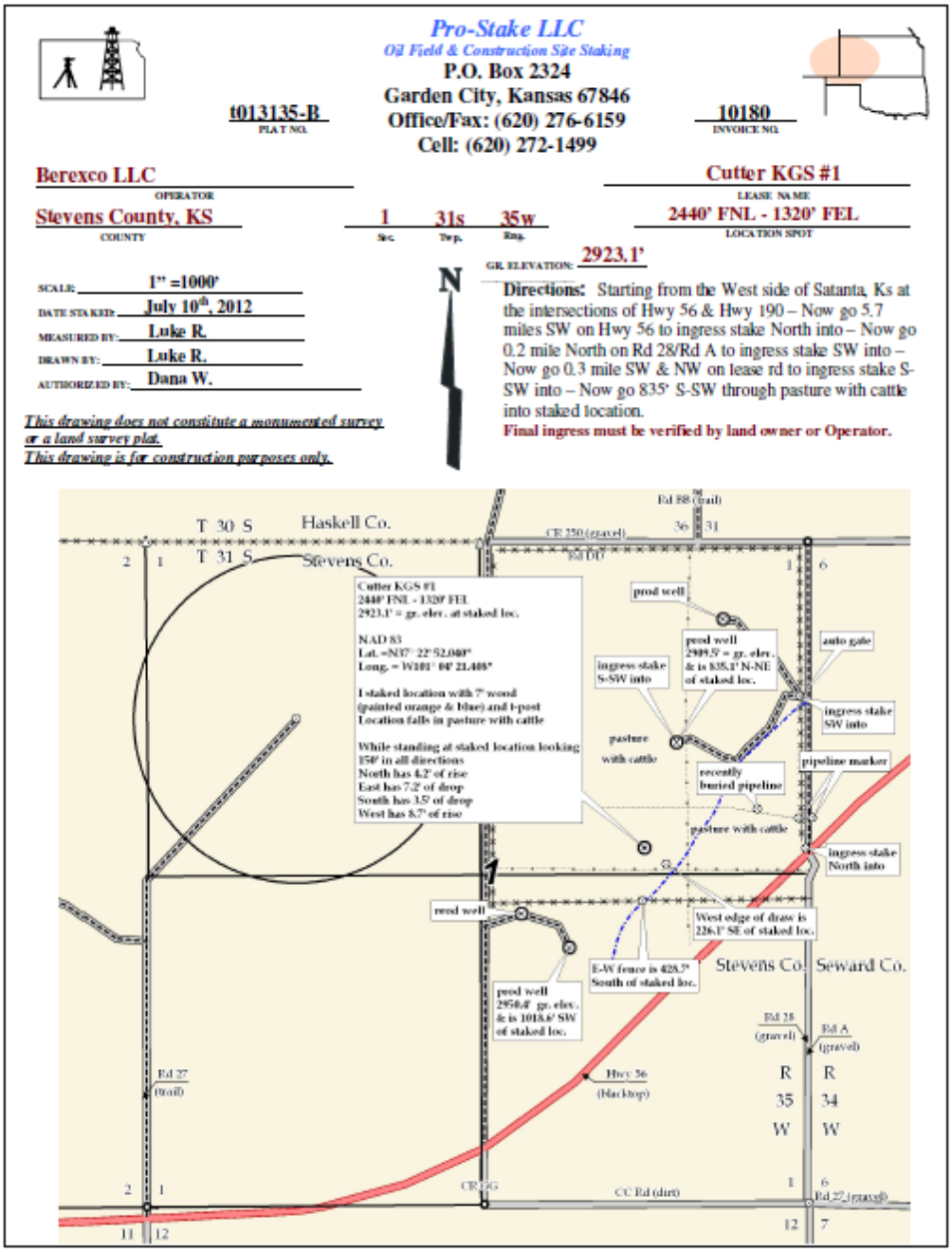


Figure 31. Intent to drill form for Cutter KGS #1, page 5.

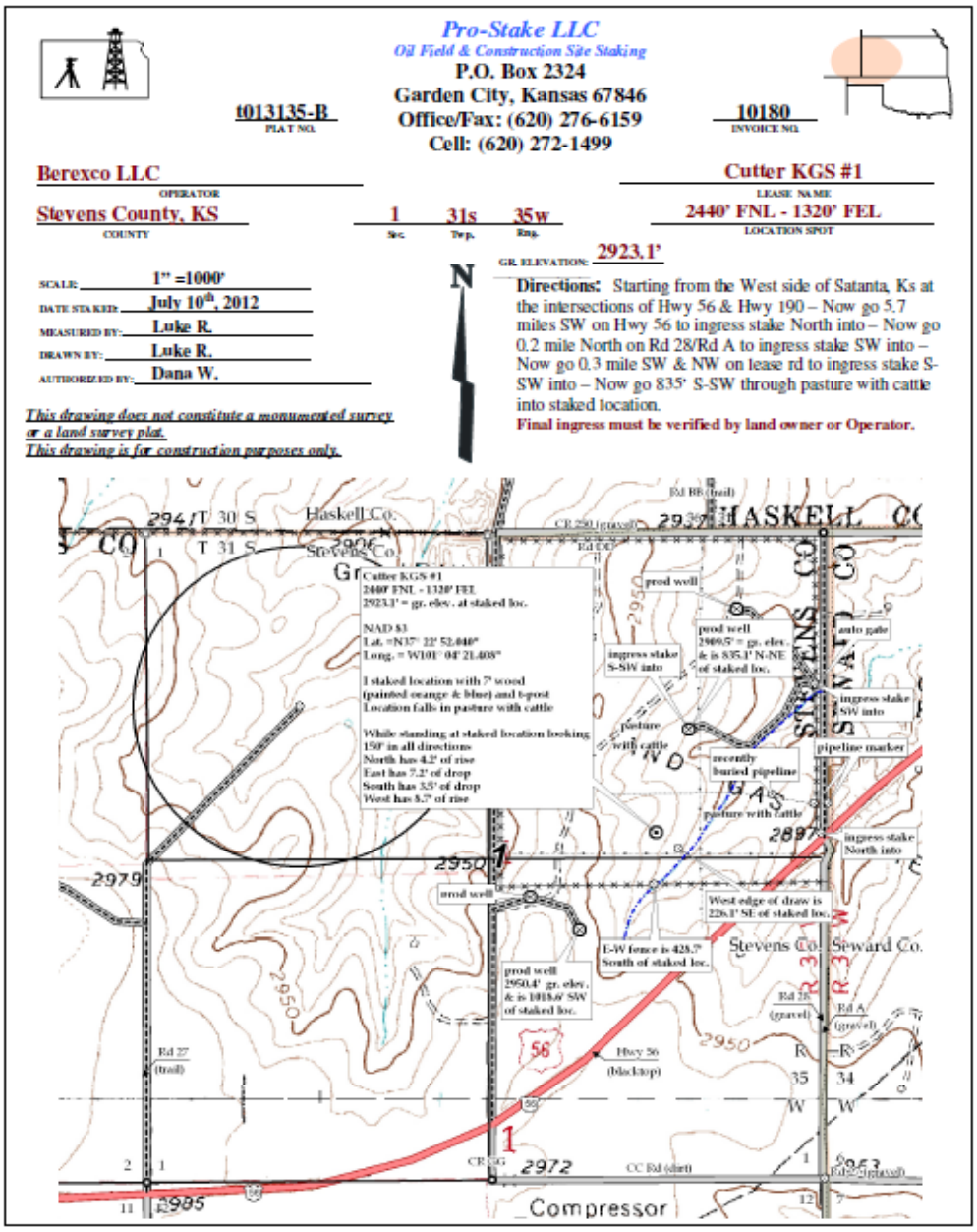


Figure 32. Intent to drill form for Cutter KGS #1, page 6.

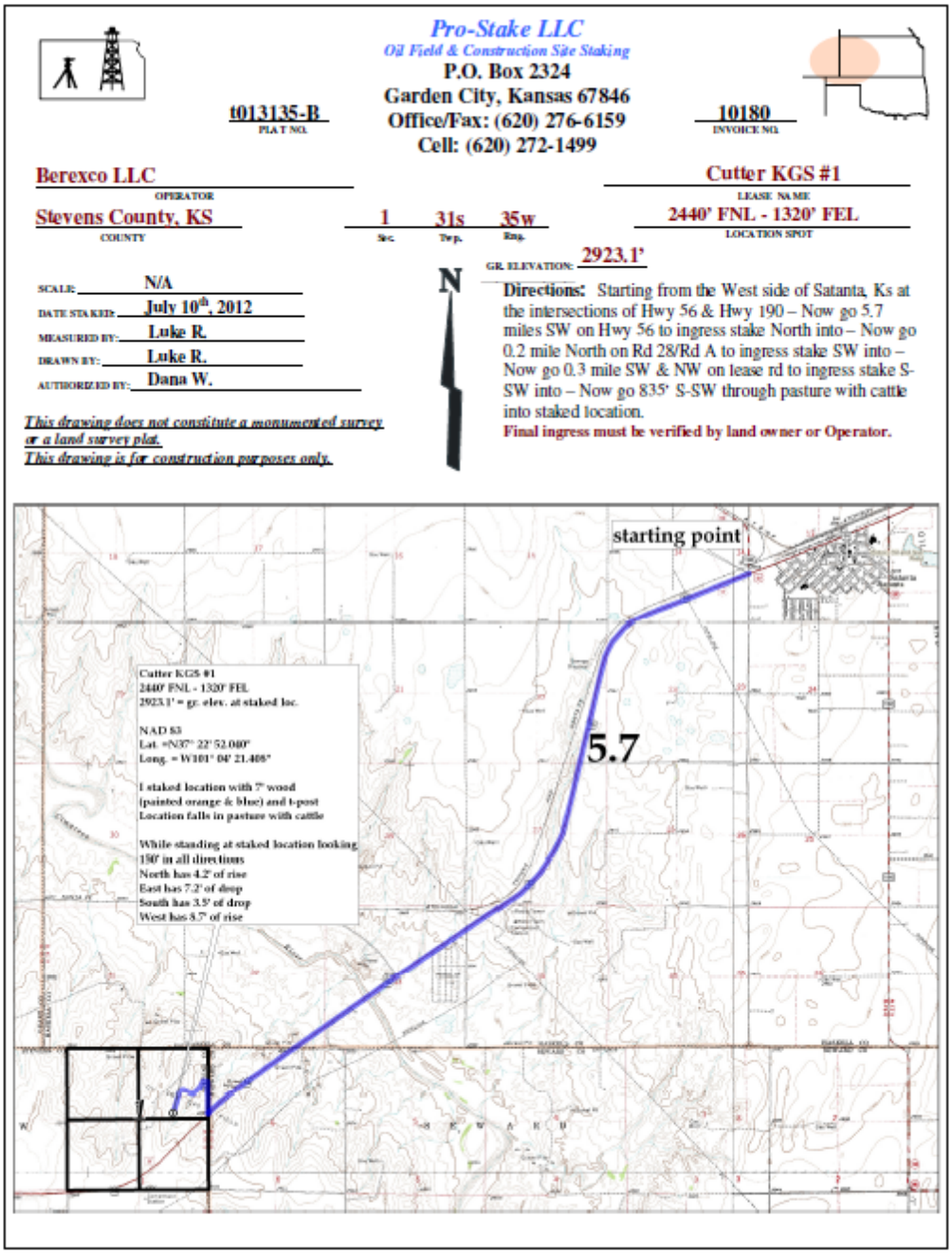


Figure 34. Intent to drill form for Cutter KGS #1, page 7.

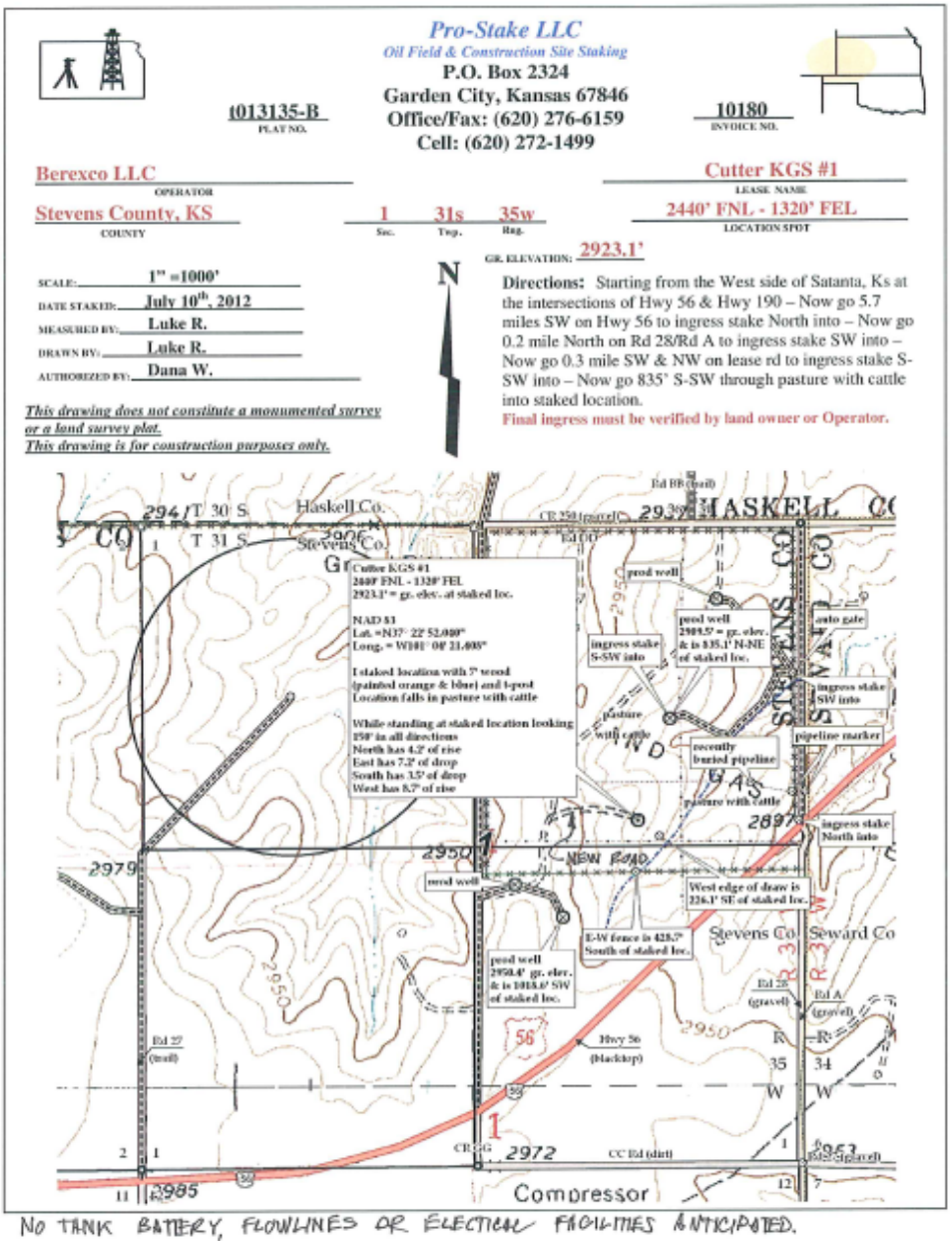


Figure 35. Intent to drill form for Cutter KGS #1, page 8.

Additional maps are shown to illustrate the "lay of the land" (Figures 36 and 37). Southwestern Kansas contains wide expanses of short grass prairie and wheat fields (Figure 38).

Figure 36. Google Maps image of the area near the wellsite.

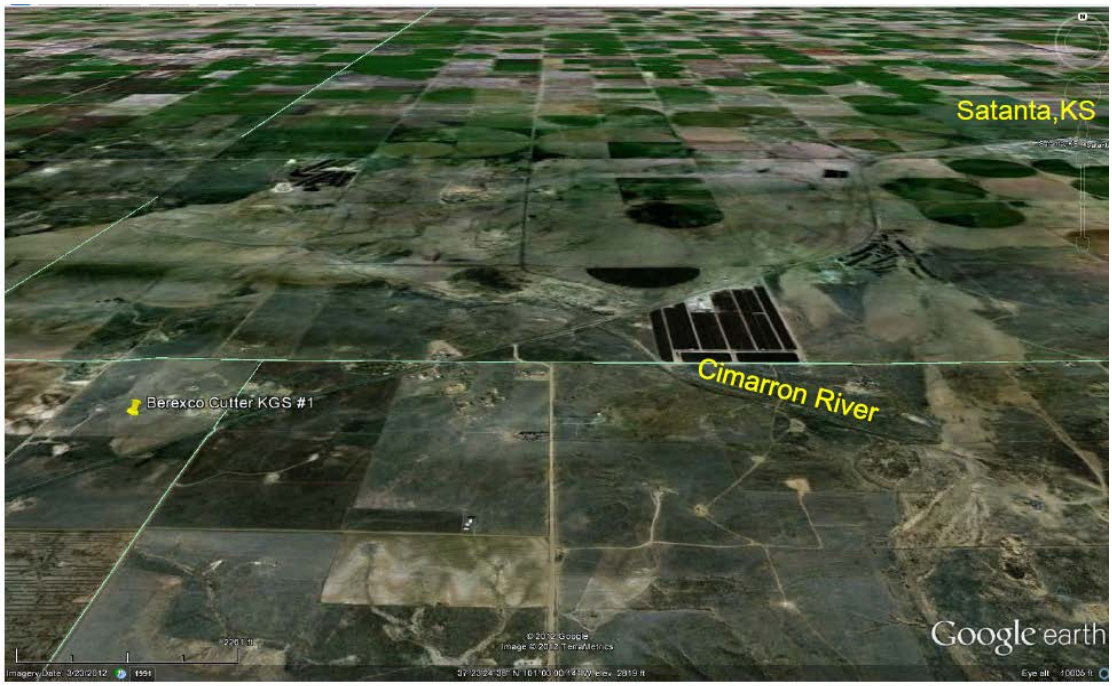


Figure 37. Oblique view of the area in the vicinity of the Cutter KGS #1 borehole.

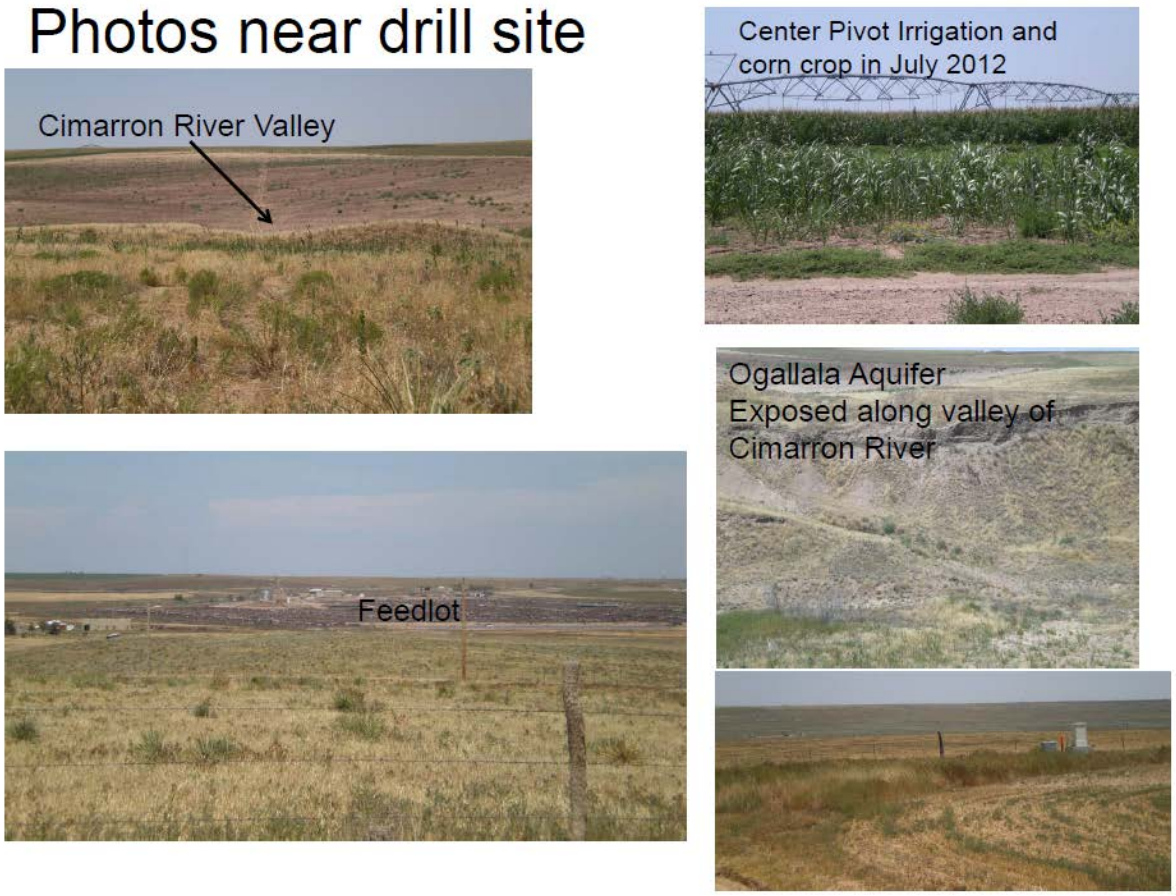


Figure 38. Photos taken from points surrounding the wellsite of Cutter KGS #1.

A georeport was prepared by the wellsite geologist that describes the rocks encountered as observed from well cuttings. Information recorded included rate of penetration in feet per minute, gas shows, and lithology encountered. Information from that report was read and parsed into the Java web application Well Profile. The resulting profile down to 7334 ft is shown in Figure 39. Actual total depth is 7550 ft. Final georeport has yet to be released.

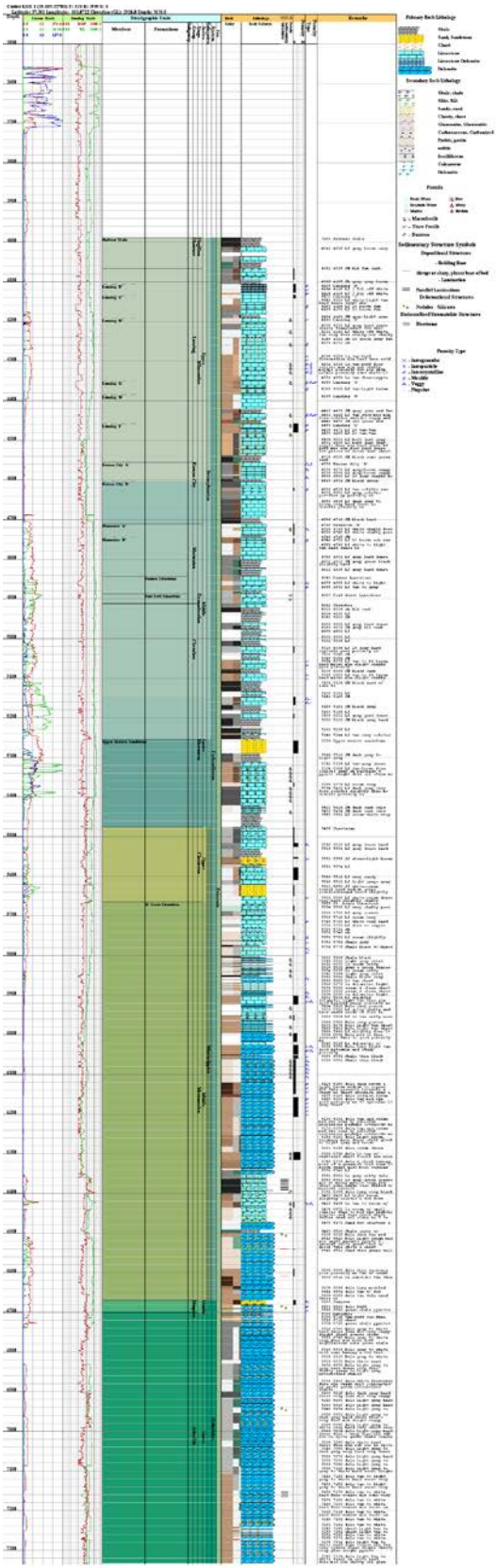


Figure 39. Composite georeport through 7334 ft for the Berexco Cutter KGS #1 generated by Well Profile software. Rate of penetration on left, stratigraphy in 2nd track, color and lithology, porosity amount as black bar and

A web page has been developed for the well and information (Figure 40). The website contains all the vital well information (Figure 41) and well log information that is summarized and graphically illustrated in Figure 42a and 42b.

KGS website for Cutter KGS #1

http://www.kgs.ku.edu/PRS/Ozark/cutter_kgs_1.html

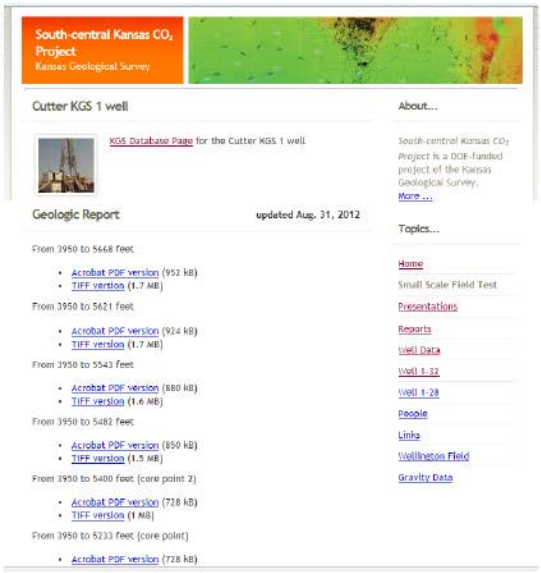


Figure 40. Website address for the Berexco Cutter KGS #1.

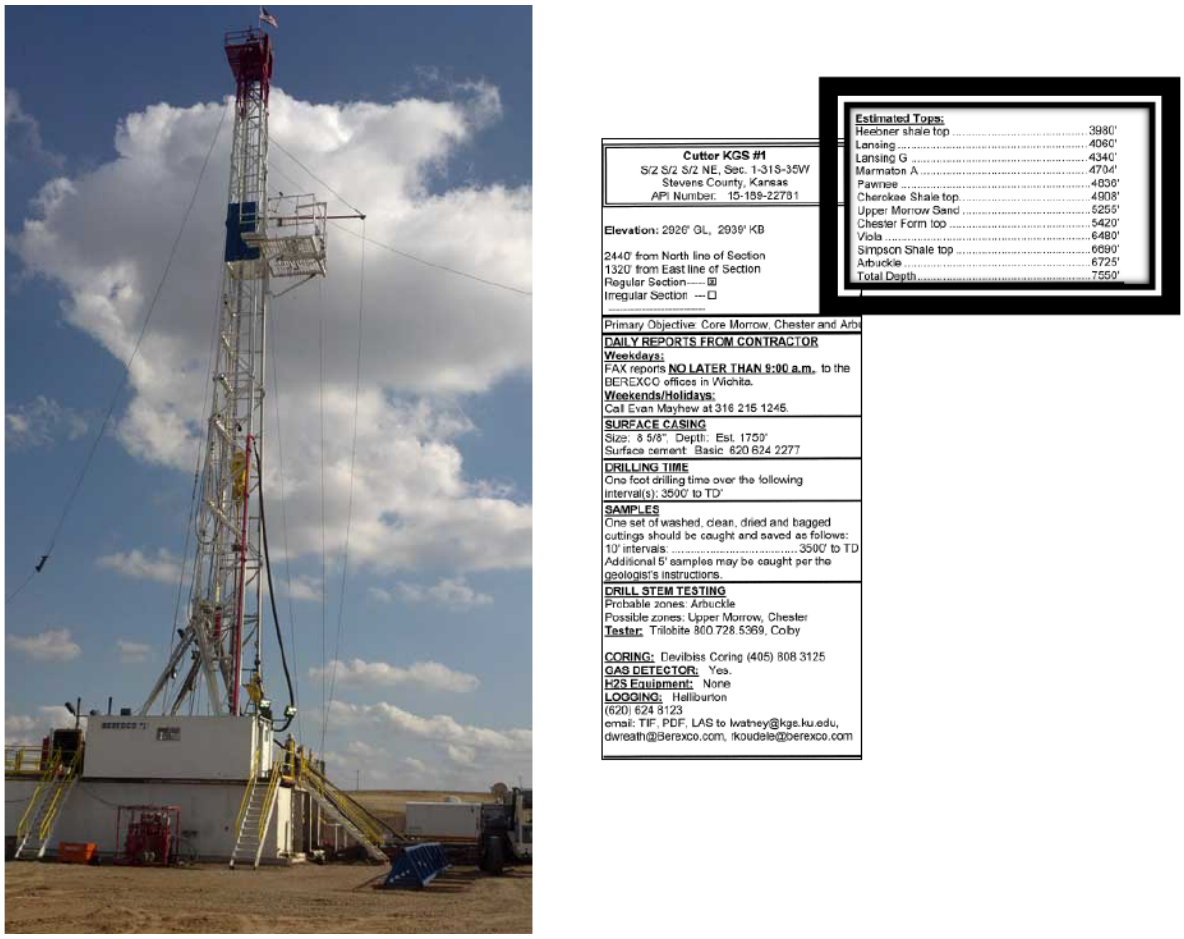


Figure 41. Vital data on the drilling of Berexco Cutter KGS #1.

- Halliburton has provided excellent service at Wellington and an equivalent log suite is requested as listed below
- SERVICE CENTER: Liberal, Kansas
- SERVICE COORDINATOR: Steven White
- SERVICE MANAGER: Scott Carr

TOOL NAME (HALLIBURTON)	ABBREVIATED NAME
Gamma Ray	(GTET-I)
Array Compensated True Resistivity	(ACRT-I)
Dual Spaced Neutron	(DSNT-I)
Spectral Density	(SDLT-I)
Microlog	(ML)
Wave Sonic - (Dipole Sonic)	(WSTT-I)
Elemental Analysis Tool	(GEM)
Comp. Spectral Natural Gamma	(CSNG-I)
Magnetic Resonance Imaging Log	(MRIL)
Extended Reach Micro Imaging Tool	(XRMI)

Figure 42a. Comprehensive well log suite ran in the Cutter KGS #1 well.

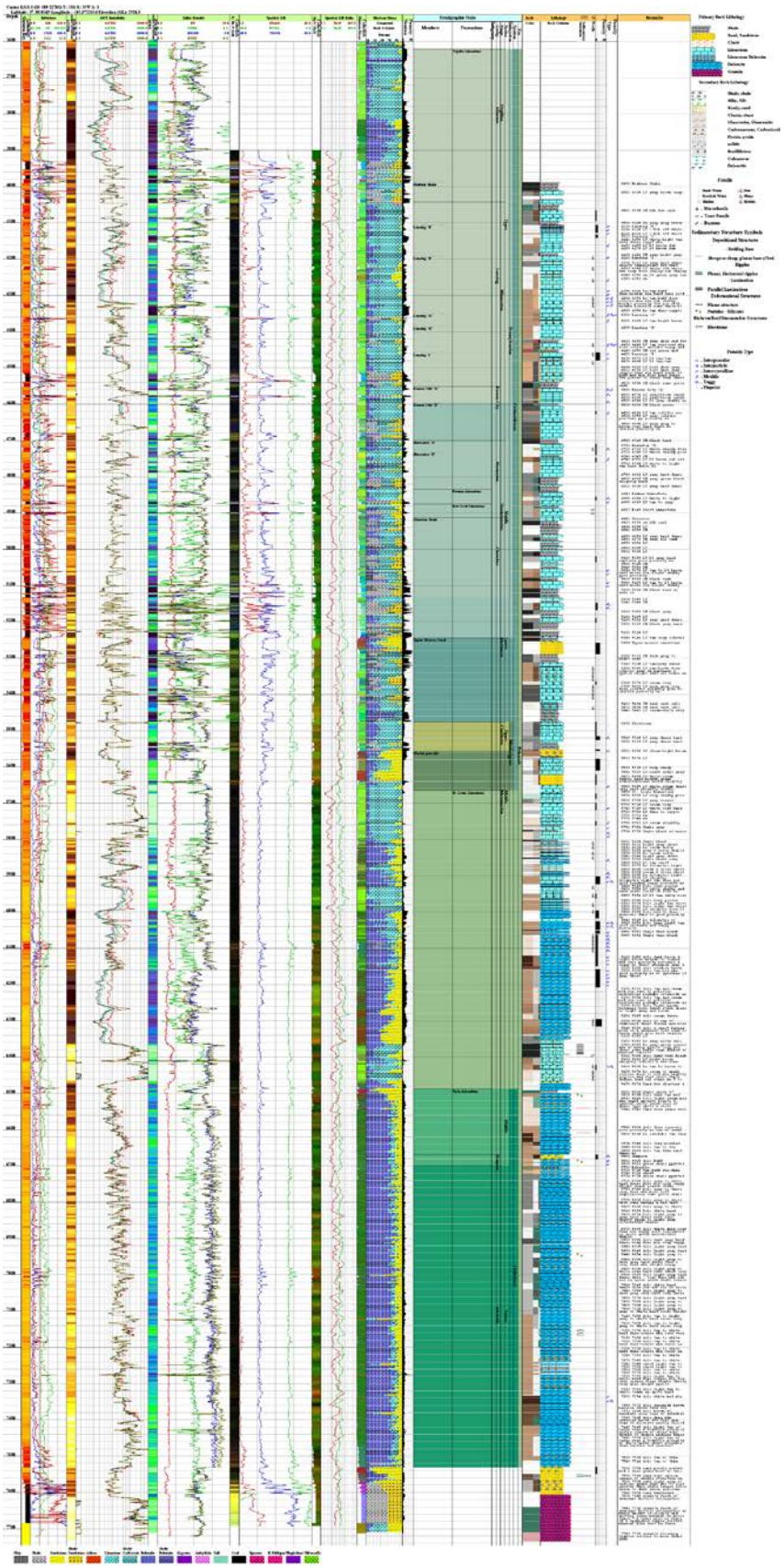


Figure 42b. Integrated well profile of triple combo log suite, gamma ray spectral log, and sample description for the Cutter KGS #1 well running from the upper Pennsylvanian lower Shawnee Group to the Precambrian granite.

Figure 43. Core was placed in secure cardboard core boxes. Core taken in the shale dominated interval of Morrowan age were cut using an aluminum liner.

The coring was done conventionally with an experienced driller. The drilling company was very prepared for any exigencies that could affect the coring. They were able to avert any large loss of circulation, which as a concern with shallow hydrocarbons and potential to stick the drillpipe if fluid loss was substantial. The coring strategy was focused on safety, while obtaining core in the most efficient manner possible.

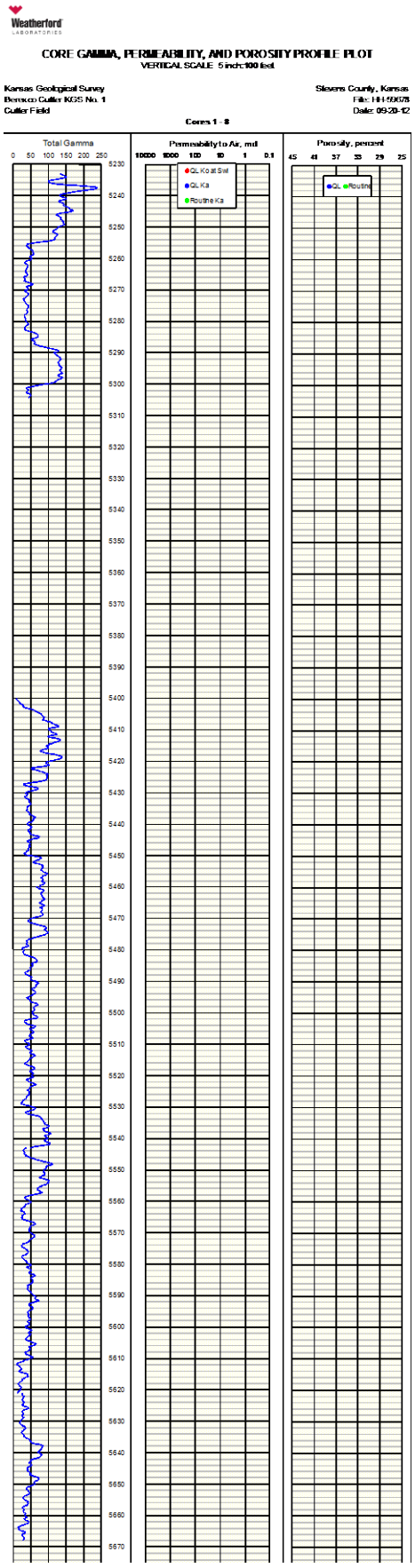


Figure 44. Core gamma from 5233-5667.7 ft.

Top Morrow through Morrow sandstone oil reservoir.

Base Morrow into St. Louis Mississippian.

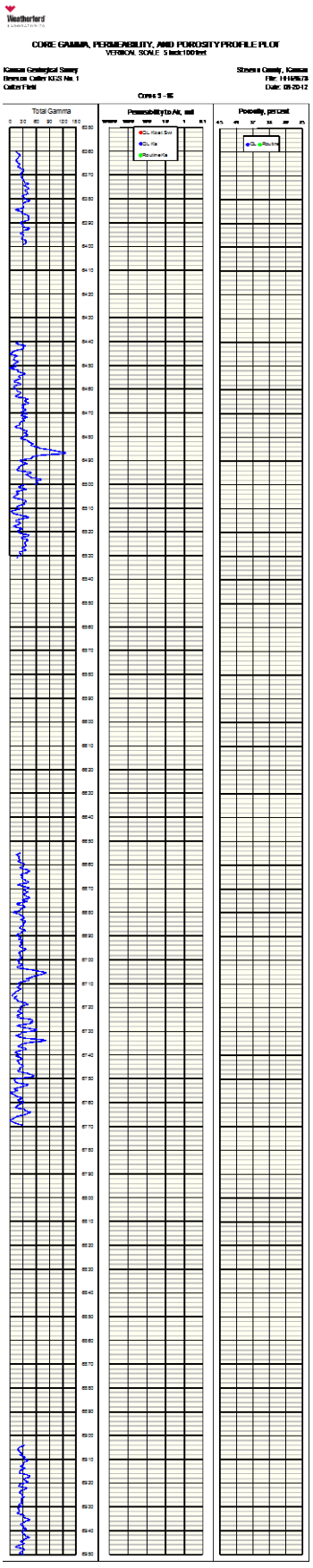


Figure 45. Core gamma from 6360-6769.4 ft.

Lower Osage Mississippian into Kinderhook Mississippian.

Kinderhook into upper Middle Ordovician Viola Ls.

Lower Viola Ls. into top of Lower Ordovician Arbuckle Group.

Upper Arbuckle Group

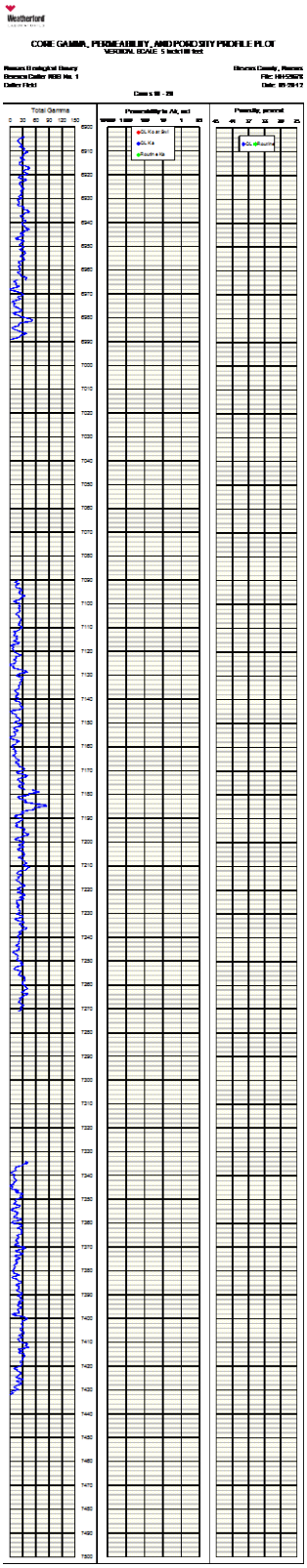


Figure 46. Core gamma from 6904-7271 ft.

Arbuckle Group.

Mid Arbuckle

Lower Arbuckle

Lower Arbuckle, ~150 ft above Precambrian

Weatherford
LABORATORIES

CORE GAMMA, PERMEABILITY, AND POROSITY PROFILE PLOT
VERTICAL SCALE 5 inch:100 feet

Kansas Geological Survey
Berexco Cutter KGS No. 1
Cutter Field

Stevens County, Kansas
File: HH-59678
Date: 09-20-12

Cores 27 - 28

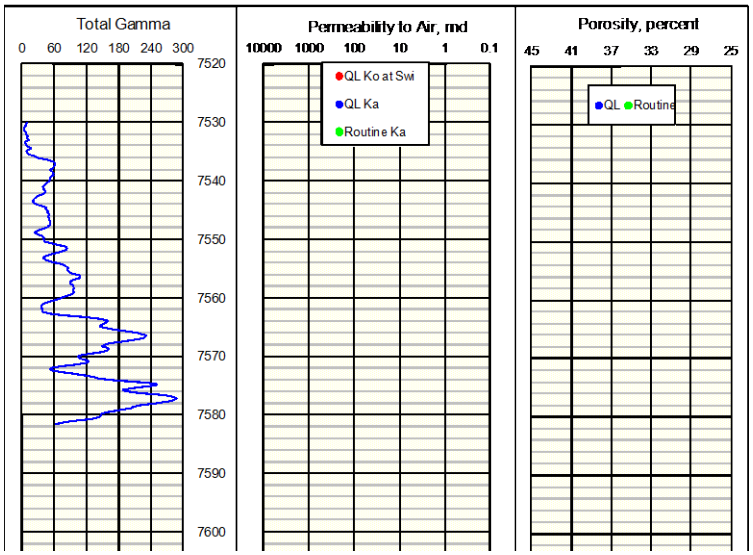


Figure 47. Core gamma from 7530-7581.6 ft.

Base Arbuckle, 30 ft above the Precambrian granite.

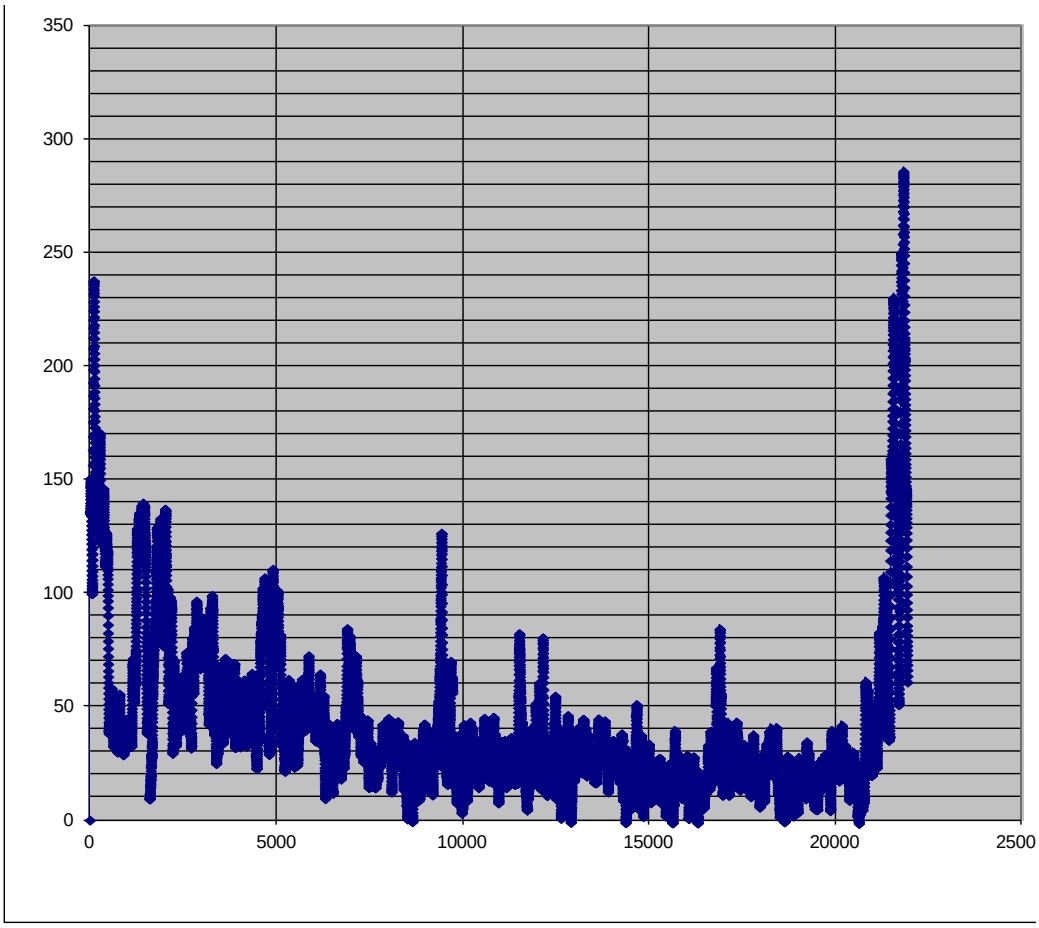


Figure 48. Running gamma ray measurements. Depth is measurement in series from top to bottom of core. Vertical axis is gamma radiation in API units. Interval extends from base of Atokan into Morrow and with 1046 ft of total core.

PRESENTATIONS

Scheffer, A.A., Gulliver, D., Roberts, J.A., Fowle, D., Watney, W.L., Doveton, J., Stotler, R., Whittemore, D., ms. in preparation, Geochemical, Microbiological, and Permeability Characteristics Indicating Vertical Zonation of the Arbuckle Saline Aquifer, a potential CO2 storage reservoir.

Barker, R., Watney, W., Rush, J., Strazisar, B., Scheffer, A., Bhattacharya, S., Wreath, D., and Datta, S, ms. in prep., Geochemical and mineralogical characterization of the Arbuckle aquifer: Studying mineral reactions and its implications for CO2 sequestration.

Sirazhiev, A., ms. in preparation, Seismic Attribute Analysis of the Mississippian Chert at the Wellington Field, south-central Kansas.

KEY FINDINGS

1. A new well, the Berexco Cutter KGS #1, 2440’ FNL-1320’ FEL Section 1-T31S-R35W, in the northeast corner of Stevens County, Kansas completed October 9, 2012. Well has met targeted objectives to date including reaching the Precambrian basement and nearly achieving 1160 ft coring objective. A total of 1046 ft total core was cut. All intended logs were acquired and are being analyzed. One DST was taken across the lowermost Arbuckle and basement rock. Another DST straddling the lower Arbuckle was unsuccessful. The decision was made to forgo further DSTs and complete the well due to deteriorating hole conditions and rig time. It was also decided to run more perf and swab testing with what should be a savings in rig time and associated expenses. In addition to the perf and swabbing, buildup tests are planned to permit estimates of permeability.
2. Regional structural and isopach mapping have identified systematic patterns to the structural evolution of southern Kansas that is closely tied to nearby tectonism, particularly the late Paleozoic development of the Anadarko Basin. Later movement and structural deformation has been more subtle, but often follow as reactivation of older structures.
3. The new multicomponent 3D and 2D seismic surveys at Cutter Field were successfully acquired and are being processed.

PLANS

1. Complete processing of the new seismic data at Cutter Field and begin interpretation.

2. Describe core at Weatherford Labs and define core analyses so that activity can begin.

3. Update geomodels of the Mississippian and Arbuckle at Wellington Field.

4. Add reaction kinetics to simulation studies.

5. Continue geomodel refinement and simulation in southwestern Kansas Chester/Morrow oil fields.

6. Complete digitizing LAS files and correlate logs so regional geomodels and simulation can be undertaken.

SPENDING PLAN

COST PLAN/STATUS

	Year 1 Starts: 12/8/09 Ends: 2/7/11					BP2 Starts 2/8/11	Ends 8/7/12					BP3 Starts 8/8/12
	12/8/09-12/31/09	1/1/10-3/31/10	4/1/10-6/30/10	7/1/10-9/30/10	10/1 - 12/31/10	1/1/11 - 3/31/11	4/1/11 - 6/30/11	7/1/11-9/30/11	10/1/11 - 12/31/11	1/1/12 - 3/31/12	4/1/12 - 6/30/12	7/1/12 - 9/30/12
Baseline Reporting Quarter	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Baseline Cost Plan (from SF-424A)	(from 424A, Sec. D)											
Federal Share	$1,007,622.75	$1,007,622.75	$1,007,622.75	$1,007,622.75	$0.00	$0.00	$0.00	$1,169,543.00	$1,169,543.00	$1,169,543.00	$1,169,543.00	$316,409.00
Non-Federal Share	$277,260.75	$277,260.75	$277,260.75	$277,260.75	$0.00	$0.00	$0.00	$303,182.75	$303,182.75	$303,182.75	$303,182.75	$81,854.50
Total Planned (Federal and Non-Federal)	$1,284,883.50	$1,284,883.50	$1,284,883.50	$1,284,883.50	$0.00	$0.00	$0.00	$1,472,725.75	$1,472,725.75	$1,472,725.75	$1,472,725.75	$398,263.50
Cumulative Baseline Cost	$1,284,883.50	$2,569,767.00	$3,854,650.50	$5,139,534.00	$5,139,534.00	$5,139,534.00	$5,139,534.00	$6,612,259.75	$8,084,985.50	$9,557,711.25	$11,030,437.00	$11,428,700.50
Actual Incurred Costs												
Federal Share	$4,019.93	$84,603.97	$494,428.37	$111,405.52	$238,675.97	$1,902,936.55	$625,853.17	$275,754.50	$523,196.12	$453,026.11	$239,049.31	$1,282,545.00
Non-Federal Share	$0.00	$43,980.04	$40,584.78	$13,195.88	$526,210.30	$35,887.31	$414,511.02	$20,247.24	$16,687.00	$61,683.20	$38,958.38	$220,506.38
Total Incurred Costs-Quarterly (Federal and Non-Federal)	$4,019.93	$84,603.97	$535,013.15	$124,601.40	$764,886.27	$1,938,823.86	$1,040,364.19	$296,001.74	$539,883.12	$514,709.31	$278,007.69	$1,503,051.38
Cumulative Incurred Costs	$4,019.93	$88,623.90	$623,637.05	$748,238.45	$1,513,124.72	$3,451,948.58	$4,492,312.77	$4,788,314.51	$5,328,197.63	$5,842,906.94	$6,120,914.63	$7,623,966.01
Variance												
Federal Share	$1,003,602.82	$923,018.78	$513,194.38	$896,217.23	-$238,675.97	-$1,902,936.55	-$625,853.17	$893,788.50	$646,346.88	$716,516.89	$930,493.69	-$966,136.00
Non-Federal Share	$277,260.75	$233,280.71	$236,675.97	$264,064.87	-$526,210.30	-$35,887.31	-$414,511.02	$282,935.51	$286,495.75	$241,499.55	$264,224.37	-$138,651.88
Total Variance-Quarterly Federal and Non-Federal)	$1,280,863.57	$1,156,299.49	$749,870.35	$1,160,282.10	-$764,886.27	-$1,938,823.86	-$1,040,364.19	$1,176,724.01	$932,842.63	$958,016.44	$1,194,718.06	-$1,104,787.88
Cumulative Variance	**$1,280,863.57**	**$2,437,163.06**	**$3,187,033.41**	**$4,347,315.51**	**$3,582,429.24**	**$1,643,605.38**	**$603,241.19**	**$1,779,965.20**	**$2,712,807.83**	**$3,670,824.27**	**$4,865,542.33**	**$3,760,754.45**