

**FINAL REPORT**

**ANALYSIS of KANSAS CITY, MARMATON, and CHEROKEE GROUP  
COAL and SHALE SAMPLES for GAS CONTENT**

**in**

**KANSAS GEOLOGICAL SURVEY  
#1 DOUGLAS COUNTY CORE HOLE**

**in**

**DOUGLAS COUNTY, KANSAS  
(N2 S2 SE SW, sec. 8-T.14S.-R.19E.)**

By

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Kansas Geological Survey Open-File Report 2012-20

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## Summary

Core samples from the Pennsylvanian Kansas City, Marmaton, and Cherokee Groups were collected from the #1 Douglas County Core Hole (N2 S2 SE SW sec. 8, T. 14 S.-., R. 19 E.; lat. 38.84215°, long. 95.32785°) operated by the Kansas Geological Survey with the aid of a grant from Steve Dixon (Edmond, OK). The well (API # 15-045-21557) was drilled from June 10, 2009, to July 23, 2009, to a depth of 1725 ft (G.L. = 940 ft), with T.D. in the Silurian–Devonian Hunton(?) Group. Core samples of dark shale and coal from this well were analyzed for their desorbed gas content. The samples tested calculate as having the following gas contents:

<i>unit, depth</i>	<i>(desorbed gas)</i>
• Eudora Shale Member, 242' 0" to 242' 8.5"	(no significant gas)
• Muncie Creek Shale Member, 438' 4.5" to 439' 4"	(no significant gas)
• Quivira Shale Member, 474' 2" to 475' 0"	(no significant gas)
• Fontana Shale Member, 513' 0" to 514' 10.5"	(no significant gas)
• Stark Shale Member, 548' 0" to 548' 8"	(no significant gas)
• Hushpuckney Shale Member, 573' 9.5" to 575' 0.5"	(11 scf/ton)
• Nuyaka Creek shale, 757' 6" to 759' 2"	(8 scf/ton)
• Unnamed shale, 765' 0" to 766' 0"	(no significant gas)
• Mulberry coal, 781' 3" to 782' 8"	(12 scf/ton)
• Lexington coal, 816' 2" to 817' 2"	(25 scf/ton)
• Bevier coal, 955' 8" to 956' 9"	(10 scf/ton)
• Croweburg coal, 965' 8" to 966' 2"	(18 scf/ton)
• Mineral coal, 995' 0" to 995' 6"	(19 scf/ton)
• Tebo coal, 1041' 5" to 1042' 11"	(21 scf/ton)
• shale below Tebo coal, 1053' 2" to 1054' 1"	(no significant gas)
• DBj coal, 1180' 6" to 1181' 6"	(34 scf/ton)
• Drywood coal, 1192' 0" to 1193' 2.5"	(45 scf/ton)
• Drywood coal, 1193' 2.5" to 1194' 8.5"	(57 scf/ton)*
• Rowe coal, 1201' 0" to 1202' 5.5"	(51 scf/ton)
• Neutral coal, 1217' 2.5" to 1217' 10.5"	(34 scf/ton)
• Riverton coal, 1271' 1" to 1271' 8"	(39 scf/ton)
• Chattanooga Shale, 1675' 0" to 1676' 0"	(no significant gas)

*\*71 scf/ton, including residual gas obtained by ball-mill grinding after desorption analysis*

The thickest coal beds were the Drywood (32.5 in), Tebo (18 in), Rowe (17.5 in), Mulberry (17 in), Bevier (13 in), Dbj (12 in), and Lexington (12 in). Four coals thinner than 12 in were also encountered.

## Background

A grant from Steve Dixon (Edmond, Oklahoma) facilitated the coring of this well in eastern Kansas (Figure 1), and allowed testing of its samples for adsorbed gas. The grant enabled the well to be drilled from the surface to 5 ft in to the top of the Mississippian limestone (i.e., 1382 ft). Deeper drilling was supported by internal funds from the Kansas Geological Survey. The ultimate objective of the hole was the Precambrian basement, but problems with borehole caving and the high likelihood that the coring device might be caught in the hole militated shut down of the operations at 1725 ft.

# LOCATION MAP

## KGS #1 Douglas County Core Hole and nearby test holes

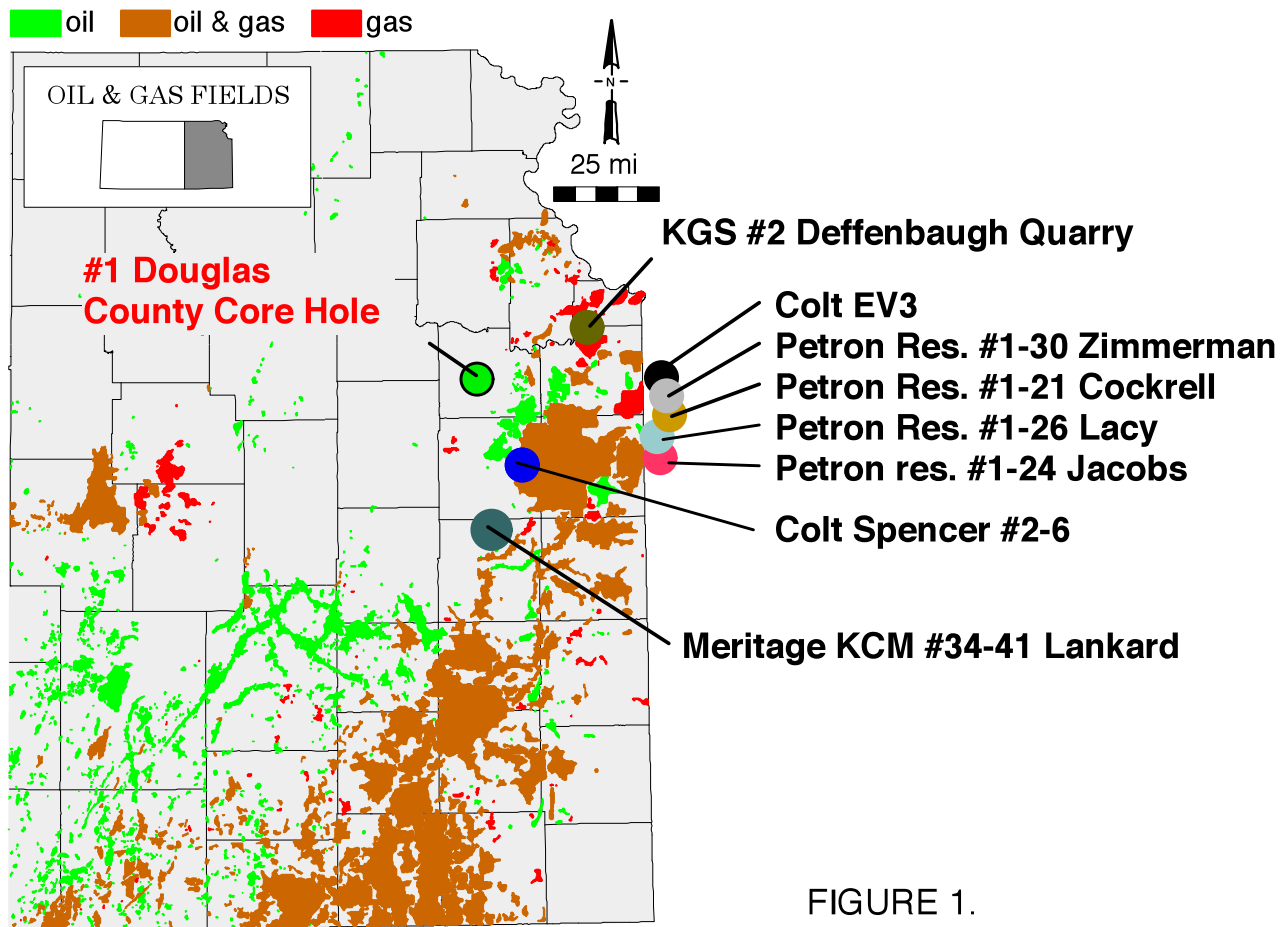


FIGURE 1.

Figure 1—Location map for the #1 Douglas County Core Hole, in relation to other wells in eastern Kansas and western Missouri from which samples were studied for adsorbed gas content.

### Procedure

Samples were described and collected for desorption analysis by K. David Newell, LeaAnn Davidson, and Kenneth R. Stalder of the Kansas Geological Survey. The well was cored by Joe Anderson, the Kansas Geological Survey (KGS) driller, and his crew using a new wireline-coring drilling rig recently acquired by the KGS. Water was used as a drilling fluid. Borehole diameter was 3 in, and the cores, which were taken from approximately 20 ft below ground surface to total depth, were NQ (2 in diameter) gauge. Kevin Bailey from GeoCertified, LLC (Shawnee, KS) donated time and instrumentation for analysis of mud gas during drilling. After reaching T.D., the well was logged behind pipe with a slim-hole natural gamma ray tool and cemented from T.D. to surface.

Cores were described at the wellsite (Appendix 1) and photographs were taken of each core box (Appendix 2).

Coal and dark shales selected for desorption testing were collected in canisters that were supplied by the Kansas Geological Survey. Lag times for samples to reach the surface (important for assessing lost gas) were determined by noting the time, to the nearest 15 seconds, when the samples were taken off-bottom, when they reached the surface, and when they were canistered.

Cores taken for desorption were immersed in water. Zephryn chloride or isopropyl alcohol was added as a biocide, with a headspace of 1 to 2 inches being preserved at the top of the canister. Temperature baths were available on site.

All samples were transported to the laboratory at the Kansas Geological Survey in Lawrence, Kansas, on a daily basis, and desorption measurements were continued at approximately 70°F (the approximate formation temperature at depth). Desorption measurements were periodically made until the canisters produced negligible gas with daily testing for at least two successive days, or if the canisters were still degassing, they were ultimately decanistered in the last week of July 2010, approximately one year after they were canistered at wellsite. This date was chosen because it was the last week of the grant duration.

Selected samples of desorption gas were collected in 120-cc vaccination bottles sent to Isotech Laboratories in Champaign, Illinois, for analysis. Gas samples were collected in these glass containers by a capillary tube connected to the desorption canister, using the internal pressure of the canister to force the gas out of the canister. The sampling container was filled with water and inverted and immersed in a water-filled bucket. Gas bubbled from the capillary tube then displaced this water out of the sampling container. The container was sealed under water.

Upon decanistering, the samples were weighed in the laboratory for a wet weight. The sample was halved and both halves were weighed again. One half of the sample was dried in air for several weeks and weighed for a dry weight, and then archived. Part of one sample (i.e., Drywood coal, 1193' 2.5" to 1194' 8.5"—the coal desorbing the greatest amount of gas) was crushed in a ball mill for a residual gas measurement. If the sample that was crushed for residual gas was only one day or less out of the canister, the residual gas from it was proportioned to the wet weight of the entire sample. If the sample that was crushed for residual gas was a dry sample, the residual gas was proportioned to the dry weight of the entire sample.

The volumetric capacity of the ball mill used for the residual gas determination was approximately 2500 ccs. The sample selected for residual gas was weighed before being placed in the ball-mill canister. Immediately before the sample was sealed in the ball-mill canister, the canister was flooded with helium so that any atmospheric oxygen that may oxidize the sample was thus removed. The sample was crushed approximately 24 hours, and after removal from the ball mill, the canister was allowed to equilibrate to laboratory temperature. The temperature and atmospheric pressure was noted at the time the canister was sealed and when the residual gas was finally measured. Corrections (5 ccs for every degree F change in temperature; 2.7 ccs for every mb change in atmospheric pressure) were applied to the gas measured from the canister. Results for the residual gas analyses are reported in the desorption tables for the well (Table 1).

Proximate analyses were performed on selected samples by Luman's Laboratories in Chetopa, Kansas. Results of the proximate analyses are reported in the desorption tables for the well (Table 1).

Density measurements for each sample were also made after each sample was dried. Core samples were weighed and then immersed in water in a beaker filled to its brim. Placing the sample in the beaker caused the



displaced water to spill from the beaker into another container. This displaced water was subsequently weighed. The weight of the water displaced by the sample is thus easily converted to volume by using 1 gram/cc for the density of the water. Results for the density measurements are reported in the desorption tables for each well (Table 1).

Correlation of the core and nearby wells cored in Franklin County, Kansas (Colt Energy #2-6 Spencer) and Bates County, Missouri (Petron Resources #1-24 Jacobs) is facilitated by a stratigraphic cross section in Appendix 3. Gamma-ray logging for the core hole is also presented on this diagram, as well as desorption analyses and identification of stratigraphic units.

## **Gas Detection**

Kevin Bailey from GeoCertified, LLC (Shawnee, Kansas) donated time and instrumentation for analysis of mud gas during drilling. The results, shown in Figure 2, show chromatograph and hotwire gas kicks are commonly associated with some of the deeper coal units. Conversely, a gas kick is associated with the Higginsville Limestone at 821 ft and an unnamed 7-ft sandstone at 917 ft depth. This sandstone has a 3-in coal overlying it, and perhaps some of the gas could have been derived from this coal. A scan of the original data received from GeoCertified, LLC is in Appendix 4.

## **Desorption Measurements**

The equipment and method for measuring desorption gas is that prescribed by McLennan and others (1995). The volumetric displacement apparatus is a set of connected dispensing burettes, one of which measures the gas evolved from the desorption canister. The other burette compensates for the compression that occurs when the desorbed gas displaces the water in the measuring burette. This compensation is performed by adjusting the cylinders so that their water levels are identical, then figuring the amount of gas that evolved by reading the difference in water level using the volumetric scale on the side of the burette.

The desorption canisters were obtained from SSD, Inc., in Grand Junction, Colorado. These canisters are 12.5 in high (32 cm), 3.5 in (9 cm) in diameter, and enclose a volume of approximately 150 cubic inches (2450 cm<sup>3</sup>). The desorbed gas that collected in the desorption canisters was periodically released into the volumetric displacement apparatus and measured as a function of time, temperature, and atmospheric pressure.

The time and atmospheric pressure were measured in the field using a portable weather station (model BA928) marketed by Oregon Scientific (Tualatin, Oregon). The atmospheric pressure was displayed in millibars on this instrument.

A spreadsheet program written by K. D. Newell (Kansas Geological Survey) was used to convert all gas volumes at standard temperature and pressure. Conversion of gas volumes to standard temperature and pressure was by application of the perfect-gas equation, obtainable from basic college chemistry texts:

$$n = PV/RT$$

where n is moles of gas, T is degrees Kelvin (i.e., absolute temperature), V is in liters, and R is the universal gas constant, which has a numerical value depending on the units in which it is measured (for example, in the metric

system  $R = 0.0820$  liter atmosphere per degree mole). The number of moles of gas (i.e., the value  $n$ ) is constant in a volumetric conversion; therefore, the conversion equation, derived from the ideal gas equation, is:

$$(P_{\text{stp}} V_{\text{stp}})/(RT_{\text{stp}}) = (P_{\text{rig}} V_{\text{rig}})/(RT_{\text{rig}})$$

Customarily, standard temperature and pressure for gas volumetric measurements in the oil industry are  $60^{\circ}\text{F}$  and  $14.7$  psi (see Dake, 1978, p. 13), therefore  $P_{\text{stp}}$ ,  $V_{\text{stp}}$ , and  $T_{\text{stp}}$ , respectively, are pressure, volume, and temperature at standard temperature and pressure, where standard temperature is degrees Rankine ( $^{\circ}\text{R} = 460 + ^{\circ}\text{F}$ ).  $P_{\text{rig}}$ ,  $V_{\text{rig}}$ , and  $T_{\text{rig}}$ , respectively, are ambient pressure, volume, and temperature measurements taken at the rig site or in the desorption laboratory.

The universal gas constant  $R$  drops out as this equation is simplified and the determination of  $V_{\text{stp}}$  becomes:

$$V_{\text{stp}} = (T_{\text{stp}}/T_{\text{rig}}) (P_{\text{rig}}/P_{\text{stp}}) V_{\text{rig}}$$

The conversion calculations in the spreadsheet were carried out in the English metric system, the customary measuring system used in American coal and oil industry.  $V$  is therefore converted to cubic feet;  $P$  is psia;  $T$  is  $^{\circ}\text{R}$ .

The desorbed gas was summed over the period for which the coal samples evolved all of their gas.

Lost gas (i.e., the gas lost from the sample from the time it was drilled, brought to the surface, to the time it was canistered) was determined using the direct method (Kissel and others, 1975; also see McLennan and others, 1995, p. 6.1-6.14) in which the cumulative gas evolved is plotted against the square root of elapsed time. Time zero is assumed to be instant the core sample is lifted from the bottom of the hole. Characteristically, the cumulative gas evolved from the sample, when plotted against the square root of time, is linear for a short time period after the sample reaches ambient pressure conditions; therefore, lost gas is determined by a line projected back to time zero. The period of linearity generally is about two hours for core samples.

## Data Presentation

### *Desorption Analyses*

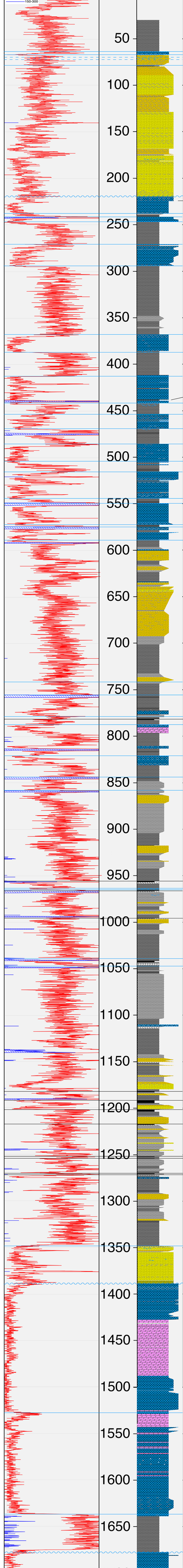
The table showing the record of desorptions (Table 1) is the basic data used for lost-gas analysis and determination of total gas desorbed from the core samples. Wellsite descriptions and results from ashing and proximate analysis are presented in the headings for each sample. Basic temperature, volume, and barometric measurements are listed at left. Farther to the right, these are converted to standard temperature, pressure, and volumes. The volumes are cumulatively summed, and converted to scf/ton based on the total weight of coal and dark shale in the sample. At the right of the table, the time of the measurements are listed and converted to hours (and square root of hours) since the sample was drilled. Results for residual gas and drying are presented below the desorption data for each sample.



# Kansas Geological Survey Douglas County Core Hole #1

K2 S2 SE SW sec. 08-T14S-R19E, datum 940' (GL)

API GAMMA RAY UNITS



ls ls ls  
m w p  
ss ss  
sh  
ln cs

Robbins Sh  
Haskell Ls  
Westphalia Ls(?)

Tonganoxie Ss

## Douglas Gp

Tonganoxie Ss

South Bend Ls  
Rock Lake Sh  
Stoner Ls  
Eudora Sh  
Captain Ck Ls

## Lansing Gp

Vilas Sh

Plattsburg Ls

Lane Sh

Wyandotte Ls

Lane Sh

Raytown Ls

Muncie Ck Sh Mbr  
Paola Ls  
Chanute Sh

Iola Ls

Dewey Ls

## Kansas City Gp

Quivera Sh

Westerville Ls

Wea Sh  
Block Ls  
Fontana Sh

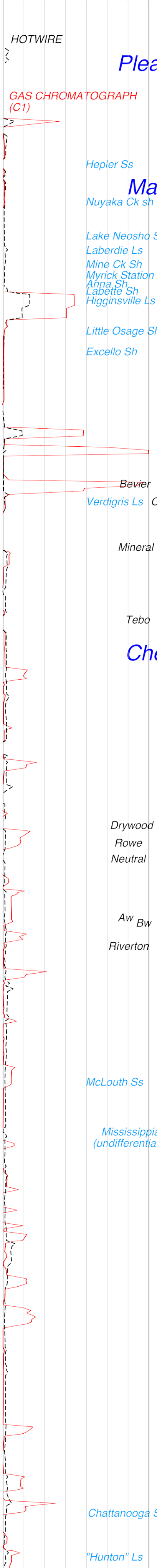
Winterset Ls

Stark Sh

Bethany Falls Ls  
Hushpuckney Sh

Sniabar Ls  
Mound City Sh  
Critzler Ls

units MUD GAS  
0 (courtesy of GeoCertified) 700



## Pleasanton Gp

Hepler Ss

## Marmaton Gp

Nuyaka Ck sh

Lake Neosho Sh

Mulberry

Laberdie Ls

Mine Ck Sh

Pawnee Ls

Myrick Station Ls

Lexington

Anna Sh

Labette Sh

Higginsville Ls

Little Osage Sh

Excello Sh

Bevier

Verdigris Ls

Croweburg

Mineral

Tebo

## Cherokee Gp

Drywood

Rowe

Neutral

Aw Bw

Riverton

McLouth Ss

Mississippian (undifferentiated)

Chattanooga Sh

"Hunton" Ls

Viola Ls(?)

Simpson Gp(?)

Arbuckle Gp(?)



TABLE 1 -- Desorption measurements for Kansas Geological Survey Douglas County Corehole #1, N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

SAMPLE: 242' 0" to 242' 8.5" (Eudora Shale) core in SSD canister 1  
density = 2.09 grams/cc

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:			elapsed time (off bottom to canistering)
		0.000	0.00			0.000	0.00	#DIV/0!	0	off bottom	at surface	in canister	56.5 minutes
										6/11/09 8:27	6/11/09 8:28	6/11/09 9:24	0.942 hours
										TIME SINCE			0.970395108 SQRT (hrs)
										off bottom	at surface	in canister	SQRT hrs. (since off bottom)
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)		CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON			TIME OF MEASURE	off bottom	at surface	in canister	SQRT hrs. (since off bottom)
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		
-4	68	978	-1E-04	527.67	14.185	-0.00013433		-3.80	-0.00013433	-3.80	#DIV/0!	#DIV/0!	6/11/09 9:46
3	68	977	0.0001	527.67	14.170	0.000100642		2.85	-3.3685E-05	-0.95	#DIV/0!	#DIV/0!	6/11/09 10:14
-1	68	978	-4E-05	527.67	14.185	-3.3582E-05		-0.95	-6.7266E-05	-1.90	#DIV/0!	#DIV/0!	6/11/09 10:51
-13	67	985	-5E-04	526.67	14.286	-0.00044052		-12.47	-0.00050779	-14.38	#DIV/0!	#DIV/0!	6/13/09 12:46

DECANISTERED 6/15/2009 discontinued due to no appreciable gas generated

SAMPLE: 438' 4.5" to 439' 4" (Muncie Creek Shale) core in SSD canister 6  
density = 2.12 grams/cc

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:			elapsed time (off bottom to canistering)
		2.524	1145.00			0.000	0.00	#DIV/0!	6	off bottom	at surface	in canister	23.3 minutes
										7/2/09 7:01	7/2/09 7:06	7/2/09 7:25	0.388 hours
										TIME SINCE			0.622494980 SQRT (hrs)
										off bottom	at surface	in canister	SQRT hrs. (since off bottom)
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)		CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON			TIME OF MEASURE	off bottom	at surface	in canister	SQRT hrs. (since off bottom)
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		
0	72	985	0	531.67	14.286	0	0	0.00	0	0.00	0.17	7/2/09 7:32	
0	72	985	0	531.67	14.286	0	0	0.00	0	0.00	0.17	7/2/09 7:47	
1	72	985	4E-05	531.67	14.286	3.35674E-05		0.95	3.3567E-05	0.95	0.03	7/2/09 8:02	
3	72	985	0.0001	531.67	14.286	0.000100702		2.85	0.00013427	3.80	0.11	7/2/09 8:35	
7	72	985	0.0002	531.67	14.286	0.000234972		6.65	0.00036924	10.46	0.29	7/2/09 9:26	
9	85	985	0.0003	544.67	14.286	0.000294896		8.35	0.00066414	18.81	0.53	7/2/09 11:31	
1	91	985	4E-05	550.67	14.286	3.24092E-05		0.92	0.00069655	19.72	0.55	7/2/09 11:46	
1	91	985	4E-05	550.67	14.286	3.24092E-05		0.92	0.00072896	20.64	0.58	7/2/09 12:59	
6	91	985	0.0002	550.67	14.286	0.000194455		5.51	0.00092341	26.15	0.73	7/2/09 14:55	
0	86	985	0	545.67	14.286	0	0	0.00	0.00092341	26.15	0.73	7/2/09 16:26	
0	72	974	0	531.67	14.127	0	0	0.00	0.00092341	26.15	0.73	7/2/09 17:34	
-5	72	974	-2E-04	531.67	14.127	-0.00016596		-4.70	0.00075745	21.45	0.60	7/7/09 16:35	
-1	72	974	-4E-05	531.67	14.127	-3.3193E-05		-0.94	0.00072426	20.51	0.57	7/8/09 17:57	
0	72	972	0	531.67	14.098	0	0	0.00	0.00072426	20.51	0.57	7/9/09 17:56	
-3	76	985	-1E-04	535.67	14.286	-9.995E-05		-2.83	0.00062431	17.68	0.49	7/12/09 15:10	

DECANISTERED 7/15/2009 discontinued due to no appreciable gas generated

SAMPLE: 474' 2" to 475' 0" (Quivera Shale) core in SSD canister  
DECANISTERED 7/2/2009 discontinued due to no appreciable gas generated

SAMPLE: 513' 0" to 514' 10.5" (Fontana Shale) core in SSD canister DG2  
density = 2.43 grams/cc

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:			elapsed time (off bottom to canistering)
		6.499	2948.00			0.000	0.00	#DIV/0!	0	off bottom	at surface	in canister	24.8 minutes
										7/2/09 12:10	7/2/09 12:12	7/2/09 12:35	0.413 hours
										TIME SINCE			0.642261629 SQRT (hrs)
										off bottom	at surface	in canister	SQRT hrs. (since off bottom)
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)		CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON			TIME OF MEASURE	off bottom	at surface	in canister	SQRT hrs. (since off bottom)
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		
3	70	984	0.0001	529.67	14.272	0.00010098		2.86	0.00010098	2.86	0.03	7/2/09 12:41	
6	70	984	0.0002	529.67	14.272	0.00020196		5.72	0.00030294	8.58	0.09	7/2/09 13:22	
5	70	984	0.0002	529.67	14.272	0.0001683		4.77	0.00047124	13.34	0.15	7/2/09 13:37	
0	70	984	0	529.67	14.272	0	0	0.00	0.00047124	13.34	0.15	7/2/09 13:52	
0	70	984	0	529.67	14.272	0	0	0.00	0.00047124	13.34	0.15	7/2/09 14:55	

DECANISTERED 7/15/2009 discontinued due to no appreciable gas generated

SAMPLE: 548' 0" to 548' 8" (Stark Shale) core in SSD canister 9  
density = 1.99 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF
BTU/lb	3841	3944	13197
Sulfur	2.98%	3.06%	
Moisture	2.62%		
Ash	68.27%	70.11%	
Volatile Matter	17.78%	18.26%	
Fixed Carbon	11.33%	11.63%	

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:			elapsed time (off bottom to canistering)
		3.135	1422.00			0.000	0.00	#DIV/0!	0	off bottom	at surface	in canister	23.0 minutes
										7/2/09 14:28	7/2/09 14:29	7/2/09 14:51	0.383 hours
										TIME SINCE			0.619139187 SQRT (hrs)
										off bottom	at surface	in canister	SQRT hrs. (since off bottom)
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)		CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON			TIME OF MEASURE	off bottom	at surface	in canister	SQRT hrs. (since off bottom)
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		
0	70	984	0	529.67	14.272	0	0	0.00	0	0.00	0.00	7/2/09 14:57	
0	70	984	0	529.67	14.272	0	0	0.00	0	0.00	0.00	7/2/09 15:22	
-7	70	984	-2E-04	529.67	14.272	-0.00023562		-6.67	-0.00023562	-6.67	-0.15	7/2/09 17:02	

DECANISTERED 7/15/2009 discontinued due to no appreciable gas generated

SAMPLE: 573' 9.5" to 575' 0.5" (Hushpuckney Shale) core in SSD canister 3

density = 1.94 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF
BTU/lb	3620	3726	12828
Sulfur	2.65%	2.73%	
Moisture	2.84%		
Ash	68.93%	70.95%	
Volatile Matter	19.84%	20.42%	
Fixed Carbon	8.39%	8.63%	

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)		
	3.413	1548.02		3.483	1579.94	2.02%	95	off bottom	at surface	in canister	25.0 minutes
								7/2/09 15:27	7/2/09 15:28	7/2/09 15:52	0.417 hours

RIG/LAB MEASUREMENTS				CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE	TIME SINCE	at surface	in canister	SQRT hrs. (since off bottom)
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		off bottom			0.645497224 SQRT (hrs)
82	74	985	0.0029	533.67	14.286	0.002751576	77.92	0.00275158	77.92	1.61	3.58	7/12/09 15:10	239:43:00	239:41:15	239:18:00	15.48278614
13	76	985	0.0005	535.67	14.286	0.000433118	12.26	0.00318469	90.18	1.87	3.83	7/12/09 15:10	239:43:00	239:41:15	239:18:00	15.48278614
20	74	976	0.0007	533.67	14.156	0.000662721	18.77	0.00384741	108.95	2.25	4.22	7/14/09 21:15	293:48:00	293:46:15	293:23:00	17.14059509
2	74	986	7E-05	533.67	14.301	6.69511E-05	1.90	0.00391437	110.84	2.29	4.26	7/17/09 16:20	360:53:00	360:51:15	360:28:00	18.99692958
10	71	981	0.0004	530.67	14.228	0.000334941	9.48	0.00424931	120.33	2.49	4.46	7/20/09 17:21	433:54:00	433:52:15	433:29:00	20.83026644
25	69	982	0.0009	528.67	14.243	0.000841377	23.83	0.00509068	144.15	2.98	4.95	7/31/09 18:55	699:28:00	699:26:15	699:03:00	26.44743214
42	72	975	0.0015	531.67	14.141	0.001395518	39.52	0.0064862	183.67	3.80	5.77	8/19/09 17:34	1154:07:00	1154:05:15	1153:42:00	33.97229263
32	73	987	0.0011	532.67	14.315	0.001074318	30.42	0.00756052	214.09	4.43	6.40	9/17/09 14:11	1846:44:00	1846:42:15	1846:19:00	42.97363533
14	65	985	0.0005	524.67	14.286	0.000476214	13.48	0.00803673	227.57	4.71	6.68	10/9/09 11:39	2372:12:00	2372:10:15	2371:47:00	48.70523586
41	71	977	0.0014	530.67	14.170	0.001367659	38.73	0.00940439	266.30	5.51	7.48	11/12/09 16:45	3193:18:00	3193:16:15	3192:53:00	56.50929127
44	67	970	0.0016	526.67	14.069	0.001468283	41.58	0.01087267	307.88	6.37	8.34	12/24/09 15:24	4199:57:00	4199:55:15	4199:32:00	64.80702122
8	68	991	0.0003	527.67	14.373	0.000272223	7.71	0.0111449	315.59	6.53	8.50	1/15/10 14:32	4727:05:00	4727:03:15	4726:40:00	68.75378777
9	68	997	0.0003	527.67	14.460	0.000308105	8.72	0.011453	324.31	6.71	8.68	1/28/10 15:57	5040:30:00	5040:28:15	5040:05:00	70.99647879
16	67	977	0.0006	526.67	14.170	0.000537774	15.23	0.01199078	339.54	7.03	8.99	2/5/10 15:43	5232:16:00	5232:14:15	5231:51:00	72.33440859
8	67	985	0.0003	526.67	14.286	0.000271089	7.68	0.01226187	347.22	7.19	9.15	2/26/10 15:44	5736:17:00	5736:15:15	5735:52:00	75.73825542
18	68	973	0.0006	527.67	14.112	0.000601377	17.03	0.01286324	364.25	7.54	9.50	3/13/10 15:12	6095:45:00	6095:43:15	6095:20:00	78.07528418
6	67	979	0.0002	526.67	14.199	0.000202078	5.72	0.01306532	369.97	7.66	9.62	3/26/10 15:17	6407:50:00	6407:48:15	6407:25:00	80.04894336
3	68	977	0.0001	527.67	14.170	0.000100642	2.85	0.01316596	372.82	7.72	9.68	4/16/10 16:59	6913:32:00	6913:30:15	6913:07:00	83.14765982
19	67	981	0.0007	526.67	14.228	0.000641221	18.16	0.01380718	390.97	8.09	10.06	4/30/10 17:45	7250:18:00	7250:16:15	7249:53:00	85.14869347
2	67	981	7E-05	526.67	14.228	6.7497E-05	1.91	0.01387468	392.89	8.13	10.10	5/12/10 17:33	7538:06:00	7538:04:15	7537:41:00	86.82232318
1	68	981	4E-05	527.67	14.228	3.36845E-05	0.95	0.01390836	393.84	8.15	10.12	5/26/10 19:42	7876:15:00	7876:13:15	7875:50:00	88.74823942
22	74	981	0.0008	533.67	14.228	0.000732728	20.75	0.01464109	414.59	8.58	10.55	6/23/10 17:21	8545:54:00	8545:52:15	8545:29:00	92.44403713
16	74	981	0.0006	533.67	14.228	0.000532893	15.09	0.01517399	429.68	8.89	10.86	7/16/10 17:30	9098:03:00	9098:01:15	9097:38:00	95.38369882
3	74	983	0.0001	533.67	14.257	0.000100121	2.84	0.01527411	432.51	8.95	10.92	7/21/10 15:52	9216:25:00	9216:23:15	9216:00:00	96.00217011

NOTE: a leak in the canister necessitated an approximation for gas desorbed prior to 7/12/09; 22% of the total of all subsequent gas was used for this amount, based on desorption characteristics of Stark and Hushpuckney shale in the nearest well (Colt #2-6 Spencer in Franklin County)  
DECANISTERED 7/21/2010; sample dried for 3 days in air

SAMPLE: 757' 6" to 759' 2" (Nuyaka Creek Shale) core in SSD canister DG3

density = 2.01 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF
BTU/lb	3689	3796	13426
Sulfur	3.00%	3.09%	
Moisture	2.80%		
Ash	69.72%	71.73%	
Volatile Matter	18.64%	19.18%	
Fixed Carbon	8.84%	9.09%	

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)		
	3.793	1720.54		3.901	1769.48	2.77%	5	off bottom	at surface	in canister	17.8 minutes
								7/7/09 13:51	7/7/09 13:54	7/7/09 14:09	0.296 hours

RIG/LAB MEASUREMENTS				CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE	TIME SINCE	at surface	in canister	SQRT hrs. (since off bottom)
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		off bottom			0.543905629 SQRT (hrs)
1	79	978	4E-05	538.67	14.185	3.28958E-05	0.93	3.2896E-05	0.93	0.02	0.11	7/7/09 14:29	0:37:45	0:35:00	0:20:00	0.793200269
0	79	978	0	538.67	14.185	0	0.00	3.2896E-05	0.93	0.02	0.11	7/7/09 14:45	0:53:45	0:51:00	0:36:00	0.946484724
3	79	978	0.0001	538.67	14.185	9.86873E-05	2.79	0.00013158	3.73	0.07	0.16	7/7/09 15:03	1:11:45	1:09:00	0:54:00	1.093541647
2	79	978	7E-05	538.67	14.185	6.57915E-05	1.86	0.00019737	5.59	0.10	0.20	7/7/09 15:17	1:25:45	1:23:00	1:08:00	1.195477589
3	79	978	0.0001	538.67	14.185	9.86873E-05	2.79	0.00029606	8.38	0.16	0.25	7/7/09 15:47	1:55:45	1:53:00	1:38:00	1.388944443
2	79	978	7E-05	538.67	14.185	6.57915E-05	1.86	0.00036185	10.25	0.19	0.28	7/7/09 16:27	2:35:45	2:33:00	2:18:00	1.611159003
9	68	978	0.0003	527.67	14.185	0.000302234	8.56	0.00066409	18.80	0.35	0.44	7/8/09 18:00	28:08:45	28:06:00	27:51:00	5.305264681
15	68	976	0.0005	527.67	14.156	0.000502693	14.23	0.00116678	33.04	0.62	0.71	7/9/09 17:56	52:04:45	52:02:00	51:47:00	7.216589684
23	68	985	0.0008	527.67	14.286	0.000777903	22.03	0.00194468	55.07	1.03	1.12	7/12/09 15:10	121:18:45	121:16:00	121:01:00	11.01419539
21	68	976	0.0007	527.67	14.156	0.00070377	19.93	0.00264845	75.00	1.40	1.49	7/14/09 21:17	175:25:45	175:23:00	175:08:00	13.2449676
20	71	986	0.0007	530.67	14.301	0.000673296	19.07	0.00332175	94.06	1.75	1.84	7/17/09 16:21	242:29:45	242:27:00	242:12:00	15.57227772
20	72	981	0.0007	531.67	14.228	0.000668622	18.93	0.00399037	112.99	2.10	2.20	7/20/09 17:23	315:31:45	315:29:00	315:14:00	17.76314068
43	72	982	0.0015	531.67	14.243	0.001439003	40.75	0.00542937	153.74	2.86	2.96	7/31/09 18:58	581:06:45	581:04:00	580:49:00	24.10627512
23	68	975	0.0008	527.67	14.141	0.000770006	21.80	0.00619938	175.55	3.27	3.36	8/19/09 16:30	1034:38:45	1034:36:00	1034:21:00	32.16591104
49	68	987	0.0017	527.67	14.315	0.001660637	47.02	0.00786002	222.57	4.14	4.24	9/17/09 14:12	1728:20:45	1728:18:00	1728:03:00	41.5733789
20	67	985	0.0007	526.67	14.286	0.000677722	19.19	0.00853774	241.76	4.50	4.59	10/9/09 11:20	2253:28:45	2253:26:00	2253:11:00	47.47082437
53	68	977	0.0019	527.67	14.170	0.001778	50.35	0.01031574	292.11	5.44	5.53	11/12/09 15:37	3073:45:45	3073:43:00	3073:28:00	55.44152325

46	68	970	0.0016	527.67	14.069	0.001532114	43.38	0.01184785	335.49	6.25	6.34	12/24/09 15:35	4081:43:45	4081:41:00	4081:26:00	63.88841183
12	70	991	0.0004	529.67	14.373	0.000406793	11.52	0.01225464	347.01	6.46	6.55	1/15/10 16:34	4610:42:45	4610:40:00	4610:25:00	67.9022275
9	68	998	0.0003	527.67	14.475	0.000308414	8.73	0.01256306	355.74	6.62	6.72	1/28/10 15:58	4922:06:45	4922:04:00	4921:49:00	70.15776864
10	67	977	0.0004	526.67	14.170	0.000336109	9.52	0.01289917	365.26	6.80	6.89	2/5/10 15:44	5113:52:45	5113:50:00	5113:35:00	71.51139187
9	67	985	0.0003	526.67	14.286	0.000304975	8.64	0.01320414	373.90	6.96	7.06	2/26/10 18:44	5620:52:45	5620:50:00	5620:35:00	74.97252274
13	68	973	0.0005	527.67	14.112	0.000434328	12.30	0.01363847	386.20	7.19	7.28	3/13/10 15:14	5977:22:45	5977:20:00	5977:05:00	77.31351219
6	67	979	0.0002	526.67	14.199	0.000202078	5.72	0.01384055	391.92	7.30	7.39	3/26/10 15:20	6289:28:45	6289:26:00	6289:11:00	79.30623662
5	68	977	0.0002	527.67	14.170	0.000167736	4.75	0.01400828	396.67	7.39	7.48	4/16/10 17:00	6795:08:45	6795:06:00	6794:51:00	82.43267455
11	67	981	0.0004	526.67	14.228	0.000371233	10.51	0.01437952	407.18	7.58	7.67	4/30/10 17:45	7131:53:45	7131:51:00	7131:36:00	84.45055259
5	67	981	0.0002	526.67	14.228	0.000168742	4.78	0.01454826	411.96	7.67	7.76	5/12/10 17:33	7419:41:45	7419:39:00	7419:24:00	86.1376563
3	68	981	0.0001	527.67	14.228	0.000101054	2.86	0.01464931	414.82	7.72	7.82	5/26/10 19:44	7757:52:45	7757:50:00	7757:35:00	88.0788236
18	74	981	0.0006	533.67	14.228	0.000599505	16.98	0.01524882	431.80	8.04	8.13	6/23/10 17:24	8427:32:45	8427:30:00	8427:15:00	91.80166574
14	74	981	0.0005	533.67	14.228	0.000466281	13.20	0.0157151	445.00	8.29	8.38	7/16/10 17:31	8979:39:45	8979:37:00	8979:22:00	94.76108115
4	74	983	0.0001	533.67	14.257	0.000133495	3.78	0.01584859	448.78	8.36	8.45	7/21/10 15:53	9098:01:45	9097:59:00	9097:44:00	95.38358961

DECANISTERED 7/21/2010; sample dried for 4 days in air

SAMPLE: 765' 0" to 766' 0" (unnamed shale) core in SSD canister DG4  
density = 2.28 grams/cc

DECANISTERED 7/7/2009 discontinued due to no appreciable gas generated

SAMPLE: 781' 3" to 782' 8" (Mulberry coal) core in SSD canister 11  
density = 1.39 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

As Received	Moisture Free	MAF	
BTU/lb	10379	11053	13963
Sulfur	4.65%	4.95%	
Moisture	6.10%		
Ash	19.57%	20.84%	
Volatile Matter	36.54%	38.92%	
Fixed Carbon	37.79%	40.24%	

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)				
	1.218	552.59		1.229	557.33	0.85%	63	off bottom	13.5 minutes				
								at surface	0.225 hours				
								in canister	0.474341649 SQRT (hrs)				
								7/7/09 15:30	7/7/09 15:32				
								7/7/09 15:32	7/7/09 15:43				
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)		CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE	TIME SINCE	SQRT hrs. (since off bottom)				
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	off bottom	at surface	in canister	
25	79	976	0.0009	538.67	14.156	0.000816116	23.11	1.34	4.99	7/10/09 16:00	72:29:45	72:27:30	72:16:15
35	74	976	0.0012	533.67	14.156	0.001159762	32.84	0.00197588	6.90	7/14/09 21:17	173:46:45	173:44:30	173:33:15
-5	74	986	-2E-04	533.67	14.301	-0.00016738	-4.74	0.00180885	6.62	7/17/09 16:21	240:50:45	240:48:30	240:37:15
4	71	981	0.0001	530.67	14.228	0.000133976	3.79	0.00194248	6.84	7/20/09 17:23	313:52:45	313:50:30	313:39:15
5	69	982	0.0002	528.67	14.243	0.000168275	4.77	0.00211075	7.12	7/31/09 18:58	579:27:45	579:25:30	579:14:15
14	72	975	0.0005	531.67	14.141	0.000465173	13.17	0.00257592	7.88	8/19/09 16:30	1032:59:45	1032:57:30	1032:46:15
-2	73	987	-7E-05	532.67	14.315	-6.7145E-05	-1.90	0.00250878	7.77	9/17/09 14:12	1726:41:45	1726:39:30	1726:28:15
5	65	985	0.0002	524.67	14.286	0.000170076	4.82	0.00267886	8.05	10/9/09 11:20	2251:49:45	2251:47:30	2251:36:15
43	71	977	0.0015	530.67	14.170	0.001434374	40.62	0.00411323	10.41	11/12/09 15:37	3072:06:45	3072:04:30	3071:53:15
22	67	970	0.0008	526.67	14.069	0.000734141	20.79	0.00484737	11.61	12/24/09 15:35	4080:04:45	4080:02:30	4079:51:15
-7	68	991	-2E-04	527.67	14.373	-0.0002382	-6.74	0.00460918	11.22	1/15/10 16:34	4609:03:45	4609:01:30	4608:50:15
-1	68	998	-4E-05	527.67	14.475	-3.4268E-05	-0.97	0.00457491	11.16	1/28/10 15:58	4920:27:45	4920:25:30	4920:14:15

NOTE: a leak in the canister necessitated an approximation for gas desorbed prior to 7/10/09; 46% of the total of all subsequent gas was used for this amount, based on desorption characteristics of Bevier coal in the nearest well (Colt #2-6 Spencer in Franklin County)

DECANISTERED 7/21/2010; sample dried for 4 days in air

SAMPLE: 816' 2" to 817' 2" (Lexington coal) core in SSD canister DC5  
density = 1.33 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

As Received	Moisture Free	MAF	
BTU/lb	10904	11993	14124
Sulfur	2.68%	2.95%	
Moisture	9.08%		
Ash	13.71%	15.08%	
Volatile Matter	34.72%	38.19%	
Fixed Carbon	42.49%	46.73%	

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)				
	1.542	699.25		1.584	718.70	2.71%	23	off bottom	17.0 minutes				
								at surface	0.283 hours				
								in canister	0.532290647 SQRT (hrs)				
								7/8/09 12:41	7/8/09 12:43				
								7/8/09 12:43	7/8/09 12:58				
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)		CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE	TIME SINCE	SQRT hrs. (since off bottom)				
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	off bottom	at surface	in canister	
10	79	979	0.0004	538.67	14.199	0.000329294	9.32	0.00032929	1.48	7/8/09 13:10	0:29:00	0:27:00	0:12:00
11	79	979	0.0004	538.67	14.199	0.000362223	10.26	0.00069152	1.95	7/8/09 13:28	0:47:00	0:45:00	0:30:00
17	79	979	0.0006	538.67	14.199	0.0005598	15.85	0.00125132	2.68	7/8/09 15:16	2:35:00	2:33:00	2:18:00
19	79	978	0.0007	538.67	14.185	0.000625019	17.70	0.00187634	3.49	7/8/09 16:20	3:39:00	3:37:00	3:22:00
14	79	978	0.0005	538.67	14.185	0.000460541	13.04	0.00233688	4.09	7/8/09 17:56	5:15:00	5:13:00	4:58:00
24	72	978	0.0008	531.67	14.185	0.000799893	22.65	0.00313677	5.12	7/9/09 17:35	28:54:00	28:52:00	28:37:00
24	72	976	0.0008	531.67	14.156	0.000798257	22.60	0.00393503	6.16	7/10/09 13:33	48:52:00	48:50:00	48:35:00
35	76	985	0.0012	535.67	14.286	0.001166086	33.02	0.00510111	7.67	7/12/09 15:05	98:24:00	98:22:00	98:07:00
49	74	976	0.0017	533.67	14.156	0.001623667	45.98	0.00672478	9.78	7/14/09 21:20	152:39:00	152:37:00	152:22:00

39	74	986	0.0014	533.67	14.301	0.001305547	36.97	0.00803033	227.39	10.42	11.47	7/17/09 16:24	219:43:00	219:41:00	219:26:00	14.82284273	estimate
21	71	981	0.0007	530.67	14.228	0.000703376	19.92	0.0087337	247.31	11.33	12.38	7/20/09 17:26	292:45:00	292:43:00	292:28:00	17.10993863	
41	69	982	0.0014	528.67	14.243	0.001379858	39.07	0.01011356	286.38	13.12	14.17	7/31/09 19:01	558:20:00	558:18:00	558:03:00	23.62907813	
56	72	975	0.002	531.67	14.141	0.001860691	52.69	0.01197425	339.07	15.54	16.59	8/19/09 17:37	1012:56:00	1012:54:00	1012:39:00	31.8266136	
44	73	987	0.0016	532.67	14.315	0.001477187	41.83	0.01345144	380.90	17.45	18.51	9/17/09 14:14	1705:33:00	1705:31:00	1705:16:00	41.29830505	
25	65	985	0.0009	524.67	14.286	0.000850381	24.08	0.01430182	404.98	18.55	19.61	10/9/09 11:43	2231:02:00	2231:00:00	2230:45:00	47.23381557	
35	71	977	0.0012	530.67	14.170	0.001167513	33.06	0.01546933	438.04	20.07	21.12	11/12/09 16:49	3052:08:00	3052:06:00	3051:51:00	55.246116	
22	67	970	0.0008	526.67	14.069	0.000734141	20.79	0.01620347	458.83	21.02	22.08	12/24/09 15:28	4058:47:00	4058:45:00	4058:30:00	63.70858132	
1	68	991	4E-05	527.67	14.373	3.40279E-05	0.96	0.0162375	459.79	21.07	22.12	1/15/10 14:36	4585:55:00	4585:53:00	4585:38:00	67.71939653	
2	67	998	7E-05	526.67	14.475	6.86666E-05	1.94	0.01630617	461.74	21.16	22.21	1/28/10 16:01	4899:20:00	4899:18:00	4899:03:00	69.99523793	
10	67	977	0.0004	526.67	14.170	0.000336109	9.52	0.01664228	471.26	21.59	22.64	2/5/10 15:45	5091:04:00	5091:02:00	5090:47:00	71.35171103	
3	67	985	0.0001	526.67	14.286	0.000101658	2.88	0.01674394	474.13	21.72	22.78	2/26/10 18:45	5598:04:00	5598:02:00	5597:47:00	74.82022899	
11	68	973	0.0004	527.67	14.112	0.000367508	10.41	0.01711144	484.54	22.20	23.25	3/13/10 15:13	5954:32:00	5954:30:00	5954:15:00	77.16562274	
3	67	979	0.0001	526.67	14.199	0.000101039	2.86	0.01721248	487.40	22.33	23.38	3/26/10 15:21	6266:40:00	6266:38:00	6266:23:00	79.16228058	
-1	68	977	-4E-05	527.67	14.170	-3.3547E-05	-0.95	0.01717894	486.45	22.29	23.34	4/16/10 17:01	6772:20:00	6772:18:00	6772:03:00	82.29418773	
11	67	981	0.0004	526.67	14.228	0.000371233	10.51	0.01755017	496.96	22.77	23.82	4/30/10 17:45	7109:04:00	7109:02:00	7108:47:00	84.31528134	
0	67	981	0	526.67	14.228	0	0.00	0.01755017	496.96	22.77	23.82	5/12/10 17:35	7396:54:00	7396:52:00	7396:37:00	86.0052324	
-1	68	981	-4E-05	527.67	14.228	-3.3685E-05	-0.95	0.01751649	496.01	22.73	23.78	5/26/10 19:44	7735:03:00	7735:01:00	7734:46:00	87.94913303	
15	74	981	0.0005	533.67	14.228	0.000499587	14.15	0.01801607	510.16	23.37	24.43	6/23/10 17:24	8404:43:00	8404:41:00	8404:26:00	91.67724181	
12	74	981	0.0004	533.67	14.228	0.00039967	11.32	0.01841574	521.47	23.89	24.95	7/16/10 17:31	8956:50:00	8956:48:00	8956:33:00	94.64054804	
3	74	983	0.0001	533.67	14.257	0.000100121	2.84	0.01851586	524.31	24.02	25.08	7/21/10 15:54	9075:13:00	9075:11:00	9074:56:00	95.26393161	

DECANISTERED 7/22/2010; sample dried for 3 days in air

SAMPLE: 955' 8" to 956' 9" (Bevier coal) core in SSD canister B  
density = 1.57 grams/cc  
PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF
BTU/lb	6294	6593	13485
Sulfur	3.33%	3.49%	
Moisture	4.53%		
Ash	48.79%	51.11%	
Volatile Matter	23.84%	24.79%	
Fixed Carbon	22.84%	23.92%	

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)								
	2.657	1205.38		2.753	1248.81	3.48%	55	off bottom	74.7 minutes								
								at surface	1.246 hours								
								in canister	1.116169043 SQRT (hrs)								
								7/9/09 15:01	7/9/09 15:04	7/9/09 16:16	1.246 hours						
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						CUMULATIVE VOLUMES (@STP)	SCF/TON	SCF/TON	TIME SINCE	SQRT hrs. (since off bottom)						
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	at surface	in canister				
15	79	980	0.0005	538.67	14.214	0.000494445	14.00	0.00049445	14.00	0.37	1.83	7/9/09 16:47	1:45:15	1:42:15	0:30:30	1.324449571	
0	72	980	0	531.67	14.214	0	0.00	0.00049445	14.00	0.37	1.83	7/9/09 17:35	2:33:15	2:30:15	1:18:30	1.598176044	
25	72	976	0.0009	531.67	14.156	0.000831518	23.55	0.00132596	37.55	1.00	2.46	7/9/09 18:33	3:31:15	3:28:15	2:16:30	1.876388375	
32	76	985	0.0011	535.67	14.286	0.001066136	30.19	0.0023921	67.74	1.80	3.26	7/12/09 15:09	72:07:15	72:04:15	70:52:30	8.492398562	back at lab
45	74	976	0.0016	533.67	14.156	0.001491123	42.22	0.00388322	109.96	2.92	4.38	7/14/09 21:21	126:19:15	126:16:15	125:04:30	11.23925413	
17	74	980	0.0006	533.67	14.214	0.000565622	16.02	0.00444884	125.98	3.35	4.81	7/17/09 16:25	193:23:15	193:20:15	192:08:30	13.90638343	
14	71	981	0.0005	530.67	14.228	0.000468917	13.28	0.00491776	139.25	3.70	5.16	7/20/09 17:27	266:25:15	266:22:15	265:10:30	16.32240281	
24	69	982	0.0008	528.67	14.243	0.000807722	22.87	0.00572548	162.13	4.31	5.77	7/31/09 19:01	531:59:15	531:56:15	530:44:30	23.06485422	
45	72	975	0.0016	531.67	14.141	0.001495198	42.34	0.00722068	204.47	5.43	6.90	8/19/09 17:37	986:35:15	986:32:15	985:20:30	31.40999045	
32	73	987	0.0011	532.67	14.315	0.001074318	30.42	0.008295	234.89	6.24	7.70	9/17/09 14:14	1679:12:15	1679:09:15	1677:57:30	40.97809374	
13	65	985	0.0005	524.67	14.286	0.000442198	12.52	0.0087372	247.41	6.58	8.04	10/9/09 11:43	2204:41:15	2204:38:15	2203:26:30	46.95409993	
27	71	977	0.001	530.67	14.170	0.000900653	25.50	0.00963785	272.91	7.25	8.72	11/12/09 16:50	3025:48:15	3025:45:15	3024:33:30	55.00731012	
17	67	970	0.0006	526.67	14.069	0.000567291	16.06	0.01020514	288.98	7.68	9.14	12/24/09 15:30	4032:28:15	4032:25:15	4031:13:30	63.50173882	
-4	68	991	-1E-04	527.67	14.373	-0.00013611	-3.85	0.0106903	285.12	7.58	9.04	1/15/10 14:36	4559:34:15	4559:31:15	4558:19:30	67.52459428	
-1	68	997	-4E-05	527.67	14.460	-3.4234E-05	-0.97	0.0100348	284.15	7.55	9.01	1/28/10 16:01	4872:59:15	4872:56:15	4871:44:30	69.80678692	
26	74	980	0.0009	533.67	14.214	0.000865068	24.50	0.01089986	308.65	8.20	9.67	7/22/10 12:09	9069:07:15	9069:04:15	9067:52:30	95.23193179	

DECANISTERED 7/22/2010; sample dried for 3 days in air

SAMPLE: 965' 8" to 966' 2" (Croweburg coal) core in SSD canister Q  
density = 1.36 grams/cc  
PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF
BTU/lb	11060	11763	14288
Sulfur	6.49%	6.90%	
Moisture	5.97%		
Ash	16.62%	17.68%	
Volatile Matter	36.94%	39.28%	
Fixed Carbon	40.47%	43.04%	

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)							
	2.058	933.27		2.098	951.75	1.94%	75	off bottom	76.8 minutes							
								at surface	1.279 hours							
								in canister	1.131002505 SQRT (hrs)							
								7/9/09 15:01	7/9/09 15:04	7/9/09 16:18	1.279 hours					
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						CUMULATIVE VOLUMES (@STP)	SCF/TON	SCF/TON	TIME SINCE	SQRT hrs. (since off bottom)					
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	at surface	in canister			
20	79	980	0.0007	538.67	14.214	0.000659261	18.67	0.00065926	18.67	0.64	3.22	7/9/09 16:46	1:44:15	1:41:15	0:27:30	1.318142633
0	72	980	0	531.67	14.214	0	0.00	0.00065926	18.67	0.64	3.22	7/9/09 17:35	2:33:15	2:30:15	1:16:30	1.598176044
33	72	976	0.0012	531.67	14.156	0.001097603	31.08	0.00175686	49.75	1.71	4.28	7/9/09 18:33	3:31:15	3:28:15	2:14:30	1.876388375



38	76	985	0.0013	535.67	14.286	0.001266037	35.85	0.0030229	85.60	2.94	5.51	7/12/09 15:09	72:07:15	72:04:15	70:50:30	8.492398562	back at lab
47	74	976	0.0017	533.67	14.156	0.001557395	44.10	0.0045803	129.70	4.45	7.03	7/14/09 21:22	126:20:15	126:17:15	125:03:30	11.23999555	
28	74	980	0.001	533.67	14.214	0.000931612	26.38	0.00551191	156.08	5.36	7.93	7/17/09 16:26	193:24:15	193:21:15	192:07:30	13.90698266	
23	71	981	0.0008	530.67	14.228	0.000770364	21.81	0.00628227	177.89	6.11	8.68	7/20/09 17:29	266:27:15	266:24:15	265:10:30	16.32342386	
46	69	982	0.0016	528.67	14.243	0.001548134	43.84	0.00783041	221.73	7.61	10.19	7/31/09 19:03	532:01:15	531:58:15	530:44:30	23.0655768	
69	72	975	0.0024	531.67	14.141	0.002292637	64.92	0.01012304	286.65	9.84	12.41	8/19/09 17:38	986:36:15	986:33:15	985:19:30	31.41025576	
48	73	987	0.0017	532.67	14.315	0.001611476	45.63	0.01173452	332.28	11.41	13.98	9/17/09 14:15	1679:13:15	1679:10:15	1677:56:30	40.9782971	
19	65	985	0.0007	524.67	14.286	0.00064629	18.30	0.01238081	350.58	12.03	14.61	10/19/09 11:44	2204:42:15	2204:39:15	2203:25:30	46.95427741	
32	71	977	0.0011	530.67	14.170	0.001067441	30.23	0.01344825	380.81	13.07	15.65	11/12/09 16:52	3025:50:15	3025:47:15	3024:33:30	55.00761311	
18	67	970	0.0006	526.67	14.069	0.000600661	17.01	0.01404891	397.82	13.66	16.23	12/24/09 15:31	4032:29:15	4032:26:15	4031:12:30	63.50187005	
-5	68	991	-2E-04	527.67	14.373	-0.00017014	-4.82	0.01387877	393.00	13.49	16.07	1/15/10 14:37	4559:35:15	4559:32:15	4558:18:30	67.5247177	
-2	68	997	-7E-05	527.67	14.460	-6.8468E-05	-1.94	0.01381033	391.06	13.42	16.00	1/28/10 16:02	4873:00:15	4872:57:15	4871:43:30	69.8069063	
68	74	980	0.0024	533.67	14.214	0.002262486	64.07	0.01607279	455.13	15.62	18.20	7/22/10 12:10	9069:08:15	9069:05:15	9067:51:30	95.2320193	

DECANISTERED 7/22/2010; sample dried for 4 days in air

SAMPLE: 995' 0" to 995' 6" (Mineral coal) core in SSD canister 10A

density = 1.62 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

BTU/lb	As Received	Moisture Free	MAF	13988
Sulfur	8602	9047		
Moisture	5.73%	6.02%		
Ash	4.92%			
Volatle Matter	33.58%	35.32%		
Fixed Carbon	26.89%	28.28%		
	34.61%	36.40%		

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)					
	0.886	401.82		0.959	434.80	7.59%	43	off bottom	35.0 minutes					
								7/10/09 8:01	0.583 hours					
								at surface	0.763762616					
								in canister	SQRT (hrs)					
								7/10/09 8:36	0.82313					
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						CUMULATIVE VOLUMES (@STP)	SCF/TON	SCF/TON	SQRT hrs. (since off bottom)				
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	at surface	in canister	SQRT hrs. (since off bottom)
10	76	982	0.0004	535.67	14.243	0.000332153	9.41	0.00033215	9.41	7/10/09 8:55	0:53:15	0:49:30	0:18:15	0.942072184
12	76	982	0.0004	535.67	14.243	0.000398583	11.29	0.00073074	20.69	7/10/09 9:19	1:17:15	1:13:30	0:42:15	1.134680572
10	76	982	0.0004	535.67	14.243	0.000332153	9.41	0.00106289	30.10	7/10/09 9:43	1:41:15	1:37:30	1:06:15	1.299038106
5	76	982	0.0002	535.67	14.243	0.000166076	4.70	0.00122897	34.80	7/10/09 10:00	1:58:15	1:54:30	1:23:15	1.403863716
1	77	982	4E-05	536.67	14.243	3.31534E-05	0.94	0.00126212	35.74	7/10/09 10:41	2:39:15	2:35:30	2:04:15	1.629161338
10	77	982	0.0004	536.67	14.243	0.000331534	9.39	0.00159365	45.13	7/10/09 11:54	3:52:15	3:48:30	3:17:15	1.967443349
4	77	981	0.0001	536.67	14.228	0.000132479	3.75	0.00172613	48.88	7/10/09 12:38	4:36:15	4:32:30	4:01:15	2.145732198
21	76	985	0.0007	535.67	14.286	0.000699652	19.81	0.00242578	68.69	7/12/09 15:15	5:51:30	5:50:30	5:43:15	7.431072152
30	74	976	0.0011	533.67	14.156	0.000994082	28.15	0.00341986	96.84	7/14/09 21:03	10:09:15	10:08:57	10:08:26	10.4413042
2	74	986	7E-05	533.67	14.301	6.69511E-05	1.90	0.00348682	98.74	7/17/09 16:30	17:28:15	17:24:30	17:53:15	13.28423251
9	71	981	0.0003	530.67	14.228	0.000301447	8.54	0.00378826	107.27	7/20/09 17:31	24:29:15	24:29:30	24:8:15	15.79517331
12	69	982	0.0004	528.67	14.243	0.000403861	11.44	0.00419212	118.71	7/31/09 19:04	51:02:15	51:4:30	51:4:27:15	22.69443764
11	72	975	0.0004	531.67	14.141	0.000365493	10.35	0.00455762	129.06	8/19/09 17:39	96:37:15	96:9:30	96:9:2:15	31.13873526
4	73	987	0.0001	532.67	14.315	0.00013429	3.80	0.00469191	132.86	9/17/09 14:15	166:13:15	166:9:30	166:1:38:15	40.77034257
2	65	985	7E-05	524.67	14.286	6.80305E-05	1.93	0.00475994	134.79	10/9/09 11:44	218:7:15	218:7:38:30	218:7:07:15	46.77289992
17	71	977	0.0006	530.67	14.170	0.000567078	16.06	0.00532701	150.84	11/12/09 16:53	3008:51:15	3008:47:30	3008:16:15	54.85302331
14	67	970	0.0005	526.67	14.069	0.000467181	13.23	0.0057942	164.07	12/24/09 15:31	4015:29:15	4015:25:30	4014:54:15	63.36787435
-1	68	991	-4E-05	527.67	14.373	-3.4028E-05	-0.96	0.00576017	163.11	1/15/10 14:38	4542:36:15	4542:32:30	4542:01:15	67.39884396
0	68	997	0	527.67	14.460	0	0.00	0.00576017	163.11	1/28/10 16:02	4856:00:15	4855:56:30	4855:25:15	69.68503546
39	74	978	0.0014	533.67	14.185	0.001294954	36.67	0.00705512	199.78	7/22/10 16:10	9056:08:15	9056:04:30	9055:33:15	95.16374047

DECANISTERED 7/22/2010; sample dried for 4 days in air

SAMPLE: 1041' 5" to 1042' 11" (Tebco coal) core in SSD canister 11A

density = 1.78 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

BTU/lb	As Received	Moisture Free	MAF	13855
Sulfur	8556	8993		
Moisture	2.94%	3.09%		
Ash	4.87%			
Volatle Matter	33.38%	35.09%		
Fixed Carbon	30.17%	31.72%		
	31.58%	33.19%		

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture weight	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)					
	3.269	1482.67		3.334	1512.13	1.95%	142	off bottom	206.0 minutes					
								7/11/09 8:36	3.433 hours					
								at surface	1.852925615					
								in canister	SQRT (hrs)					
								7/11/09 8:39	0.82313					
RIG/LAB MEASUREMENTS	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						CUMULATIVE VOLUMES (@STP)	SCF/TON	SCF/TON	SQRT hrs. (since off bottom)				
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	at surface	in canister	SQRT hrs. (since off bottom)
18	77	984	0.0006	536.67	14.272	0.000597976	16.93	0.00059798	16.93	7/11/09 12:54	4:18:00	4:14:15	0:52:00	2.073644135
19	77	984	0.0007	536.67	14.272	0.000631197	17.87	0.00122917	34.81	7/11/09 14:02	5:26:00	5:22:15	2:00:00	2.330951165
17	77	984	0.0006	536.67	14.272	0.000564756	15.99	0.00179393	50.80	7/11/09 14:55	6:19:00	6:15:15	2:53:00	2.513297966
15	77	984	0.0005	536.67	14.272	0.000498314	14.11	0.00229224	64.91	7/11/09 16:02	7:26:00	7:22:15	4:00:00	2.726414006
14	78	984	0.0005	537.67	14.272	0.000464228	13.15	0.00275647	78.05	7/11/09 17:10	8:34:00	8:30:15	5:08:00	2.926886856
33	76	985	0.0012	535.67	14.286	0.001099453	31.13	0.00385592	109.19	7/12/09 14:47	30:11:00	30:07:15	26:45:00	5.493936051
85	74	976	0.003	533.67	14.156	0.002816565	79.76	0.00667249	188.94	7/14/09 20:59	84:23:00	84:19:15	80:57:00	9.186040133

75	74	986	0.0026	533.67	14.301	0.002510667	71.09	0.00918316	260.04	5.62	8.69	7/17/09 16:30	151:54:00	151:50:15	148:28:00	12.3247718
58	71	981	0.002	530.67	14.228	0.001942658	55.01	0.0112581	315.05	6.81	9.88	7/20/09 17:32	224:56:00	224:52:15	221:30:00	14.9977761
89	69	982	0.0031	528.67	14.243	0.002995302	84.82	0.01412112	399.86	8.64	11.71	7/31/09 19:04	490:28:00	490:24:15	487:02:00	22.14648204
99	72	975	0.0035	531.67	14.141	0.003289436	93.15	0.01741055	493.01	10.65	13.72	8/19/09 17:40	945:04:00	945:00:15	941:38:00	30.74193661
80	73	987	0.0028	532.67	14.315	0.002685794	76.05	0.02009635	569.06	12.30	15.36	9/17/09 14:16	1637:40:00	1637:36:15	1634:14:00	40.46809443
45	65	985	0.0016	524.67	14.286	0.001530687	43.34	0.02162703	612.41	13.23	16.30	10/9/09 11:45	2163:09:00	2163:05:15	2159:43:00	46.50967641
52	71	977	0.0018	530.67	14.170	0.001734591	49.12	0.02336162	661.53	14.29	17.36	11/12/09 16:54	2984:18:00	2984:14:15	2980:52:00	54.62874701
38	67	970	0.0013	526.67	14.069	0.001268062	35.91	0.02462969	697.43	15.07	18.14	12/24/09 15:34	3990:58:00	3990:54:15	3987:32:00	63.17409807
12	68	991	0.0004	527.67	14.373	0.000480835	11.56	0.02503802	709.00	15.32	18.39	1/15/10 14:38	4518:02:00	4517:58:15	4514:36:00	67.21631746
9	68	997	0.0003	527.67	14.460	0.000308105	8.72	0.02534613	717.72	15.51	18.58	1/28/10 16:03	4831:27:00	4831:23:15	4828:01:00	69.50863256
11	67	977	0.0004	526.67	14.170	0.00036972	10.47	0.02571585	728.19	15.73	18.80	2/5/10 15:46	5023:10:00	5023:06:15	5019:44:00	70.87430188
8	67	985	0.0003	526.67	14.286	0.000271089	7.68	0.02598693	735.87	15.90	18.97	2/26/10 18:46	5530:10:00	5530:06:15	5526:44:00	74.36509038
14	68	973	0.0005	527.67	14.112	0.000467738	13.24	0.02645467	749.11	16.19	19.25	3/13/10 15:15	5886:39:00	5886:35:15	5883:13:00	76.72450717
8	67	979	0.0003	526.67	14.199	0.000269437	7.63	0.02672411	756.74	16.35	19.42	3/26/10 15:22	6198:46:00	6198:42:15	6195:20:00	78.73224668
5	68	977	0.0002	527.67	14.170	0.000167736	4.75	0.02689184	761.49	16.45	19.52	4/16/10 17:02	6704:26:00	6704:22:15	6701:00:00	81.88060413
13	67	981	0.0005	526.67	14.228	0.00043873	12.42	0.02733058	773.91	16.72	19.79	4/30/10 17:45	7041:09:00	7041:05:15	7037:43:00	83.91156059
5	67	981	0.0002	526.67	14.228	0.000168742	4.78	0.02749932	778.69	16.83	19.89	5/12/10 17:35	7328:59:00	7328:55:15	7325:33:00	85.60948156
4	68	981	0.0001	527.67	14.228	0.000134738	3.82	0.02763406	782.51	16.91	19.98	5/26/10 19:45	7667:09:00	7667:05:15	7663:43:00	87.56226356
21	74	981	0.0007	533.67	14.228	0.000699422	19.81	0.02833348	802.31	17.34	20.40	6/23/10 17:25	8336:49:00	8336:45:15	8333:23:00	91.30616993
20	74	981	0.0007	533.67	14.228	0.000666116	18.86	0.02899959	821.17	17.74	20.81	7/16/10 17:32	8888:56:00	8888:52:15	8885:30:00	94.28113986
10	74	978	0.0004	533.67	14.185	0.00033204	9.40	0.02933163	830.58	17.95	21.02	7/22/10 16:12	9031:36:00	9031:32:15	9028:10:00	95.03473049

DECANISTERED 7/22/2010; sample dried for 4 days in air

SAMPLE: 1053' 2" to 1054' 1" (shale below where Tebo coal should be) core in SSD canister 12A  
density = 2.45 grams/cc

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture %	est. lost gas (cc) =		TIME OF:	elapsed time (off bottom to canistering)					
		2.607	1182.37			2.767	1255.08	5.79%	22		off bottom	at surface	in canister	7/11/09 8:36	7/11/09 8:39	7/11/09 9:05	29.0 minutes 0.483 hours
RIG/LAB MEASUREMENTS		CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE		TIME SINCE				
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas	off bottom	at surface	in canister	SQRT hrs. (since off bottom)		
5	77	983	0.0002	536.67	14.257	0.000165936	4.70	0.00016594	4.70	0.13	0.72	7/11/09 9:18	0:42:45	0:39:00	0:13:45	0.844097151	
4	77	983	0.0001	536.67	14.257	0.000132749	3.76	0.00029868	8.46	0.23	0.83	7/11/09 9:33	0:57:00	0:53:15	0:28:00	0.974679435	
4	77	983	0.0001	536.67	14.257	0.000132749	3.76	0.00043143	12.22	0.33	0.93	7/11/09 9:49	1:13:15	1:09:30	0:44:15	1.10491327	
5	77	983	0.0002	536.67	14.257	0.000165936	4.70	0.00059737	16.92	0.46	1.05	7/11/09 10:06	1:30:30	1:26:45	1:01:30	1.228142228	
4	77	983	0.0001	536.67	14.257	0.000132749	3.76	0.00073012	20.67	0.56	1.16	7/11/09 10:21	1:45:00	1:41:15	1:16:00	1.322875656	
5	77	984	0.0002	536.67	14.272	0.000166105	4.70	0.00089622	25.38	0.69	1.28	7/11/09 11:58	3:22:00	3:18:15	2:53:00	1.834847859	
12	77	984	0.0004	536.67	14.272	0.000398651	11.29	0.00129487	36.67	0.99	1.59	7/11/09 12:56	4:20:00	4:16:15	3:51:00	2.081666	
4	77	984	0.0001	536.67	14.272	0.000132884	3.76	0.00142776	40.43	1.10	1.69	7/11/09 14:03	5:27:00	5:23:15	4:58:00	2.334523506	
5	77	984	0.0002	536.67	14.272	0.000166105	4.70	0.00159386	45.13	1.22	1.82	7/11/09 14:57	6:21:00	6:17:15	5:52:00	2.519920634	
2	77	984	7E-05	536.67	14.272	6.64418E-05	1.88	0.0016603	47.01	1.27	1.87	7/11/09 16:03	7:27:00	7:23:15	6:58:00	2.729468813	
1	78	984	4E-05	537.67	14.272	3.31591E-05	0.94	0.00169346	47.95	1.30	1.90	7/11/09 17:10	8:34:00	8:30:15	8:05:00	2.926886856	
-30	76	985	-0.001	535.67	14.286	-0.00099995	-28.30	0.00069396	19.65	0.53	1.13	7/12/09 14:49	30:13:00	30:09:15	29:44:00	5.496968862	
0	74	976	0	533.67	14.156	0	0.00	0.00069396	19.65	0.53	1.13	7/14/09 21:01	84:25:00	84:21:15	83:56:00	9.187854302	
-4	74	986	-1E-04	533.67	14.301	-0.0001339	-3.79	0.00056006	15.86	0.43	1.03	7/17/09 16:31	151:55:00	151:51:15	151:26:00	12.32544793	

DECANISTERED 7/22/2010; sample dried for 4 days in air

SAMPLE: 1180' 6" to 1181' 6" (DBJ coal) core in SSD canister DCB14  
density = 1.79 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF
BTU/lb	8847	9079	13927
Sulfur	7.93%	8.14%	
Moisture	2.56%		
Ash	33.92%	34.81%	
Volatle Matter	31.24%	32.06%	
Fixed Carbon	32.28%	33.13%	

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture %	est. lost gas (cc) =		TIME OF:	elapsed time (off bottom to canistering)					
		2.213	1003.93			2.264	1026.88	2.23%	35		off bottom	at surface	in canister	7/13/09 12:48	7/13/09 12:59	7/13/09 13:27	39.5 minutes 0.658 hours
RIG/LAB MEASUREMENTS		CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE		TIME SINCE				
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas	off bottom	at surface	in canister	SQRT hrs. (since off bottom)		
6	77	981	0.0002	536.67	14.228	0.000198718	5.63	0.00019872	5.63	0.18	1.30	7/13/09 13:30	0:42:30	0:31:00	0:03:00	0.841625412	
3	78	981	0.0001	537.67	14.228	9.91741E-05	2.81	0.00029789	8.44	0.27	1.39	7/13/09 14:36	1:48:30	1:37:00	1:09:00	1.34474285	
23	79	981	0.0008	538.67	14.228	0.000758923	21.49	0.00105682	29.93	0.95	2.07	7/13/09 15:07	2:19:00	2:07:30	1:39:30	1.522060008	
15	80	981	0.0005	539.67	14.228	0.000494033	13.99	0.00155085	43.91	1.40	2.52	7/13/09 15:50	3:02:00	2:50:30	2:22:30	1.74164673	
8	80	981	0.0003	539.67	14.228	0.000263484	7.46	0.00181433	51.38	1.64	2.76	7/13/09 16:32	3:44:45	3:33:15	3:05:15	1.935415545	
7	79	981	0.0002	538.67	14.228	0.000230977	6.54	0.00204531	57.92	1.85	2.97	7/13/09 17:20	4:32:30	4:21:00	3:53:00	2.131188642	
4	79	981	0.0001	538.67	14.228	0.000131987	3.74	0.0021773	61.65	1.97	3.08	7/13/09 17:42	4:54:30	4:43:00	4:15:00	2.215475871 estimate	
4	79	981	0.0001	538.67	14.228	0.000131987	3.74	0.00230928	65.39	2.09	3.20	7/13/09 18:03	5:15:45	5:04:15	4:36:15	2.294013949	
5	79	981	0.0002	538.67	14.228	0.000164983	4.67	0.00247427	70.06	2.24	3.35	7/13/09 18:30	5:42:00	5:30:30	5:02:30	2.387467277	
4	79	981	0.0001	538.67	14.228	0.000131987	3.74	0.00260625	73.80	2.36	3.47	7/13/09 18:56	6:08:00	5:56:30	5:28:30	2.476556749	
3	79	981	0.0001	538.67	14.228	9.899E-05	2.80	0.00270524	76.60	2.44	3.56	7/13/09 19:16	6:28:00	6:16:30	5:48:30	2.54296415	
86	74	976	0.003	533.67	14.156	0.002849701	80.69	0.00555494	157.30	5.02	6.14	7/14/09 20:47	31:59:00	31:47:30	31:19:30	5.65380919 back at lab	
107	74	986	0.0038	533.67	14.301	0.003581885	101.43	0.00913683	258.73	8.26	9.37	7/17/09 16:32	99:44:00	99:32:30	99:04:30	9.986657766	

76	71	981	0.0027	530.67	14.228	0.002545551	72.08	0.01168238	330.81	10.56	11.67	7/20/09 17:34	172:46:00	172:34:30	172:06:30	13.14407344
125	69	982	0.0044	528.67	14.243	0.004206885	119.13	0.01588926	449.93	14.36	15.47	7/31/09 19:07	438:19:00	438:07:30	437:39:30	20.93601363
129	72	975	0.0046	531.67	14.141	0.004286235	121.37	0.02017555	571.30	18.23	19.35	8/19/09 17:42	892:54:00	892:42:30	892:14:30	29.88143236
92	73	987	0.0032	532.67	14.315	0.003088663	87.46	0.02326416	658.77	21.02	22.14	9/17/09 14:17	1585:29:00	1585:17:30	1584:49:30	39.8181282
51	65	985	0.0018	524.67	14.286	0.001734778	49.12	0.02499894	707.89	22.59	23.71	10/9/09 11:46	2110:58:00	2110:46:30	2110:18:30	45.94525728
79	71	977	0.0028	530.67	14.170	0.002635244	74.62	0.02763419	782.51	24.97	26.09	11/12/09 16:55	2932:07:00	2931:55:30	2931:27:30	54.14902277
60	67	970	0.0021	526.67	14.069	0.002002203	56.70	0.02963639	839.21	26.78	27.90	12/24/09 15:35	3938:47:00	3938:35:30	3938:07:30	62.759727
13	68	991	0.0005	527.67	14.373	0.000442363	12.53	0.03007875	851.73	27.18	28.30	1/15/10 14:39	4465:51:00	4465:39:30	4465:11:30	66.8270155
11	68	997	0.0004	527.67	14.460	0.000376573	10.66	0.03045532	862.40	27.52	28.64	1/28/10 16:04	4779:16:00	4779:04:30	4778:36:30	69.13224043
22	67	977	0.0008	526.67	14.170	0.000739439	20.94	0.03119476	883.33	28.19	29.31	2/5/10 15:47	4970:59:00	4970:47:30	4970:19:30	70.50520075
14	67	985	0.0005	526.67	14.286	0.000474405	13.43	0.03166917	896.77	28.62	29.73	2/26/10 18:47	5477:59:00	5477:47:30	5477:19:30	74.01339969
26	68	973	0.0009	527.67	14.112	0.000868656	24.60	0.03253782	921.37	29.40	30.52	3/13/10 15:16	5834:28:00	5834:16:30	5833:48:30	76.38368063
11	67	979	0.0004	526.67	14.199	0.000370476	10.49	0.03290883	931.86	29.74	30.85	3/26/10 15:23	6146:35:00	6146:23:30	6145:55:30	78.40014881
5	68	977	0.0002	527.67	14.170	0.000167736	4.75	0.03307604	936.61	29.89	31.01	4/16/10 17:02	6652:14:00	6652:02:30	6651:34:30	81.56122445
26	67	981	0.0009	526.67	14.228	0.00087746	24.85	0.03395355	961.45	30.68	31.80	4/30/10 17:46	6988:58:00	6988:46:30	6988:18:30	83.60003987
5	67	981	0.0002	526.67	14.228	0.000168742	4.78	0.03412224	966.23	30.83	31.95	5/12/10 17:36	7276:48:00	7276:36:30	7276:08:30	85.30416168
3	68	981	0.0001	527.67	14.228	0.000101054	2.86	0.03422329	969.09	30.93	32.04	5/26/10 19:46	7614:58:00	7614:46:30	7614:18:30	87.26377637
34	74	981	0.0012	533.67	14.228	0.001132398	32.07	0.03535569	1001.16	31.95	33.07	6/23/10 17:26	8284:38:00	8284:26:30	8283:58:30	91.01996118
25	74	981	0.0009	533.67	14.228	0.000832645	23.58	0.03618834	1024.74	32.70	33.82	7/16/10 17:33	8836:45:00	8836:33:30	8836:05:30	94.00398928
12	74	979	0.0004	533.67	14.199	0.000398855	11.29	0.03658719	1036.03	33.06	34.18	7/23/10 14:26	9001:38:00	9001:26:30	9000:58:30	94.87693784

DECANISTERED 7/23/2010; sample dried for 3 days in air

SAMPLE: 1192' 0" to 1193' 2.5" (Drywood coal) core in SSD canister 80

density = 1.51 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF	
BTU/lb	10817	11181		14142
Sulfur	10.60%	10.96%		
Moisture	3.26%			
Ash	20.25%	20.94%		
Volatile Matter	37.36%	38.62%		
Fixed Carbon	39.13%	40.14%		

dry sample weight:	lbs.	grams	wet sample weight:	lbs.	grams	moisture %	est. lost gas (cc) =
	2.509	1137.88		2.570	1165.73	2.39%	55

RIG/LAB MEASUREMENTS		CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE	TIME SINCE			elapsed time (off bottom to canistering)		
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	off bottom	at surface	in canister	7/13/09 15:39	7/13/09 15:46	7/13/09 16:15	35.3 minutes
										0.49:30	0:43:15	0:14:15	0.588 hours			
										0:49:30	0:43:15	0:14:15	0.766485486 SQRT (hrs)			
										0:49:30	0:43:15	0:14:15	SQRT hrs. (since off bottom)			
16	81	981	0.0006	540.67	14.228	0.000525994	14.89	0.00052599	14.89	0.42	1.97	7/13/09 16:29	0:49:30	0:43:15	0:14:15	0.908295106
7	81	981	0.0002	540.67	14.228	0.000230122	6.52	0.00075612	21.41	0.60	2.15	7/13/09 16:40	1:00:15	0:54:00	0:25:00	1.002081168
6	79	981	0.0002	538.67	14.228	0.00019798	5.61	0.0009541	27.02	0.76	2.31	7/13/09 16:48	1:08:45	1:02:30	0:33:30	1.070436048
15	79	981	0.0005	538.67	14.228	0.00049495	14.02	0.00144905	41.03	1.16	2.70	7/13/09 17:19	1:39:15	1:33:00	1:04:00	1.286144108
19	79	981	0.0007	538.67	14.228	0.000626937	17.75	0.00207598	58.79	1.66	3.20	7/13/09 18:00	2:20:15	2:14:00	1:45:00	1.528888485
15	79	981	0.0005	538.67	14.228	0.00049495	14.02	0.00257093	72.80	2.05	3.60	7/13/09 18:32	2:52:45	2:46:30	2:17:30	1.696810734
9	79	981	0.0003	538.67	14.228	0.00029697	8.41	0.0028679	81.21	2.29	3.83	7/13/09 18:58	3:18:15	3:12:00	2:43:00	1.817736688
6	79	981	0.0002	538.67	14.228	0.00019798	5.61	0.00306588	86.82	2.44	3.99	7/13/09 19:18	3:38:15	3:32:00	3:03:00	1.907223112
157	74	976	0.0055	533.67	14.156	0.005202361	147.31	0.00826824	234.13	6.59	8.14	7/14/09 20:50	29:10:15	29:04:00	28:35:00	5.401002993 back at lab
167	74	986	0.0059	533.67	14.301	0.005590419	158.30	0.01385866	392.43	11.05	12.60	7/17/09 16:35	96:55:15	96:49:00	96:20:00	9.844837903
115	71	981	0.0041	530.67	14.228	0.003851821	109.07	0.01771048	501.50	14.12	15.67	7/20/09 17:36	169:56:15	169:50:00	169:21:00	13.03600782
175	69	982	0.0062	528.67	14.243	0.005889639	166.78	0.02360012	668.28	18.82	20.36	7/31/09 19:09	435:29:15	435:23:00	434:54:00	20.86833726
184	72	975	0.0065	531.67	14.141	0.006113699	173.12	0.02971382	841.40	23.69	25.24	8/19/09 17:44	890:04:15	889:58:00	889:29:00	29.83405493 gas sampled
153	73	987	0.0054	532.67	14.315	0.005136581	145.45	0.0348504	986.85	27.78	29.33	9/17/09 14:21	1582:41:15	1582:35:00	1582:06:00	39.78300517
87	65	985	0.0031	524.67	14.286	0.002959328	83.80	0.03780973	1070.65	30.14	31.69	10/9/09 11:47	2108:07:15	2108:01:00	2107:32:00	45.91427701
107	71	977	0.0038	530.67	14.170	0.003569255	101.07	0.04137899	1171.72	32.99	34.54	11/12/09 17:00	2929:20:15	2929:14:00	2928:45:00	54.12335448
85	67	970	0.003	526.67	14.069	0.002836455	80.32	0.04421544	1252.04	35.25	36.80	12/24/09 15:37	3935:57:15	3935:51:00	3935:22:00	62.73718329
33	68	991	0.0012	527.67	14.373	0.00112292	31.80	0.04533836	1283.83	36.15	37.69	1/15/10 14:41	4463:01:15	4462:55:00	4462:26:00	66.80584431
21	68	998	0.0007	527.67	14.475	0.000719633	20.38	0.04605799	1304.21	36.72	38.27	1/28/10 16:05	4776:25:15	4776:19:00	4775:50:00	69.11165483
22	67	977	0.0008	526.67	14.170	0.000739439	20.94	0.04679743	1325.15	37.31	38.86	2/5/10 15:49	4968:09:15	4968:03:00	4967:34:00	70.48513437
21	67	985	0.0007	526.67	14.286	0.000711608	20.15	0.04750904	1345.30	37.88	39.43	2/26/10 18:48	5475:08:15	5475:02:00	5474:33:00	73.99417207
28	68	973	0.001	527.67	14.112	0.000935475	26.49	0.04844452	1371.79	38.62	40.17	3/13/10 15:18	5831:38:15	5831:32:00	5831:03:00	76.36515894
17	67	979	0.0006	526.67	14.199	0.000572554	16.21	0.04901707	1388.00	39.08	40.63	3/26/10 15:25	6143:45:15	6143:39:00	6143:10:00	78.38210361
13	68	977	0.0005	527.67	14.170	0.000436113	12.35	0.04945318	1400.35	39.43	40.98	4/16/10 17:04	6649:24:15	6649:18:00	6648:49:00	81.54387878
24	67	981	0.0008	526.67	14.228	0.000809964	22.94	0.05026315	1423.29	40.07	41.62	4/30/10 17:47	6986:07:15	6986:01:00	6985:32:00	83.58301761
11	67	981	0.0004	526.67	14.228	0.000371233	10.51	0.05063438	1433.80	40.37	41.92	5/12/10 17:37	7273:57:15	7273:51:00	7273:22:00	85.28747954
10	68	981	0.0004	527.67	14.228	0.000336845	9.54	0.05097123	1443.34	40.64	42.19	5/26/10 19:47	7612:07:15	7612:01:00	7611:32:00	87.24746892
40	74	981	0.0014	533.67	14.228	0.001322232	37.72	0.05230346	1481.06	41.70	43.25	6/23/10 17:28	8281:48:15	8281:42:00	8281:13:00	91.00441839
34	74	981	0.0012	533.67	14.228	0.001132398	32.07	0.05343586	1513.13	42.60	44.15	7/16/10 17:35	8833:55:15	8833:49:00	8833:20:00	93.98893995
16	74	979	0.0006	533.67	14.199	0.000531807	15.06	0.05396766	1528.19	43.03	44.57	7/23/10 14:38	8998:58:15	8998:52:00	8998:23:00	94.86290547

DECANISTERED 7/23/2010; sample dried for 3 days in air

SAMPLE: 1193' 2.5" to 1194' 8.5" (Drywood coal) core in SSD canister DCB18

density = 1.30 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF	
BTU/lb	11964	12430		14803

Sulfur	2.55%	2.65%
Moisture	3.76%	
Ash	15.43%	16.03%
Volatile Matter	39.21%	40.74%
Fixed Carbon	41.60%	43.23%

dry sample weight:		lbs.	grams	wet sample weight:			lbs.	grams	moisture %	est. lost gas (cc) =		TIME OF:				elapsed time (off bottom to canister)				
		2.734	1240.08				2.832	1284.79	3.48%	63		off bottom	at surface	in canister			38.3 minutes			
													7/13/09 15:39	7/13/09 15:46	7/13/09 16:18	0.638 hours				
RIG/LAB MEASUREMENTS		CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)							CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE				TIME SINCE		0.798435971 SQRT (hrs)	
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		TIME	off bottom	at surface	in canister	SQRT hrs. (since off bottom)			
24	81	981	0.0008	540.67	14.228	0.00078899	22.34	0.00078899	22.34	0.58	2.20	7/13/09 16:27	0:47:30	0:41:15	0:09:15			0.889756521		
6	81	981	0.0002	540.67	14.228	0.000197248	5.59	0.00098624	27.93	0.72	2.35	7/13/09 16:36	0:57:00	0:50:45	0:18:45			0.974679434		
7	79	981	0.0002	538.67	14.228	0.000230977	6.54	0.00121721	34.47	0.89	2.52	7/13/09 16:47	1:08:00	1:01:45	0:29:45			1.064581295		
18	79	981	0.0006	538.67	14.228	0.000593994	16.82	0.00181115	51.29	1.32	2.95	7/13/09 17:18	1:38:15	1:32:00	1:00:00			1.279648389		
20	79	981	0.0007	538.67	14.228	0.000659933	18.69	0.00247109	69.97	1.81	3.44	7/13/09 17:59	2:19:15	2:13:00	1:41:00			1.523428152		
14	79	981	0.0005	538.67	14.228	0.000461953	13.08	0.00293304	83.05	2.15	3.77	7/13/09 18:30	2:51:00	2:44:45	2:12:45			1.688194302		
10	79	981	0.0004	538.67	14.228	0.000329967	9.34	0.00326301	92.40	2.39	4.01	7/13/09 18:57	3:17:15	3:11:00	2:39:00			1.813146436		
5	79	981	0.0002	538.67	14.228	0.000164983	4.67	0.00342799	97.07	2.51	4.14	7/13/09 19:17	3:37:30	3:31:15	2:59:15			1.903943276		
160	74	976	0.0057	533.67	14.156	0.005301769	150.13	0.00872976	247.20	6.39	8.01	7/14/09 20:48	29:02:00	28:30:00	28:30:00			5.397916265		
189	74	986	0.0067	533.67	14.301	0.006326882	179.16	0.01550664	426.36	11.01	12.64	7/17/09 16:34	96:54:15	96:48:00	96:16:00			9.843991399		
136	71	981	0.0048	530.67	14.228	0.004555197	128.99	0.01961184	555.34	14.35	15.97	7/20/09 17:35	169:55:15	169:49:00	169:17:00			13.03536855		
226	69	982	0.008	528.67	14.243	0.007606048	215.38	0.02721789	770.72	19.91	21.54	7/31/09 19:07	435:27:15	435:21:00	434:49:00			20.86753859		
245	72	975	0.0087	531.67	14.141	0.008140524	230.51	0.03535841	1001.23	25.87	27.49	8/19/09 16:29	888:49:15	888:43:00	888:11:00			29.81309835		
221	73	987	0.0078	532.67	14.315	0.007419506	210.10	0.04277792	1211.33	31.29	32.92	9/17/09 14:19	1582:39:15	1582:33:00	1582:01:00			39.78258622		
131	65	985	0.0046	524.67	14.286	0.004455999	126.18	0.04723392	1337.51	34.55	36.18	10/9/09 11:46	2108:06:15	2108:00:00	2107:28:00			45.91409551		
153	71	977	0.0054	530.67	14.170	0.005103701	144.52	0.05233762	1482.03	38.29	39.92	11/12/09 16:58	2929:18:15	2929:12:00	2928:40:00			54.12304654		
122	67	970	0.0043	526.67	14.069	0.004071147	115.28	0.05640876	1597.31	41.27	42.89	12/24/09 15:36	3935:56:15	3935:50:00	3935:18:00			62.73705046		
56	68	991	0.002	527.67	14.373	0.001905562	53.96	0.05831433	1651.27	42.66	44.29	1/15/10 14:40	4463:00:15	4462:54:00	4462:22:00			66.80571957		
34	68	998	0.0012	527.67	14.475	0.001165121	32.99	0.05947945	1684.26	43.51	45.14	1/28/10 16:04	4776:24:15	4776:18:00	4775:46:00			69.11153425		
31	67	977	0.0011	526.67	14.170	0.001041937	29.50	0.06052138	1713.77	44.27	45.90	2/5/10 15:48	4968:08:15	4968:02:00	4967:30:00			70.48501614		
34	67	985	0.0012	526.67	14.286	0.001152127	32.62	0.06167351	1746.39	45.12	46.75	2/26/10 18:48	5475:08:15	5475:02:00	5474:30:00			73.99417207		
38	68	973	0.0013	527.67	14.112	0.001269573	35.95	0.06294308	1782.34	46.05	47.67	3/13/10 15:17	5831:37:15	5831:31:00	5830:59:00			76.36504982		
25	67	979	0.0009	526.67	14.199	0.000841992	23.84	0.06378508	1806.19	46.66	48.29	3/26/10 15:24	6143:44:15	6143:38:00	6143:06:00			78.3819973		
28	68	977	0.001	527.67	14.170	0.000939321	26.60	0.06472444	1832.78	47.35	48.98	4/16/10 17:03	6649:23:15	6649:17:00	6648:45:00			81.54377659		
50	67	981	0.0018	526.67	14.228	0.001687424	47.78	0.06641182	1880.57	48.58	50.21	4/30/10 17:47	6986:07:15	6986:01:00	6985:29:00			83.58301761		
33	67	981	0.0012	526.67	14.228	0.0011137	31.54	0.06732552	1912.10	49.40	51.03	5/12/10 17:36	7273:56:15	7273:50:00	7273:18:00			85.28738183		
27	68	981	0.001	527.67	14.228	0.000909482	25.75	0.068435	1937.86	50.06	51.69	5/26/10 19:46	7612:06:15	7612:00:00	7611:28:00			87.24737341		
67	74	981	0.0024	533.67	14.228	0.002231489	63.19	0.07066649	2001.04	51.70	53.32	6/23/10 17:27	8281:47:15	8281:41:00	8281:09:00			91.00432682		
57	74	981	0.002	533.67	14.228	0.001898431	53.76	0.07256492	2054.80	53.09	54.71	7/16/10 17:34	8833:54:15	8833:48:00	8833:16:00			93.98885129		
27	74	979	0.001	533.67	14.199	0.000897424	25.41	0.07346235	2080.21	53.74	55.37	7/23/10 14:37	8998:57:15	8998:51:00	8998:19:00			94.86281762		
50	74	978	0.0018	533.67	14.185	0.001660198	47.01	0.07512254	2127.23	54.96	56.58	8/10/10 15:45	9432:05:15	9431:59:00	9431:27:00			97.11893482		
610.94	74	978	0.0216	533.67	14.185	0.020285626	574.42	0.09540817	2701.65	69.80	71.42	8/12/10 17:30	9481:50:15	9481:44:00	9481:12:00			97.37472721		

DECANISTERED 7/23/2010; sample dried for 3 days in air; 242.82 grams of sample ground in ball mill. 107.19 ccs @ stp released, which is proportional to 574.42 ccs residual gas for 1240.08 grams of dry sample

SAMPLE: 1201' 0" to 1202' 5.5" (Rowe coal) core in SSD canister F

density = 1.32 grams/cc

PROXIMATE ANALYSIS by Luman's Laboratories, Chetopa, KS

	As Received	Moisture Free	MAF
BTU/lb	12235	13003	14628
Sulfur	4.48%	4.76%	
Moisture	5.90%		
Ash	10.45%	11.11%	
Volatile Matter	37.54%	39.89%	
Fixed Carbon	46.11%	49.00%	

dry sample weight:		lbs.	grams	wet sample weight:			lbs.	grams	moisture %	est. lost gas (cc) =		TIME OF:				elapsed time (off bottom to canister)				
		2.448	1110.55				2.557	1160.04	4.27%	73		off bottom	at surface	in canister			38.8 minutes			
													7/13/09 15:39	7/13/09 15:46	7/13/09 16:18	0.646 hours				
RIG/LAB MEASUREMENTS		CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)							CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME OF MEASURE				TIME SINCE		0.803637563 SQRT (hrs)	
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas		TIME	off bottom	at surface	in canister	SQRT hrs. (since off bottom)			
10	81	981	0.0004	540.67	14.228	0.000328746	9.31	0.00032875	9.31	0.27	2.37	7/13/09 16:30	0:50:45	0:44:30	0:12:00			0.919691977		
5	81	981	0.0002	540.67	14.228	0.000164373	4.65	0.00049312	13.96	0.40	2.51	7/13/09 16:37	0:57:45	0:51:30	0:19:00			0.981070844		
4	81	981	0.0001	540.67	14.228	0.000131498	3.72	0.00062462	17.69	0.51	2.62	7/13/09 16:44	1:04:15	0:58:00	0:25:30			1.034810772		
5	79	981	0.0002	538.67	14.228	0.000164983	4.67	0.0007896	22.36	0.65	2.75	7/13/09 16:49	1:09:45	1:03:30	0:31:00			1.078192933		
20	79	981	0.0007	538.67	14.228	0.000659933	18.69	0.00144953	41.05	1.18	3.29	7/13/09 17:19	1:40:00	1:33:45	1:01:15			1.290994449		
24	79	981	0.0008	538.67	14.228	0.00079192	22.42	0.00224145	63.47	1.83	3.94	7/13/09 18:01	2:21:45	2:15:30	1:43:00			1.537042615		
20	79	981	0.0007	538.67	14.228	0.000659933	18.69	0.00290139	82.16	2.37	4.48	7/13/09 18:35	2:55:15	2:49:00	2:16:30			1.709044567		
10	79	981	0.0004	538.67	14.228	0.000329967	9.34	0.00323135	91.50	2.64	4.75	7/13/09 18:58	3:18:45	3:12:30	2:40:00			1.820027472		
4	79	981	0.0001	538.67	14.228	0.000131987	3.74	0.00336334	95.24	2.75	4.85	7/13/09 19:19	3:39:30	3:33:15	3:00:45			1.912677007		
188	74	976	0.0066	533.67	14.156	0.006295979	176.40	0.00959292	271.64	7.84	9.94	7/14/09 20:52	29:12:15	29:06:00	28:33:30			5.404087959		
207	74	986	0.0073	533.67	14.301	0.006929442	196.22	0.01652236	467.86	13.50	15.60	7/17/09 16:37	96:57:15	96:51:00	96:18:30			9.846530692		
139	71	981	0.0049	530.67	14.228	0.004655679	131.83	0.02117804	599.69	17.30	19.41	7/20/09 17:37	169:57:15	169:51:00	169:18:30			13.03664706		
214	69	982	0.0076	528.67	14.243	0.007202187	203.94	0.02838023	803.64	23.18	25.29	7/31/09 19:11	435:31:15	435:25:00	434:52:30			20.8691359		
210	71	975	0.0074	530.67	14.141	0.00699074	197.95	0.03537097	1001.59	28.89	31.00	8/19/09 16:30	888:50:15	888:44:00	888:11:30			29.81337787		
178	73	987	0.0063	532.67	14.315	0.005975892														





Ash 19.06% 19.68%  
 Volatile Matter 35.16% 36.30%  
 Fixed Carbon 42.65% 44.02%

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture %	est. lost gas (cc) =	TIME OF:	elapsed time (off bottom to canistering)					
		0.978	443.62			1.027	466.04	4.81%	56	off bottom	at surface	in canister	39.0 minutes			
										7/14/09 12:32	7/14/09 12:38	7/14/09 13:11	0.650 hours			
													0.806225775 SQRT (hrs)			
RIG/LAB MEASUREMENTS		CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						CUMULATIVE VOLUMES (@STP)		SCF/TON	SCF/TON	TIME SINCE			SQRT hrs. (since off bottom)	
measured cc	measured T (F)	measured P	cubic ft	temp (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft	cc	without lost gas	with lost gas	off bottom	at surface	in canister	0:00:30	
3	79	979	0.0001	538.67	14.199	9.87882E-05	2.80	9.8788E-05	2.80	0.20	4.25	7/14/09 13:12	0:39:30	0:33:30	0:00:30	0.81137743
7	79	979	0.0002	538.67	14.199	0.000230506	6.53	0.00032929	9.32	0.67	4.72	7/14/09 13:22	0:49:15	0:43:15	0:10:15	0.905998528
5	79	979	0.0002	538.67	14.199	0.000164647	4.66	0.00049394	13.99	1.01	5.05	7/14/09 13:29	0:56:15	0:50:15	0:17:15	0.968245837
10	79	979	0.0004	538.67	14.199	0.000329294	9.32	0.00082323	23.31	1.68	5.73	7/14/09 13:42	1:10:00	1:04:00	0:31:00	1.08012345
4	79	979	0.0001	538.67	14.199	0.000131718	3.73	0.00095495	27.04	1.95	6.00	7/14/09 14:05	1:33:00	1:27:00	0:54:00	1.24498996
8	79	979	0.0003	538.67	14.199	0.000263435	7.46	0.00121839	34.50	2.49	6.54	7/14/09 14:29	1:57:00	1:51:00	1:18:00	1.396424004
13	79	979	0.0005	538.67	14.199	0.000428082	12.12	0.00164647	46.62	3.37	7.41	7/14/09 15:23	2:50:45	2:44:45	2:11:45	1.68695979
9	79	979	0.0003	538.67	14.199	0.000296365	8.39	0.00194283	55.01	3.97	8.02	7/14/09 16:29	3:56:30	3:50:30	3:17:30	1.985363107
42	79	979	0.0015	538.67	14.199	0.001383034	39.16	0.00332587	94.18	6.80	10.85	7/14/09 17:10	4:38:00	4:32:00	3:59:00	2.152517905
-10	74	976	-4E-04	533.67	14.156	-0.00033136	-9.38	0.00299451	84.79	6.12	10.17	7/14/09 20:56	8:23:15	8:17:15	7:44:15	2.896118092
73	74	986	0.0026	533.67	14.301	0.002443716	69.20	0.00543822	153.99	11.12	15.17	7/17/09 16:41	76:08:15	76:02:15	75:29:15	8.725680489 back at lab
48	71	981	0.0017	530.67	14.228	0.001607717	45.53	0.00704594	199.52	14.41	18.45	7/20/09 17:40	149:07:15	149:01:15	148:28:15	12.21150414
51	69	982	0.0018	528.67	14.243	0.001716409	48.60	0.00876235	248.12	17.92	21.96	7/31/09 19:14	414:41:15	414:35:15	414:02:15	20.36387733
50	72	979	0.0018	531.67	14.199	0.001668147	47.24	0.0104305	295.36	21.33	25.37	8/19/09 16:30	867:57:15	867:51:15	867:18:15	29.46106187 gas sampled
24	73	987	0.0008	532.67	14.315	0.000805738	22.82	0.01123624	318.17	22.98	27.02	9/17/09 14:05	1561:32:15	1561:26:15	1560:53:15	39.51629411 gas sampled
18	65	985	0.0006	524.67	14.286	0.000612275	17.34	0.01184851	335.51	24.23	28.27	10/9/09 11:26	2086:53:15	2086:47:15	2086:14:15	45.68246381 gas sampled
51	71	977	0.0018	530.67	14.170	0.001701234	48.17	0.01354974	383.68	27.71	31.75	11/12/09 15:48	2907:15:15	2907:09:15	2906:36:15	53.91895925 gas sampled
15	67	982	0.0005	526.67	14.243	0.000506743	14.35	0.01405649	398.03	28.74	32.79	12/21/09 14:43	3842:10:15	3842:04:15	3841:31:15	61.9852469
9	67	970	0.0003	526.67	14.069	0.000300331	8.50	0.01435682	406.54	29.36	33.40	12/24/09 15:40	3915:07:15	3915:01:15	3914:28:15	62.57092642
-4	68	991	-1E-04	527.67	14.373	-0.00013611	-3.85	0.01422071	402.68	29.08	33.12	1/15/10 14:43	4442:10:15	4442:04:15	4441:31:15	66.6496124
1	68	998	4E-05	527.67	14.475	3.42683E-05	0.97	0.01425497	403.65	29.15	33.20	1/28/10 16:08	4755:35:15	4755:29:15	4754:56:15	68.96076783
14	67	977	0.0005	526.67	14.170	0.000470552	13.32	0.01472553	416.98	30.11	34.16	2/5/10 15:53	4947:20:15	4947:14:15	4946:41:15	70.33731229
2	67	985	7E-05	526.67	14.286	6.77722E-05	1.92	0.0147933	418.90	30.25	34.30	2/26/10 18:52	5454:19:15	5454:13:15	5453:40:15	73.85337388
16	68	973	0.0006	527.67	14.112	0.000534557	15.14	0.01532786	434.03	31.34	35.39	3/13/10 15:20	5810:47:15	5810:41:15	5810:08:15	76.22852157
2	67	979	7E-05	526.67	14.199	6.73594E-05	1.91	0.01539522	435.94	31.48	35.53	3/26/10 15:27	6122:54:15	6122:48:15	6122:15:15	78.24898828
-4	68	977	-1E-04	527.67	14.170	-0.00013419	-3.80	0.01526103	432.14	31.21	35.25	4/16/10 17:06	6628:33:15	6628:27:15	6627:54:15	81.41593313
17	67	981	0.0006	526.67	14.228	0.000573724	16.25	0.01583475	448.39	32.38	36.43	4/30/10 17:52	6965:19:15	6965:13:15	6964:40:15	83.45849767
-1	67	981	-4E-05	526.67	14.228	-3.3748E-05	-0.96	0.015801	447.43	32.31	36.36	5/12/10 17:39	7253:06:15	7253:00:15	7252:27:15	85.16515817
-2	68	981	-7E-05	527.67	14.228	-6.7369E-05	-1.91	0.01573363	445.53	32.17	36.22	5/26/10 19:51	7591:18:15	7591:12:15	7590:39:15	87.12809057
20	74	981	0.0007	533.67	14.228	0.000666116	18.86	0.01639975	464.39	33.54	37.58	6/23/10 17:30	8260:57:15	8260:51:15	8260:18:15	90.88979132
11	74	981	0.0004	533.67	14.228	0.000366364	10.37	0.01676611	474.76	34.29	38.33	7/16/10 17:36	8813:03:15	8812:57:15	8812:24:15	93.87786835
6	74	979	0.0002	533.67	14.199	0.000199427	5.65	0.01696554	480.41	34.69	38.74	7/23/10 14:41	8978:08:15	8978:02:15	8977:29:15	94.75303425

DECANISTERED 7/23/2010; sample dried for 3 days in air

SAMPLE: 1675' 0" to 1676' 0" (Chattanooga Shale) core in SSD canister  
 density = 2.47 grams/cc  
 DECANISTERED 7/22/2009 discontinued due to no appreciable gas generated

*Lost-Gas Determinations*

Gas lost prior to the canistering of the sample was estimated by extrapolation of the first few data points after the sample was canistered. The linear characteristic of the initial desorption measurements was usually lost within the first two hours after canistering; thus, data are presented in the lost-gas graphs for only up to nine hours after canistering. Lost-gas volume determined for each sample (see Figure 3) is incorporated in the data table described above (see Table 1).

438' 4.5" to 439' 4" (Muncie Creek Shale Member) core in SSD canister 6  
KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

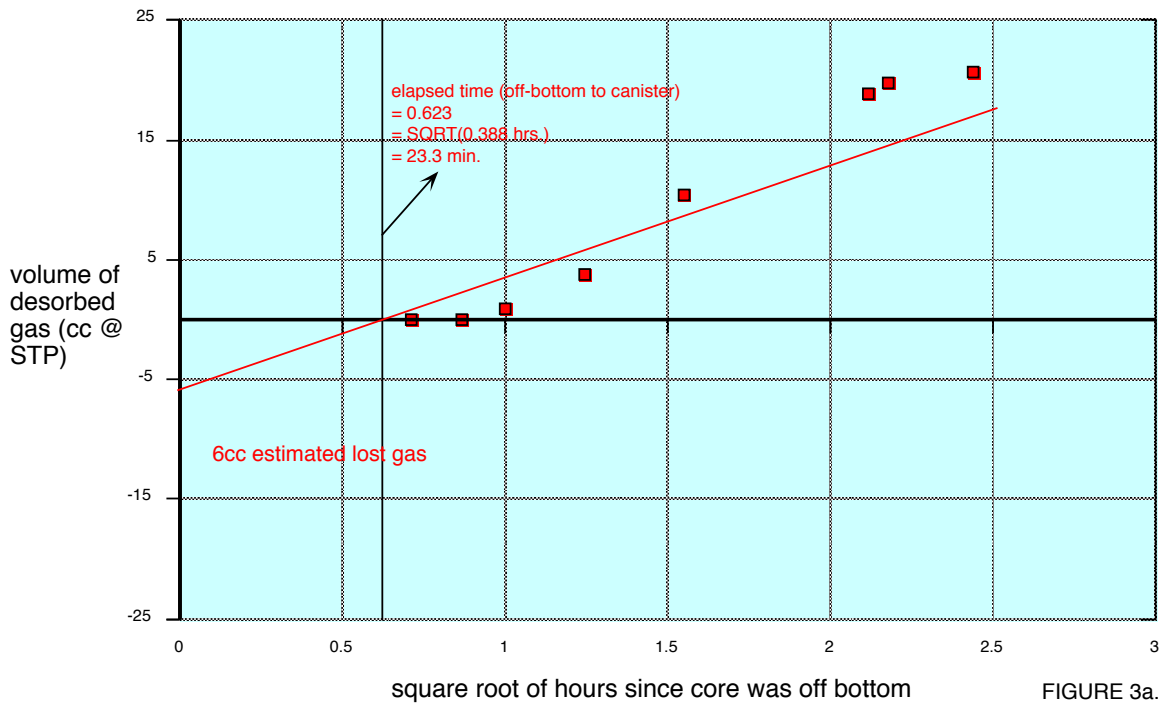


Figure 3a—Lost-gas determination for 438' 5" to 439' 4" (Mulberry coal).



757' 6" to 759' 2" (Nuyaka Creek shale) core in SSD canister DG3  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

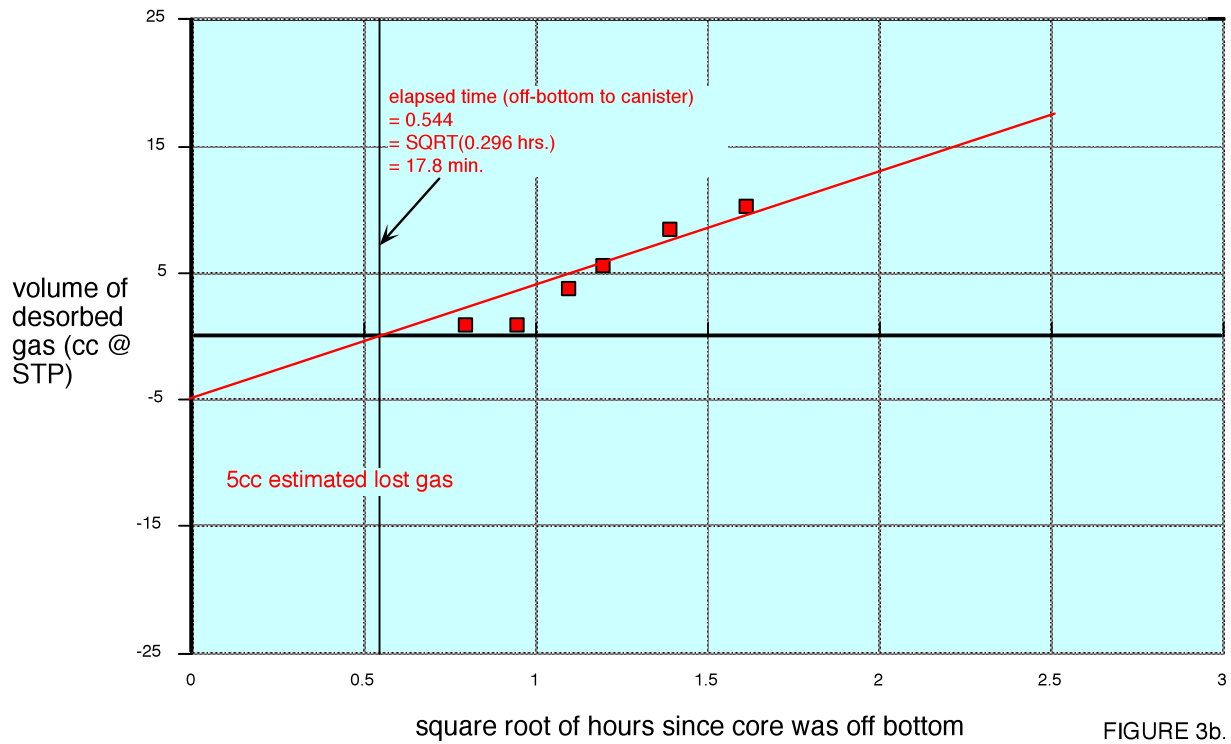


FIGURE 3b.

Figure 3b—Lost-gas determination 757' 6" to 759' 2" (Nuyaka Creek shale).

816' 2" to 817' 2" (Lexington coal) core in SSD canister DC5  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

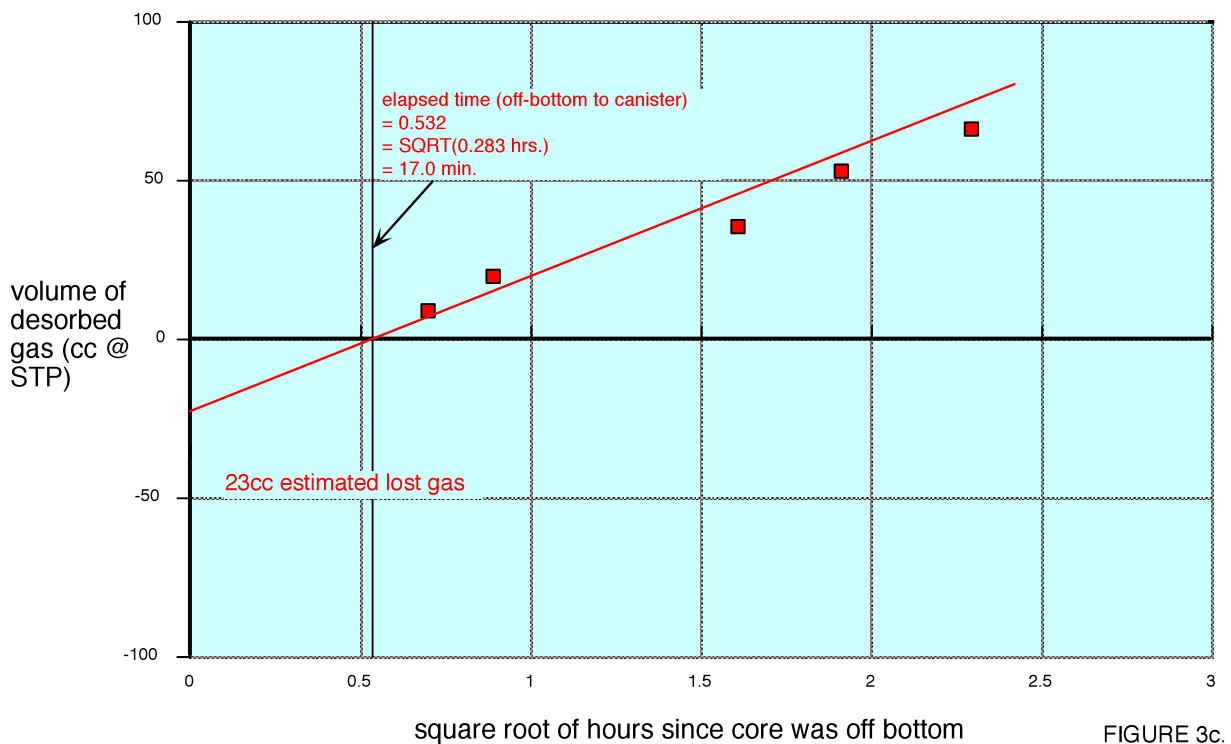


FIGURE 3c.

Figure 3c—Lost-gas determination 816' 2" to 817' 2" (Lexington coal).

955' 8" to 956' 9" (Bevier coal) core in SSD canister B

KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

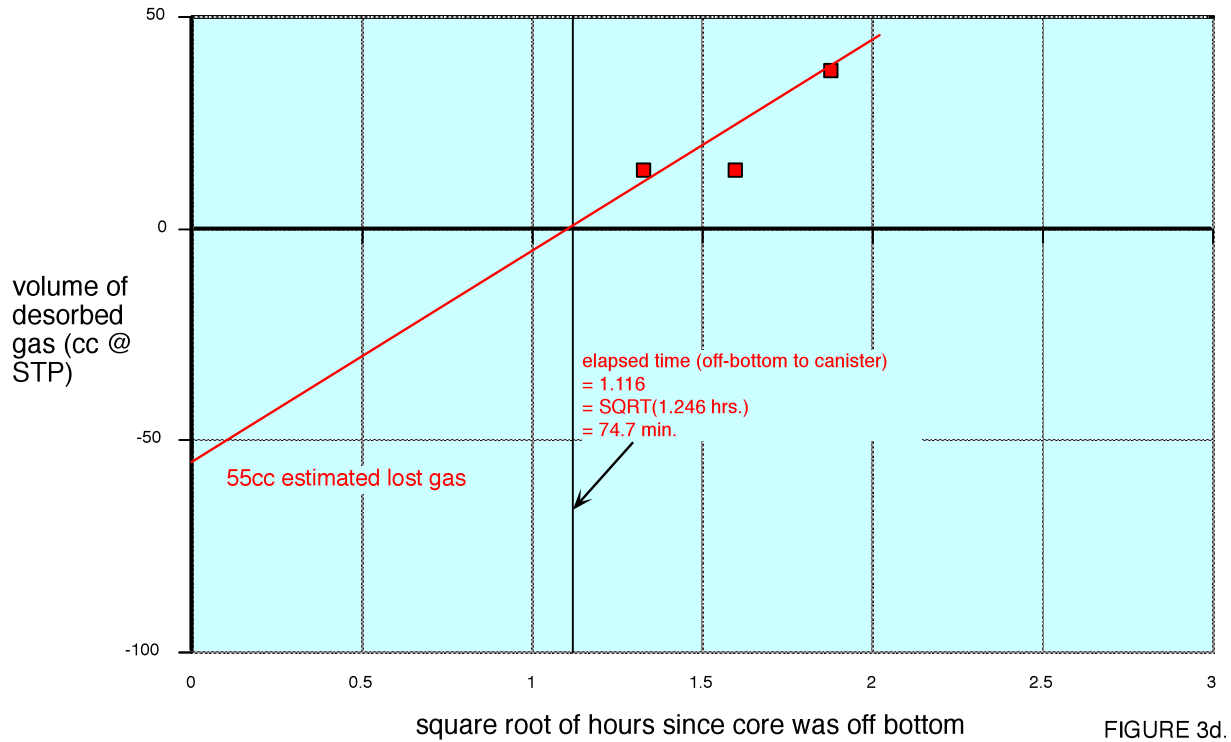


FIGURE 3d.

Figure 3d—Lost-gas determination for 955' 8" to 956' 9" (Bevier coal).

965' 8" to 966' 2" (Croweburg coal) core in SSD canister Q

KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

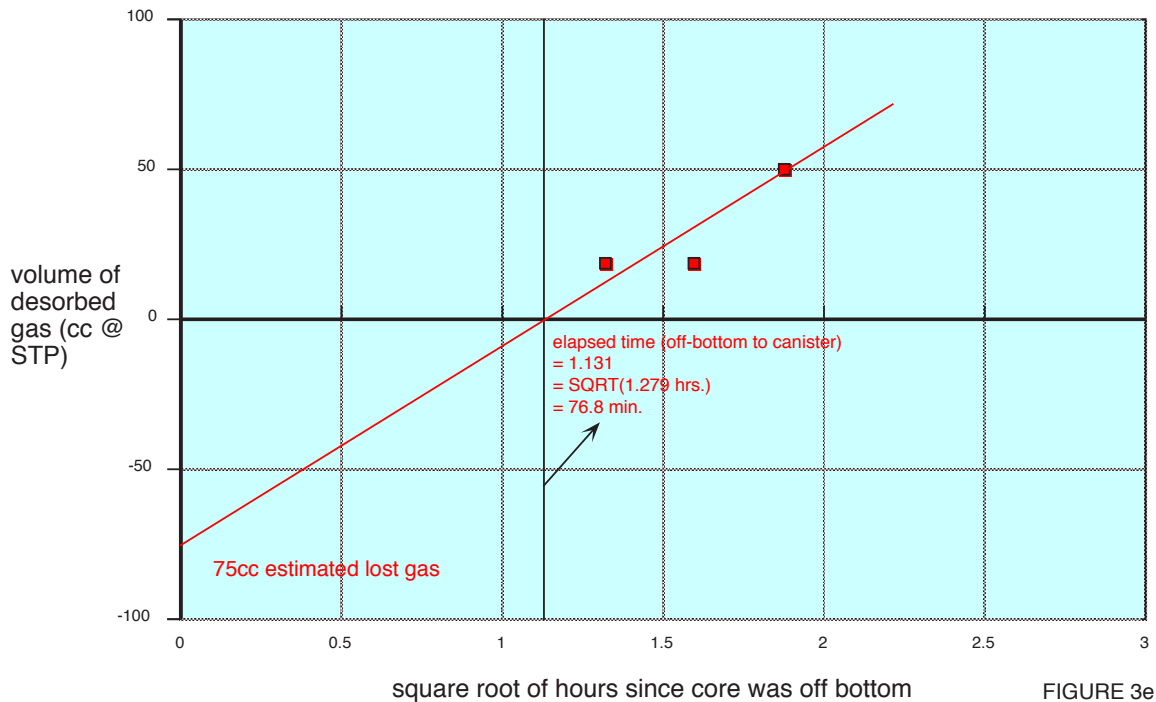


FIGURE 3e.

Figure 3e—Lost-gas determination for 965' 8" to 966' 2" (Croweburg coal).

995' 0" to 995' 6" (Mineral coal) core in SSD canister 10A  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

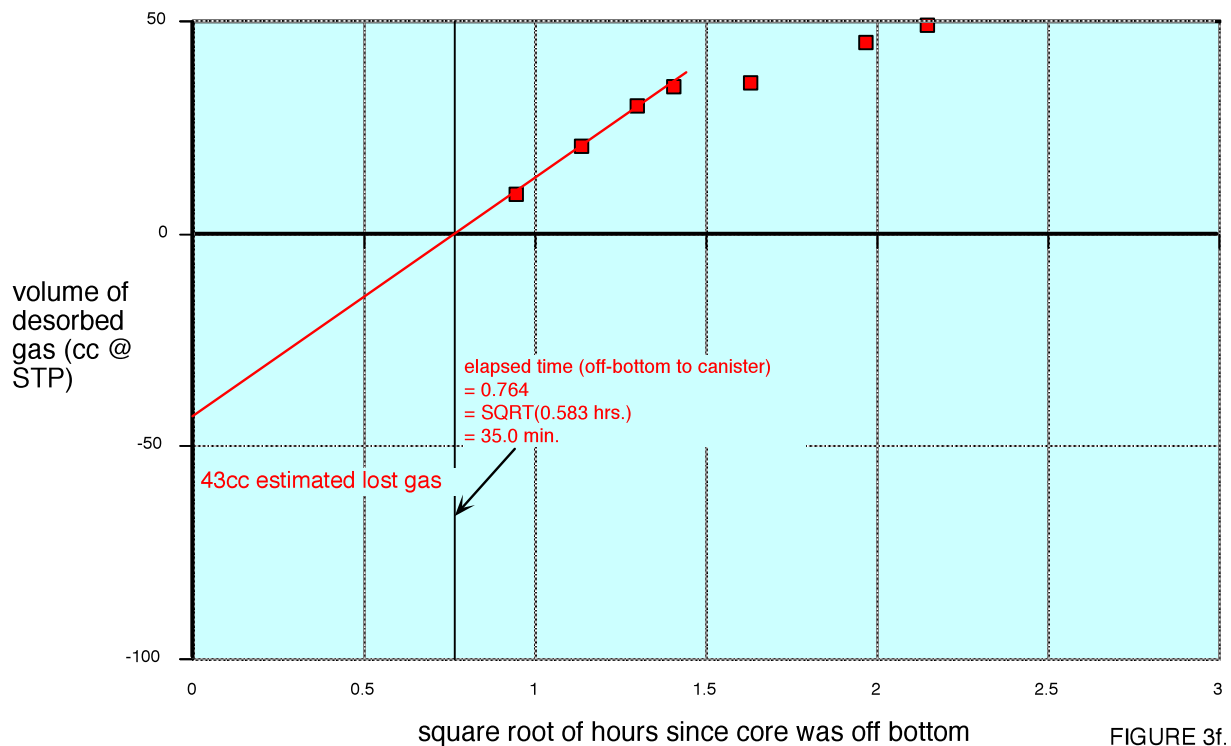


FIGURE 3f.

Figure 3f—Lost-gas determination for 995' 0" to 995' 6" (Mineral coal).

1041' 5" to 1042' 11" (Tebco coal) core in SSD canister 11A  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

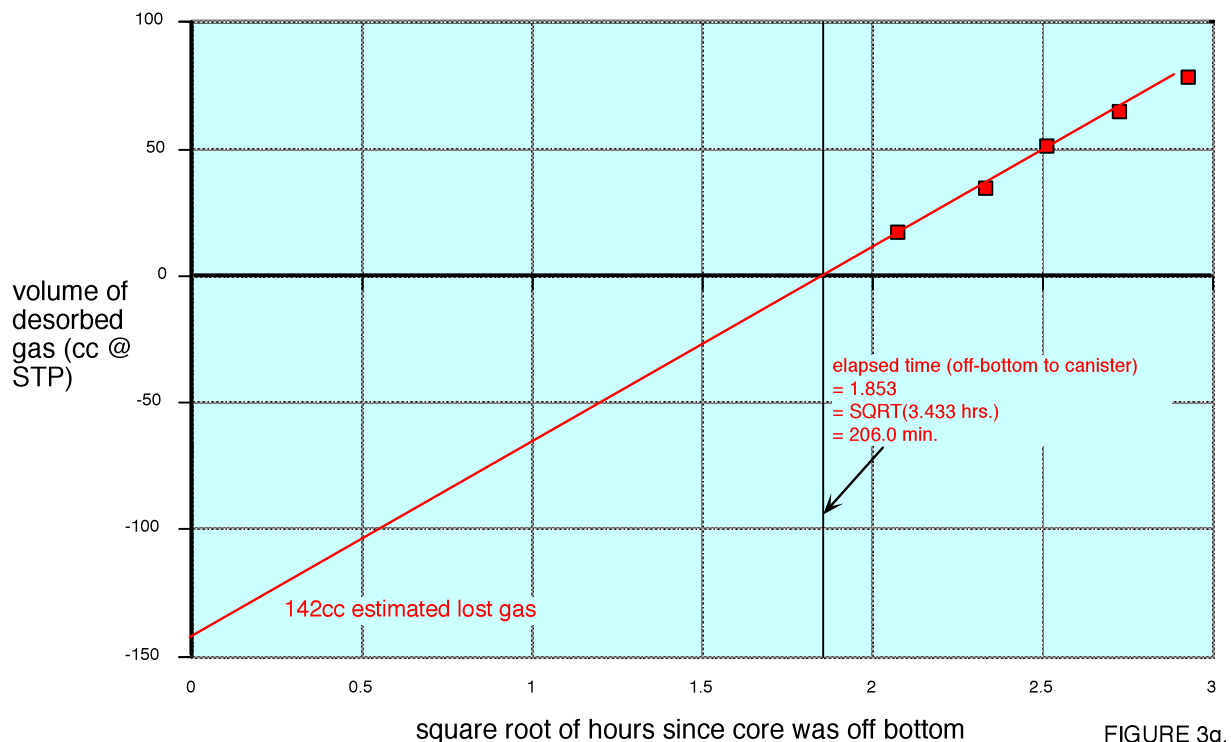


FIGURE 3g.

Figure 3g—Lost-gas determination for 1041' 5" to 1042' 11" (Tebco coal).

1053' 2" to 1054' 1" (shale below Tebo coal) core in SSD canister 12A  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

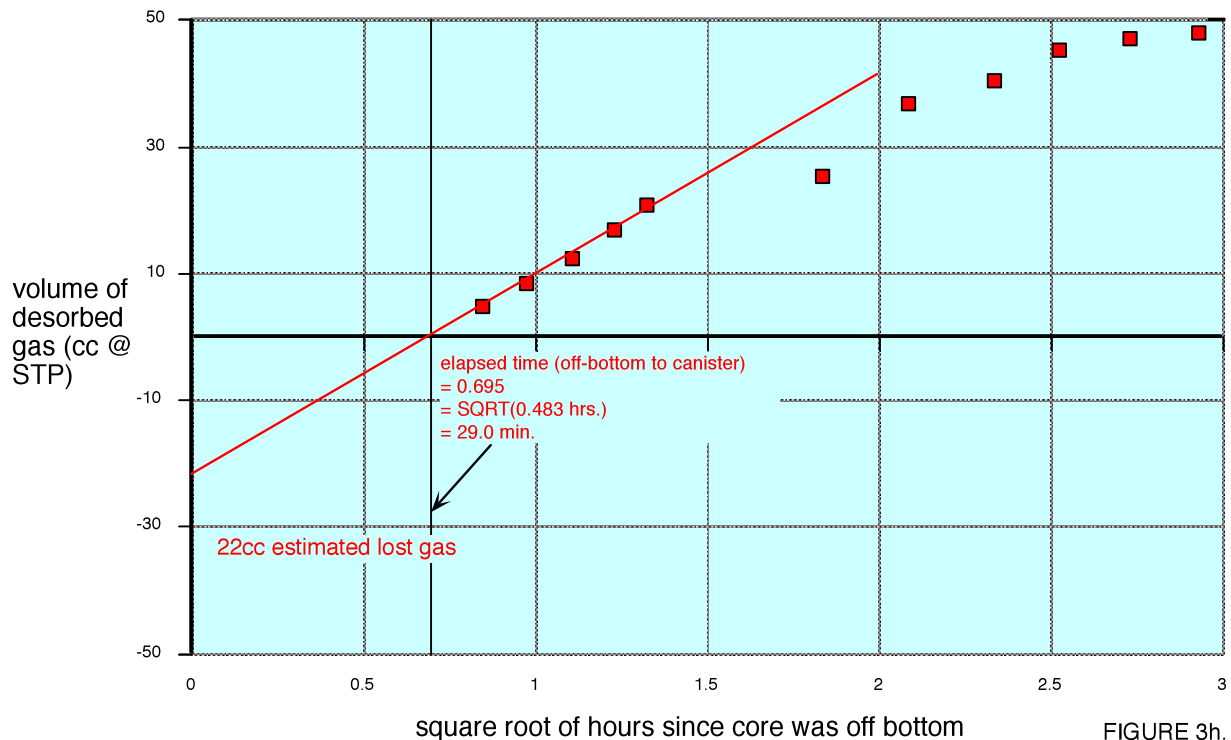


FIGURE 3h.

Figure 3h—Lost-gas determination for 1053' 2" to 1054' 1" (shale below Tebo coal).

1180' 6" to 1181' 6" (DBj coal) core in SSD canister DCB14  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

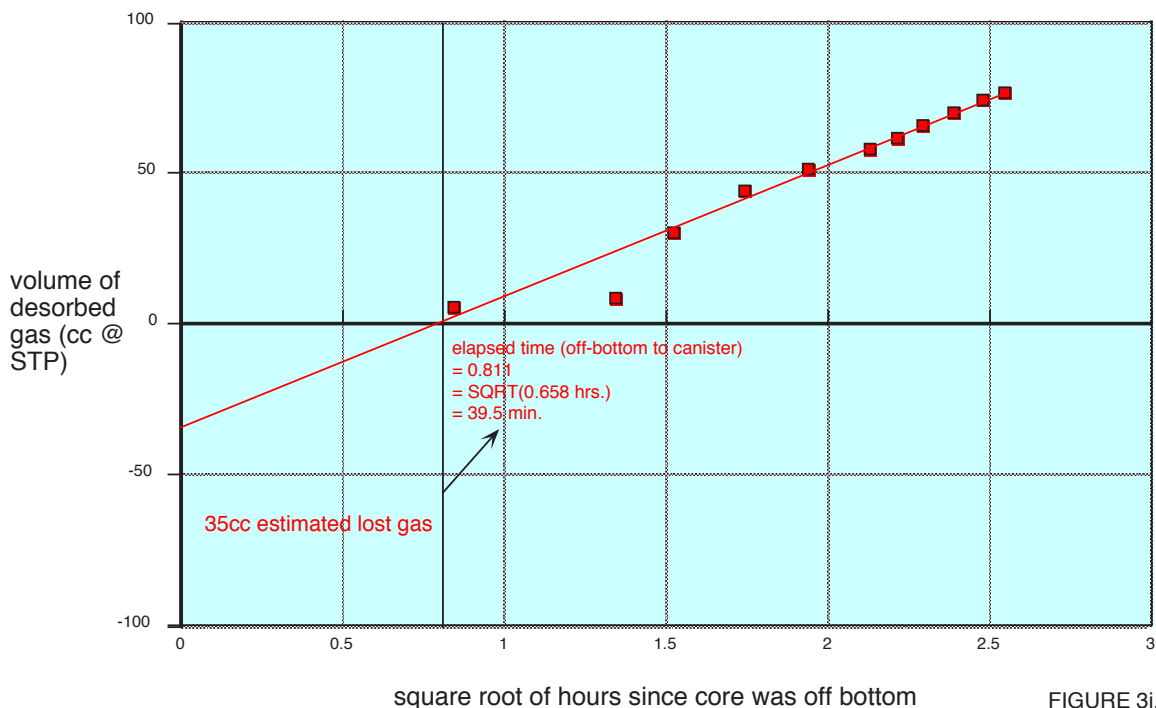


FIGURE 3i.

Figure 3i—Lost-gas determination for 1180' 6" to 1181' 6" (DBj coal).

1192' 0" to 1193' 2.5" (Drywood coal) core in SSD canister 80  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

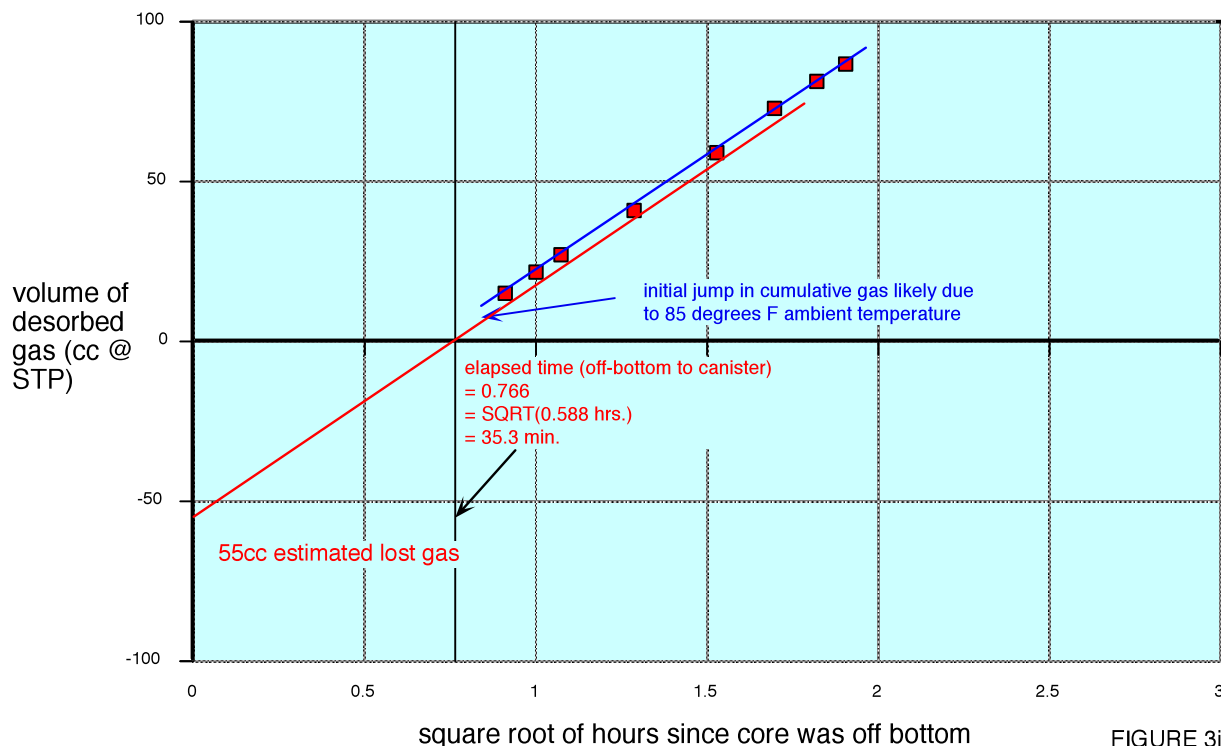


FIGURE 3j.

Figure 3j—Lost-gas determination for 1192' 0" to 1193' 2.5" (Drywood coal).

1193' 2.5" to 1194' 8.5" (Drywood coal) core in SSD canister DCB18  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

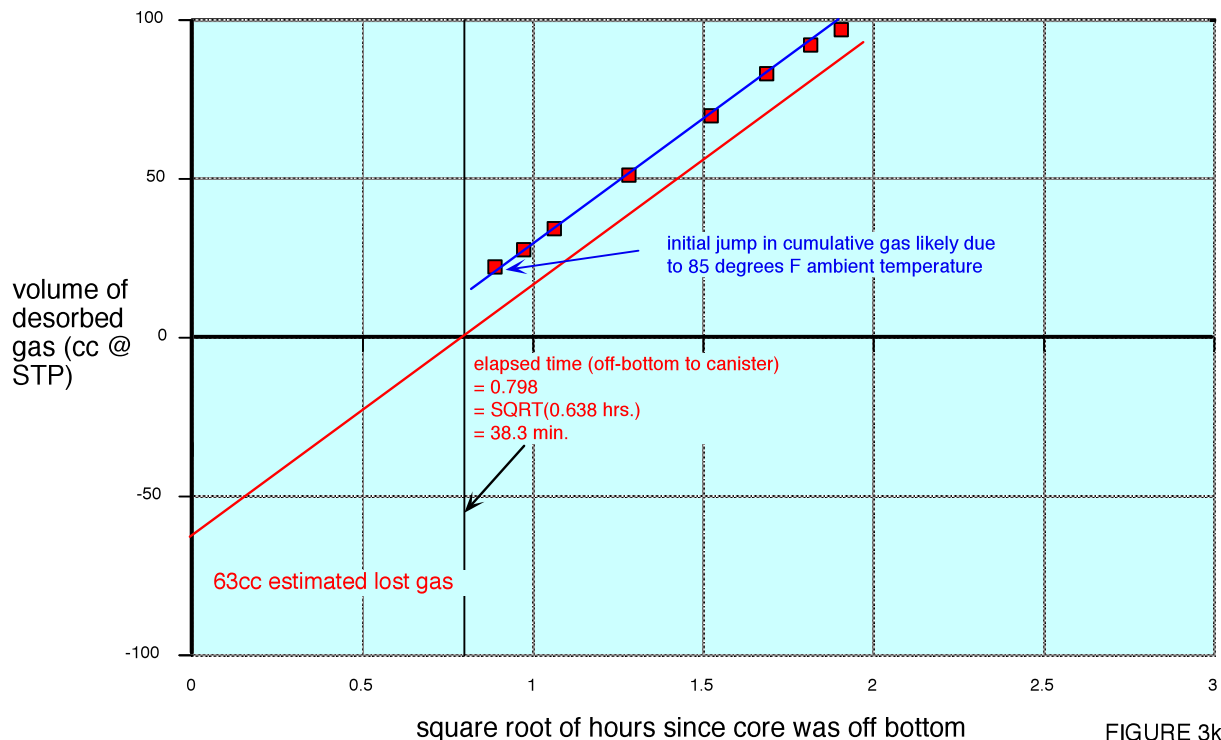


FIGURE 3k.

Figure 3k—Lost-gas determination for 1193' 2.5" to 1194' 8.5" (Drywood coal).

1201' 0" to 1202' 5.5" (Rowe coal) core in SSD canister F  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

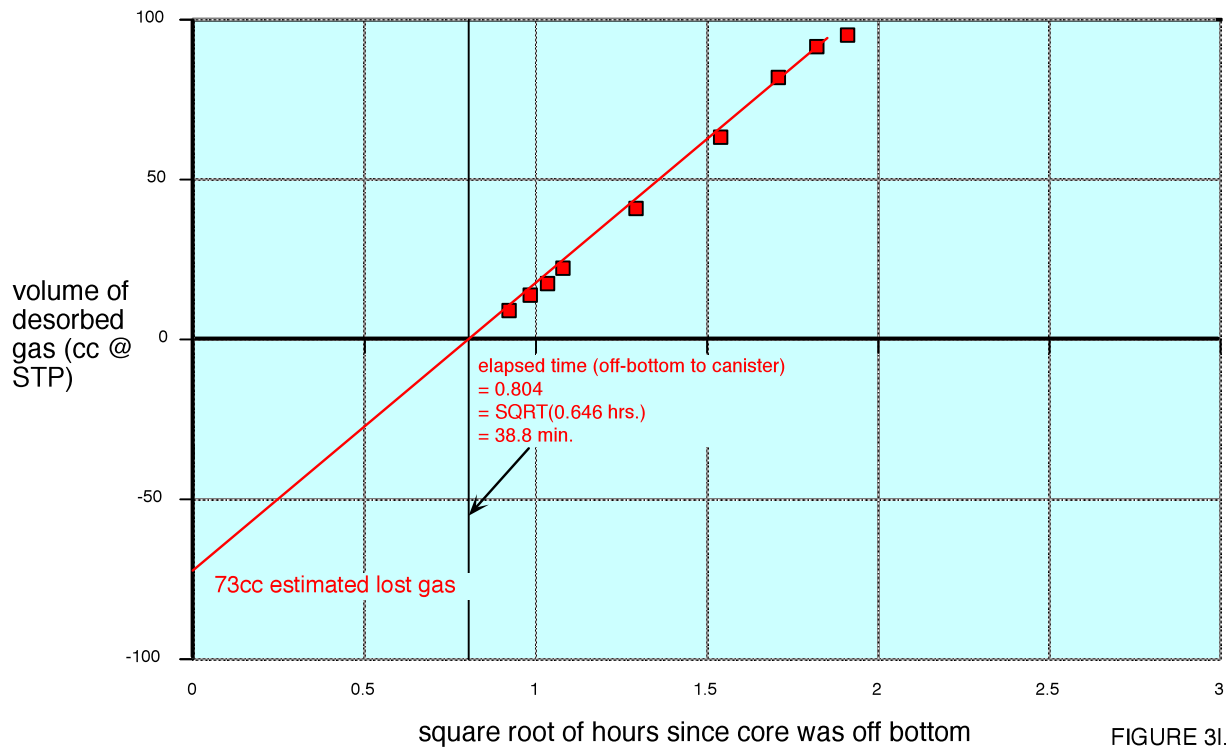


FIGURE 3l.

Figure 3l—Lost-gas determination for 1201' 0" to 1202' 5.5" (Rowe coal).

1217' 2.5" to 1217' 10.5" (Neutral coal) core in SSD canister DCBJ  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

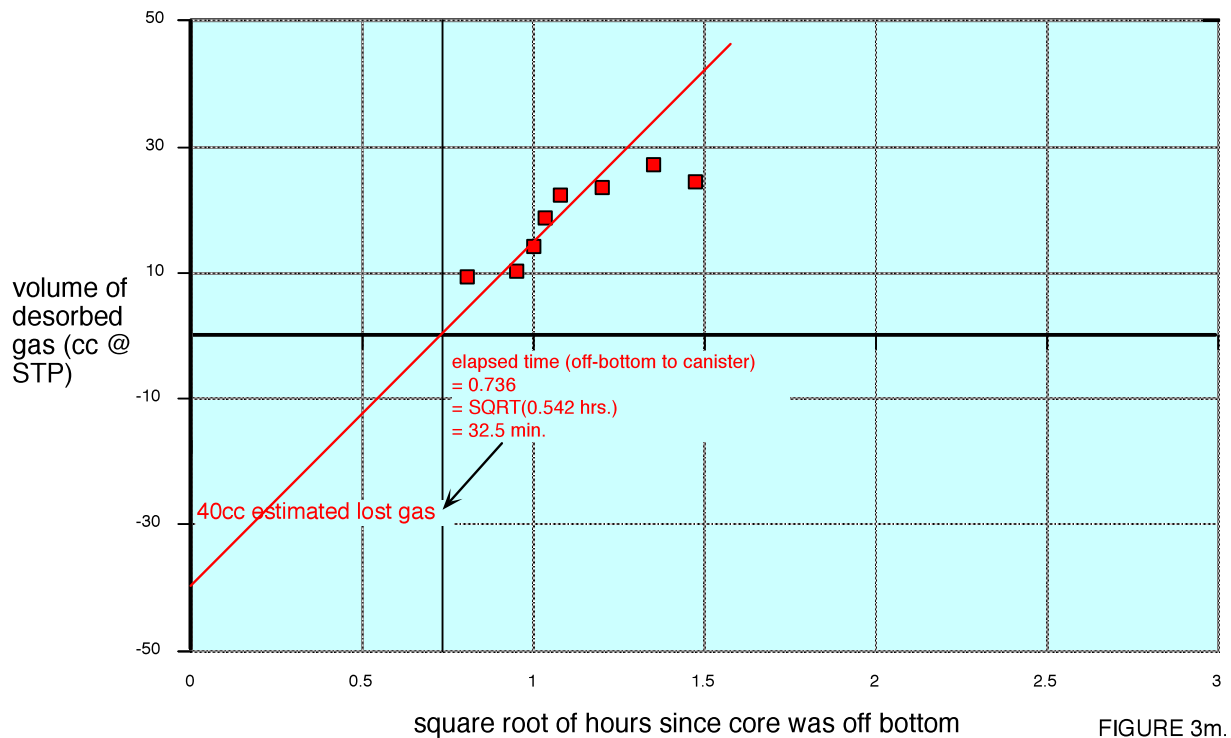


FIGURE 3m.

Figure 3m—Lost-gas determination for 1217' 2.5" to 1217' 10.5" (Neutral coal).

1271' 1" to 1271' 8" (Riverton coal) core in SSD canister DCB38  
 KGS #1 Douglas County Corehole; N2 S2 SE SW sec. 08-T.14S.-R.19E., Douglas Co., KS

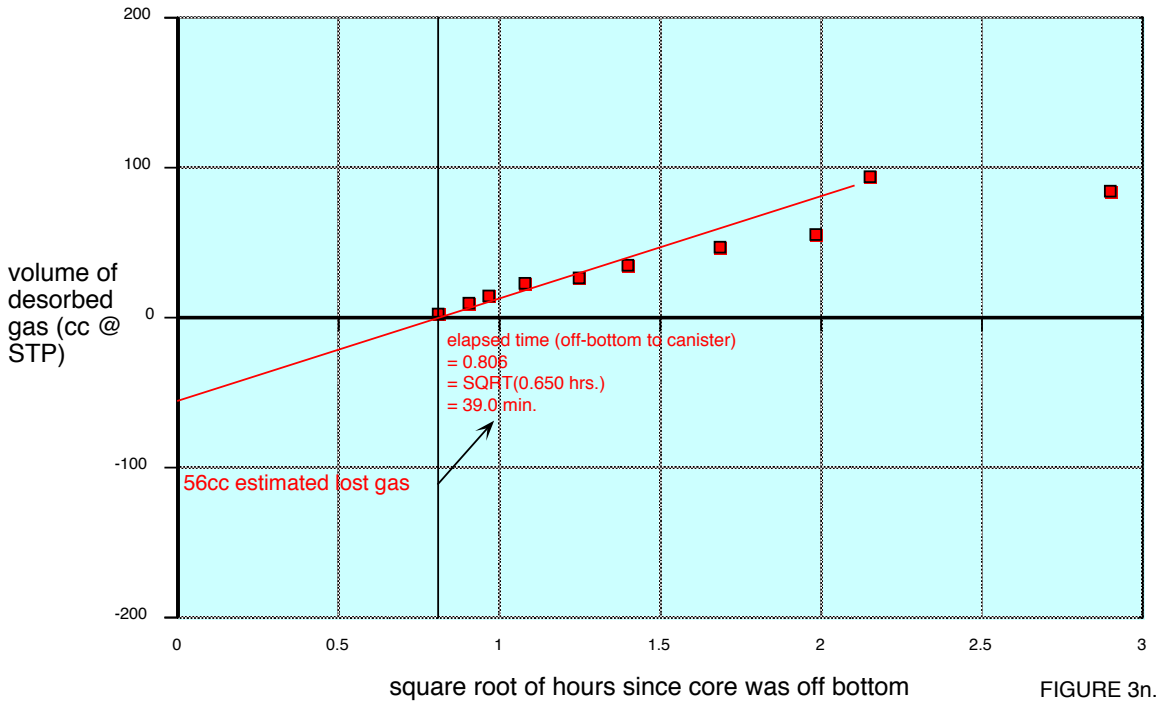


Figure 3n—Lost-gas determination for 1271' 1" to 1271' 8" (Riverton coal).

*Desorbed Gas*

The coal desorption graphs (Figure 4) are all at a common scale and are presented by specific coals, from shallowest to deepest in the well. These coals are also compared to stratigraphically correlative coals in the nearby Colt Energy #2-6 Spencer well (sec. 6, T. 18 S., R. 21 E., Franklin Co., Kansas). The gas contents in all the coals from the #1 Douglas County Core Hole are substantially less than the coals in the Spencer well.

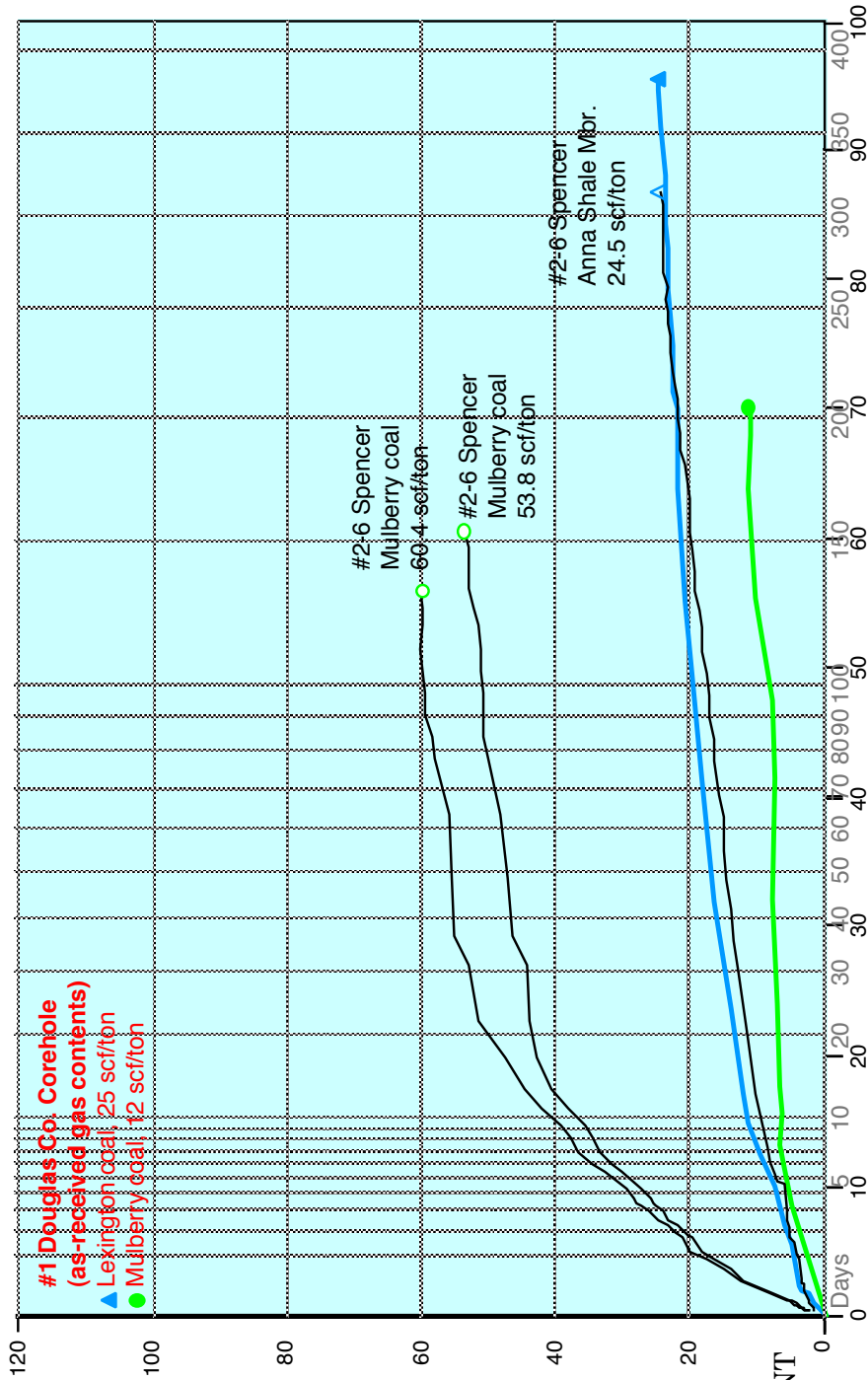


**#1 Douglas Co. #2-6 Spencer Corehole**



**Desorption Comparison of Coal Samples**  
Colt Energy #2-6 Spencer (sec. 6-T.18S.-R.21E., Franklin Co., KS)

and  
**Kansas Geological Survey #1 Douglas County Corehole** (sec. 8-T.14S.-R.19E., Douglas Co., KS)



TIME (square root of hours since bottom hole time of core)

FIGURE 4a.

Figure 4a—Desorption characteristics of coals in upper part of hole (700-900 ft).

**#1 Douglas Co. Corehole** **#2-6 Spencer Corehole**

# Desorption Comparison of Coal Samples

Colt Energy #2-6 Spencer (sec. 6-T.18S.-R.21E., Franklin Co., KS) and  
 Kansas Geological Survey #1 Douglas County Corehole (sec. 8-T.14S.-R.19E., Douglas Co., KS)

Colt Energy #2-6 Spencer (sec. 6-T.18S.-R.21E., Franklin Co., KS) and  
 Kansas Geological Survey #1 Douglas County Corehole (sec. 8-T.14S.-R.19E., Douglas Co., KS)

Colt Energy #2-6 Spencer (sec. 6-T.18S.-R.21E., Franklin Co., KS) and  
 Kansas Geological Survey #1 Douglas County Corehole (sec. 8-T.14S.-R.19E., Douglas Co., KS)

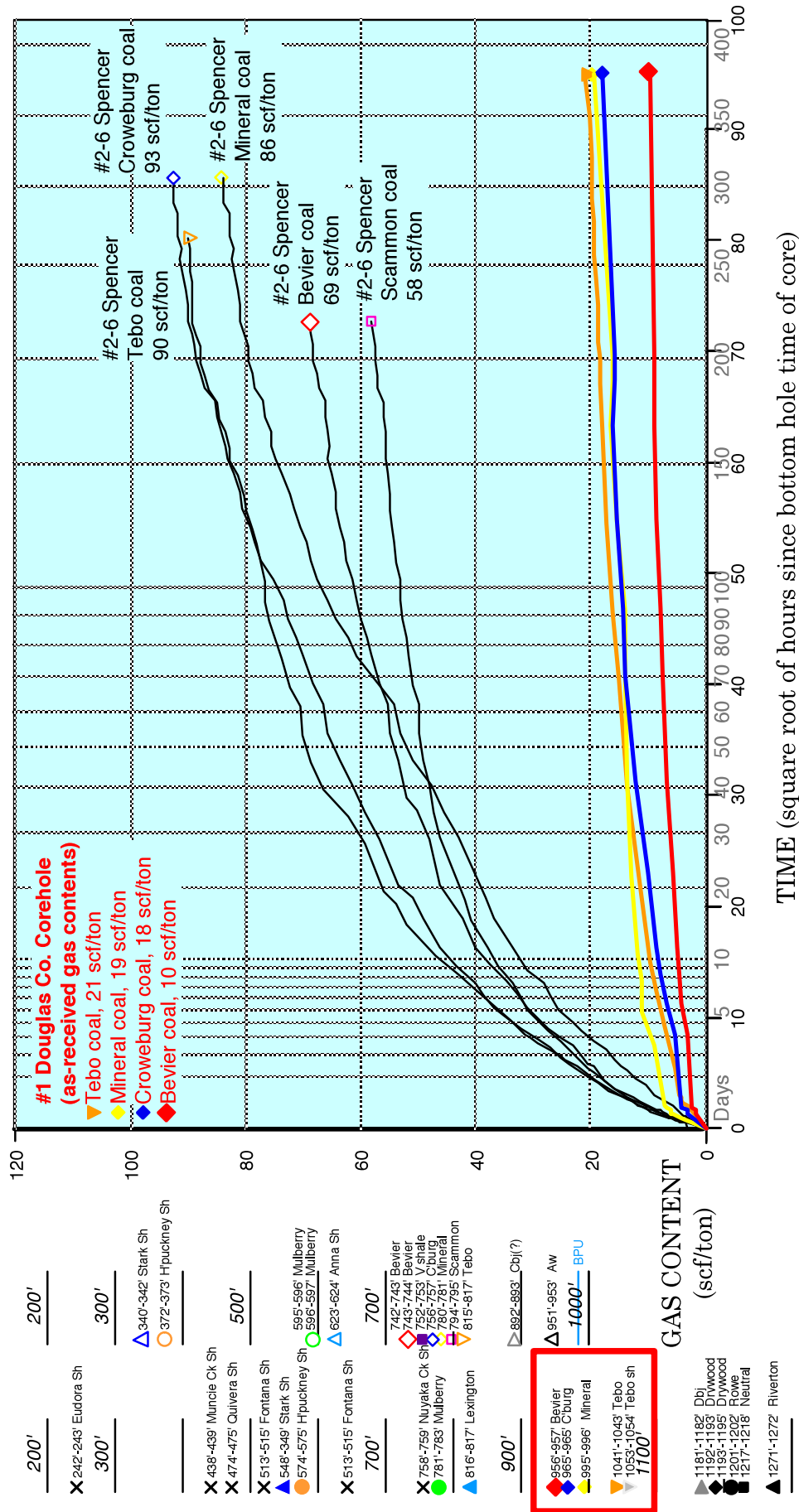


FIGURE 4b.

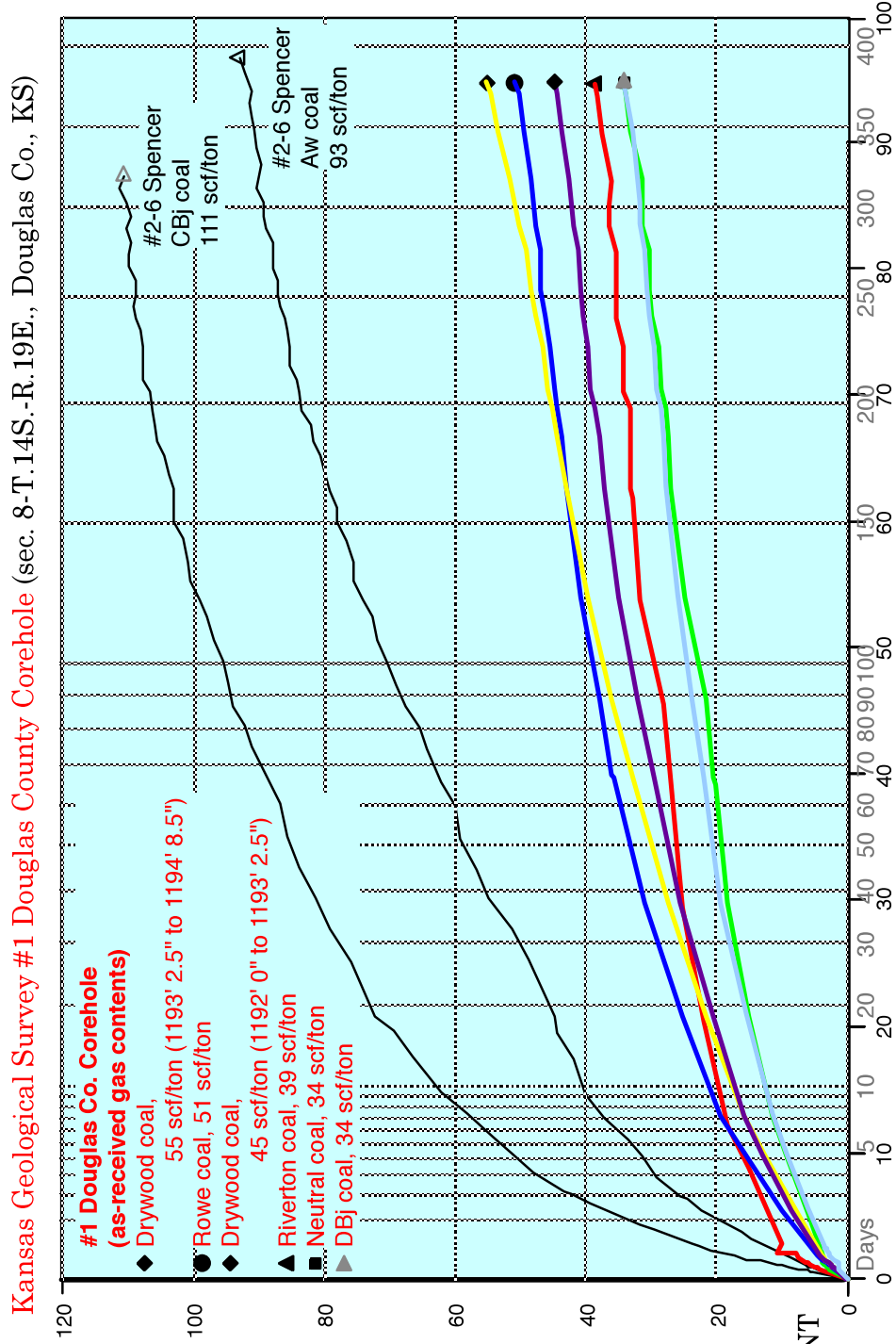
Figure 4b—Desorption characteristics of coals in middle part of hole (900-1100 ft).

**#1 Douglas Co. Corehole**  
**#2-6 Spencer**  
**Corehole**

# Desorption Comparison of Coal Samples

Colt Energy #2-6 Spencer (sec. 6-T.18S.-R.21E., Franklin Co., KS)  
 and  
 Kansas Geological Survey #1 Douglas County Corehole (sec. 8-T.14S.-R.19E., Douglas Co., KS)

Colt Energy #2-6 Spencer (sec. 6-T.18S.-R.21E., Franklin Co., KS)  
 and  
 Kansas Geological Survey #1 Douglas County Corehole (sec. 8-T.14S.-R.19E., Douglas Co., KS)



TIME (square root of hours since bottom hole time of core)

FIGURE 4C.

Figure 4c—Desorption characteristics of coals in lower part of hole (>1100 ft).

Ash content and proximate analysis allows for determination of ash-free gas content of samples and rank of the coals by the Parr Formula (see ASTM, 1993, p. 202) (Table 2).

Table 2—Desorbed gas content on an as-received and ash-free basis, with calculated coal rank for samples with less than 50% ash content.

<b>SAMPLE</b>	<b>As-received gas content (scf/ton)</b>	<b>Ash-free gas content (scf/ton)</b>	<b>Ash Content (as-received) (%)</b>	<b>Moisture Content (as-received) (%)</b>	<b>Coal Rank</b>
Stark Shale Mbr., 548' 0"	negligible	negligible	68.27	2.62	
Hushpuckney Sh. Mbr., 573' 9.5"	10.9	41.7	68.93	2.84	
Nuyaka Ck. sh., 757' 6"	8.5	33.2	69.72	2.80	
Mulberry, 816' 2"	11.2	15.4	19.57	6.10	hvCb
Lexington, 371' 2"	25.1	33.1	13.71	9.08	hvCb
Bevier, 955' 8"	9.7	21.8	48.79	4.53	hvBb
Croweburg, 965' 8"	18.2	23.8	16.62	5.97	hvBb
Mineral, 995' 0"	19.4	32.4	33.58	4.92	hvBb
Tebo, 1041' 5"	21.0	35.0	33.38	4.87	hvBb
DBj, 1180' 6"	34.2	54.6	33.92	2.56	hvBb
Drywood, 1192' 0"	44.6	69.0	20.25	3.26	hvBb
Drywood, 1193' 2.5"	55.4	61.2	15.43	3.76	hvBb
Rowe, 1201' 0"	50.8	61.2	10.45	5.90	hvBb
Neutral, 1217' 2.5"	34.4	43.1	14.67	4.68	hvBb
Riverton, 1271' 1"	38.7	50.2	19.06	3.13	hvBb

hvBb = high-volatile bituminous B

hvCb = high-volatile bituminous C

Based on these analyses, most coals in the #1 Douglas County Core Hole assay along the boundary between high-volatile bituminous B and C ranks.

Gas Chemistry

Gas isotopic chemistry from the #1 Douglas County Core Hole is crossplotted and compared to other nearby gases (Figure 5). Based on these data, the origin of the gas in the #1 Douglas County Core Hole is biogenic in origin. A sample of desorption gas from the Nuyaka Creek shale (757' 6" to 759' 2") is isotopically very light—  $-73.04\delta^{13}C_1$ , comparable to a Hushpuckney Shale Member (424 ft) sample from northern Anderson County (i.e.,  $-72.44 \delta^{13}C_1$ ). The methane in the deeper samples of the #1 Douglas County Core Hole is slightly less depleted (i.e., less negative), hence thermogenesis may account for a small amount of the methane in these deeper samples. The isotopic chemistry of the gases is shown in Table 3.

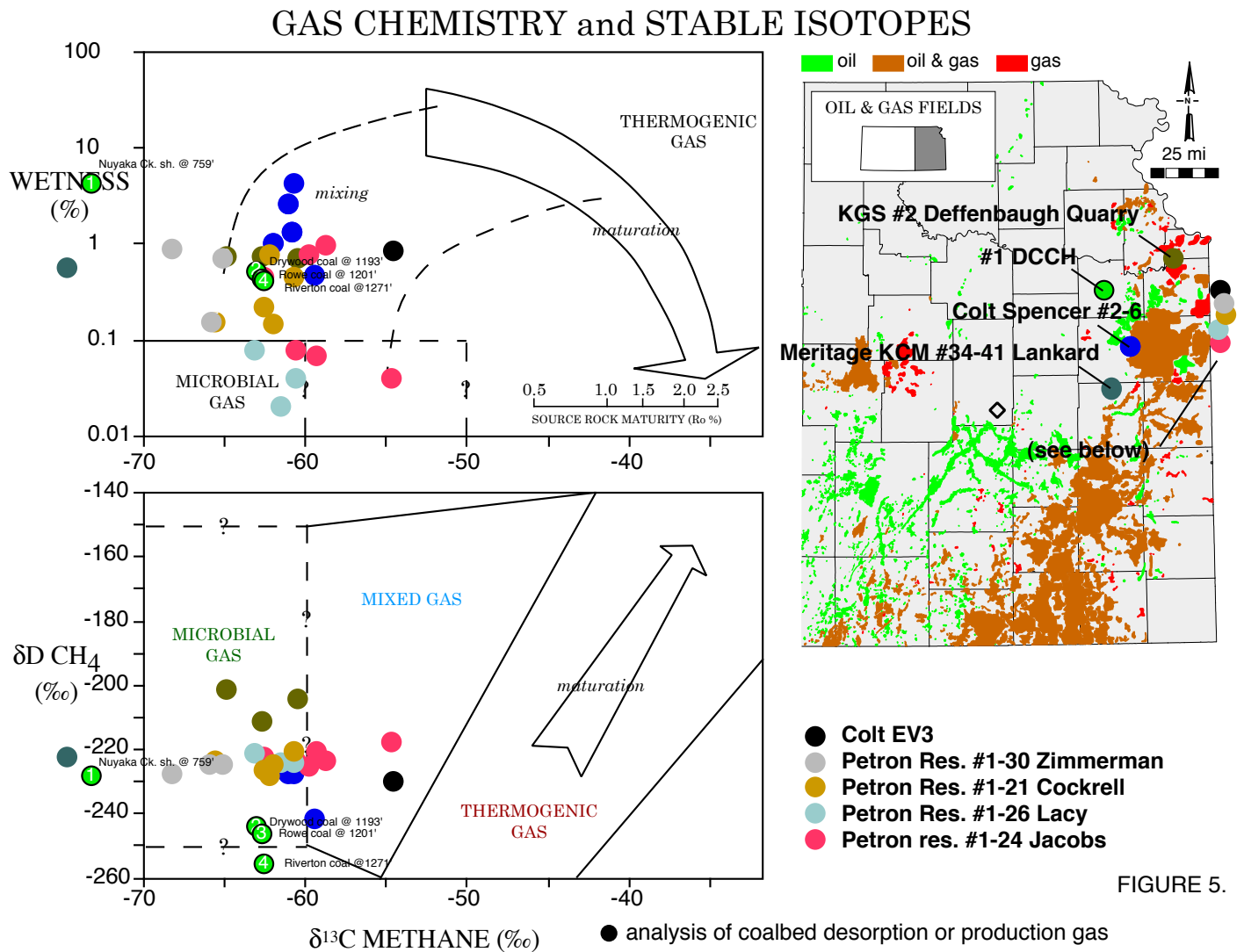


FIGURE 5.

Figure 5—Isotope and chemistry cross-plot for desorption gases from #1 Douglas County Core Hole and desorption gases from the nearby Colt Energy #2-6 Spencer well.

Table 3—Isotopes of the Douglas County Core Hole gases.

<b>SAMPLE</b>	$\delta^{13}\text{CO}_2$ per mil	$\delta^{13}\text{C1}$ per mil	$\delta\text{DC1}$ per mil	$\delta^{13}\text{C2}$ per mil	$\delta^{13}\text{C3}$ per mil
<b>Nuyaka Ck. sh.</b> 757' 6" - 759' 2"	-20.14	-73.04	-228.6	-40.83	-33.93
<b>Drywood coal</b> 1193' 2.5" - 1194' 8.5"	-11.86	-62.99	-243.7	-31.71	
<b>Rowe coal</b> 1201' 0" - 1202' 5.5"	-9.34	-62.55	-246.1	-31.29	
<b>Riverton coal</b> 1271' 1" - 1271' 8"	-16.46	-62.50	-255.3	-31.23	

Raw (i.e., uncorrected for atmosphere) hydrocarbon percentages for the desorbed gases are in Table 4.

Table 4a—Raw hydrocarbon percentages in the desorbed gases.

<b>Sample</b>	<b>methane</b> (%)	<b>ethane</b> (%)	<b>propane</b> (%)	<b>n-butane</b> (%)	<b>Iso-butane</b> (%)	<b>n-pentane</b> (%)	<b>so-pentane</b> (%)	<b>hexane +</b> (%)
<b>Nuyaka Ck. shale</b> 717' 6" - 718' 6"	54.94	1.37	0.733	0.113	0.0260	0.0125	0.0260	0.0132
<b>Drywood coal</b> 1193' 2.5" - 1194' 8.5"	72.56	0.385	0.0014	0.0006	0.0005	0.0002	0.0002	0.0002
<b>Rowe coal</b> 1201' 0" - 1202' 5.5"	67.20	0.289	0.0034	0.0002	0.0002	0	0	0
<b>Riverton coal</b> 1271' 1" - 1271' 8"	40.94	0.161	0.0025	0.0006	0.0005	0.0004	0.0004	0

Table 4b—Raw non-hydrocarbon percentages in the desorbed gases.

<b>SAMPLE</b>	<b>nitrogen</b> (%)	<b>oxygen</b> (%)	<b>argon</b> (%)	<b>carbon dioxide</b> (%)	<b>helium</b> (%)
<b>Nuyaka Ck. sh.</b> 717' 6" - 718' 6"	41.73	0.15	0.415	0.28	0.0775
<b>Drywood coal</b> 1193' 2.5" - 1194' 8.5"	25.71	0.33	0.244	0.71	0.0550
<b>Rowe coal</b> 1201' 0" - 1202' 5.5"	30.13	0.53	0.302	1.50	0.0410
<b>Riverton coal</b> 1271' 1" - 1271' 8"	56.30	0.95	0.639	0.98	0.0296

Recalculating the component gases minus any contribution by air entails using the volume of oxygen in each sample and using the ratios of the other atmospheric gases to oxygen. The composition of dry atmosphere was taken to be that stated in Weaver (1966). The percentage of air by volume according to Weaver (1966): nitrogen, 78.00; oxygen, 20.95; argon, 0.93; carbon dioxide, 0.03; neon, 0.0018; helium 0.0005; methane, 0.0002; krypton, 0.0001; nitrous oxide, 0.00005; hydrogen, 0.00005; xenon, 0.000008; ozone, 0.000001.

The percentages (recalculated to 100% and two decimal places) of component gases in the samples, without air, are in Table 5. Helium percentage is presented to four decimal places.

Table 5—Recalculated percentages of component gases, excluding atmosphere. Based on the above percentages, gas quality can be calculated by the atmosphere-out gas percentages and the BTU content of the hydrocarbon component gases (see Table 6).

SAMPLE	C1 (%)	C2 (%)	C3 (%)	n-C4 (%)	i-C4 (%)	n-C5 (%)	i-C5 (%)	C6+ (%)	N <sub>2</sub> (%)	Ar (%)	CO <sub>2</sub> (%)	He (%)
<b>Nuyaka Ck. shale</b> 717' 6" - 718' 6"	55.34	1.38	0.74	0.11	0.13	0.01	0.02	0.01	41.47	0.41	0.28	0.0781
<b>Drywood coal</b> 1193' 2.5" - 1194' 8.5"	73.72	0.39	0.00	0.00	0.00	0.00	0.00	0.00	24.87	0.23	0.72	0.0559
<b>Rowe coal</b> 1201' 0" - 1202' 5.5"	68.95	0.30	0.00	0.00	0.00	0.00	0.00	0.00	28.89	0.29	1.54	0.0421
<b>Riverton coal</b> 1271' 1" - 1271' 8"	42.88	0.17	0.00	0.00	0.00	0.00	0.00	0.00	55.26	0.63	1.03	0.0310

Table 6—Heating value, total non-flammable gas percentages, and hydrocarbon wetness (i.e.,  $(1 - [C1/\Sigma Cn]) * 100$ ).

SAMPLE	calculated BTU (BTU/cubic ft)	total non-HC gas (%)	hydrocarbon wetness (%)
<b>Nuyaka Ck. shale</b> 717' 6" - 718' 6"	640	42.25	4.17
<b>Drywood coal</b> 1193' 2.5" - 1194' 8.5"	787	25.88	0.53
<b>Rowe coal</b> 1201' 0" - 1202' 5.5"	734	30.75	0.43
<b>Riverton coal</b> 1271' 1" - 1271' 8"	457	56.95	0.40

Total BTU was calculated using the following BTUs for each of the hydrocarbon component gases: methane (1057), ethane (1847), propane (2639), n-butane (3401), i-butane (3427), n-pentane (4204), i-pentane (4230), and hexane+ (4963).

The BTU calculations (Table 6) indicate that perhaps all the coals in the #1 Douglas County Core Hole may have low heat content unacceptable for sale to pipelines (i.e., nominally <950 BTU/scf is necessary for sale without penalty). Production would require upgrading to reject the nitrogen and, in some cases, removing carbon dioxide in addition to the nitrogen.



### Adsorbed Gas-in-Place Calculation

Gas-in-place (GIP) is calculated based on desorption data—desorbed gas content (as-received), coal thickness, and coal density. The adsorbed GIP is presented by coal bed in Table 7. Coal beds with gas content less than 30 scf/ton were not considered. Any coal bed less than 10 inches thick was not considered in the summed gas-in-place.

Table 7—Gas-in-place for coals. Beds less than 10 inches thick, or 30 scf/ton are not considered.

<b>Coal bed</b>	<b>Gas Content (scf/ton)</b>	<b>Density (grams/cc)</b>	<b>Thickness (inches)</b>	<b>Gas per Acre (cubic ft)</b>
DBj, 1180' 6"	34.2	1.79	18	124,858
Drywood, 1192' 0"	51.2*	1.39*	32.5	262,080
Rowe, 1201' 0"	50.8	1.32	17.5	132,966
Neutral, 1217' 2.5"	34.4	1.35	8	(too thin)
Riverton, 1271' 1"	38.7	1.45	7	(too thin)
<b>SUM</b>				<b>519,905</b>

\*weighted average (14.5" @ 44.6 scf/ton, 18" @ 56.6 scf/ton; 14.5" @ 1.51 gr/cc, 18" @ 1.30 gr/cc)

### Sorption Time

Sorption time, or the time necessary for 63.2% of the gas to desorb from a sample, is a relative measure of how readily gas will flow from a unit. Sorption times are illustrated in Figure 6 for the five coals in the #1 Douglas County Core Hole (listed in Table 7). Desorbed gas content (as-received) and sorption time is crossplotted in an inset graph for the coals in the #1 Douglas County Core Hole of the coal units in this well (Figure 6). For comparison, two deep coals from the Colt Energy #2-6 Spencer well are also added to the graphs in Figure 6. The comparatively longer sorption times (and lesser gas contents) are likely due to the lesser coal ranks at the #1 Douglas County Core Hole.

### Isotherm

A methane isotherm was performed on one sample—the lower part of the Drywood coal (1193' 2.5" to 1194' 8.5") by TerraTek (a division of Schlumberger) in Salt Lake City, Utah. The methane isotherm for this coal is presented in Figure 7, together with a data point depicting the pressure and gas content state of the Drywood coal in the #1 Douglas County Core Hole. This data point is determined by the crossplotted point of the total gas content for the Drywood coal (77 scf/ton) and its present formation pressure (568 psi). The gas content (77 scf/ton) is the sum of the desorbed gas content and residual gas (see calculations in Table 1). Residual gas was determined by ball-mill grinding after desorption; see Table 1). The inferred pressure (568 psi) was calculated by multiplying the subsurface depth (1193 ft) times a 0.476 psi/ft hydrostatic gradient. This hydrostatic gradient was determined by Carr and others (2005) for an average brine (145,000 ppm) in Kansas.

The Drywood coal is undersaturated in that the coal contains considerably less adsorbed gas than it is

## Sorptions Time of Coal Samples

KGS #1 Douglas County Core Hole (sec. 8-T.14S.-R.19E., Douglas Co., KS)  
with comparison to samples from Colt Energy #2-6 Spencer  
(sec. 6-T.18S.-R.21E., Franklin Co., KS)

#1 Douglas Co. Core Hole    #2-6 Spencer Core Hole

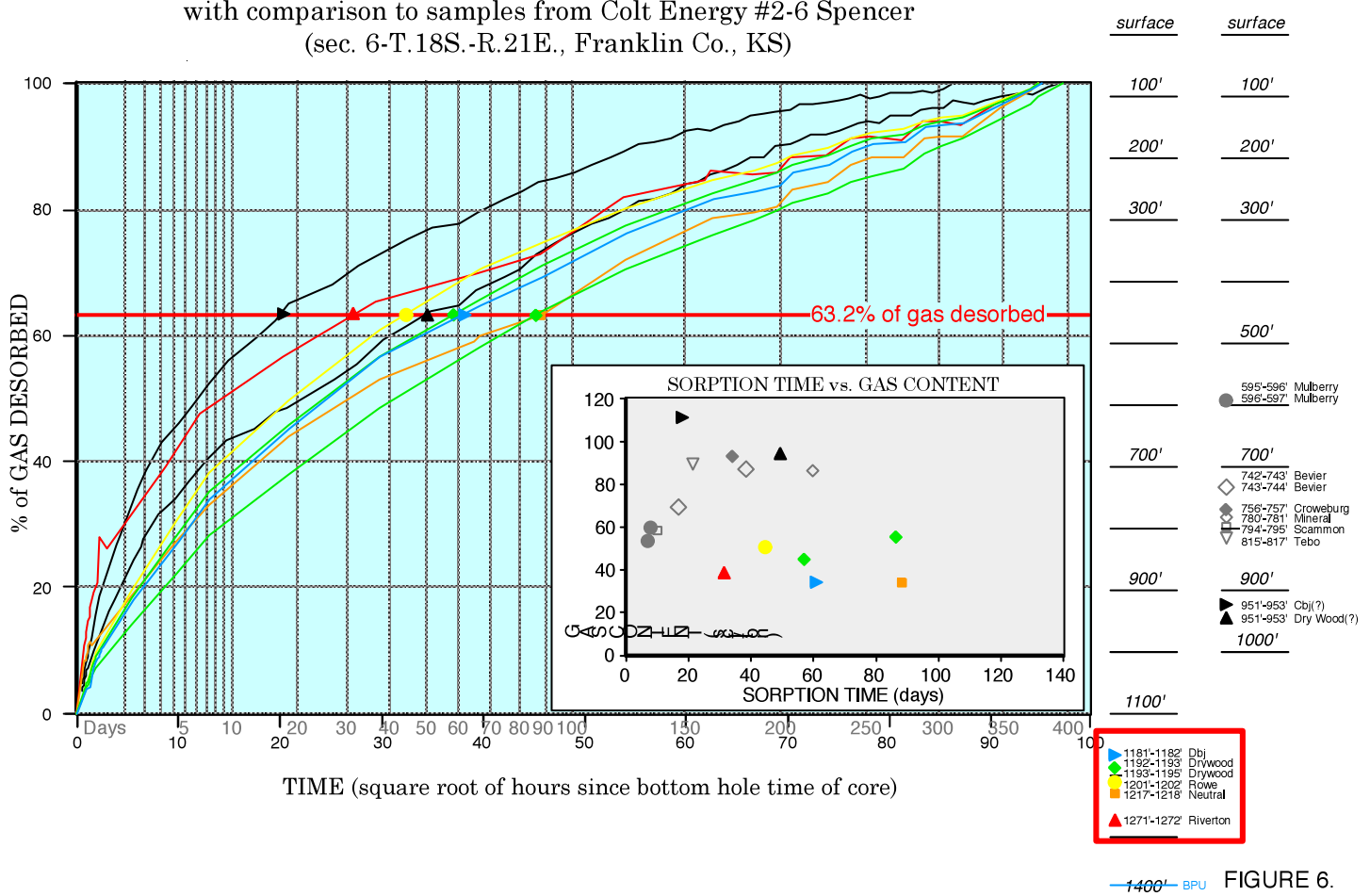


Figure 6—Sorptions times for #1 Douglas County Core Hole compared to two selected deep coals from the nearby Colt Energy #2-6 Spencer well in Franklin County (in black).

capable of holding, according to its isotherm (see Figure 7). In order to start this coal desorbing, the ambient pressure on it has to be reduced to at least 161 psi, which is equivalent to pumping down the well until there is less than 338 ft of water above the coal.

### Results and Discussion

Coal beds in the #1 Douglas County Core Hole were encountered between 268 ft and 705 ft depth. In this part of the Bourbon arch, regional dip is to the northwest at 10 to 20 ft per mile (Johnson, 2004).

The thickest coal beds were the Drywood (32.5 in), Tebo (18 in), Rowe (17.5 in), Mulberry (17 in), Bevier (13 in), Dbj (12 in), and Lexington (12 in). The Drywood coal, by virtue of its gas content (~57 scf/ton, as received) and thickness, holds the greatest adsorbed gas-in-place per acre of all the coals encountered.

The gas contents of the coal beds encountered in the well are low compared to coal in southeastern Kansas. Southeastern Kansas coals have a median as-received gas content of 139 scf/ton and samples with gas content as great as 370 scf/ton have been recorded (Newell and Carr, 2009). By comparison, the Drywood coal sample registering the greatest gas content in the #1 Douglas County Core Hole (57 scf/ton) ranks in the bottom

# Methane Adsorption Isotherm

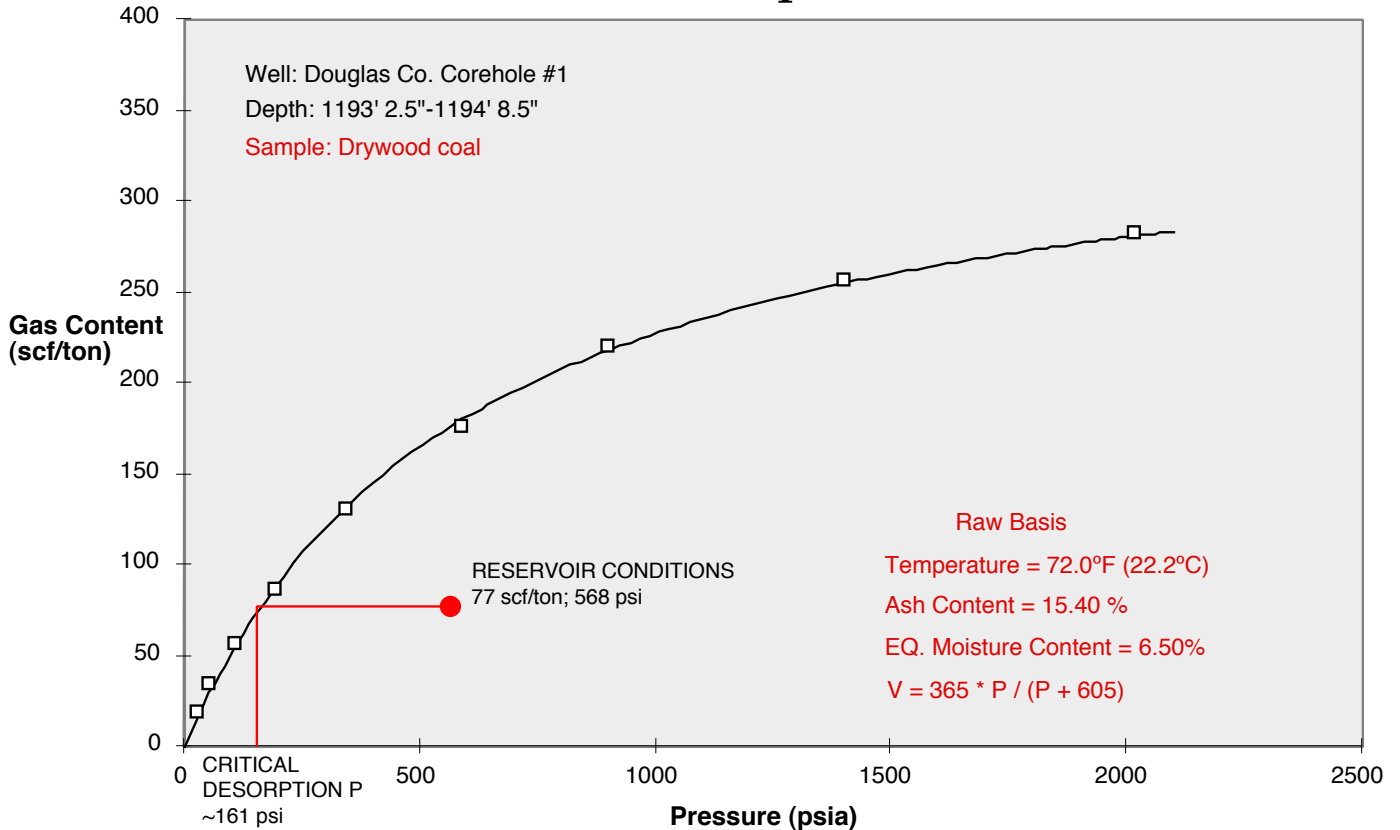


FIGURE 7.

Figure 7—Methane isotherm for Drywood coal, as-received basis, compared to total gas content of the sample and its reservoir pressure.

10% of all samples recorded in southeastern Kansas.

Gas in the coals at the #1 Douglas County Core Hole originated largely biogenic and to a smaller extent, mixed biogenic-thermogenic processes. Most coals are borderline in rank between high-volatile C bituminous and high-volatile B bituminous grades. Gas contents of coal at this locality were less than in other wells analyzed nearby in the Forest City basin to the south and southeast. Coals at the nearby Colt Energy #2-6 Spencer well in Franklin County are generally more thermally mature—high-volatile B and high-volatile A bituminous grades. This lesser maturity at the #1 Douglas County Core Hole could account for comparatively a) lesser gas content in its coals, b) longer sorption times, and c) lesser hydrocarbon gas content in its coals and shales.

The comparatively low thermal maturation at the #1 Douglas County Core Hole is somewhat of an anomaly, for equivalent strata farther southward and eastward higher on the flank of the Cherokee basin record higher coal rank, despite presently being 200 to 400 ft shallower. Lesser geothermal gradient at the #1 Douglas County Core Hole may be responsible, or alternatively, lesser thermal maturation may be due to cooling of northward-moving heated formation water derived from the deeper parts of Arkoma and Anadarko basins in Oklahoma.

Gas quality is less than 950 BTU/scf (i.e., nominal pipeline quality) for the three coals (Drywood, Rowe, and Riverton) sampled for gas chemistry. Excess nitrogen is the main culprit, but percentages of carbon dioxide in close to 1% may also dictate that some gas upgrading may be necessary before pipeline-quality gas can be sold. Upgrading would be necessary before the gas could be commercially sold.

Comparison of isotherms with gas content of the Drywood coal indicates that this coal is undersaturated with respect to its total capacity to hold gas. Dewatering of deeper coals will be necessary before these coals start desorbing gas.

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